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COPING WITH NATURAL DISASTERS

*Medical Research in the Ancient and
the Biblical Times from the Viewpoint
of Contemporary Perspective*



*Examination of passages from the Bible,
exactly as written*

Liubov Ben-Nun

The increase in the number of natural disasters and their effecting population is of growing concern. The numbers of persons killed or disabled because of earthquakes, cyclones, floods and famines have reached record levels in the last decade. Natural disasters result in excess morbidity or mortality. Human vulnerability to any disaster is a complex phenomenon involving social, economic, health, and cultural dimensions.

Are natural disasters described in the Bible? Were humans affected? How did humans respond to these calamities? How did they cope with these disasters? Are natural disasters widespread in contemporary times? What types of disasters are most common?

In order to answer these questions biblical texts were examined and verses in which humans were afflicted or coped with natural disasters were studied closely from a contemporary viewpoint.

76th Book

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NOT FOR SALE

COPING WITH NATURAL DISASTERS

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Lot and his daughters flee from Sodom
and the burning cities. Albrecht Dürer.

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MY VIEW

MEDICINE IN THE BIBLE AS A RESEARCH CHALLENGE

This is a voyage along the well-trodden routes of contemporary medicine to the paths of the Bible. It covers the connection between body and soul, and the unbroken link between our earliest ancestors, accompanied by spiritual yearning and ourselves. Through the verses of the Bible flows a powerful stream of ideas for Medical Research combined with study of our roots and the Ancient texts.

The Bible exists as evidence in the Book of Books, open to all humankind. The text has been translated into hundreds of languages and dialects, and remains our eternal taboo.

Many people ask me about the connection between the Bible and medical science. My reply is simple: the roots of science are buried deep in the Biblical period and I am just the archeologist and medical researcher. This scientific medical journey to the earliest roots of the nation in the Bible has been and remains moving, exciting and enjoyable. It has created a kind of meeting in my mind between the present and those Ancient times, through examining events frozen in times.

Sometimes it is important to stop, to look back a little. In real time, it is hard to study every detail, because time is passing as they appear. However, when we look back we can freeze the picture and examine every detail, see many events that we missed during that fraction of a second when they occurred.

The Book of Books, the Bible, is an essential source for the whole world.

FOREWORD

Global climate change will increase the probability of extreme weather events, including heatwaves, drought, wildfire, cyclones, and heavy precipitation that could cause floods and landslides. Such events create significant public health needs that can exceed local capacity to respond, resulting in excess morbidity or mortality and in the declaration of disasters. Human vulnerability to any disaster is a complex phenomenon with social, economic, health, and cultural dimensions. Vulnerability to natural disasters has two sides: the degree of exposure to dangerous hazards (susceptibility) and the capacity to cope with or recover from disaster consequences (resilience). Vulnerability reduction programs reduce susceptibility and increase resilience. Susceptibility to disasters is reduced largely by prevention and mitigation of emergencies. Emergency preparedness and response and recovery activities, including those that address climate change, increase disaster resilience. Because adaptation must occur at the community level, local public health agencies are uniquely placed to build human resilience to climate-related disasters (1).

Global warming could increase the number and severity of extreme weather events. These events are often known to result in public health disasters, but we can lessen the effects of these disasters can be lessen. By addressing the factors that cause changes in climate, we can mitigate the effects of climate change. By addressing the factors that make society vulnerable to the effects of climate, we can adapt to climate change. To adapt to climate change, a comprehensive approach to disaster risk reduction has been proposed. By reducing human vulnerability to disasters, we can lessen and at times even prevent their impact. Human vulnerability is a complex phenomenon that comprises social, economic, health, and cultural factors. Because public health is uniquely placed at the community level, it has the opportunity to lessen human vulnerability to climate-related disasters. At the national and international level, a supportive policy environment can enable local adaptation to disaster events. The basic concept of disaster risk reduction can be applied to preventing and mitigating the negative effects of climate change and to examine the role of community-focused public health as a means for lessening human vulnerability and, as a result, the overall risk of climate-related disasters (2).

Forced separation from one's home may trigger emotional distress. People who remain in their homes may experience emotional distress due to living in a severely damaged environment. These people experience a type of 'homesickness' similar to nostalgia because the land around them no longer resembles the home they knew and loved. What they lack is solace or comfort from their home; they long for the home environment to be the way it was before. "Solastalgia" is a term created to describe feelings which arise in people when an environment changes so much that it negatively affects an individual's quality of life. Such changed environments may include drought-stricken areas and open-cut mines. How solastalgia, originally conceptualized as the result of man-made environmental change, can be similarly applied to the survivors of natural disasters? Using volcanic eruptions as a case example, people who experience a natural disaster are likely to suffer from solastalgia for a number of reasons, which may include the loss of housing, livestock and farmland, and the ongoing danger of living in a disaster-prone area. These losses and fears challenge people's established sense of place and identity and can lead to feelings of helplessness and depression (3).

The literature on the psychological consequences of sudden and violent losses, including disaster and military losses, and risk and resilience factors for grief and mental health and the effects and possible benefit of psychosocial interventions are described. There are gaps in the literature on grief and bereavement after sudden and violent deaths. Still, some preliminary conclusions can be made. Several papers show that a sudden and violent loss of a loved one can adversely affect mental health and grief in a substantial number of the bereaved. The prevalence of mental disorders such as PTSD, MDD, and PGD*, also termed complicated grief, varies widely, however, from study to study. Mental health disorders are more elevated after sudden and violent losses than losses following natural deaths, and the trajectory of recovery seems to be slower. Several factors related to the circumstances of the loss may put the bereaved at heightened risk for mental distress. These factors are possibly related to different outcomes; some increase the risk for PTSD, others for PGD. Given the special circumstances, bereavement following sudden and violent death may require different interventions than for loss from natural death (4).

*PGD. All Abbreviations – see page 140.

With a documented increase in average global surface temperatures of 0.6 degrees C since 1975, Earth now appears to be warming due to a variety of climatic effects, most notably the cascading effects of greenhouse gas emissions resulting from human activities. There remains, however, no universal agreement on how rapidly, regionally, or asymmetrically the planet will warm or on the true impact of global warming on natural disasters and public health outcomes. Most reports to date of the public health impact of global warming have been anecdotal and retrospective in design and have focused on the increase in heat-stroke deaths following heat waves and on outbreaks of airborne and arthropod-borne diseases following tropical rains and flooding that resulted from fluctuations in ocean temperatures. The effects of global warming on rainfall and drought, tropical cyclone and tsunami activity, and tectonic and volcanic activity will have far-reaching public health effects not only on environmentally associated disease outbreaks but also on global food supplies and population movements. As a result of these and other recognized associations between climate change and public health consequences, many of which have been confounded by deficiencies in public health infrastructure and scientific debates over whether climate changes are spawned by atmospheric cycles or anthropogenic influences, the active responses to progressive climate change must include combinations of economic, environmental, legal, regulatory, and, most importantly, public health measures (5).

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INTRODUCTION

The increase in the number of natural disasters and their effecting population is of growing concern to countries at risk and agencies involved in health and humanitarian action. The numbers of persons killed or disabled because of earthquakes, cyclones, floods and famines have reached record levels in the last decade. Population density, rampant urbanization and climatic changes have brought about risk patterns that are exposing larger and larger sections of populations in developing countries to life-threatening natural disasters. Despite substantial spending on emergency relief, the approaches to relief remain largely ad hoc and amateurish, resulting generally in inappropriate and/or delayed action. In recent years, mass emergencies experienced in Bangladesh or the Sahelian countries have highlighted the importance of rapid assessment of health needs for better allocation of resources and relief management. As a result, the development of techniques for rapid assessment of health needs has been identified as a priority for effective emergency action, including the health context of disasters in terms of mortality and morbidity patterns, initial assessment techniques used and their methodological biases and constraints, assessment needs which vary between different types of disasters and the time frame within which assessments are undertaken. Earthquakes, cyclones, famines, epidemics or refugees all have specific risk profiles and emergency conditions which differ for each situation. Vulnerability to mortality changes according to age and occupation, for earthquakes and famines. These risk factors then have significant implications for the design of rapid assessment protocols and checklists (1).

Since 1980, over 2 million people have died as an immediate result of natural and man-made disasters and by 1992, the refugee population registered nearly 16 million people. The human effect of disasters is a composite of 2 elements: the catastrophic event itself and the vulnerability of people. The specific case of women and children in the current world emergency context is also examined. Four broad policy areas that affect women and children in disaster situations are identified. The first policy area addresses humanitarian assistance and armed conflicts, and armed conflict and international humanitarian law, the use of food as instrument of war, mines and civilian disability, and rape and sexual violence. The second problem

is the issue of unaccompanied and abandoned children in terms of its magnitude and implications for relief response. Thirdly, the article examines the differential risks in emergencies for mortality and morbidity, specifically for women and children. Finally, it addresses certain policies and approaches to disaster rehabilitation which effectively mirror and reinforce inherent inequities in the affected society. The data indicate that: 1] the largest proportion of disaster victims today arise from civil strife and food crises and the majority of those killed, wounded and permanently disabled are women and children; and 2] the ability of any country to respond effectively to disasters depends on the strength of its health and social infrastructure, and its overall developmental status (2).

Disaster planning and response to a mass casualty incident pose unique demands on the medical community. Because they would be required to confront many casualties with bodily injury and surgical problems, surgeons in particular must become better educated in disaster management. Compared with routine practice, triage principles in disasters require an entirely different approach to evaluation and care and often run counter to training and ethical values. An effective response to disaster and mass casualty events should focus on an "all hazards" approach, defined as the ability to adapt and apply fundamental disaster management principles universally to any mass casualty incident, whether caused by people or nature. Organizational tools such as the Incident Command System and the Hospital Incident Command System help to effect a rapid and coordinated response to specific situations. The United States federal government, through the National Response Plan, has the responsibility to respond quickly and efficiently to catastrophic incidents and to ensure critical life-saving assistance. International medical surgical response teams are capable of providing medical, surgical, and intensive care services in austere environments anywhere in the world (3).

Cultural, ethical, and spiritual implications of disaster depend on various factors. The impact of a disaster on a particular culture depends on the people in that culture and the strength and resilience of the culture. Disasters may slow cultural development; however, typically the customs, beliefs, and value systems remain the same even if the outward expressions of culture change. Critical to survivors is the implication of aid that is culturally sensitive. Ethical questions and dilemmas associated with disasters and their

management is profound. Adhering to ethical principles does not solve all of the issues related to disaster management, but awareness of their utility is important. People affected by a disaster possibly are not be capable of responding to human rights violations, so it is the first responders who must be cognizant of their responsibility to protect the victims' dignity and rights. Ethical treatment of survivors entails a crucial blend of knowledge about ethnic culture, religious beliefs, and human rights. A strong awareness of ethical principles is merely a beginning step to well-informed decision making in disaster situations. The literature suggests that during a crisis, spirituality helps victims to cope. Important to any catastrophic event is the understanding that every disaster creates unique circumstances that require relief responses tailored to the specific situation (4).

Thus, the increase in the number of natural disasters and their effecting population is of growing concern. The numbers of persons killed or disabled because of earthquakes, cyclones, floods and famines have reached record levels in the last decade. Natural disasters result in excess morbidity or mortality. Human vulnerability to any disaster is a complex phenomenon involving social, economic, health, and cultural dimensions.

Are natural disasters described in the Bible? Were humans affected? How did humans respond to these calamities? How did they cope with these disasters? Are natural disasters widespread in contemporary times? What types of disasters are most common?

In order to answer these questions biblical texts were examined and verses in which humans were afflicted or coped with natural disasters were studied closely from a contemporary viewpoint. Since nuclear power plant disasters associated with modern technology usually affect human beings, coping with these disasters were also explored.

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THE BIBLICAL DESCRIPTIONS

NOAH'S ARK

Noah was the first Biblical character afflicted by a natural disaster. Noah was warned of the coming flood and told to construct the ark.

"I....do bring a flood of waters upon the earth, to destroy all flesh, wherein in the breath of life, from under heaven; and every thing that is in the earth shall die" (Genesis 6:17). Here, Noah is requested to build an ark:

"Make an ark of gopher wood; rooms shall thou make in the ark, and shalt pitch it within and without with pitch" (6:14) and to take "you shalt come into the ark, the sons, the wife, and his sons' wives" (6:18). So "And of every living thing of all flesh, two of every sort you shalt you bring into the ark, to keep them alive; they shall be male and female" (6:19).



The Building of Noah's Ark. A French master. 1675.

"And the flood was forty days upon the earth: and the waters increased, and bare up the ark, and it was lift up above the earth" (Genesis 7:17). Later, "...in the six hundredth and first years, on the first month, the first day of the month, the waters were dried up from off the earth: and Noah removed the covering of the ark, and looked, and behold, the face of the ground was dry" (8:13).

Thanks to the Ark, he and his family, as well as two of all other living creatures, survived the flood.



Noah's Ark. The American folk painter
Edward Hicks. 1846.

Afterwards, Noah planted a vineyard and become drunk from wine (1-2): *"Noah began to be a husband, and he planted a vineyard. And he drank of the wine, and he was uncovered within his tent"* (Genesis 9:20,21).

Is there any evidence for floods? The flood of Noah was a Euphrates River flood in southern Sumer similar to the flood of 1954 in southern Iraq. The "earth" in Genesis 7:17-18 refers to the ground/land in the flooded region, not the entire planet (3).

The Euphrates River flooded about 2900 BC at the end of the Jemdet Nasr period and the beginning of the Early Dynastic period. This river flood left a few feet of yellow mud in Shuruppak and a few other Sumerian cities. Polychrome pottery from the Jemdet Nasr period was found immediately below this flood layer. Hence Noah/Ziusudra reigned during the end of the Jemdet Nasr period. The flood layer has been radiocarbon dated to 2900 BC (3).

The ark being afloat throughout the flood and subsequent receding of the waters before it came to rest on the Mountains of Ararat (4).

ASSESSMENT: the Bible gives us a precise description of the flooding and how Noah and his family, and the other living beings survived in the Ark.

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DESTRUCTION OF SODOM AND GOMORRAH

The destruction of Sodom and Gomorrah by earthquake was a devastating event. One day Lot was instructed to leave: *"..get you up of this place; for the Lord will destroy this city. Arise, take your wife, and the two daughters. Then the Lord rained upon Sodom and upon Gomorrah brimstone and fire from the Lord out of heaven. And he overthrew those cities, and all the plain, and all the inhabitants of the cities, and that which grew upon the ground. While "the smoke of the country went up as the smoke of furnace" (Genesis 19:14,15,24,25,28).*



Lot's and his daughters. Orazio Lomi Gentileschi (1563–1639).

"And Lot went up put of Zoar, and dwelt in the mountain, and his two daughters with him: and he dwelt in a cave, he and his two daughters"(19:30). Later, "And the first-born said unto the younger: Our father is old, and there is not a man on earth to come unto us after the manner of all the earth. Come let us make our father drink wine and we will lie with him, that we may preserve seed of our father. And they made their father drink wine that night. And the first-born went in and lay with her father; and he knew not when she lay down nor when she arose. And it came to pass on the morrow that the first-born said unto the younger: Behold I lay yesternight with my father. Let us make him drink wine this night also, and go thou in and lie with him, that we may preserve seed of our father. And they made their father drink wine that night also. And the younger arose and lay with him; and he knew not when she lay down nor when she arose. Thus were both the daughters of Lot with child by their father. And the first-born bore a son and called his name Moab – and he is father of the Moabites to this day. And the younger also bore a son and

called his name Ben-Ami, and he is father of the children of Ammon to this day" (Genesis 19:31-37).

The Moabites are descended from Lot. His older daughter called her son "Moab", meaning "born to the father". In the book of Ruth it is mentioned that King David was descended from Ruth the Moabite who became Jewish. Ben-Ami, the name of Lot's second son from his younger daughter, was the ancestor of the Ammonites. The name indicates that their origins involve incest (1-3).



Lot and his daughters

ASSESSMENT: Lot's and his daughters story shows that even in desperate situations such as destructive earthquakes, human can survive. In this case, Lot and his daughters escaped by fleeing the devastating area. Subsequently in order to continue the human race, Lot's daughters gave birth by incest to two boys.

There is an example in the Bible of how people can escape simply by leaving the earthquake zone.

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EARTHQUAKE IN THE WILDERNESS

This occurs in the story of Korah and his supporters who rebelled against Moses. The biblical verses indicate a terrible earthquake: "... the earth opened her mouth, and swallow them up (Korah and his supporters), with all that appertain unto them, and they go down alive into the pit. And the earth opened her mouth, and swallowed them up, and their homes, and all the men that appertained unto Korah, and all their goods. They, and all that appertained to them, went down alive into the pit, and earth closed upon them: and they perished from among the congregation. ..all Israel that were round about them fled at the city of them: for they said: Lest the earth swallow us up also.. And there came out a fire ..., and consumed two hundred and fifty men..." (Numbers 16:30,32-35).



Death of Korah, Datan and Abiram. Gustave Doré.

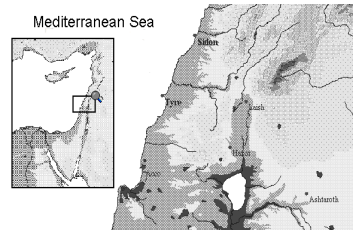
ASSESSMENT: the biblical verses indicate that there was a devastating earthquake in the wilderness, in which 245 men perished. However, those who fled survived.

DEVASTATION OF TYRE

These verses predict an earthquake of a devastating trading city, Tyre "And they shall take up a lamentation for thee, and say to thee, How art thou destroyed, that was peopled from the seas, the renowned city, which was strong in the sea, she and her inhabitants, which cause their terror to be on all that haunt it! Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure" (Ezekiel 26:17,18). The sailors and captains of the sea will mourn about their fallen city. "... in their wailing they shall take up a lamentation for them, and lament over them, saying What city is like Tyrus, like the destroyed in

the midst of the sea? When the wares went forth out the seas, thou didst fill many people; thou didst enrich the kings of the earth with the multitude of the riches of the merchandise. In the time when you shall be broken by the seas in the depths of the waters; the merchandise and all the company are fallen in the midst" (Ezekiel 27:32-34).

"You has defiled the sanctuaries by the multitude of the iniquities, by the inequity of the traffic; therefore I bring forth a fire from the midst of them, is shall devour them, and I will bring them to the ashes upon the earth in the sight of all them that behold them" (28:18).



Many people perished in this calamity. How did survivors manage to cope? *"And they shall take up a lamentation for thee, and say to thee, How art thou destroyed, that was peopled from the seas, the renowned city, which was strong in the sea, she and her inhabitants, which cause their terror to be on all that haunt it! Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure. ...the noise of the songs to cease; and the sound of the harps shall be no more heard" ((Ezekiel 26:13,17,18).* In this situation, people should mourn together for the destroyed city: *".. the mariners, and all the pilots of the sea, shall come down from their ships, they shall stand upon the land (27:29). and shall cry bitterly, and shall cast dust upon their heads, they shall wallow themselves in the ashes" (27:30).* Later, *" And they shall dwell safely therein, and shall build houses, and plant vineyards; . they shall dwell with confidence" (28:26).*

These verses show that after the destruction, singing and playing of harps had to stop as a sign of mourning. Perhaps the people found grieving together helped them to overcome their terrible losses. Eventually they will recover; they will re-build their destroyed houses and plant vineyards. This is the power of the continuation of life.

ADDITIONAL EARTHQUAKES

"And there was a trembling in the camp, in the field, and among all the people. Even the garrison and the raiders trembled, and the earth quaked so that it became a great trembling" (1 Samuel 14:15). This earthquake involved the land and the people. No fatalities are reported for this earthquake.

The following verses show that *"In that day there shall be a great shaking in the land of Israel. So that the fishes of the sea, and the birds of the sky, and the beasts of the field, and creeping things that creep upon the earth, and all the men, that are upon the face of the earth, shall shake ... and the mountains shall be thrown down, and the steep places shall fall, and every wall shall fall to the ground"* (Yehezkel 38:19,20). These verses predict a severe earthquake that will afflict the land, and living things. No fatalities are noted.

EVIDENCE FOR EARTHQUAKES

The Holy Land is a region where earthquakes occur frequently. By one means or another, big earthquakes have been documented in the Holy Land for a period exceeding 4,000 years. Many are known from history and literature, especially the Bible. Holy Land earthquakes are also evidenced from archaeological excavations. No other region of the earth has such a long and well-documented chronology of big earthquakes (1).

Geologists have investigated the 4,000-year chronology of earthquake disturbances within the uppermost 19 feet of laminated sediment of the Dead Sea (2). Hypersaline waters preserve seasonally laminated sediment because organisms cannot live or burrow in the bed of the lake. As a result, only a nearby earthquake (or very large distant earthquake) can homogenize the lake's uppermost sediment layers, producing a "mixed layer" devoid of laminations (3).

A sketch of a sediment core from the west side of the Dead Sea appears in Figure 1. The sketch shows the depth of the "mixed layers" within the laminated sediment sequence (4).

Two deeper mixed layers in the Dead Sea are datable from historical, archaeological, and geological associations with faulting - the earthquakes of 31 B.C. (the Qumran earthquake) and 750 B.C. (Amos' earthquake). Other earthquakes are represented in the Dead

Sea sediment core with dates approximated by assuming a steady rate of sedimentation (3).

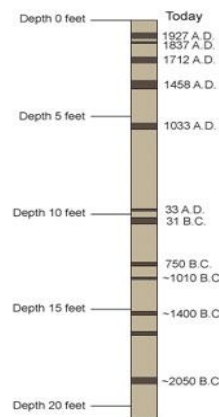


Figure 1. Dead Sea Sediment Core, shoreline at En Gedi

Of the five “cities of the plain” (Genesis 13:12; 14:8), only Zoar is described as surviving the catastrophe. Zoar is the site to which Lot and his family fled with the approval of the angels (Genesis 19:20-23). As a city, it flourished through the time of Moses and the kings of Israel, even being described as a city of the region of Moab by the prophets (Deuteronomy 34:1-3; Isaiah 15:5; Yermiah 48:34). Arab historians in the Middle Ages refer to Zoar and identify the city as modern Safi southeast of the Dead Sea in Jordan. Because Lot and his family made the journey by foot in just a few hours (Genesis 19:15, 23), Sodom must be less than about 20 miles from Zoar (modern Safi). Two Early Bronze Age archaeological sites southeast of the Dead Sea (Bab edh-Dhra and Numeira) reveal evidence of catastrophic collapse and burning along the eastern border fault of the Dead Sea Transform Fault. These two sites are likely the remains of Sodom and Gomorrah. A thick disturbed zone within the Dead Sea sediment core, assignable to the Sodom and Gomorrah event, occurs at a depth of about 18.5 feet (3).

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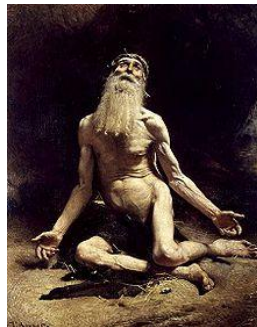
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JOB

This is the story of JOB: *"There was a man in the land of UZ, whose name was JOB; and that man was perfect and upright.."* (The Book of Job: 1:1). JOB had *".... seven sons and three daughters"* (1:1). He was rich *"And his possessions also was seven thousand sheep, and three thousand camels, and five hundred yoke of oxen, and five hundred she asses, and very many servants; so that this man was the greatest of all men of the east"* (1:3). One day *"And there came a messenger unto JOB ..."* (1:14). This messenger told that *"..the Sabeans fell upon them, and took them away; and slew the servants with the edge of the sword... While he was yet speaking, there came also another, and said, The fire of God has fallen from heaven, and has burned up the sheep, and the servants, and consumed them..... While he was yet speaking, there came also another, and said, The Chaldeans formed three bands, and fell upon the camels, and have carried them away, and slain the servants with the edge of the sword..."* (1:15-17).



Portrait of JOB. Bonnat.

Subsequently, *"While he was yet speaking, there came also another, and said, The sons and the daughters were eating and drinking wine in their eldest brother's house. And behold, there came a great wind from across the wilderness, and smote the four corners of the house, and it fell upon the young men, and they are dead...(1:18,19).* In addition, *".....the adversary... smote JOB with vile sores from the sole of his foot to his crown"* (2:7). Following all these disasters, *"Only his flesh upon him had pain, and his*

soul within him mourned" (14:22). After all these calamities: *"Then JOB arose, and rent his coat and shaved his head, and fell down upon the ground, and prostrated himself"* (1:20).

Here *"....when JOB's three friends heard of all this evil that was come upon him, they came every one from his own place.... for they had made an appointment together to come to mourn with him and to comfort him....they lifted up their voice, and wept; and they rent every one his coat, and sprinkled dust upon their heads toward heaven. So they sat down with him upon the ground seven days and seven nights, and none spoke a word unto him: for they saw that his suffering was very great"* (2:11-13).

After some time, JOB became a rich man having *"....fourteen thousand sheep, and six thousand camels, and a thousand yoke of oxen, and a thousand she asses"* (42:12). Once again, a family was formed *"He had also seven sons and three daughters"* (52:13). *"After this lived JOB a hundred and forty years, and saw his sons, and his son's, even four generations"* (42:15).

In spite of all these calamities, JOB recovered and regained his property and built a new family with sons and daughters. His life span was indeed long, indicating that he was a happy man with many children, grandchildren and great-grand children (1).



Job with his friends. Gerard Seghers.

ASSESSMENT: we see that a variety of disasters affected JOB. His cattle – dozens of sheep, camels, and oxen were slaughtered, and many of his servants were killed. In addition, his family including his sons and daughters perished. After all these calamities, Job remained alone having lost all his property and his family. Fortunately, JOB had friends who supported him. The support of JOB's friends helped him to cope with all the calamities that afflicted him. This support shows the psychotherapeutic effect of close friends.

JOB's case illustrates that even in desperate situations, human can re-build their lives.

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NATURAL DISASTERS

DEVASTATING FLOODS

Floods are the most common type of disaster globally, responsible for almost 53,000 deaths in the last decade alone (23:1 low vs. high-income countries). Recent epidemiological evidence on the impacts of floods on human health was assessed. Published articles (2004-2011) on the quantitative relationship between floods and health systematically reviewed identified 35 relevant epidemiological studies. Health outcomes were categorized into short- and long-term and were found to depend on the flood characteristics and people's vulnerability. Long-term health effects are currently not well understood. Mortality rates increase by up to 50% in the first year post-flood. After floods, there is an increased risk of disease outbreaks such as hepatitis E, gastrointestinal disease and leptospirosis, particularly in areas with poor hygiene and displaced populations. Psychological distress in survivors (prevalence 8.6% to 53% 2 years post-flood) can also exacerbate their physical illness. There is a need for effective policies to reduce and prevent flood-related morbidity and mortality. Such steps are contingent upon the improved understanding of potential health impacts of floods. Global trends in urbanization, burden of disease, malnutrition and maternal and child health must be better reflected in flood preparedness and mitigation programs (1).

Globally, floods are the most common and the most devastating of natural disasters. Natural disasters such as floods affect local businesses, increase local unemployment by up to 8.2%. Previous research has linked individual losses from disasters with symptoms such as PTSD. University students, who are often living far away from family support structures and have limited resources, possibly are particularly vulnerable. Students' psychological health following a large flood was examined at a university. Students who experienced

flood-related job loss or disruption had a higher proportion of psychological symptoms than those who did not experience job loss or disruption, controlling for individual loss such as injury, home loss or evacuation. On June 8, 2008, a major flood affected 7 U.S. Midwestern states. Two dozen people were killed and 148 injured, although no deaths or serious injuries were reported in the population used for this study. At the study, university operations were closed for 1 week, and 20 buildings were severely damaged. A cross-sectional survey of all students enrolled during the semester of the flood was conducted. Students sent an online survey 6 weeks after the flood. In addition to questions about damage to their homes, the survey asked students if their work was disrupted because of the floods. Symptoms of PTSD were measured through the modified Child PTSD Symptom Scale. Of the 1,231 responding students with complete surveys, 667 (54.2%) reported that their work was disrupted due to the floods. Controlling for gender, ethnicity, grade, and damage to the student's home, students reporting work disruption were more than 4 times more likely to report PTSD symptoms (95% CI 2.5-8.2). Work disruption was independently associated with decreases in general mental and physical health following the floods, as well as with increases in alcohol use. The data indicate that individuals who lose their jobs are a vulnerable population post-disaster (2).



Floods are the most common type of global natural disaster. Floods have a negative impact on mental health. Available scientific evidence on mental health impacts of floods caused by extended periods of heavy rain in river catchments was reviewed. A systematic mapping review of published scientific literature was conducted in five languages for mixed studies on floods and mental health.

PUBMED and Web of Science were searched to identify all relevant articles from 1994 to May 2014 (no restrictions). The electronic search strategy identified 1331 potentially relevant papers. Finally, 83 papers met the inclusion criteria. Four broad areas are identified: 1] the main mental health disorders - PTSD, depression and anxiety; 2] the factors associated with mental health among those affected by floods; 3] the narratives associated with flooding, which focuses on the long-term impacts of flooding on mental health as a consequence of the secondary stressors; and 4] the management actions identified. The quantitative and qualitative studies have consistent findings. However, very few studies have used mixed methods to quantify the size of the mental health burden as well as exploration of in-depth narratives. Floods following extreme events were excluded from the review. The findings show that although the level of exposure to floods has been systematically associated with mental health problems, the paucity of longitudinal studies and lack of confounding controls precludes strong conclusions (3).

The scientific and engineering understanding of various types of inland and coastal flooding was reviewed by considering the different causes and dynamic processes involved, especially in extreme events. Clear progress has been made in the accuracy of numerical modeling of meteorological causes of floods, hydraulics of flood water movement and coastal wind-wave-surge. Probabilistic estimates from ensemble predictions and the simultaneous use of several models are recent techniques in meteorological prediction that could be considered for hydraulic and oceanographic modeling. The contribution of remotely sensed data from aircraft and satellites is also considered. The need to compare and combine statistical and computational modeling methodologies for long range forecasts and extreme events is emphasized, because this has become possible with the aid of kilometer scale computations and network grid facilities to simulate and analyze time-series and extreme events. Despite the adverse effects of climatic trends on flooding, appropriate planning of rapidly growing urban areas could mitigate some of the worst effects. However, resources for flood prevention, including research, have to be considered in relation to those for other natural disasters. Policies have to be relevant to the differing geology, meteorology and cultures of the countries affected (4).

Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide. Risk of catastrophic

losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores. The impact of flood events on human populations was examined in terms of mortality, injury, and displacement and, to the extent possible, risk factors associated with these outcomes were identified. Data on the impact of floods were compiled using 2 methods, a historical review of flood events from 1980 to 2009 from multiple databases and a systematic literature review of publications ending in October 2012. There were 539,811 deaths (range: 510,941 to 568,680), 361,974 injuries and 2,821,895,005 people affected by floods between 1980 and 2009. Inconsistent reporting suggests this is an underestimate, particularly in terms of the injured and affected populations. The primary cause of flood-related mortality is drowning; in developed countries a motor vehicle and male gender are associated with increased mortality, whereas female gender is linked to higher mortality in low-income countries. The data show that expanded monitoring of floods, improved mitigation measures, and effective communication with civil authorities and vulnerable populations has the potential to reduce loss of life in future flood events (5).

The long term psychological effect of the distress and trauma caused by the memory of damage and losses associated with flooding of communities remains an under researched impact of flooding. This is particularly important for communities that are likely to be repeatedly flooded where levels of mental health disorder will damage long term resilience to future flooding. There are a variety of factors that affect the prevalence of mental health disorders in the aftermath of flooding including pre-existing mental health, socio-economic factors and flood severity. However, previous research has tended to focus on the short term impacts immediately following the flood event and much less focus has been given to the longer terms effects of flooding. Understanding of factors affecting the longer term mental health outcomes for flooded households is critical in order to support communities in improving social resilience. Hence, the characteristics associated with psychological distress and mental health deterioration were explored over the longer term. Responses from a postal survey of households flooded during the 2007 flood event across England were examined. Household characteristics, flood event characteristics and post-flood stressors and coping strategies were related to reported measures of stress, anxiety,

depression and mental health deterioration. The results showed that household income, depth of flooding; having to move out during reinstatement and mitigating actions are related to the prevalence of psycho-social symptoms in previously flooded households. In particular, relocation and household income were the most predictive factors. The practical implication of these findings for recovery after flooding are: to consider the preferences of households in terms of the need to move out during restorative building works and the financial resource constraints that may lead to severe mental hardship. The findings suggest that support with installing mitigation measures may lead to improved mental health outcomes for communities at risk (6).

Coastal storms can take a devastating toll on the public's health. Urban areas like New York City possibly is particularly at risk, given their dense population, reliance on transportation, energy infrastructure that is vulnerable to flood damage, and high-rise residential housing, which may be hard-hit by power and utility outages. Climate change will exacerbate these risks in the coming decades. Sea levels are rising due to global warming, which will intensify storm surge. These projections make preparing for the health impacts of storms even more important. A broad review of the health impacts of U.S. coastal storms was conducted to inform climate adaptation planning efforts, with a focus on outcomes relevant to New York City and urban coastal areas, and incorporated some lessons learned from recent experience with Superstorm Sandy. Based on the literature, indicators of health vulnerability were selected and mapped within New York City neighborhoods. Preparing for the broad range of anticipated effects of coastal storms and floods may help reduce the public health burden from these events (7).

In the 50 years since the catastrophic southern North Sea storm surge of 31 January-1 February 1953, there have been technological advances in the engineering of flood protection, increased understanding of physical processes in shallow seas and estuaries, and developments in the mathematical statistics of extreme events. This introductory paper reviews how the scientific understanding of surge events, their impacts and the human responses to them is evolving on many fronts, often across disciplinary boundaries. The question of how the long-term nature of the problem itself will be

influenced by possible climate, land use and policy changes is addressed, along with their associated uncertainties (8).

Framed by a previously established conceptual model of youths' PTS responses following a disaster, the current longitudinal study examined the relation of predisaster child characteristics (age, gender, depressive symptoms, and ruminative coping), predisaster environmental characteristics (negative life events and supportive and negative friendship interactions), and level of disaster exposure to youths' PTS symptoms in the wake of a natural disaster. Prior to the 2010 Nashville, Tennessee, flood, 239 predominantly Caucasian youth from four elementary and middle schools (ages = 10-15 years, 56% girls) completed measures of depressive symptoms, rumination, negative life events, and social support in the form of both supportive and negative friendship interactions. Approximately 10 days after returning to school, 125 completed measures of disaster exposure and postflood PTS symptoms. Disaster-related PTS symptoms were unrelated to age, gender, or predisaster supportive friendship interactions and significantly positively related to level of disaster exposure and predisaster levels of negative life events, depressive symptoms, rumination, and negative friendship interactions. After controlling for level of disaster exposure and other predisaster child and environmental characteristics, depressive symptoms and negative friendship interactions predicted postdisaster PTS symptoms. The effect of child's flood-related experiences on PTS symptoms was not moderated by any of the preexisting child characteristics or environmental indicators. Faced with limited resources after a natural disaster, school counselors and other health professionals should focus special attention on youths who experienced high levels of disaster-related losses and whose predisaster emotional and interpersonal lives were problematic (9).

Probabilistic catastrophe loss modeling techniques, comprising a large stochastic set of potential storm-surge flood events, each assigned an annual rate of occurrence, have been employed for quantifying risk in the coastal flood plain of eastern England. Based on the tracks of the causative extratropical cyclones, historical storm-surge events are categorized into three classes, with distinct windfields and surge geographies. Extreme combinations of "tide with surge" are then generated for an extreme value distribution developed for each class. Fragility curves are used to determine the probability and magnitude of breaching relative to water levels and

wave action for each section of sea defence. Based on the time-history of water levels in the surge, and the simulated configuration of breaching, flow is time-stepped through the defences and propagated into the flood plain using a 50 meters horizontal-resolution digital elevation model. Based on the values and locations of the building stock in the flood plain, losses are calculated using vulnerability functions linking flood depth and flood velocity to measures of property loss. The outputs from this model for a U.K. insurance industry portfolio include "loss exceedence probabilities" as well as "average annualized losses", which can be employed for calculating coastal flood risk premiums in each postcode (10).

The summer of 2007 was the wettest in the U.K. since records began in 1914 and resulted in severe flooding in several regions. A health impact assessment was carried out using population-based surveys to assess the prevalence of and risk factors for the psychosocial consequences of this flooding in the U.K. Surveys were conducted in two regions using postal, online, telephone questionnaires and face-to-face interviews. Exposure variables included the presence of flood water in the home, evacuation and disruption to essential services (incident management variables), perceived impact of the floods on finances, house values and perceived health concerns. Validated tools were used to assess psychosocial outcome (mental health symptoms): psychological distress (GHQ-12), anxiety (GAD-7), depression (PHQ-9) and probable PTSD (PTSD checklist-shortform). The prevalence of all mental health symptoms was two to five-folds higher among individuals affected by flood water in the home. People who perceived negative impact on finances were more likely to report psychological distress (OR 2.5, 1.8-3.4), probable anxiety (OR 1.8, 1.3-2.7) probable depression (OR 2.0, 1.3-2.9) and probable PTSD (OR 3.2, 2.0-5.2). Disruption to essential services increased adverse psychological outcomes by two to three-folds. Evacuation was associated with some increase in psychological distress but not significantly for the other three measures. The findings indicate that the psychosocial and mental health impact of flooding is a growing public health concern and improved strategies for minimizing disruption to essential services and financial worries need to be built in to emergency preparedness and response systems. Public Health Agencies should address the underlying predictors of adverse psychosocial and mental health

when providing information and advice to people who are or are likely to be affected by flooding (11).

A range of symptoms results from exposure to natural disasters such as flooding. Among these consequences, individuals may experience symptoms of PTSD, depression and anxiety. The psychological impact of flooding in the U.K. was examined. A cross-sectional survey was used to investigate the psychological symptoms associated with the aftermath of the flood amongst adults living in the affected communities. A questionnaire battery including the Harvard Trauma Questionnaire (trauma and symptoms associated with PTSD), Hopkins Symptom Checklist (anxiety and depression), Coping Strategies Questionnaire and a range of questions addressing sociodemographic characteristics and factors relating to the flood was administered to households in flood-affected areas. Four hundred and forty four completed questionnaires were returned. Of participants, 27.9% met criteria for symptoms associated with PTSD, 24.5% for anxiety and 35.1% for depression. Females had higher mean scores on PTSD, anxiety and depression than males. Most frequently reported coping strategies were rational, detached and avoidant, with the least frequent being emotional coping. Having to vacate home following flood, previous experience of flooding and poor health were associated with greater psychological distress. Detached coping appeared to be related to less distress. Although it is impossible to determine whether the symptoms were a direct consequence of the flood, symptoms of distress is a significant issue amongst communities affected by environmental events warranting further attention to prevent chronic distress (12).

Urban slums are hostile environments for the growth of infants and young children. Flooding is a hazard commonly found in Dhaka slums (Bangladesh) which negatively impacts infants and young children's nutritional and health status. The impact of flooding on infants and young children's feeding practices was identified, and the coping strategies developed by caregivers were explored. Qualitative data (participant observation and semi-structured interviews) and quantitative data (household questionnaire and anthropometric measurements) collected in slums in Dhaka (n=18 mothers, n=5 community health workers, and n=55 children) were analyzed. The subjects of the interviews were mothers and Bangladesh Rural Advancement Committee community health workers living and working in the slums. Research findings showed that breastfeeding

and complementary feeding practices for infants and young children were poor and inappropriate due to lack of knowledge, time, and resources in normal times and worse during flooding. One coping strategy developed by mothers purposely to protect their infants and young children's nutritional status was to decrease their personal food intake. The findings suggest that mothers perceived the negative impact of flooding on their infants and young children's nutritional health but did not have the means to prevent it. They could only maintain their health through coping strategies which had other negative consequences. The results suggest a holistic approach combining 1] provision of relief for nutritionally vulnerable groups during flooding, 2] support to mothers in their working role, 3] breastfeeding counseling and support to lactating mothers with difficulties, and 4] preventing malnutrition in under 2 year old children (13).

The long-term prognosis and influence of social support and coping style of patients with PTSD were explored after suffering from floods. Patients suffered PTSD due to Dongting lake flood in 1998 were selected through cluster random sampling. PCL-C was used to examine and diagnose the participants in this study. PTSD was then evaluated by the SSRS and the SCSQ. Among all the 120 subjects, 14(11.67%) of them were diagnosed as having PTSD. Compared with the rehabilitation group, scores on subjective support, objective support, total social support and positive coping, total of coping style from the non-rehabilitation group all appeared significant low ($p < 0.05$). Data from the multivariate logistic regression showed that social support (OR 0.281, 95% CI 0.117-0.678) and coping style (OR 0.293, 95% CI 0.128-0.672) were protective factors of the chronic PTSD after the floods while disaster experience (OR 1.626, 95% CI 1.118-2.365) appeared as a risk factor. The data indicate that chronic PTSD developed after the floods called for attention. Better social support, positive coping style could significantly improve the long-term prognosis of patients with PTSD after the floods (14).

The prevalence and determinants of chronic PTSD among flood victims was explored. A cross-sectional survey was carried out in 2014 among individuals who had experienced the 1998 floods and had been diagnosed with PTSD in 1999 in Hunan, China. Cluster sampling was used to select subjects from the areas that had been surveyed in 1999. PTSD was diagnosed according to DSM-IV criteria, social support was measured according to a Social Support Rating

Scale, coping style was measured according to a Simplified Coping Style Questionnaire, and personality was measured by use of the revised Eysenck Personality Questionnaire Short Scale for Chinese. Data were collected through face-to-face interviews by use of a structured questionnaire. A total of 123 subjects were interviewed, 17 of whom (14.4%) were diagnosed with chronic PTSD that was significantly associated with disaster stressors (OR 1.74, 95% CI 1.22-2.47), nervousness (OR 1.09, 95% CI 1.01-1.17), and social support (OR 0.85; 95 CI%, 0.74-0.98). The data indicate that chronic PTSD in flood victims is significantly associated with disaster stressors, nervousness, and social support. These factors may play important roles in identifying persons at high risk of chronic PTSD (15).

Floods adversely affect community well-being and health. The present health vulnerability of households to floods in a rural flood-prone area of northeastern Thailand and their adaptation measures were assessed. The participants were the representatives of 312 randomly selected households, and data were collected using an interview questionnaire. Health vulnerability was assessed in terms of flood exposure, flood sensitivity, and flood adaptive capacity. The results showed that 47.1% of the households had a low level of health vulnerability to flooding, while in 21.2% the level was high. Households had been adapting themselves to cope with the health impacts from flood. Their coping practices included special arrangements for the protection of property, food management, the provision of water supply and waste disposal, the elimination of sources of vector-borne diseases, family health care, the protection of family livelihood, and communication and transportation (16).

About 7000 Swedish citizens were on Christmas holiday in the disaster area at the time of the South-east Asian tsunami in 2004, in many cases with children and adolescents in their families. Experience of a traumatic exposure to a natural disaster was investigated in adolescents. Twenty adolescents aged 16-19 years, who had experienced the 2004 tsunami and participated in a follow-up study 19 months post-disaster, were randomly selected and interviewed about their reactions, their life afterwards and their families. The face-to-face, semi-structured interviews were combined with questionnaire data on mental health for 4910 Swedish adolescents and adults. The themes that emerged inductively during the analysis of the interviews were psychological reactions during the catastrophe, the coping after, changes in self-image, worldview, role

in the family, risk interpretation and altruism. The disaster had profound impact on family relations, social networks and plans for the future. Many felt strengthened by the experience and by their ability to cope in comparison with other family members, but also perceived isolation and lack of understanding. The general mental health status among the adolescents did not differ significantly from those of older age at the 19-month follow-up. The data indicate that according to the adolescents', they experienced the tsunami-disaster differently than others around them. Their subjective interpretation of the event and its aftermath indicates resilience, especially among the young men (17).

The immediate impact of a recurrent flood on mental health and functioning among an affected population in the rural district of Bahraich, Uttar Pradesh, India, was compared with a population in the same region that is not affected by floods. A total of 318 affected respondents were compared with 308 individuals who were not affected by floods. Symptoms of anxiety and depression were assessed by the HSCL-25. Psychological and physical functioning was assessed by using the Short Form-12 (SF-12). The affected group showed large to very large differences with the comparison group on symptoms of anxiety ($D = .92$) and depression ($D = 1.22$). The affected group scored significantly lower on psychological and physical functioning than the comparison group (respectively $D = .33$ and $D = .80$). However, hierarchical linear regressions showed insignificant relationship between mental health and the domains of functioning in the affected group, whereas mental health and the domains of functioning were significantly related in the comparison group. The data indicate a large negative impact of the recurrent floods on mental health outcomes and psychological and physical functioning. However, in a context with recurrent floods, disaster mental health status is not a relevant predictor of functioning. The observed mental health status and impaired functioning in this context are also outcomes of another mechanism: both outcomes are likely to be related to the erosion of the social and environmental and material context. As such, the findings refer to a need to implement psychosocial context-oriented interventions to address the erosion of the context rather than specific mental health interventions (18).

Vietnam is one of the most disaster-prone countries in the world. The country suffers from many kinds of natural disasters, of which

the most common and serious one is flooding. Long and heavy rainfall during the last days of October and the first week of November 2008 resulted in a devastating flood unseen for over 3 decades in the capital city of Hanoi. It caused a substantial health impact on residents in and around the city and compromised the capacity of local health services. The vulnerability and health impacts of the devastating flood in Hanoi were assessed by identifying the differences in mortality, injuries, and morbidity patterns (dengue, pink eye, dermatitis, psychological problems, and hypertension) between flood affected and non-affected households. A cross-sectional study was carried out involving 871 households in 4 selected communes (2 heavily flood affected and 2 comparatively less affected) from 2 severely flooded districts of Hanoi. Participants were interviewed and information collected on the social, economic, and health impacts of the devastation within 1 month after the flood. The self-reported number of deaths and injuries reported in this study within 1 month after the heavy rainfall were higher in severely affected communes as compared to the less affected communes. The findings showed higher incidences of dengue fever, pink eye, dermatitis, and psychological problems in communes severely affected by flood as compared to the controlled communes. The data indicate that for people in flood prone areas flood prevention and mitigation strategies need to be seriously thought through and acted upon, as these people are exposed to greater health problems such as psychological issues and communicable diseases such as pink eye or dermatitis (19).

An outbreak of acute viral hepatitis is described among children in a flood rescue camp at Rudraprayag district of Uttarakhand State, India. In May 2013, there was a disastrous natural calamity, the Himalayan Tsunami in Himalayan and Sub-Himalayan region of Uttarakhand. More than 5700 people were feared dead, and thousands were sheltered in different rescue camps. A linkage was hypothesized between the infected individuals and the common water sources feared of being contaminated faecally. Etiological agent of the present outbreak was hepatitis A virus that is emerging in an outbreak form in India, emphasizing a need for formulating mandatory vaccination and proper control strategies (20).

Cholera is often caused when drinking water is contaminated through environmental sources. In recent years, the drastic cholera epidemics in Odisha (2007) and Haiti (2010) were associated with

natural disasters (flood and Earthquake). Almost every year the state of Assam India witnesses flood in Brahmaputra River valley during reversal of wind system (monsoon). This is often followed by outbreak of diarrheal diseases including cholera. Beside the incidence of cholera outbreaks, there is lack of experimental evidence for prevalence of the bacterium in aquatic environment and its association with cholera during/after flood in the state. A molecular surveillance during 2012-14 was carried out to study prevalence, strain differentiation, and clonality of *Vibrio cholerae* in inland aquatic reservoirs flooded by Brahmaputra River in Assam. Water samples were collected, filtered, enriched in alkaline peptone water followed by selective culturing on thiosulfate bile salt sucrose agar. Environmental isolates were identified as *Vibrio cholerae*, based on biochemical assays followed by sero-grouping and detailed molecular characterization. The incidence of the presence of the bacterium in potable water sources was higher after flood. Except one O1 isolate, all of the strains were broadly grouped under non-O1/non-O139 whereas some of them did have cholera toxin. Haitian *ctxB* in two non-O1/non-O139 strains was detected. MLST analyses based on *pyrH*, *recA* and *rpoA* genes revealed clonality in the environmental strains. The isolates showed varying degree of antimicrobial resistance including tetracycline and ciprofloxacin. The strains harbored the genetic elements SXT constins and integrons responsible for multidrug resistance. Genetic characterization is useful as phenotypic characters alone have proven to be unsatisfactory for strain discrimination. An assurance to safe drinking water, sanitation and monitoring of the aquatic reservoirs is of utmost importance for combating the impending epidemic threat in the flood affected areas. The management of flood through multi-prong approaches and sustainable utilization of environmental resources would be effective in disease management (21).

ASSESSMENT: floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide, affecting local businesses, increasing local unemployment, and work disruption. Risk of catastrophic losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores.

There is a large negative impact of the recurrent floods on mental health outcomes and psychological and physical functioning. The

psychosocial and mental health impact of flooding is a growing public health concern and improved strategies for minimizing disruption to essential services and financial worries need to be built. A range of symptoms from exposure to natural disasters include PTSD, depression and anxiety. Psychological problems affect individuals in communes severely affected by flood, and can exacerbate their physical illness.

After floods, there is an increased risk of disease outbreaks such as hepatitis A, hepatitis E, cholera, gastrointestinal diseases and leptospirosis, dengue fever, pink eye, and dermatitis particularly in areas with poor hygiene and displaced populations,

Thus, floods have affected humans throughout their long existence. Except for Noah, there are no accounts of using large boats or ships in order to survive.

The Bible describes precisely the flooding that covered the whole earth and how one family managed to escape the devastation. Noah was the only human in the biblical history who built a Huge ARK so that he and his family, along with a pair of all living creatures survived.

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DISASTROUS EARTHQUAKES

Population growth and increasing urbanization in earthquake-prone areas suggest that earthquake impacts on human populations will increase in the coming decades. Recent large earthquakes affecting large populations in Japan, Haiti, Chile and New Zealand are evidence of this trend that illustrates significant variations in outcomes such damage and mortality levels. The impact of earthquakes on human populations in terms of mortality, injury and displacement were described and, to the extent possible, risk factors associated with these outcomes were identified. This is 1 of 5 reviews on the human impact of natural disasters. Data on the

impact of earthquakes were compiled using 2 methods, a historical review from 1980 to mid 2009 of earthquake events from multiple databases and a systematic literature review of publications, ending in October 2012. From 1980 through 2009, there were 372,634 deaths (range 314,634-412,599), 995,219 injuries (range 845,345-1,145,093), and more than 61 million people affected by earthquakes, with mortality greatest in Asia. Inconsistent reporting across data sources suggests that the numbers injured and affected are likely underestimates. Findings from a systematic review of the literature indicate that the primary cause of earthquake-related death was trauma due to building collapse and, the very young and the elderly were at increased mortality risk, while gender was not consistently associated with mortality risk. Strategies to mitigate the impact of future earthquakes should include improvements to the built environment and a focus on populations most vulnerable to mortality and injury (1).

After a devastating earthquake, the site selection for the sheltering of earthquake victims is an important task. In order to generate a list of appropriate criteria for deciding on temporary sheltering site selection, the experience of experts and the findings of published documents were combined. Having explored published papers, a list of criteria was generated for the selection of the best location for temporary sheltering. In the next step, all criteria were presented to a group of experts in Iran and after a scientific discussion, the list was updated. In the last step, the final list of criteria was developed using the Delphi method in three rounds. Based on our previous systematic review, 27 criteria were presented for sheltering site selection. Expert interviews added 12 more items to them. The Delphi process approved 21 criteria of all proposed ones. These items then grouped into four categories: land suitability, socio-cultural considerations, service availability and disaster risk reduction. The data indicate that after an earthquake, the list of criteria may help the disaster team to select the best locations for temporary sheltering with minimum confusion. The consent of the earthquake victims and cost reduction of the operation would be the minimum benefits of using the appropriate criteria. The criteria could be used by researchers to make objective and reproducible assessments of temporary sheltering site selection (2).

On 6 April 2009, a violent earthquake that destroyed almost its entire medieval centre hit the city of L'Aquila, Italy, and the surviving

inhabitants were evacuated and relocated in temporary quarters or undamaged homes. The perceived quality of life (QOL) of the elderly population was investigated 3 years after the earthquake in relation to the social and logistic issues of new housing. The investigation was carried out between October 2011 and March 2012, and involved 571 subjects aged over 65 years living in the municipality of L'Aquila. The interviews took place in the surgeries of general practitioners and the city's Department of Prevention and Vaccination in the anti-influenza immunization period. The instrument used was a 36-item questionnaire with closed, multiple choice answers divided into the following sections: demographics, everyday activities, health and perceived health, and the QOL in the city. The results show that, 3 years after the earthquake, the elderly population living in the new towns and temporary housing of L'Aquila had a worse perception of their QOL than the others. They felt a certain social isolation and wished to live elsewhere. Governments faced with the problems arising from a natural calamity should take into account the elements making up a good QOL and, before making choices, to consider both their immediate and long-term social consequences (3).



The prevalence of PTSD was investigated in people who had left their damaged homes and were still living in temporary housing more than a year after the April 2009 L'Aquila (Italy) earthquake. In addition, the differences in coping strategies implemented by persons who had and who did not have PTSD were evaluated. A sample included 281 people aged >18 years and living in temporary housing after the earthquake. The questionnaires used include the Davidson Trauma Scale and the Brief Cope. The prevalence of PTSD was 43%. Women and the non-employed were more vulnerable to PTSD, while, age and level of education were not associated with

PTSD. Those with PTSD symptoms often employed maladaptive coping strategies for dealing with earthquake and had the highest scores in the domains of denial, venting, and behavioral disengagement, self-blame. By contrast, those without PTSD generally had more adaptive coping mechanisms. Adults who were living in temporary housing after the earthquake experienced high rates of PTSD. The difference in coping mechanisms between those who have PTSD and those who do not also suggests that they influence the likeliness of developing PTSD (4).

Natural disasters provoke an increase in mental and medical disorders in survivors. Monitoring drug prescription changes after natural disasters can provide an indirect evaluation of trauma impact in the population. It could be useful to both identify risk categories that require special assistance and assess possible drug abuse or misuse. The effects of earthquake that occurred on April 6, 2009 on the use of antidepressant and antipsychotic drugs were assessed in the province of L'Aquila. The general population of L'Aquila and Caserta provinces in Southern Italy was included. In a retrospective, drug utilization all the persons who received at least 1 dispensing of antidepressant and/or antipsychotic drugs during the period April 1st, 2008-March 31st, 2010 were identified. The monthly prevalence of use of these drugs, 1 year prior and after the date of earthquake in L'Aquila was compared between the 2 provinces, L'Aquila and Caserta. An increase in the use of antipsychotic drugs and, to lesser extent, of antidepressant agents (mostly typical and tricyclics, respectively) in the first 2 months after the earthquake in L'Aquila but not in Caserta were observed. This increase was almost 2-fold higher in women older than 75 years. After the first 2 months from the earthquake, the use of antidepressants and antipsychotics was stabilized at the pre-earthquake levels in L'Aquila. The data indicate that the earthquake determined a short-term increase in the use of antipsychotics (mostly haloperidol and promazine) and, to lesser extent, of antidepressants (i.e. tricyclics), especially in older women of L'Aquila (5).

QOL changes were estimated over an 18-month period in an adult population sample after the L'Aquila 2009 earthquake. Participants included 397 healthy adult subjects. Exclusion criteria were comorbidities such as physical, psychological, psychiatric or neurodegenerative diseases at the beginning of the study. The primary outcome measure was QOL, as assessed by the WHOQOL-

BREF instrument. Overall, QOL scores were observed to be significantly higher 18 months after the earthquake in all WHOQOL-BREF domains. The model detected an average increase in the physical QOL scores (from 66.6 ± 5.2 to 69.3 ± 4.7), indicating a better overall physical QOL for men. Psychological domain scores (from 64.9 ± 5.1 to 71.5 ± 6.5) were observed to be worse in men than in women. Levels at the WHOQOL domain for psychological health increased from the second assessment onwards in women, indicating higher resiliency. Men averaged higher scores than women in terms of social relationships and the environmental domain. Regarding the physical, psychological and social domains of QOL, scores in the elderly group (age >60) were observed to be similar to each other regardless of the significant covariates used. WHOQOL-BREF scores of the psychological domain displayed trends conditioned by age and education: older subjects experienced less satisfaction with psychological health on average. Less-educated subjects always demonstrated the worst QOL scores. Gender, age and education affected the variability of QOL in the environmental dimension in the elderly (6).

One and 1/2 years after the 1988 earthquake in Armenia was conducted to assess the frequency and severity of posttraumatic stress reactions among elderly and younger adult victims and to assess the relation of exposure, age, sex, and death of a family member to these reactions. One hundred seventy-nine subjects of both sexes were evaluated with the PTSD Reaction Index. A subgroup of 60 individuals was also assessed for PTSD with the DSM-III-R criteria. There was a strong association between the presence of severe symptoms on the index and a DSM-III-R diagnosis of PTSD. Elderly and younger adult victims in cities closer to the epicenter (higher exposure) had significantly higher index scores than elderly and adult victims in more distant locations. In comparison with previous studies of natural disasters, much greater rates of chronic severe PTS reactions were found among the highly exposed individuals. Although there was no difference in total mean score on the PTSD Reaction Index, a significant difference in symptom profile was found between the elderly and younger adults; the elderly scored higher on arousal symptoms and lower on intrusive symptoms. There was a positive correlation between loss of family members and severity of PTS reaction. These findings indicate that after a major natural disaster with subsequent multiple adversities, a

substantial proportion of the adult population may experience severe and chronic PTS reactions. The risk factors may prove useful in screening exposed individuals for appropriate treatment (7).

Every year in most earthquakes more than thousands of lives are lost, mainly in middle- and low-income countries. Disability and rehabilitation in third world countries could cause disastrous negative effect in living expense of families. So many preventable disabilities are result of these earthquakes and reminding it will make a difference (8).

The 2010 Haiti earthquake was one of the most catastrophic episodes in history, leaving 5% of the nation's population killed or injured, and 19% internally displaced. The distinctive combination of earthquake hazards and vulnerabilities, extreme loss of life, and paralyzing damage to infrastructure, predicts population-wide psychological distress, debilitating psychopathology, and pervasive traumatic grief. The limited MHPSS services provided in the first 8 months generally lacked coordination and empirical basis. There is a need to customize and coordinate disaster mental health assessments, interventions, and prevention efforts around the novel stressors and consequences of each traumatic event. An analysis of the key features of the 2010 Haiti earthquake was conducted, defining its "Trauma Signature" based on a synthesis of early disaster situation reports to identify the unique assortment of risk factors for post-disaster mental health consequences. This assessment suggests that multiple psychological risk factors were prominent features of the earthquake in Haiti. For rapid-onset disasters, Trauma Signature analysis can be performed during the post-impact/pre-deployment phase to target the MHPSS response in a manner that is evidence-based and tailored to the event-specific exposures and experiences of disaster survivors. Formalization of tools to perform Trauma Signature analysis is needed to enhance the timeliness and accuracy of these assessments and to extend this approach to human-generated disasters and humanitarian crises (9).

Few papers have focused on the mental health consequences of indirect exposure to disasters caused by naturally occurring hazards. The present study assessed indirect exposure to the 2010 earthquake in Haiti among Haitian-Americans now living in Miami; these subjects had no direct exposure to the earthquake, but retained their cultural identity, language, and connection to family and friends in Haiti. Two months following the earthquake a sample of Haitian-Americans was

surveyed inquiring about: 1] their psychological reactions to the quake; 2] types of exposures experienced by their family members and friends in Haiti; and 3] symptom levels of: a) major depression, (b) GAD, (c) complicated grief, (d) mental health status, and (e) physical health status. Haitian-Americans living in Miami experienced a broad spectrum of indirect exposures to the 2010 earthquake in Haiti. These exposures were strongly associated with psychological distress, trauma-related mental health consequences, and diminished health status. Most notable was the multiplicity of indirect exposures to the on-scene experiences of multiple family members and friends in Haiti. The data indicate that consideration should be given to the psychological impact and needs for support among indirectly exposed populations with strong affiliation to directly impacted victims (10).

In the first population-based study of psychopathology conducted in Haiti, earthquake-related experiences were associated with risk for PTSD and MDD two-four months following the 2010 Haiti earthquake. A population-based survey was conducted of 1,323 survivors randomly selected from the general non-displaced community, internally displaced persons camps, and a community clinic. Respondents were from the Nazon area of Port-au-Prince, ~20 miles from the epicenter. Respondents (90.5%) reported at least 1 relative/close friend injured/killed, 93% saw dead bodies, and 20.9% lost their job post-earthquake. The prevalence of PTSD (24.6%) and MDD (28.3%) was high. History of violent trauma was associated with risk of PTSD and MDD (AOR 1.4, 95% CI 1.0-1.9; AOR 1.7, 95% CI 1.3-2.2, respectively). Low social support (AOR 1.7, 95% CI 1.2- 2.3; AOR 1.4, 95% CI 1.0-1.9, respectively) increased risk of PTSD and MDD among women. Suffering damage to the home increased risk of MDD in males (AOR 2.8, 95% CI 1.5-5.5). Associations between being trapped in rubble, major damage to house, job loss, and PTSD; and participation in rescue/recovery, friends/family injured/killed, and MDD varied based on prior history of violent trauma. The data indicate that addressing mental health in a post-earthquake setting such as Haiti will require focusing resources on screening and treatment of identified vulnerable groups while targeting improvement of post-earthquake living conditions. Investment in sources of social support for women may help mitigate the vulnerability of women to PTSD and MDD (11).

The evaluation of a structural model that seeks to identify predictors and mediators of PTG of people affected by a natural disaster is presented. The sample was composed of 349 adult men and women who experienced the earthquake and tsunami on February 27, 2010 in Chile. A modeling with structural equations was used, contrasting two predictive models of PTG. The latent variables assessed were subjective severity, social sharing of emotion, intrusive rumination, deliberate rumination, problem-focused coping and posttraumatic growth. The best fit was obtained with the model that shows a direct influence of the subjective severity, problem-focused coping, and deliberate rumination in the presence of PTG. Problem-focused coping mediated the relation between subjective severity and social sharing with PTG. In turn, deliberate rumination mediated the relation of problem-focused coping and intrusive rumination with PTG. The results show the relevant role of cognitive processes such as deliberate rumination and behavioral processes such as problem-focused coping and intrusive rumination with PTG (12).

Bam earthquake was the most catastrophic natural disasters in recent years. Different aspects of crisis management during and after the catastrophic earthquake in Bam City, Iran were reviewed. Data needed for this systematic review were collected through searching PubMed, EMBASE and SID databases, for the period from 2003 to 2011. Keywords included earthquake, Iran and Bam earthquake. The data were analyzed using Content Analysis. Out of 422 articles, 25 articles were included in the study. Crisis Management aspects and existing pitfalls were classified into seven categories including planning and organization, human resource management, management of logistics, international humanitarian aids, field performance of the military and security forces, health and medical service provision, and information management. Positive aspects and major pitfalls of crisis management have been introduced in all the mentioned categories (13).

Earthquakes are one the most common natural disasters that lead to increased mortality and morbidity from transmissible diseases, partially because the rodents displaced by an earthquake can lead to an increased rate of disease transmission. The prevalence of plague and tularemia in rodents in the earthquake zones was evaluated in southeastern Iran. In April 2013, a research team was dispatched to explore the possible presence of diseases in rodents displaced by a recent earthquake magnitude 7.7 around the cities of Khash and

Saravan in Sistan and Baluchestan Province. Rodents were trapped near and in the earthquake zone, in a location where an outbreak of tularemia was reported in 2007. Rodent serums were tested for a serological survey using an enzyme-linked immunosorbent assay. In the 13 areas that were studied, nine rodents were caught over a total of 200 trap-days. Forty-eight fleas and 10 ticks were obtained from the rodents. The ticks were from the *Hyalomma* genus and the fleas were from the *Xenopsylla* genus. All the trapped rodents were *Tatera indica*. Serological results were negative for plague, but the serum agglutination test was positive for tularemia in one of the rodents. *Tatera indica* has never been previously documented to be involved in the transmission of tularemia. The data indicate no evidence of the plague cycle in the rodents of the area, but evidence was found of tularemia infection in rodents, as demonstrated by a positive serological test for tularemia in one rodent (14).

Until now, an estimate quotes that 1100 healthcare facilities were damaged and over 100,000 livestock lost in the two earthquakes that occurred in April and May of 2015 in Nepal. Threats of infectious diseases, mostly zoonoses, could affect Nepal's economy, trade, and tourism, and reaching the targets of the United Nations Millennium Development Goals. Historically, outbreaks of infectious diseases, including zoonoses, were largely associated with the aftereffects of the earthquakes. It has been documented that zoonoses constitute 61% of all known infectious diseases. The infectious disease outbreaks after earthquakes around the world were examined and the risk assessment of the zoonoses threats reported in Nepal were explored and adopting One Health were highlighted. Summaries on reported zoonoses in Nepal have shown that parasitic zoonoses were predominant, but other infectious disease outbreaks can occur. The fragile public health infrastructure and inadequately trained public health personnel can accelerate the transmission of infections, mostly zoonoses, in the post impact phase of the earthquake in Nepal. Therefore, with the support of aid agencies, veterinarians and health professionals can team up to resolve the crisis under One Health (15).

A Cuban field hospital deployment is presented in response to the major earthquake that struck Chile in February 2010. It also reveals the initial difficulties the medical team faced and how collaboration with local social, medical and military partners contributed to response efficiency, and highlights the importance of Cuba's

international health cooperation, especially in emergency situations. Over 254 days, Cuban health professionals had 50,048 patient encounters (outpatient visits and hospitalizations), a daily average of 197. They performed 1778 surgeries (1427 major, 80.2% of total) and accumulated valuable experience in managing a field hospital in a disaster situation (16).

The HRQOL and the APHC were assessed in residents living in post-earthquake zones in Sichuan Province, China, as well as the effect of HRQOL on APHC were evaluated. A sample survey included 5 counties in Sichuan in May and June 2013 (n=2000). The 12-item Short Form Health Survey (SF-12) was used to measure HRQOL. The APHC scale was self-developed and was based on real-life conditions in China. Confirmatory factor analysis and structural equation model were used to analyze how HRQOL affected APHC. The physical component summary significantly affected APHC, while the effect of the mental component summary was insignificant. APHC had the greatest effect on the adaptation to poor infrastructures ($r=0.721$) and the least effect on the adaptation to poor social security systems ($r=0.608$). The data indicate that the HRQOL of residents living in post-earthquake zones positively affected APHC, particularly physical health. The findings suggested the need for governmental improvement of infrastructures in post-disaster areas (17).

The QOL for survivors living in temporary settlements (prefab house) was evaluated 2 years after "5.12" earthquake and to explore related influencing factors. A random sample of 560 subjects was investigated by adopting a subscale of SF-36, PCL-C, PSQI and Social Demographic Questionnaire. One-way variance analysis results showed that the scores of SF-36 domains of victims living in prefab houses were significantly lower than norms ($p<0.05$) except for mental health. Difference in disastrous areas, gender, age, education, occupation, marital status might affect some dimensions and the weighted average score of SF-36. The result of multivariate regression analysis showed that the score of PSQI, the score of PCL-C as well as occupation are the main influencing factors. The data indicate that 2 years after Wenchuan Earthquake in China, the levels of QOL of survivors living in prefab houses were low. The critical measures for improving the QOL of victims should be included as follows: people from heavy disaster area Beichuan, female, with sleeping disorder and PTSD and low income should be viewed as the priority of attention (18).

After the devastating earthquake in Haiti, the U.S., Air Force deployed multiple medical units as part of the disaster response. Air Force Special Operations Command medical teams provided initial medical response and assisted in the organization of medical assets. A small portable expeditionary aeromedical rapid response team with the assistance of a mobile aeromedical staging facility team stabilized patients for flight and coordinated air evacuation to the U.S. An expeditionary medical support hospital was set up and assisted in patient movement to and from the USNS Comfort hospital ship. These units were able to adapt to the unique circumstances in Haiti and provide great patient care. The lessons learned from these experiences may help the U.S. better respond to future disasters (19).

Worldwide, there is a gap between the burden of mental distress and disorder and access to mental health care. This gap is particularly large in LMICs. After the 2010 earthquake in Haiti, the international health care organizations Partners in Health and Zanmi Lasante worked to expand local mental health services in rural Haiti. Clinical characteristics of the patients served during a pilot project are described to deliver community-based psychiatric services in rural Haiti and to show how this experience complements the Mental Health Gap Action Program ("mhGAP"), a tool developed by the World Health Organization to support mental health care delivery by nonspecialists in LMICs. The pilot was conducted in March 2011. A visiting psychiatrist traveled to rural Haiti and paired with local clinicians to evaluate patients and to support quality improvement practices in psychiatric care. Patients received a standard neuropsychiatric evaluation. mhGAP was an important clinical reference. To assess the experience, a retrospective chart review of outpatient encounters was conducted. Sixty-five patients presented with a wide range of common psychiatric, neurologic, and general medical conditions. Forty-nine of these patients (75%) reported primary problems subsumed by an mhGAP module. Fifteen patients (23%) reported headache as their chief complaint, a condition that is not currently covered by mhGAP. Only 3 patients (5%), reported earthquake-related distress. The clinical data reinforce the need for provision of standard psychiatric and neurologic services in LMICs. Such services ought to accompany interventions targeted specifically at disaster-related problems. Clinical situations falling outside existing mhGAP modules inspired the development of supplemental treatment protocols. These observations informed coordinated

efforts at Zanmi Lasante to build a sustainable, integrated mental health system in Haiti that may be relevant to other resource-limited settings (20).

Exposure to earthquake has been associated with psychological distress, in particular, the development of PTSD. The prevalence of PTSD were estimated, the associated risk factors among adult survivors 6 months after the Wenchuan earthquake in China were explored, and the findings were compared to other studies about the Wenchuan earthquake and other earthquakes that occurred in the past. Multistage stratified random sampling methods were conducted in 3 severely affected areas in the Wenchuan earthquake. A total of 14,798 individuals were identified with simple random selection methods at the sampling sites, these individuals were screened with the 12-item GHQ-12, and 3,692 individuals were administered a Chinese version of the Structured Clinical Interview for DSM-IV axis I disorders (SCID-I/P) by 180 psychiatrists. The prevalence of PTSD was 15.57%. The risk factors for PTSD included old age, female gender, living alone, buried in the earthquake, injured in the earthquake, operated on after the earthquake, witnessing someone get injured in the earthquake, witnessing someone get buried in the earthquake, witnessing someone die in the earthquake ($p < 0.05$). The data indicate that PTSD is common after a major disaster. Risk factors help people to identify the potential victims after disasters in time. Post-disaster mental health recovery interventions include early identification, sustained psychosocial support, governmental programs that provide social and economic support (21).

The current QOL of elderly residents living in prefabricated communities in areas damaged by the 2008 Sichuan earthquake were explored and factors of influence on QOL values were identified. The ultimate objective was to provide evidence-based guidance for health improvement measures. The short form WHOQOL-BREF was used to assess the QOL of 191 elderly residents of prefabricated communities in the Sichuan Province 2008 earthquake zone. Results indicate that the self-assessed QOL of participants as good, although scores in the physical (average 56.2) and psychological (average 45.7) domains were significantly lower than the norm in China. Marital status, capital loss in the earthquake, number of children, level of perceived stress, income, interest, and family harmony each correlated with at least 1 of the short form WHOQOL-BREF domains in t-test and 1-way

analyses. Interest, family harmony, monthly income and stress were significant predictors of physical domain QOL, explaining 13.8% of total variance. Family harmony and interest explained 15.3% of total variance for psychological domain QOL; stress, marital status, family harmony, capital loss in the earthquake, number of children and interest explained 19.5% of total variance for social domain QOL; and stress, family harmony and interest explained 16.5% of total variance for environmental domain QOL. Family harmony and interest were significant factors across all domains, while others influenced a smaller proportion. The data indicate that QOL for elderly living in prefabricated communities should be improved. Key steps to promoting QOL in this population include improving family harmony, helping to cultivate well-rounded interests, alleviating economic stresses, providing necessary medical and psychological counseling services, and affording social support (22).

The exposure experience and prevalence of PTSD was assessed among adolescent victims in the worst affected region (Chungliiao) near the epicenter of a severe earthquake (7.3 on the Richter scale) that occurred on September 21, 1999, in Taiwan. The experience of exposure to the earthquake and subjective symptoms of junior high school students aged 12 to 14 who remained in the area were assessed with self-rated questionnaires. Psychiatrists made independent diagnoses for PTSD by using the Children's Interview for Psychiatric Syndromes. Six weeks after the earthquake, 21.7% of 323 students demonstrated PTSD. Those with PTSD showed significantly more psychiatric symptoms than those without PTSD. Being physically injured and experiencing the death of a close family member with whom they had lived were the 2 major risk factors for PTSD. The data indicate that PTSD among adolescent victims of a severe earthquake in Taiwan is not as high as that reported in other studies. Long-term follow-up of these victims is recommended to prevent the development of other psychiatric complications (23).

The prevalence of psychiatric disorders and risk factors for PTSD and MDD among bereaved survivors of a severe earthquake also in Taiwan were examined. A total of 120 survivors received a psychiatric interview conducted by board-certified psychiatrists. The 2 most prevalent disorders were PTSD (37 percent) and MDD (16 percent). The risk factors for PTSD were psychosocial stressors and initial feelings of guilt. The risk factor for MDD was female gender. Only 25 percent of the survivors with PTSD and 26 percent of those

with MDD sought help at primary care clinics. These results indicate a need to develop an effective outreach strategy for dealing with psychiatric disorders among disaster victims (24).

Devastating disasters may increase suicide rates due to mental distress. Previous domestic studies have reported decreased suicide rates among men following disasters. Few reports are available regarding factors associated with disasters, making it difficult to discuss how these events affect suicide rates. Changes in suicide rates in disaster-stricken and neighboring areas following the GEJED were observed, and associations between suicide rates and economic factors were examined. Monthly suicide rates were observed from March 2009 to February 2013, during which time the earthquake occurred on March, 2011. Data were included from disaster-stricken (Iwate, Miyagi, and Fukushima Prefectures) and neighboring (control: Aomori, Akita, and Yamagata Prefectures) areas. The association between changes in suicide rates and economic variables was evaluated based on the number of bankruptcy cases and ratio of effective job offers. In disaster-stricken areas, post-disaster male suicide rates decreased during the 24 months following the earthquake. This trend differed relative to control areas. Female suicide rates increased during the first seven months. Bankruptcy cases ($p=0.038$) and ratio of effective job offers ($p=0.018$) were only significantly associated with male post-disaster suicide rates in control areas. Post-disaster suicide rates differed by gender following the earthquake. The findings suggest that considering gender differences might be important for developing future post-disaster suicide prevention measures. Increasing effective job offers and decreasing bankruptcy cases can affect protectively male suicide rates in control areas (25).

On March 11, 2011, a massive undersea earthquake and tsunami struck East Japan. The association of trauma experiences was investigated during the GEJED on clinically significant behavior problems among preschool children 2 years after the earthquake. Participants were children who were exposed to the 2011 disaster at preschool age (affected area, $n=178$; unaffected area, $n=82$). Data were collected from September 2012 to June 2013 (around 2 years after the earthquake), thus participants were aged 5 to 8 years when assessed. Severe trauma exposures related to the earthquake (e.g., loss of family members) were assessed by interview, and trauma events in the physical environment related to the earthquake (e.g.

housing damage), and other trauma exposure before the earthquake, were assessed by questionnaire. Behavior problems were assessed by caregivers using the CBCL, which encompasses internalizing, externalizing, and total problems. Children who exceeded clinical cut-off of the CBCL were defined as having clinically significant behavior problems. Rates of internalizing, externalizing, and total problems in the affected area were 27.7%, 21.2%, and 25.9%, respectively. The rate ratio suggests that children who lost distant relatives or friends were 2.36 times more likely to have internalizing behavior problems (47.6% vs. 20.2%, 95% CI 1.10-5.07). Other trauma experiences before the earthquake also showed significant positive association with internalizing, externalizing, and total behavior problems, which were not observed in the unaffected area. The data indicate that one in four children still had behavior problems even 2 years after the GEJED. Children who had other trauma experiences before the earthquake were more likely to have behavior problems. The data will be useful for developing future interventions in child mental health after a natural disaster (26).

Reperfusion rate, therapeutic time course and in-hospital mortality pre- and post-Japan earthquake disaster were evaluated comparing patients with STEMI treated in the inland area or the Tsunami-stricken area of Iwate prefecture. Subjects were 386 consecutive STEMI patients admitted to the four PCI centers in Iwate prefecture in 2010 and 2011. Patients were divided into two groups: those treated in the inland or Tsunami-stricken area. Clinical characteristics, time course and in-hospital mortality were compared in both years in the two groups. PCI was performed in 310 patients (80.3%). Door-to-balloon (D2B) time in the Tsunami-stricken area in 2011 was significantly shorter than in 2010 in patients treated with PCI. However, the rate of PCI performed in the Tsunami-stricken area in March-April 2011 was significantly lower than that in March-April 2010 (41.2% vs 85.7%; $p=0.03$). In-hospital mortality increased three-fold from 7.1% in March-April 2010 to 23.5% in March-April 2011 in the Tsunami-stricken area. SMR in March-April 2011 in the Tsunami-stricken area was significantly higher than the control SMR (SMR 4.72, 95% CI 1.77-12.6, $p=0.007$). The data indicate that the rate of PCI decreased and in-hospital mortality increased immediately after the Japan earthquake disaster in the Tsunami-stricken area. Disorder in hospitals and in the distribution systems after the disaster impacted the clinical care and outcome of STEMI patients (27).

The GEJED struck the northeast region of Honshu, the main island of Japan, on March 11, 2011. This mega-disaster claimed more than 15,000 lives, with approximately 3000 later deaths being disaster related. The GEJED consisted of a mega-earthquake, tsunami, and nuclear accident. Survivors living in temporary shelters might have received insufficient levels of vitamins, with the exception of vitamin B1, which appeared to be overestimated, and excess levels of sodium. However, scientific data collection and surveys following the GEJED were extremely limited. This experience highlights the need to prepare an “emergency nutrition assessment” system for optimal nutrition in future disasters (28).

The trajectory of probable PTSD prevalence and severity was examined, and the predictors for PTSD severity in bereaved survivors at 6 months and 18 months were analyzed after the 2008 Sichuan earthquake. A total of 226 bereaved survivors were sampled post-earthquake. The instrument used in the study was the revised version of the Impact of Event Scale. The results showed that the prevalence of probable PTSD in bereaved survivors decreased significantly from 38.9% at 6 months to 16.8% at 18 months post-earthquake. Loss of a child, being directly exposed to the death of family members and property loss during the earthquake, and mental health services utilization after the earthquake were significant predictors for PTSD severity at both assessments. The findings can contribute to post-disaster psychological rescue work. The bereaved survivors at high risk for more severe PTSD should be particularly targeted (29).

Disasters usually involve massive casualties, yet few post-disaster studies explore the prevalence of complicated grief among survivors. Complicated grief is a distinct psychological disorder, and is associated with impaired physical and psychological functions. Given such gap in the literature and the significance of this topic, this study is hoped to offer more information of complicated grief among survivors who lost their loved ones in disaster. Adopting a large scale survey, the prevalence and risk factors of complicated grief among bereaved survivors one year after the Sichuan earthquake in China were explored. In total 803 bereaved survivors participated the study by filling a questionnaire on measuring complicated grief symptoms, PTSD symptoms, intrapersonal factors, earthquake related factors, bereavement related factors, and an interpersonal factor. There were 71.1% of the participants scored higher than the

cutoff point of complicated grief symptoms. Close relationship with the deceased, PTSD symptoms, losing means of livelihood, physical injury, and terrifying experience in the earthquake were identified to be risk factors for complicated grief. The large portion of bereaved earthquake survivors suffered from complicated grief symptoms one year after the disaster. Risk factors can be used to identify high risk groups, who need special care, support, and bereavement interventions (30).

Disaster has a negative impact on health conditions, especially on those of temporary housing residents. Health status has a close relationship with physical activity and performance. However, few reports have assessed physical performance among residents living in temporary housing. Physical capabilities between the elderly who evacuated to temporary housing and those who stayed in their own homes were compared after the GEJED. Subjects were recruited from those over 65 years of age who participated in the medical check-ups for temporary housing residents (TH group) or check-ups for residents of downtown areas (control group) in Soma City, Fukushima, in 2012. The subjects underwent grip strength, one-leg standing (OLS), and timed up and go tests (TUG). In total, 1890 participants were recruited. The TH group showed significantly stronger grip strength than that of the control group. On the other hand, the TH group showed weaker standing stability, according to decreased OLS and increased TUG scores. Standing stability was impaired among elderly temporary housing residents 1.5 years after the disaster. Disaster responders should take into account the health risks associated with living in temporary housing (31).

PTSD and PTG can coexist in individuals following traumatic experiences, and cognitive pathways to PTSD and PTG can be different. Nevertheless, to date, no study using the longitudinal-design has examine the cognitive process of PTSD and PTG, nor has the specific causal relation between cognitive factors and PTSD/PTG been clarified in the aftermath of disaster. The possible cognitive mechanism of PTSD and PTG were examined in a long-time frame after earthquake. A total of 310 middle school students in Lushan County were assessed using the Event-Related Rumination Inventory, the Post-Traumatic Growth Inventory and the Child PTSD Symptom Scale at 6 months (T1), 12 months (T2) and 18 months (T3) after the Ya'an earthquake. Intrusive rumination at T2 partly mediated the relationship of intrusive rumination at T1 to PTSD but not PTG at T3.

Deliberate rumination at T2 did not mediate the relationship of intrusive rumination at T1 and PTG/PTSD at T3 but completely mediated the relation of intrusive rumination at T2 and PTSD/PTG at T3. The results suggest that PTSD and PTG are influenced by different mechanisms and that intrusive rumination leads to PTSD, whereas deliberate rumination elicits PTG in a long time after trauma (32).

Psychological distress and HRQOL were examined in relocated and nonrelocated survivors aged 60 years and older, and to analyze predictors for psychological distress and HRQOL in older survivors 5 years after the 2008 Sichuan earthquake. A total of 112 relocated older survivors and 156 nonrelocated older survivors were examined. A multistage sampling method was used. The measurements used in the study included self-reporting questionnaire-20, medical outcomes study 36-item short form health survey, and an instrument measuring demographic and disaster-related characteristics. Descriptive and multiple linear regression analysis were performed to determine factors that contributed to psychological distress and HRQOL. The prevalence of psychological distress in relocated group (20.5%) was significantly higher compared to those in nonrelocated group (4.8%). Scores for HRQOL in relocated older survivors was significantly lower than those in nonrelocated older survivors. Relocation from preearthquake residence was the most significant predictor for psychological distress and HRQOL in the total sample. Other predictors were advanced age, lower educational level, the loss of family members during the earthquake, and the presence of chronic illnesses as well as the death of a spouse after the earthquake. The data indicate strategies can be designed in postdisaster recovery program, particularly for older survivors at high risk for psychological distress and poor HRQOL (33).

Nurses' perspectives following the Canterbury (New Zealand) 2010-2011 earthquake sequence and the subsequent recovery process were explored. Qualitative semi-structured interviews were undertaken with 11 nurses from the Christchurch (New Zealand) area to explore the challenges faced by the nurses during and following the earthquakes. The interviews took place three years after the start of the earthquake experience to enable exploration of longer term aspects of the recovery process. The interview transcripts were analyzed and coded using a grounded theory approach. The data analysis identified that the nurses had faced a number of challenges and these were characterized as practical, emotional, and

professional. While some of the challenges were short-lived in the aftermath of the earthquakes, some were long-lasting due to the extended nature of the recovery process. Dealing with house damage, insurance negotiations, and working in damaged environments had a negative impact on the nurses. The nurses experienced a range of emotions, both negative and positive, after the disaster, though many had needed time to elapse before feeling able to reflect on their experiences. The findings suggest that secondary stressors have a negative impact on the psychosocial recovery process. The nurses recognized that they received support from others and were also required to focus on others. Keeping busy appeared to be the most common coping strategy. This lack of reflection on their experiences may have resulted in delayed emotional responses. Some of the nurses changed their work role, hours, and responsibilities suggesting that working in this environment were having a detrimental impact. The data indicate the research indicates the challenges faced by nurses in the initial impact of the earthquakes and during the longer term recovery process. There is a need to consider the psychosocial impact of working and living in a post-disaster context and to develop support packages to ensure the health and well-being of nurses in this environment (34).

The long-term effect of 1976 Tangshan, China, earthquake exposure in early life on performance of working memory in adulthood was investigated. A total of 907 study subjects born and raised in Tangshan were enrolled in this study. They were divided into three groups according to the dates of birth: infant exposure (3-12 months, $n=274$), prenatal exposure ($n=269$), and no exposure (born at least 1 year after the earthquake, $n=364$). The prenatal group was further divided into first, second, and third trimester subgroups based on the timing of exposure during pregnancy. Hopkins Verbal Learning Test-Revised and BVMT-R were used to measure the performance of working memory. The Hopkins Verbal Learning Test-Revised scores did not show significant difference across the three groups. Compared with no exposure group, the BVMT-R scores were slightly lower in the prenatal exposure group and markedly decreased in the infant exposure group. When the BVMT-R scores were analyzed in three subgroups, the results showed that the subjects whose mothers were exposed to earthquake in the second and third trimesters of pregnancy had significantly lower

BVMT-R scores compared with those in the first trimester. Education level and early-life earthquake exposure were identified as independent risk factors for reduced performance of visuospatial memory indicated by lower BVMT-R scores. The data indicate that infant exposure to earthquake-related stress impairs visuospatial memory in adulthood. Fetuses in the middle and late stages of development are more vulnerable to stress-induced damage that consequently results in impaired visuospatial memory. Education and early-life trauma can influence the performance of working memory in adulthood (35).

Although investigations have targeted technological and natural disasters involving children and adolescents (e.g., kidnappings, shootings, accidents, wars, fires, and hurricanes), little is known about the influence of specific risk factors on functioning post-disaster. There are questions yet to be fully addressed, including: How do children and adolescents cope with technological and natural disasters? What are the most salient risk factors for children and adolescents, prior to, during, and following disasters? How do these risk factors interact in predicting psychological adjustment? And what is the relative role of risk factors on psychological adjustment over time? In fact, these and related questions hold the potential to move this important area of inquiry forward in a variety of meaningful ways (36).

Cutaneous leishmaniasis is a major disease with significant public health concerns in Iran. The severity of cutaneous leishmaniasis among the patients before and after the earthquake in the city and suburbs of Bam, southeastern Iran was compared. House-to-house visits were carried out in 2010 in Bam, southeastern Kerman province of Iran, where a massive earthquake has recently occurred. Overall, 1,481 individuals were selected as a cluster random sampling. Suspected lesions were detected by direct smear preparation. Overall, 1,481 individuals (mean age; 25.7 ± 17.6 years) consisting of 51.4% males and 48.6% females were randomly selected; 549 individuals showed history of cutaneous leishmaniasis; 23.4% belonged to before and 13.7% belonged to after the earthquake. When the overall severity in terms of location, number, size and duration of lesions was considered, the lesions were less severe in the time period after the earthquake ($p < 0.05$) than those before the earthquake. Cutaneous leishmaniasis is currently considered as a growing public health concern worldwide, mainly due to creation of

various risk factors particularly after a major natural disaster. Possibly the establishment of the cutaneous leishmaniasis health clinic to serve patients and to coordinate various activities had a major role in planning control strategies and thus reduction in severity of the cutaneous leishmaniasis disease (37).

The transmission risk and the prevalence potential of malaria was evaluated in Cangyuan county, China, after earthquake. The malaria epidemiological data were collected through the web-based reporting system and the malaria statistics annual reporting system from 2005 to April 2015, and the epidemic factors of malaria after earthquake in the recent three years in Cangyuan County of Yunnan Province were analyzed. According to the web-based reporting system, 799 malaria cases were reported in Cangyuan County from 2005 to April 2015, of which 652 were vivax malaria, 127 falciparum malaria, and 20 unclassified. The highest number of cases occurred in 2006 (n=326), and one indigenous falciparum malaria case was reported after earthquake. In addition, the cases were mainly distributed in Mangka (n=320, 40.1%), Banlao (n=191, 23.9%), Banhong (n=98, 12.3%) and Mengdong (n=92, 11.5%). According to the annual reporting system, there were a total of 519 indigenous cases (58.4%) and 370 imported cases (41.6%) from 2005 to April 2015. The proportion of indigenous was above 65% in each year except for 2006, when it was less than 15%. The risk indicator in western townships of Cangyuan County was higher, especially in Mangka and Mengjiao. The data indicate that there is a potential risk of malaria transmission in Cangyuan County of Yunnan province, due to the huge natural, social and biological alterations after earthquake and the yet presence of malaria transmission vehicle. The available evidence indicated poor crisis management during Bam earthquake that resulted in aggravating the losses as well as diminishing the effect of interventions. Thus, concerning the importance of different aspects of the crisis management and the high prevalence of disasters in Iran, the observed vulnerability in disaster management process should be addressed (38).

ASSESSMENT: the main cause of earthquake-related death is trauma due to building collapse and, the very young and the elderly are at increased mortality risk.

The distinctive combination of earthquake hazards and vulnerabilities, extreme loss of life, and paralyzing damage to

infrastructure predicts population-wide psychological distress, debilitating psychopathology, and pervasive traumatic grief. Natural disasters provoke an increase in mental and medical disorders in survivors, and a substantial proportion of the adult population may experience severe and chronic PTS reactions.

Exposure to earthquake is associated with psychological distress, in particular, the development of PTSD and MDD. PTSD is common after a major disaster. In disaster-stricken areas, post-disaster male suicide rates decrease during the 24 months following the earthquake.

Children who lost distant relatives or friends are 2.36 times more likely to have internalizing behavior problems.

Predictors of PTSD severity include loss of a child, being directly exposed to the death of family members, property loss during the earthquake, and mental health services utilization after the earthquake are significant predictors for PTSD severity at both assessments.

After earthquake, the levels of QOL of survivors living in prefab houses are low. They feel a certain social isolation and wish to live elsewhere. The earthquake determines a short-term increase in the use of antipsychotics (mostly haloperidol and promazine) and antidepressants (i.e. tricyclics), especially in older women.

Earthquakes are one the most common natural disasters that lead to increased mortality and morbidity from transmissible diseases, partially because the rodents displaced by an earthquake can lead to an increased rate of disease transmission. Tularemia infection is found in rodents. In addition, there is a potential risk of malaria transmission in Cangyuan County of Yunnan province after earthquake and the presence of malaria transmission vehicle.

Cutaneous leishmaniasis lesions are less severe in the time period after the earthquake than those before the earthquake.

The Bible provides a precise description of devastating earthquake of Sodom and Gomorrah: *"Then the Lord rained upon Sodom and upon Gomorrah brimstone and fire from the Lord out of heaven. And he overthrew those cities, and all the plain, and all the inhabitants of the cities, and that which grew upon the ground. ..the smoke of the country went up as the smoke of furnace (Genesis 19:24,25,28); the wilderness in which Korah and his 252 supporters perished: "And the earth opened her mouth, and swallowed them up, and their homes, and all the men that appertained unto Korah, and all their goods. They, and all that appertained to them, went down alive into the pit, and earth closed upon them,: and they*

perished from among the congregation. ..all Israel that were round about them fled at the city of them: for they said: Lest the earth swallow us up also.. And there came out a fire ..., and consumed two hundred and fifty men..." (Numbers 16:32,33,35); and a prediction a devastating earthquake on a trading city, Tyre: " Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure" (Ezekiel 26:18).

In all these disasters there was no way to prevent their occurrence. The only way to survive was to flee the affected zone.

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SAND STORMS

The frequency and variation of sandstorm in Minqin Oasis was investigated. Using daily observational data of sandstorm and other meteorologic data from 1954 to 2000, the relationship between sandstorm, meteorological parameters and human activities was illuminated. The results of the analysis show that the highest frequency of sandstorms occurrence and their duration mainly focus on March, April and May, especially in April. Most of sandstorms occur from midday to nightfall, but relative few appear from midnight to forenoon, which apparently correlates to the daily variations of atmospheric thermal stability within atmospheric boundary layer. Monthly mean and annual mean duration of sandstorms coincide well with the frequencies of sandstorm occurrence (1).



A sandstorm approaching Al Asad, Iraq, just before nightfall on April 27, 2005.

Aeroallergens and antigens in sandstorm dust, extracts of which were skin prick test positive in allergic patients, were detected by rocket immunoelectrophoresis and ELISA. Fungi and bacteria isolated by agar settle plates and soil dilution and soil washing methods were enumerated and identified. Cat dander, Acacia, Alternaria, Aspergillus, Chenopodium, Cladosporium, Bermuda grass, Pithecellobium, Prosopis, Rumex, cultivated rye, and Washingtonia palm allergens were detected by both methods. Viable microbes including 1892 \pm 325 colony-forming units (cfu) of bacteria, and 869 \pm 75 cfu of fungi were isolated per gram of dust by the soil dilution method. Randomly selected microbial colonies on streaking and subculture were found to consist of between two and seven mixed colonies. Fungi including Alternaria, Aspergillus, Botrytis, Cladosporium, Mortierella, Mucor, Mycelia sterilia, Penicillium, Pythium, Ulocladium, Verticillium, and some yeasts were isolated. Actinomyces, Bacillus, Pseudomonas, and mostly coagulase-negative Staphylococcus species were identified, but the bulk of unidentified bacterial isolates were mainly mixed colonies of rods, cocci, coccobacilli, and some filamentous types. Six-hour agar settle-plate counts during sandstorms were 100 and 40% higher for bacteria and fungi, respectively, than without sandstorms. The most abundant aeroallergens were those of Acacia, Alternaria, Aspergillus, Bermuda grass, Cladosporium, cultivated rye, Prosopis, and cat dander. Pithecellobium dulce, Rumex crispus, and Washingtonia palm allergens were detectable for the first time in Riyadh. IgE reactivities of the dust in man were demonstrated by ELISA using sera from atopic, exposed, and normal subjects. The results indicate that sandstorm dust is a prolific source of potential triggers of allergic and nonallergic respiratory ailments, and the methods should be routinely used for quick sampling of the environment (2).

On June 2, 2014 a sandstorm hit Tehran, the capital city of Iran which killed 5 and injured 44 people. The early warning system did not operate properly and the alarm was not transferred to at risk population and the related organizations in time and in a right manner. Additionally, people who were exposed to the winds didn't know the appropriate safety measures. Focusing much more on establishing early warning system to alert the risk prone population timely and public education for taking safety measures when exposed to the disastrous situation is recommended (3).



Arabian Sandstorm

Sandstorms are metrological events and frequently occur in many regions throughout the world. Sandstorms are a main source of long-distance transport of dust, air pollution and cause various health problems. The acute respiratory and general health complaints were investigated in subjects exposed to sandstorm at Riyadh, Saudi Arabia. in the Department of Physiology, College of Medicine, King Saud University, during the period March 2011- June 2012. A total number of 517 (308 males, 59.58%) and (209 females, 40.42%), apparently healthy volunteers, with mean age 28.6 ± 3.14 years had single outside exposure to sandstorm for the period of 24 ± 2.68 minutes. The acute respiratory and general health complaints were recorded through a comprehensive questionnaire. A large proportion of the subjects who were exposed to sandstorm had complaints of cough 247 (47.77%), runny nose 264 (51.06%), wheeze 173 (33.46%), acute asthmatic attack 108 (20.88%), eye irritation/redness 252 (48.74%), headache 179 (34.62%), body ache 199 (38.5%), sleep disturbance 157(30.36%) and psychological disturbances 194 (37.52%). The data indicate that exposure to

sandstorm causes cough, runny nose, wheeze, acute asthmatic attack, eye irritation/redness, headache, body ache, sleep and psychological disturbances. Sandstorm is a prolific source of respiratory and general ailments. It is therefore, suggested that an unnecessary exposure to sandstorm must be avoided (4).

ASSESSMENT: in Minqin Oasis, from 1954 to 2000, the highest frequency of sandstorms and their duration mainly occurred on March, April and May.

Sandstorm dust is a source of potential triggers of allergic and nonallergic respiratory ailments. Sandstorms are metrological events and frequently occur in many regions throughout the world. Sandstorms are a main source of long-distance transport of dust, air pollution and cause various health problems. Exposure to sandstorm causes cough, runny nose, wheeze, acute asthmatic attack, eye irritation/redness, headache, body ache, sleep, and psychological disturbances.

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CATASTROPHIC FIRES

The impacts of climate change on forest fires and how this, in turn, will affect the forests of the U.S. are evaluated. In addition to reviewing existing studies on climate change and forest fires, 2 transient GCMs, namely the Hadley Centre and the Canadian GCMs were used to estimate fire season severity in the middle of the next century. Ratios of 2 x CO₂ SSR over present day SSR were calculated for the means and maximums for North America. The results suggest that the SSR will increase by 10-50% over most of North America; although, there are regions of little change or where the SSR may

decrease by the middle of the next century. Increased SSRs should translate into increased forest fire activity. Thus, forest fires could be viewed as an agent of change for U.S. forests as the fire regime will respond rapidly to climate warming. This change has the potential to overshadow the direct effects of climate change on species distribution and migration (1).

The terrorist attacks of September 11th have prompted interest in developing plans to manage thousands of burn casualties. There is little actual experience in the U.S. in managing disasters of this magnitude. As an alternative, lessons may be learned from the historical experiences of previous civilian burn or fire disasters occurring in this country. A review of relevant medical, fire service, and popular literature pertaining to civilian burn or fire disasters occurring in the U.S. between the years 1900 and 2000 was performed. In the 20th century, 73 major U.S. fire or burn disasters have occurred. With each disaster prompting a strengthening of fire regulations or building codes, the number of fatalities per incident has steadily decreased. Detailed examination of several landmark fires demonstrated that casualty counts were great but that most victims had fatal injuries and died on the scene or within 24 hours. A second large cohort comprised the walking wounded, who required minimal outpatient treatment. Patients requiring inpatient burn care comprise a small percentage of the total casualty figure but consume enormous resources during hospitalization. Burn mass casualty incidents are uncommon. The number of casualties per incident decreased over time. In most fire disasters, the majority of victims either rapidly dies or have minimal injuries and can be treated and released. As a result, most disasters produce fewer than 25 to 50 patients requiring inpatient burn care. This would be a rational point to begin burn center preparations for mass casualty incidents. A robust outpatient capability to manage the walking wounded is also desirable (2).



Fire is an important and arguably unnatural component of many wet Amazonian and Andean forest systems. Soil charcoal has been used to infer widespread human use of landscapes prior to European Conquest. An analysis of Amazonian soil carbon records reveals that the records have distinct spatial and temporal patterns, suggesting that either fires were only set in moderately seasonal areas of Amazonia or that strongly seasonal and aseasonal areas are under sampled. Synthesizing data from 300 charcoal records, an age-frequency diagram reveals peaks of fire apparently coinciding with some periods of very strong El Niño activity. However, the El Niño record does not always provide an accurate prediction of fire timing, and a better match is found in the record of insolation minima. After the time of European contact, fires became much scarcer within Amazonia. In both the Amazonia and the Andes, modern fire pattern is strongly allied to human activity. On the flank of the Andes, forests that have never burned are being eroded by fire spreading down slope from grasslands. Species of these same forests are being forced to migrate upslope due to warming and will encounter a firm artificial fire boundary of human activity (3).

Widespread occurrence of fires in Amazonian forests is associated with extreme droughts, but historical data on the location and extent of forest fires are fundamental to determining the degree to which climate conditions and droughts have affected fire occurrence in the region. Remote sensing to derive a 23-year time series of annual landscape-level burn scars in a fragmented forest of the eastern Amazon was used. The burn scar data set is based on a new routine developed for the CLAS, called CLAS-BURN, to calculate a physically based burn scar index with an overall accuracy of 93% (Kappa coefficient 0.84). This index uses sub-pixel cover fractions of photosynthetic vegetation, non-photosynthetic vegetation, and shade/burn scar spectral end members. From 23 consecutive Landsat images processed with the CLAS-BURN algorithm, fire frequencies, the variation in fire return intervals, and rates of conversion of burned forest to other land uses in a 32,400 km² area were quantified. From 1983 to 2007, 15% of the forest burned; 38% of these burned forests were subsequently deforested, representing 19% of the area cleared during the period of observation. While 72% of the fire-affected forest burned only once during the 23-year study period, 20% burned twice, 6% burned 3 times, and 2% burned 4 or more times, with the maximum of 7 times. These frequencies suggest

that the current fire return interval is 5-11 times more frequent than the estimated natural fire regime. The results quantify the substantial influence of climate and extreme droughts caused by a strong ENSO on the extent and likelihood of returning forest fires mainly in fragmented landscapes. The results are an important indication of the role of future warmer climate and deforestation in enhancing emissions from more frequently burned forests in the Amazon (4).

The area burned in the North American boreal forest is controlled by the frequency of mid-tropospheric blocking highs that cause rapid fuel drying. Climate controls the area burned through changing the dynamics of large-scale teleconnection patterns (PDO/ENSO and AO) that control the frequency of blocking highs over the continent at different time scales. Changes in these teleconnections may be caused by the current global warming. Thus, an increase in temperature alone need not be associated with an increase in area burned in the North American boreal forest. Since the end of the Little Ice Age, the climate has been unusually moist and variable: large fire years have occurred in unusual years, fire frequency has decreased and fire-climate relationships have occurred at interannual to decadal time scales. Prolonged and severe droughts were common in the past and were partly associated with changes in the PDO/ENSO system. Under these conditions, large fire years become common, fire frequency increases and fire-climate relationships occur at decadal to centennial time scales. A suggested return to the drier climate regimes of the past would imply major changes in the temporal dynamics of fire-climate relationships and in area burned, a reduction in the mean age of the forest, and changes in species composition of the North American boreal forest (5).

Mass burn disasters are among the most difficult disasters to manage, with major burns requiring complex management in a multidisciplinary setting and specialist burns services having limited capacity to deal with large numbers of complex patients. There is a paucity of literature addressing health system responses to mass burn disasters resulting from wildfires, with the events of the "Black Saturday" disaster in the state of Victoria, Australia, able to provide a unique opportunity to draw lessons and increase awareness of key management issues arising in mass burn casualty disasters. The event comprised the worst natural disaster in the state's history and

one of the worst wildfire disasters in world history, claiming 173 lives and costing more than 4 billion Australian dollar rates (6).



Fireworks are used worldwide to celebrate popular events (e.g. festivals, official celebrations, weddings). The festival of lights (Diwali) is celebrated with fireworks in India. During this period, many patients from all age groups present to hospital with injuries due to fireworks. Prevalence, period of occurrence, sex and age variation, adult supervision, causative fireworks, mode of lighting, age groups prone to injury, patterns of injury caused by individual fireworks, and the body parts injured were studied. One hundred and fifty-seven cases (92 retrospective, 65 prospective) with injury due to fireworks presenting to the Department of Plastic Surgery at KEM Hospital between 1997 and 2006, India, were studied. The prevalence of injuries has decreased steadily over the last 10 years (41 cases in 1997, 3 cases in 2006). The maximum number of injuries (35%) was seen in the age group 5-14 years; 92% of these children were unsupervised. The commonest cause of injury was firework misuse (41% of cases), followed by device failure (35%). Device failure was commonest with flares/fountains (ground firework emitting sparks upwards) and aerial devices. Flare/fountains caused most injury (39%), sparklers the least (0.6%). Flare/fountains, ground spinners, sparklers, and gunpowder (explosive material from cracker, obtained by tearing paper wrapper and obtaining chemicals) caused only soft tissue burns; stringbombs (high-intensity fire cracker made by wrapping chemicals with jute strings/coir in layers) and rockets (aerial device that zooms upwards and bursts) caused blast injuries, leading to soft tissue disruption and bony injuries. Emergency surgery was done if indicated: tendon and/or neurovascular repair, fracture fixation, flap cover or amputation. Superficial burns were treated with dressings. Certain wounds needed only thorough

cleansing of the wound and primary suturing. The data indicate that over a 10-year period, the prevalence of firework injury decreased due to increased awareness in the community (7).

During a 5-day period that commenced on August 30, 1987, dry lightning strikes ignited more than 1,500 fires that destroyed in excess of 600,000 acres of California forests. To evaluate the public health impact of the smoke on the general population, all hospital emergency rooms located in the six counties most severely affected by smoke or fire were surveyed. Selected hospital information was abstracted for a 2 1/2-wk period during the fires and during two reference periods. During the period of major forest fire activity, visits of persons with asthma and chronic obstructive pulmonary disease increased in number (observed/expected ratios of 1.4 and 1.3, respectively), as did visits of persons with sinusitis, upper respiratory infections, and laryngitis. A few patients with acute respiratory or eye irritation also visited the ED. Even recognizing the limited sensitivity of emergency room surveys, the overall public health impact was relatively modest. The increased respiratory morbidity, however, supports the notion that persons with pre-existing respiratory disease represent a sensitive subpopulation, who should be targeted for purposes of public health intervention when exposure to forest fire smoke is likely (8).

The level of vulnerability to the hazard of fire that exists in Makola Market in Accra, Ghana was explored, and how this threat can be reduced through a community-based risk assessment was assessed. It examines the perceptions of both market-stall occupants and primary stakeholders regarding the hazard of fire, and analyses the availability of local assets (coping strategies) with which to address the challenge. Through an evaluation of past instances of fire, as well as in-depth key stakeholder interviews, field visits, and observations, a detailed hazard map of the market was produced. It goes on to recommend that policymakers consider short-to-long-term interventions to reduce the degree of risk. By foregrounding the essence of holistic and integrated planning, the paper calls for the incorporation of disaster mitigation measures in the overall urban planning process and for the strict enforcement of relevant building and fire safety codes by responsible public agencies (9).

Factors associated with higher levels of PTSD and depression symptoms were examined in 1,468 adolescents, 6 months after a wildfire. The rate of probable PTSD was 29.4% and 20% for probable

depression. Findings on predisaster, disaster-related, and postdisaster factors revealed that disaster-related factors—specifically objective and perceived threat to self and others—were associated with symptoms of PTSD but not depression. Predisaster life events, postdisaster losses, and escape-oriented coping strategies were associated with higher levels of both PTSD and depression symptoms, while control-oriented coping and perceived social support were associated with symptoms of depression. Findings have implications for the assessment and treatment of traumatized and depressed adolescents after a disaster (10).

Current understanding of risk and protective factors for post-disaster adjustment was evaluated by examining relationships between disaster-related cognitions, three empirically supported risk factors for poorer adjustment (i.e., greater disaster impact, female gender, and racial/ethnic minority status), and three common post-disaster outcomes (i.e., depression, anxiety, and somatic complaints). Participants were 200 students exposed to wildfire disaster. Simultaneous hierarchical regression analyses revealed that, during the acute stress period: 1] disaster-related cognitions in interaction with fire impact and minority status, as well as gender, were related to anxiety symptoms, 2] cognitions were related to depression symptoms, and 3] cognitions in interaction with minority status, as well as fire impact, were related to somatic symptoms. No examined variables predicted symptom change (11).

Cumulative stress among firefighters may present as behavior changes that could be considered destructive for an individual and for the fire crew on which they serve. Through the use of effective leadership and open communication between personnel, destructive behaviors may be mitigated before a cascade of poor decisions affects the health and livelihood of the individual and those around him/her. The Peer Support Action Plan presents several different intervention techniques in order to best cope with destructive behaviors, while providing follow-up and continued support by a trained Peer Support Action Team. The Peer Support Action Plan is not a disciplinary measure nor is it a guarantee of continued employment, but rather a coaching and support strategy to correct behaviors and keep firefighters at their optimum level of functioning and performance through coping efficacy (problem focused and seeking social support) (12).

Workers who experience fire in the workplace are faced with disruption to their work routine, as well as the emotional strain of the fire. In the broader occupational stress literature, researchers have suggested that social support will be most effective at reducing the negative effects of stressors on strain when the type of support matches the type of stressor being experienced (either instrumental or emotional). A preliminary investigation was carried out into employee responses to less routine stressors, such as workplace fires, and the role of different sources of social support in predicting coping effectiveness. This was an attempt at considering the influence of the social context (in terms of group identification) on the effectiveness of social support as a predictor of coping effectiveness. Specifically, it was predicted that social support would be more effective when it came from multiple sources within the organization, that it would be especially effective when provided from a group that workers identified more strongly with, and that simply feeling part of a group would improve adjustment. Both quantitative and qualitative data were collected from 33 employees who had recently experienced a significant fire in their workplace. Results suggested that the type of stressors experienced and the type of support were mismatched, but despite this, coping effectiveness was generally moderate to high. There was mixed support for predictions about the effects of social support-no moderating effect of group identification on coping effectiveness was observed for measures of workplace support, although it did moderate the effects of family support on this adjustment indicator (13).

Has a particular traumatic event (the Gdańsk Shipyard concert-hall fire) caused any psychopathological changes in the victims? If yes, how do the dynamics of these changes manifest themselves? Two psychological methods were used. Adjective Check List, which measures the structure of psychological needs, and in some way, the picture of oneself (before and after the fire) and HADS-M, which measures the intensity of negative emotions (anxiety, depressiveness and aggression). The first investigation in 1995 included two groups: 46 victims of the fire and a control group (47 youngsters, who did not participate in this particular concert). The investigation of the victims group was then repeated twice, in 1996 (35 persons) and in 1999 (39 persons). The series of investigations lead to the conclusion that the traumatic event (Gdańsk Shipyard hall fire) caused statistically significant, psychopathological changes in the victims (the first

investigation). The changes concerned the worsening of the picture of oneself and an increase in the intensity of negative emotions (anxiety, depressiveness, and aggression). All these changes still exist, despite the time which passed since the traumatic event (the repeated investigations) (14).

ASSESSMENT: mass burn disasters are among the most difficult disasters to manage, with major burns requiring complex management in a multidisciplinary setting and specialist burns services having limited capacity to deal with large numbers of complex patients.

Detailed examination of several landmark fires demonstrates that casualty counts are great while most victims have fatal injuries and die on the scene or within 24 hours.

In most fire disasters, the majority of victims either rapidly dies or has minimal injuries that can be treated and released.

Fireworks are used worldwide to celebrate popular events (e.g. festivals, official celebrations, and weddings). The festival of lights (Diwali) is celebrated with fireworks in India. During this period, many patients from all age groups present to hospital with injuries due to fireworks.

During the period of forest fire activity, ED visits of persons with asthma and chronic obstructive pulmonary disease, sinusitis, upper respiratory infections, and laryngitis increase. A few patients with acute respiratory or eye irritation also visited the emergency rooms.

The traumatic event causes significant, psychopathological changes in the victims. Predisaster life events, postdisaster losses, and escape-oriented coping strategies are associated with higher levels of both PTSD and depression symptoms.

The Bible describes the catastrophic fire that affected JOB "*And there came a messenger unto JOB ..." (1:14). Among various disasters "The fire of God has fallen from heaven, and has burned up the sheep, and the servants, and consumed them...." (The Book of Job: 1:16).*

Here JOB's friends supported him, wept, and mourned together over losses. This event shows that good friends are important in coping with various disasters.

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WIND DISASTERS

Wind disasters are responsible for tremendous physical destruction, injury, loss of life and economic damage. It is important to advance planning and adequate preparation as well as prompt and well-organized response to potential damage involving healthcare infrastructure and the associated consequences to the medical response system. There are ways to minimize both the extent of infrastructure damage and its effects on the healthcare system (1).

Catastrophic winds from tornadoes and downbursts are a major cause of natural disturbance in forests of eastern North America, accounting for thousands of hectares of disturbed area annually. Wind disturbance shows substantial regional variation, decreasing from the mid-west to the east and from the Southeast to New England. In terms of the relative importance among these types of

storms, more forest damage results from tornadoes in the Southeast and Midwest, while downbursts are the most important type of wind disturbance in the Great Lakes area. Downbursts vary widely in size, but large ones can damage thousands of hectares, while tornadoes are much smaller, seldom affecting more than several hundred hectares. Tornadoes cause the most severe wind disturbances. Site characteristics such as physiography, soil moisture, and soil depth; stand characteristics like density and canopy roughness; and tree characteristics such as size, species, rooting depth, and wood strength, are the factors most recognized as influencing damage patterns. The consequences of wind damage to forests, such as change in environmental conditions, density, size structure, species composition, and successional status, occur on both immediate (hours-to-days) and long-term (months-to-decades) time scales. Most wind disturbances result in the post-disturbance vegetation being comprised of surviving canopy trees, and varying amounts of sprouts, released understory stems, and new seedlings. Stand size structure is usually reduced, and successional status of a forest is often advanced. Diversity can be either increased or decreased, depending on the measure of abundance used to calculate diversity. Because tornadoes and downbursts are in part products of thermodynamic climatic circumstances, they may be affected by anticipated changes in climatic conditions as the 21st century progresses. However, the current understanding of tornado and downburst formation from supercell storms is very incomplete, and climate-change model predictions sufficiently coarse, while predictions of changes in frequency, size, intensity, or timing of these extreme events must be regarded as highly uncertain. Retrospective approaches that employ tree demography and dendrochronology require prohibitively large sample sizes to resolve details of the relationship between climate fluctuations and characteristics of these storms. To improve predictions of changes in the climatology of these storms, we need improved understanding of the genesis of tornadoes and downbursts within thunderstorms, and greater resolution in global climate models. To improve coping strategies, forest scientists can contribute by giving more attention to how various silvicultural actions influence stand and tree vulnerability. Increased focus on the dynamics of forest recovery and regrowth may suggest management actions that can facilitate desired objectives after one of these unpredictable wind disturbances (2).

Moderate-severity disturbances appear to be common throughout much of North America, but they have received relatively little detailed study compared to catastrophic disturbances and small gap dynamics. The immediate impact of moderate-intensity windstorms on stand structure, opening sizes, and light regimes in 3 hemlock-hardwood forests of northeastern Wisconsin were examined. These were compared to 3 stands managed by singletree and group selection, the predominant forest management system for northern hardwoods in the region. Windstorms removed an average of 41% of the stand basal area, compared to 27% removed by uneven-aged harvests, but both disturbances removed trees from a wide range of size classes. The removal of nearly half of the large trees by wind in 2 old-growth stands caused partial retrogression to mature forest structure, which has been hypothesized to be a major disturbance pathway in the region. Windstorms resulted in residual stand conditions that were much more heterogeneous than in managed stands. Gap sizes ranged from less than 10 m² up to 5000 m² in wind-disturbed stands, whereas the largest opening observed in managed stands was only 200 m². Wind-disturbed stands had, on average, double the available solar radiation at the forest floor compared to managed stands. Solar radiation levels were also more heterogeneous in wind-disturbed stands, with 6 times more variability at small scales (0.1225 ha) and 15 times more variability at the whole-stand level. Modification of uneven-aged management regimes to include occasional harvests of variable intensity and spatial pattern may help avoid the decline in species diversity that tends to occur after many decades of conventional uneven-aged management. At the same time, a multi-cohort system with these properties would retain a high degree of average crown cover, promote structural heterogeneity typical of old-growth forests, and maintain dominance by late-successional species (3).

Windstorms occur frequently and some researchers have predicted an increase in severe gales in the future, resulting in an urgent need to understand the related patterns of morbidity and mortality. A systematic literature review of international evidence on the impacts of windstorms on human health was conducted in May 2012. This review of published evidence demonstrates that human health can be severely affected by windstorms. Direct effects occur during the impact phase of a storm, causing death and injury due to the force of the wind. Becoming airborne, being struck by flying

debris or falling trees and road traffic accidents are the main dangers. Indirect effects, occurring during the pre- and post-impact phases of the storm, include falls, lacerations and puncture wounds, and occur when preparing for, or cleaning up after a storm. Power outages are a key issue and can lead to electrocution, fires and burns and carbon monoxide poisoning from gasoline powered electrical generators. Additionally, worsening of chronic illnesses due to lack of access to medical care or medication can occur. Other health impacts include infections and insect bites. The data indicate public health advice can reduce morbidity and mortality from windstorms (4).



Heavy winds stoke wildfires

How accurately do people perceive extreme wind speeds and how does that perception affect the perceived risk? Prior research on human-wind interaction has focused on comfort levels in urban settings or knock-down thresholds. No systematic experimental research has attempted to assess people's ability to estimate extreme wind speeds and perceptions of their associated risks. Seventy six people were exposed to 10, 20, 30, 40, 50, and 60 mph (4.5, 8.9, 13.4, 17.9, 22.3, and 26.8 m/s) winds in randomized orders and asked them to estimate wind speed and the corresponding risk they felt. Multilevel modeling showed that people were accurate at lower wind speeds but overestimated wind speeds at higher levels. Wind speed perceptions mediated the direct relationship between actual wind speeds and perceptions of risk (i.e., the greater the perceived wind speed, the greater the perceived risk). The number of tropical cyclones people had experienced moderated the strength of the actual-perceived wind speed relationship; consequently, mediation was stronger for people who had experienced fewer storms (5).



Windstorm

Based on the field investigation in windfall areas of Changbai Mountains, this paper studied the community recovery characteristics of broad-leaved Korean pine forest (BKPF), spruce fir forest (SFF), and Erman's birch forest (EBF) that were disturbed by wind disaster 23 years ago. The recovery rate of these three forest types was in the order of BKPF > SFF > EBF, and their total community index was 0.49, 0.44, and 0.33, respectively. The effects of the wind disaster on the forest tree species composition and diversity were different. In BKPF, the total number of trees increased significantly, but the tree species number and alpha diversity index had no significant change; in SFF, only the Shannon diversity index and Simpson dominance index decreased significantly; while in EBF, all diversity indices except Pielou evenness index had significant decrease. The responses of dominance tree composition and regeneration to the wind disaster depended on forest types. Comparing with the plots not suffered from wind disaster, the BKPF under wind disaster disturbance had greatly different dominance tree compositions, but the difference in both SFF and EBF was not significant. The BKPF's sapling regeneration was fairly good, while the SFF's was small, and EBF almost had no sapling regeneration. All the results suggested that the effects of wind disaster disturbance on the test forest ecosystems in study areas was not removed even after 23 years, and the recovery of forest after wind disaster disturbance needs a relatively long time (6).

ASSESSMENT: wind disasters are responsible for tremendous physical destruction, injury, loss of life and economic damage. Tornadoes cause the most severe wind disturbances.

Catastrophic winds from tornadoes and downbursts are a major cause of natural disturbance in forests of eastern North America, accounting for thousands of hectares of disturbed area annually.

Wind disturbance shows substantial regional variation, decreasing from the mid-west to the east and from the southeast to New England.

Site characteristics such as physiography, soil moisture, and soil depth; stand characteristics like density and canopy roughness; and tree characteristics such as size, species, rooting depth, and wood strength, are the factors mostly recognized as influencing damage patterns. The consequences of wind damage to forests, such as change in environmental conditions, density, size structure, species composition, and succession status that occur on both immediate (hours-to-days) and long-term (months-to-decades) time scales. Most wind disturbances result in the post-disturbance vegetation being comprised of surviving canopy trees, and varying amounts of sprouts, released understory stems, and new seedlings.

The Bible describes the catastrophic wind that affected JOB causing the destruction and death *"And behold, there came a great wind from across the wilderness, and smote the four corners of the house, and it fell upon the young men, and they are dead..."* (The Book of Job: 1:19).

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WIND TURBINES. The term "Wind Turbine Syndrome" was coined in a recently self-published book, which hypothesized that a multitude of symptoms such as headache and dizziness resulted from wind turbines generating low frequency sound. A summary of the peer-reviewed literature in provided on the research that has examined the relationship between human health effects and exposure to low frequency sound and sound generated from the

operation of wind turbines. A specific health condition has been classified as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines. Communities are experiencing a heightened sense of annoyance and fear from the development and siting of wind turbine farms. High-quality research and effective risk communication can advance this course from one of panic to one of understanding and exemplification for other environmental advancements (1).



Throughout history, people have suffered from physical symptoms that they have attributed to modern technologies. Often these attributions are strongly held, but not supported by scientific evidence. Symptoms attributed to the operation of wind turbines (called "wind turbine syndrome" by some) may fit into this category. Several psychological mechanisms might account for symptoms attributed to wind turbines. First, the "nocebo effect" is a well-recognized phenomenon in which the expectation of symptoms can become self-fulfilling. Second, misattribution of pre-existing or new symptoms to a novel technology can also occur. Third worry about a modern technology increases the chances of someone attributing symptoms to it. Fourth, social factors, including media reporting and interaction with lobby groups can increase symptom reporting. For wind turbines, there is already some evidence that a nocebo effect can explain the attributed symptoms while misattribution seems likely. Although worry has not been directly studied, people who are annoyed by the sound that turbines produce are more likely to report symptoms and that annoyance is associated with attitudes toward the visual impact of wind farms and whether a person benefits economically from a wind farm. Given that these mechanisms

possibly are sufficient to account for the experiences reported by sufferers, policy-makers, clinicians and patients should insist on good-quality evidence before accepting a more direct causal link (2).

Wind turbine noise exposure and suspected health-related effects have attracted substantial attention. Various symptoms such as sleep-related problems, headache, tinnitus and vertigo have been described by subjects suspected of having been exposed to wind turbine noise. This review was conducted systematically with the purpose of identifying any reported associations between wind turbine noise exposure and suspected health-related effects. A search of the scientific literature concerning the health-related effects of wind turbine noise was conducted on PubMed, Web of Science, Google Scholar and various other Internet sources. All studies investigating suspected health-related outcomes associated with wind turbine noise exposure were included. Wind turbines emit noise, including low-frequency noise, which decreases incrementally with increases in distance from the wind turbines. Likewise, evidence of a dose-response relationship between wind turbine noise linked to noise annoyance, sleep disturbance and possibly even psychological distress was present in the literature. Currently, there is no further existing statistically-significant evidence indicating any association between wind turbine noise exposure and tinnitus, hearing loss, vertigo or headache. Selection bias and information bias of differing magnitudes were in all current studies investigating wind turbine noise exposure and adverse health effects. Only articles published in English, German or Scandinavian languages were reviewed. The data indicate that Exposure to wind turbines does seem to increase the risk of annoyance and self-reported sleep disturbance in a dose-response relationship. There appears, though, to be a tolerable level of around LAeq of 35 dB. Of the many other claimed health effects of wind turbine noise exposure reported in the literature, however, no conclusive evidence could be found (3).

The association between wind turbines and health effects is highly debated. Some argue that reported health effects are related to wind turbine operation [electromagnetic fields, shadow flicker, audible noise, low-frequency noise, and infrasound]. Others suggest that when turbines are sited correctly, effects are more likely attributable to a number of subjective variables that result in an annoyed/stressed state. A bibliographic-like summary and analysis of the science around this issue is provided specifically in terms of noise

(including audible, low-frequency noise, and infrasound), electromagnetic fields, and shadow flicker. Now there are roughly 60 scientific peer-reviewed articles on this issue. The available scientific evidence suggests that electromagnetic fields, shadow flicker, low-frequency noise, and infrasound from wind turbines are not likely to affect human health; some studies have found that audible noise from wind turbines can be annoying to some. Annoyance may be associated with some self-reported health effects (e.g., sleep disturbance) especially at sound pressure levels >40 dB(A). Because environmental noise above certain levels is a recognized factor in a number of health issues, sitting restrictions have been implemented in many jurisdictions to limit noise exposure. These setbacks should help alleviate annoyance from noise. Subjective variables (attitudes and expectations) are also linked to annoyance and have the potential to facilitate other health complaints via the nocebo effect. Therefore, it is possible that a segment of the population may remain annoyed (or report other health impacts) even when noise limits are enforced. Based on the findings and scientific merit of the available studies, the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health (4).

ASSESSMENT: throughout history, people have suffered from physical symptoms that they have attributed to modern technologies.

The term "Wind Turbine Syndrome" hypothesizes that a multitude of symptoms such as headache and dizziness result from wind turbines generating low frequency sound. Health effects are related to wind turbine operation [electromagnetic fields, shadow flicker, audible noise, low-frequency noise, and infrasound], or when turbines are sited correctly, effects are attributable to a number of subjective variables that result in an annoyed/stressed state.

A specific health condition has been classified as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines.

Wind turbine noise exposure is related to sleep-related problems, headache, tinnitus and vertigo.

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VOLCANIC ERUPTIONS

Volcanoes pose a threat to almost half a billion people; today there are approximately 500 active volcanoes on Earth, and every year there are 10 to 40 volcanic eruptions. Volcanic eruptions produce hazardous effects for the environment, climate, and the health of the exposed persons, and are associated with the deterioration of social and economic conditions. Along with magma and steam (H₂O), the following gases surface in the environment: carbon dioxide (CO₂), sulphur dioxide (SO₂), carbon monoxide (CO), hydrogen sulphide (H₂S), carbon sulphide (CS), carbon disulfide (CS₂), hydrogen chloride (HCl), hydrogen (H₂), methane (CH₄), hydrogen fluoride (HF), hydrogen bromide (HBr) and various organic compounds, as well as heavy metals (mercury, lead, gold). Their unfavorable effects depend on the distance from a volcano, on magma viscosity, and on gas concentrations. The hazards closer to the volcano include pyroclastic flows, flows of mud, gases and steam, earthquakes, blasts of air, and tsunamis. Among the hazards in distant areas are the effects of toxic volcanic ashes and problems of the respiratory system, eyes and skin, as well as psychological effects, injuries, transport and communication problems, waste disposal and water supplies issues, collapse of buildings and power outage. Further effects are the deterioration of water quality, fewer periods of rain, crop damages, and the destruction of vegetation. During volcanic eruptions and their immediate aftermath, increased respiratory system morbidity has been observed as well as mortality among those affected by volcanic eruptions. Unfavorable health effects could partly be prevented by timely application of safety measures (1).

More than 500 million people live within the potential exposure range of a volcano. The risk of catastrophic losses in future eruptions is significant given population growth, proximities of major cities to

volcanoes, and the possibility of larger eruptions. The impact of volcanoes on the human population, in terms of mortality, injury, and displacement are described and, to the extent possible, identify risk factors associated with these outcomes. This is 1 of 5 reviews on the human impact of natural disasters. Data on the impact of volcanoes were compiled using 2 methods, a historical review of volcano events from 1900 to 2009 from multiple databases and a systematic literature review of publications ending in October 2012. There were 91,789 deaths (range 81,703-102,372), 14,068 injuries (range 11,541-17,922), and 4.72 million people affected by volcanic events between 1900 and 2008. Inconsistent reporting suggests this is an underestimate, particularly in terms of numbers injured and affected. The primary causes of mortality in recent volcanic eruptions were ash asphyxiation, thermal injuries from pyroclastic flow, and trauma. Mortality was concentrated with the ten deadliest eruptions accounting for more than 80% of deaths; 84% of fatalities occurred in 4 locations [the Island of Martinique (France), Colombia, Indonesia, and Guatemala]. The data indicate that changes in land use practices and population growth provide a background for increasing risk; in conjunction with increasing urbanization in at risk areas, this poses a challenge for future volcano preparedness and mitigation efforts (2).



Millions of people are potentially exposed to volcanic gases worldwide, and exposures may differ from those in anthropogenic air pollution. A systematic literature review found few primary studies relating to health hazards of volcanic gases. SO₂ and acid aerosols from eruptions and degassing events were associated with respiratory morbidity and mortality but not childhood asthma prevalence or lung function decrements. Accumulations of H₂S and CO₂ from volcanic and geothermal sources have caused fatalities from asphyxiation. Chronic exposure to H₂S in geothermal areas was

associated with increases in nervous system and respiratory diseases. Some impacts were on a large scale, affecting several countries (e.g., Laki fissure eruption in Iceland in 1783-4) (3).

In 2008, the Kilauea Volcano on the island of Hawai'i increased eruption activity and emissions of sulfurous volcanic air pollution called vog. A relative increase in cases of medically diagnosed acute illnesses was examined in an exposed Hawaiian community. Using a within-clinic retrospective cohort design, comparisons were made for visits of acute illnesses during the 14 weeks prior to the increased volcanic emissions (low exposure) to 14 weeks of high vog exposure when ambient sulfur dioxide was threefold higher and averaged 75 parts per billion volume per day. There were significant positive associations between high vog exposure and visits for medically diagnosed cough, headache, acute pharyngitis, and acute airway problems. More than a 6-fold increase in odds was estimated for visits with acute airway problems, primarily experienced by young Pacific Islanders. The findings suggest that the elevated volcanic emissions in 2008 were associated with increased morbidity of acute illnesses in age and racial subgroups of the general Hawaiian population. Culturally appropriate primary- and secondary-level health prevention initiatives are recommended for populations in Hawai'i and volcanically active areas worldwide (4).

Volcano eruptions occur around the world and can have an impact on health in many ways both locally and on a global scale because of airborne dispersion of gases and ash or as impact on climate. A volcanic eruption in Eyjafjallajökull in Iceland and its effects on aviation around the globe and on respiratory health in those exposed to the volcanic ash are described. The effects of a large volcano eruption in Iceland in 1789 had the effect on a global scale by causing air pollution. The acute and chronic health effects of volcanic ash depended on particle size (how much respiratory), mineralogical composition (crystalline silica content) and the physico-chemical properties of the surfaces of ash particles. These can vary between volcanoes and even between eruptions, making comparison difficult. Acute respiratory symptoms suggesting asthma and bronchitis have been mentioned. Exacerbations of pre-existing lung and heart disease are common after inhalation of volcanic ash. Limited information is available on increase in mortality from recent eruptions but historical evidence is well described. No long-term effects on lung function have been found after exposure to volcanic

ash. There are concerns for the long-term risks of silicosis from chronic exposure to volcanic ash but no cases have been described. The data indicate that acute respiratory symptoms after exposure to volcanic ash can occur but no long-term effects have been found (5).

Volcanic eruptions can generate widespread deposits of ash that are subsequently subjected to erosive forces, which causes detrimental effects on ecosystems. Wind erosion of the freshly deposited Eyjafjallajökull ash at a field site the first summer after the 2010 eruption were measured. Over 30 wind erosion events occurred (June-October) at wind speeds $> 10 \text{ m s}^{-1}$ in each storm with gusts up to 38.7 m s^{-1} . Surface transport over 1 m wide transect (surface to 150 cm height) reached $> 11,800 \text{ kg m}^{-1}$ during the most intense storm event with a rate of $1,440 \text{ kg m}^{-1} \text{ hr}^{-1}$ for about $6\frac{1}{2}$ hours. This storm is among the most extreme wind erosion events recorded on Earth. The Eyjafjallajökull wind erosion storms caused dust emissions extending several hundred km from the volcano affecting both air quality and ecosystems showing how wind erosion of freshly deposited ash prolongs impacts of volcanic eruptions (6).

The Mount Merapi volcanic eruption in October 2010 was one of Indonesia's largest and most recent natural disasters. A cross-sectional study was undertaken to measure the psychosocial impact of the eruption on survivors in two locations in Yogyakarta, Java, Indonesia. The Impact of Event Scale Revised was used to assess participants' symptoms of PTSD. PTSD responses and demographic characteristics were compared in both locations. The relative contributions of demographic variables and psychosocial impact were examined using multiple linear regression analyses. Two years after the eruption, survivors from the area closest to the eruption had significantly higher Impact of Event Scale Revised scores than those in the comparison area. In particular, females, adults between the ages of 18 and 59, and people who owned their own home experienced the highest levels of psychosocial impact. Nurses and other health professionals need to be aware of the impact of natural disasters on survivors and develop interventions to help people adjust to the psychosocial impact of these events (7).

People of Montserrat have experienced serious volcanic eruptions since the middle of 1995. These resulted in the evacuation of the capital town Plymouth in 1997. An exclusion zone was declared and two-thirds of the original population of 10,324 migrated abroad. The

remainder was left to initiate the recovery process. The action taken to maintain and to restore the health services and the health of the people was reviewed. The recovery process is now well advanced and is following a characteristic pattern described as the Post Disaster Recovery Scenario. A new hospital was set up in the North of the island and the four remaining clinics refurbished. The health service was restored to a reasonable standard by the end of 2000. A Disaster Preparedness Team is kept on full alert to deal with any emergencies. The disaster caused serious disruption to the health services and to the way of life of the people. It had a number of adverse health effects which included immediate harm to respiratory health followed by other more serious problems such as mental illness, poor nutrition and violence. These were due to the disruption caused by resettlement, overcrowding, breakdown of family life and economic hardship (8).



Mount St. Helens eruption, July 22, 1980. Photo: Jim Vallance.

After the May 18, 1980 volcanic eruption of Mount St. Helens, increases were observed in the number of patients who, because of asthma or bronchitis, sought medical care at emergency rooms of major hospitals in areas of ash fall. An interview study of 39 asthma and 44 bronchitis patients who became sick during the 4 weeks following the eruption and who attended the emergency rooms of two major hospitals in Yakima, Washington, and of healthy matched controls indicated that a history of asthma, and possibly of bronchitis, were risk factors for contracting respiratory problems. The interview indicated that the main exacerbating factor was the elevated level of airborne total suspended particulates (in excess of 30,000 micrograms/m³) after the eruption. An interview study of 97 patients who had chronic lung disease and who lived in the same area as the above-mentioned patients, but who did not go to a

hospital, showed that the ash fall exacerbated the condition in about one-third of these. Emergency planners and their geologist advisers should be aware that special preventive measures are justified for people with a history of asthma or chronic lung disease who live in communities at risk to volcanic ash falls (9).

Mount Etna, located in the eastern part of Sicily (Italy), is the highest and most active volcano in Europe. During the sustained eruption that occurred in October-November 2002 huge amounts of volcanic ash fell on a densely populated area south-east of Mount Etna in Catania province. The volcanic ash fall caused extensive damage to infrastructure utilities and distress in the exposed population. Whether or not there was an association between ash fall and acute health effects was examined in exposed local communities. The number and type of visits to the ED was examined for diseases that could be related to volcanic ash exposure in public hospitals of the Province of Catania between October 20 and November 7, 2002. The magnitude of differences in ED visits between the ash exposure period in 2002 and the same period of the previous year 2001 were compared. A significant increase of ED visits for acute respiratory and cardiovascular diseases, and ocular disturbances during the ash exposure time period was observed. The data show that there was a positive association between exposure to volcanic ash from the 2002 eruption of Mount Etna and acute health effects in the Catania residents. The findings document the need for public health preparedness and response initiatives to protect nearby populations from exposure to ash fall from future eruptions of Mount Etna (10).



Mount Etna eruption

A 57-year-old woman inhaled much volcanic ash without using a mask every day during the eruption of the Miyake Volcano in August 2000. An abnormal shadow was pointed out on her chest

radiography by chance, after she sought refuge in Higashimurayama city in September. She had no respiratory symptoms and her chest radiography in an annual health check in July 2000 had showed no abnormality. She was admitted to the hospital and thoracoscopic lung biopsy was performed. It was diagnosed as lung inflammation caused by volcanic ash. The reasons for diagnosis were because the abnormal shadow appeared after the inhalation of volcanic ash, chest computed tomography showed diffuse irregular shadows with air bronchogram, thoracoscopic lung biopsy showed cellular-bronchiolitis around crystals, and the results of mineralogical analysis of the particles in alveolar macrophages detected in the biopsy specimen by scanning electron microscopy were similar to those of volcanic ash. The shadow on her chest radiography disappeared gradually without any treatment, but she avoided further exposure to volcanic ash. It is necessary to consider volcanic ash capable of causing lung inflammation (11).

In the aftermath of the Icelandic volcano Grimsvötn's eruption on 21 May 2011, volcanic ash reached Northern Europe. Elevated levels of ambient particles were registered in mid Sweden. The Grimsvötn eruption effect on mortality in Sweden was investigated. Based on ambient particles measurements at 16 sites across Sweden, data were classified into an ash exposed data set (Ash area) and an unexposed data set (No ash area). Data on daily all-cause mortality were obtained from Statistics Sweden for the time period 1 April through 31 July 2011. Mortality ratios were calculated as the ratio between the daily number of deaths in the Ash area and the No ash area. The exposure period was defined as the week following the days with elevated particle concentrations, namely 24 May through 31 May. The control period was defined as 1 April through 23 May and 1 June through 31 July. There was no absolute increase in mortality during the exposure period. However, during the exposure period the mean mortality ratio was 2.42 compared with 2.17 during the control period, implying a relatively higher number of deaths in the Ash area than in the No ash area. The differences in ratios were mostly due to a single day, 31 May, and were statistically insignificant. The statistical power was low with only 8 days in the exposure period (24 May through 31 May). Assuming that the observed relative differences were not due to chance, the results would imply an increase of 128 deaths during the exposure period 24-31 May. If 31 May was excluded, the number of extra deaths was

reduced to 20. The results are contradicting and inconclusive, but may indicate that all-cause mortality was increased by the ash-fall from the Grímsvötn eruption. Meta-analysis or pooled analysis of data from neighboring countries might make it possible to reach sufficient statistical power to study effects of the Grímsvötn ash on morbidity and mortality (12).

Volcanic ash contributed significantly to particulate matter in Iceland following the eruptions in Eyjafjallajökull 2010 and Grímsvötn 2011. The association between different particulate matter sources and emergency hospital visits were examined for cardiorespiratory causes from 2007 to 2012. Indicators of particulate matter 10 sources; "volcanic ash", "dust storms", or "other sources" (traffic, fireworks, and re-suspension) on days when particulate matter 10 exceeded the daily air quality guideline value of 50 $\mu\text{g}/\text{m}^3$ were entered into generalized additive models, adjusted for weather, time trend and co-pollutants. The average number of daily emergency hospital visits was 10.5. particulate matter 10 exceeded the air quality guideline value 115 out of 2191 days; 20 days due to volcanic ash, 14 due to dust storms (two days had both dust storm and ash contribution) and 83 due to other sources. High particulate matter 10 levels from volcanic ash tended to be significantly associated with the emergency hospital visits; estimates ranged from 4.8% (95% CI 0.6-9.2) per day of exposure in unadjusted models to 7.3% (95% CI -0.4-15.5) in adjusted models. Dust storms were not consistently associated with daily emergency hospital visits and other sources tended to show a negative association (13).

ASSESSMENT: volcanoes pose a threat to almost half a billion people; today there are approximately 500 active volcanoes on Earth, and every year there are 10 to 40 volcanic eruptions. Volcanic eruptions produce hazardous effects for the environment, climate, and the health of the exposed persons, and are associated with the deterioration of social and economic conditions, injuries, transport and communication problems, waste disposal and water supplies issues, collapse of buildings and power outage, the deterioration of water quality, fewer periods of rain, crop damages, and the destruction of vegetation.

Unfavorable effects depend on the distance from a volcano, on magma viscosity, and on gas concentrations. The hazards closer to the volcano include pyroclastic flows, flows of mud, gases and steam,

earthquakes, blasts of air, and tsunamis. Among the hazards in distant areas are the effects of toxic volcanic ashes.

There are associations between high vog exposure and visits for medically diagnosed cough, headache, acute pharyngitis, and acute airway problems. Problems of the acute respiratory symptoms suggest asthma and bronchitis, exacerbations of pre-existing lung and heart disease, eyes and skin, as well as psychological effects.

The primary causes of mortality in volcanic eruptions are ash asphyxiation, thermal injuries from pyroclastic flow, and trauma.

Adverse health effects include immediate harm to respiratory health followed by other more serious problems such as mental illness, poor nutrition and violence.

A history of asthma and possibly of bronchitis is risk factors for respiratory problems. Volcanic ash is capable to cause lung inflammation, and exacerbate chronic lung disease.

There is significant increase of ED visits for acute respiratory and cardiovascular diseases, and ocular disturbances during the ash exposure time period.

There are numerous accounts of volcanic eruption in the Bible. Since the primary aim of this study was to examine verses in which humans were afflicted or coped with natural disasters, the verses dealing only with volcanic eruptions were not explored.

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DESTRUCTIVE CYCLONES

Cyclones have significantly affected populations in Southeast Asia, the Western Pacific, and the Americas over the past quarter of a century. Future vulnerability to cyclones will increase due to factors including population growth, urbanization, increasing coastal settlement, and global warming. The impact of cyclones on human populations was described in terms of mortality, injury, and displacement and, to the extent possible, risk factors associated with these outcomes were identified. Data on the impact of cyclones were compiled using 2 methods, a historical review from 1980 to 2009 of cyclone events from multiple databases and a systematic literature review of publications ending in October 2012. There were 412,644 deaths, 290,654 injured, and 466.1 million people affected by cyclones between 1980 and 2009, and the mortality and injury burden were concentrated in less developed nations of Southeast Asia and the Western Pacific. Inconsistent reporting suggests this is an underestimate, particularly in terms of the injured and affected populations. The primary cause of cyclone-related mortality is drowning; in developed countries, male gender is associated with increased mortality risk, whereas females experience higher mortality in less developed countries. The data indicate that additional attention to preparedness and early warning, particularly in Asia, can lessen the impact of future cyclones (1).

Conclusions drawn and lessons learned from past cyclones can be used to mitigate and better respond to future occurrences. Some of

the most helpful are listed below: 1] Outbreaks of cholera do not follow cyclones. Cholera must be endemic previously to a community; 2] Waterborne diseases do not increase as a result of cyclones; 3] Massive food aid rarely is required after a cyclone; 4] Used clothing almost never is needed. It usually is culturally inappropriate. Though accepted by disaster victims, it almost never is worn; 5] Blankets can be useful, but if they are needed, they usually can be found locally and do not need to be imported; 6] Assistance by outsiders is most effective in the reconstruction period, not the emergency phase; 7] Most needs are met by the victims themselves or their local governments; 8] In general, victims do not respond to disasters with abnormal behavior. Cyclones do not incite panic, hysteria, or rioting; 9] Cyclone relief and reconstruction programs should be integrated with long-term development programs; 10] When properly executed, reconstruction assistance can provide a strong stimulus to recovery and a base for future development work; 11] Reconstruction programs should seek to reduce vulnerability to future disaster; 12] Re-establishment of the local economy, income security, and agriculture usually are more important to cyclone victims than is material assistance; and 13] Churches, schools, and other large buildings that often are designated as cyclone shelters usually are not safe. The number of deaths attributed to destroyed or flooded shelters is alarming. Most experts agree that the best alternative is adequate warning and evacuation of the threatened areas (2).

The number of tropical cyclones and cyclone days as well as tropical cyclone intensity was examined over the past 35 years, in an environment of increasing sea surface temperature. A large increase was seen in the number and proportion of hurricanes reaching categories 4 and 5. The largest increase occurred in the North Pacific, Indian, and Southwest Pacific Oceans, and the smallest percentage increase occurred in the North Atlantic Ocean. These increases have taken place while the number of cyclones and cyclone days has decreased in all basins except the North Atlantic during the past decade (3).



Destructive Cyclone

The assessment of changes in tropical cyclone activity within the context of anthropogenically influenced climate change has been limited by the short temporal resolution of the instrumental tropical cyclone record (less than 50 years). Controversy exists regarding the robustness of the observational record, especially before 1990. On the basis of a new tropical cyclone activity index, the present low levels of storm activity on the mid west and northeast coasts of Australia are unprecedented over the past 550 to 1,500 years. The cyclone activity index allows for a direct comparison between the modern instrumental record and long-term palaeotempest (prehistoric tropical cyclone) records derived from the (18)O/(16)O ratio of seasonally accreting carbonate layers of actively growing stalagmites. The results reveal a repeated multicentennial cycle of tropical cyclone activity, the most recent of which commenced around AD 1700. The present cycle includes a sharp decrease in activity after 1960 in Western Australia. This is in contrast to the increasing frequency and destructiveness of Northern Hemisphere tropical cyclones since 1970 in the Atlantic Ocean and the Western North Pacific Ocean. Other papers project a decrease in the frequency of tropical cyclones towards the end of the twenty-first century in the southwest Pacific, southern Indian and Australian regions. The results, although based on a limited record, suggest that this may be occurring much earlier than expected (4).

Improving tropical cyclones forecast and mitigating its destructive potential requires knowledge of various environmental factors that influence the cyclone's path and intensity. Tropical cyclone intensification is significantly affected by salinity-induced barrier layers, which are "quasi-permanent" features in the upper tropical oceans. When tropical cyclones pass over regions with barrier layers,

the increased stratification and stability within the layer reduce storm-induced vertical mixing and sea surface temperature cooling. This causes an increase in enthalpy flux from the ocean to the atmosphere and, consequently, an intensification of tropical cyclones. On average, the tropical cyclone intensification rate is nearly 50% higher over regions with barrier layers, compared to regions without. The finding, which underscores the importance of observing not only the upper-ocean thermal structure but also the salinity structure in deep tropical barrier layer regions, possibly is a key to more skillful predictions of tropical cyclone intensities through improved ocean state estimates and simulations of barrier layer processes. As the hydrological cycle responds to global warming, any associated changes in the barrier layer distribution must be considered in projecting future tropical cyclone activity (5).

Regardless of this uncertainty, flooding by tropical cyclones will increase as a result of accelerated sea-level rise. Under similar rates of rapid sea-level rise during the early Holocene epoch most low-lying sedimentary coastlines were generally much less resilient to storm impacts. Society must learn to live with a rapidly evolving shoreline that is increasingly prone to flooding from tropical cyclones. These impacts can be mitigated partly with adaptive strategies, which include careful stewardship of sediments and reductions in human-induced land subsidence (6).

Theory and modeling predict that hurricane intensity should increase with increasing global mean temperatures, but work on the detection of trends in hurricane activity has focused mostly on their frequency and shows no trend. An index of the potential destructiveness of hurricanes based on the total dissipation of power was defined, and integrated over the lifetime of the cyclone, showing that this index has increased markedly since the mid-1970s. This trend is due to both longer storm lifetimes and greater storm intensities. The record of net hurricane power dissipation is highly correlated with tropical sea surface temperature, reflecting well-documented climate signals, including multi-decadal oscillations in the North Atlantic and North Pacific, and global warming. Future warming may lead to an upward trend in tropical cyclone destructive potential, and taking into account an increasing coastal population a substantial increase in hurricane-related losses in the twenty-first century (7).

On August 24, 2005, Tropical Depression 12 became Tropical Storm Katrina, the 11th named storm of the 2005 Atlantic hurricane season. Late on August 25, Katrina made initial landfall in south Florida as a category 1 hurricane on the Saffir-Simpson Hurricane Scale. Katrina strengthened rapidly upon reaching the Gulf of Mexico, attaining category 5 intensity. On August 29, Hurricane Katrina struck the Gulf Coast near the Louisiana-Mississippi border as a category 3 hurricane. The effect of earlier category 5 wind speeds on Gulf waters and the massive size of the storm combined to create devastating storm-surge conditions for coastal Mississippi, Louisiana, and Alabama and damage as far east as the Florida panhandle. Storm-induced breeches in the New Orleans levee system resulted in the catastrophic flooding of approximately 80% of that city. Hurricane Katrina was the deadliest hurricane to strike the U.S. since 1928. Preliminary mortality reports indicate approximately 1,000 Katrina-related deaths in Louisiana, 200 in Mississippi, and 20 in Florida, Alabama, and Georgia (8).

Trajectories of PTSD symptoms were examined in Hurricane Katrina affected youth. A total of 426 youth (51% female; 8-16 years old; mean age=11 years; 75% minorities) completed assessments at 4 time points post-disaster. Measures included Hurricane impact variables (initial loss/disruption and perceived life threat); history of family and community violence exposure, parent and peer social support, and post-disaster PTS symptoms. Latent class growth analysis demonstrated that there were three distinct trajectories of PTSD symptoms identified for this sample of youth (resilient, recovering, and chronic, respectively). Youth trajectories were associated with Hurricane-related initial loss/disruption, community violence, and peer social support. The results suggest that youth exposed to Hurricane Katrina have variable PTSD symptom trajectories. Significant risk and protective factors were identified. Specifically, youth Hurricane and community violence exposure increased risk for a more problematic PTSD symptom trajectory, while peer social support served as a protective factor for these youth. Identification of these factors suggests directions for future research as well as potential target areas for screening and intervention with disaster exposed youth (9).



Two population-based surveys of South Dade County, Florida, were conducted after Hurricane Andrew to compare hurricane-related symptoms of mental distress and describe the impact of mental health outreach teams. Households were selected by three-stage cluster sampling and findings from the two surveys, 13 months apart, were compared. Response rates were 75% and 84%. The prevalence of symptoms of mental distress decreased over time. However, in the households contacted by the teams (25% of sample), the prevalence of symptoms (50%) did not differ from households not contacted (43%). Households contacted by teams that reported symptoms were just as likely to have been referred for help by the teams (72%) as those without symptoms (68%). Households reporting symptoms were equally likely to get counseling regardless of whether the teams visited. Mental health teams had insignificant impact on mental health symptoms or the use of mental health services. Alternative approaches to mental health outreach teams need to be explored (10).

Families exposed to disasters such as Hurricane Katrina are at risk for numerous adverse outcomes. While previous literature suggests that the degree of disaster exposure corresponds with experiencing negative outcomes, it is unclear if parents and children report similar levels of disaster exposure. Levels of disaster stressor agreement were examined among mother-child dyads affected by Hurricane Katrina, and discrepancies in disaster stressor reports are associated with higher levels of PTS symptoms were evaluated. Participants included 353 dyads of mothers (age $M = 38.79$ years, $SD = 7.52$; 68% African American) and children (52% girls; age $M = 11.61$ years, $SD = 1.57$) exposed to Hurricane Katrina. Parents and children were

assessed at two timepoints, 3 - 7 months and 14 - 17 months postdisaster. Parent and child responses to items regarding hurricane related stressor exposure and PTS symptoms were analyzed. Agreement on hurricane related exposures was predominately slight to moderate, with kappas ranging from $\kappa = .19$ to $\kappa = .83$. Polynomial regression analyses revealed that when mothers reported low levels of Immediate Loss/Disruption stressors and children reported high levels of these stressors, children reported higher levels of Time 2 PTS symptoms, $b = -.72$ (.33), $p = 0.03$. The data indicate levels of mother-child response agreement were low. Discrepancies in mother and child reports predicted higher levels of child PTS symptoms. Clinicians may want to query both parents and children about their disaster experiences when working with families postdisaster (11).

On 29 August 2005, a category 4 Hurricane struck the Gulf Coast of Mississippi and southeast Louisiana, resulting in widespread destruction caused by winds in excess of 190 km/h (120 miles/h), heavy rain, and flooding. Communication, electricity, and fresh water supplies were disrupted throughout the region, rendering much of the area uninhabitable. Despite tremendous obstacles, the U.S. military spearheaded the eventually successful rescue, recovery, and relief operations (12).

Depression trajectories were examined over two years among mothers exposed to Hurricane Katrina. Risk and protective factors for depression trajectories, as well as associations with child outcomes were analyzed. A total of 283 mothers (age at time 1, $M = 39.20$ years, $SD = 7.21$; 62% African American) were included. Mothers were assessed at four time points over two years following Hurricane Katrina. Mothers reported PTS symptoms, hurricane exposure, traumatic life events, and social support at time 1. Depressive symptoms were modeled at times 2, 3, and 4. Youth reported their distress symptoms (PTS, depression, and anxiety) at time 4. Latent class growth analyses identified three maternal depression trajectories among mothers exposed to Hurricane Katrina: low (61%), resilient (29%), and chronic (10%). Social support was identified as a protective factor among mothers. The findings show three main trajectories of maternal depression following Hurricane Katrina. Social support was protective for mothers. Identified trajectories were not associated with children's distress outcomes (13).

Children and adolescents are especially vulnerable to environmental exposures and their respiratory effects. Following Hurricane Katrina in 2005, residents experienced multiple adverse environmental exposures. The association between upper respiratory symptoms (URS) and lower respiratory symptoms (LRS) and environmental exposures among children and adolescents affected by Hurricane Katrina were characterized. Following the return of the population to New Orleans after Hurricane Katrina (October 2005 and February 2006) a convenience sample of children and adolescents attending New Orleans health facilities was examined. Of 1,243 participants, 47% were Caucasian, 50% were male, and 72% were younger than 11 years of age. Multiple environmental exposures were identified during and after the storm and at current residences: roof/glass/storm damage (50%), outside mold (22%), dust (18%), and flood damage (15%). Self-reported URS and LRS (76% and 36%, respectively) were higher after the hurricane than before the hurricane (22% and 9%, respectively, $p < 0.0001$). Roof/glass/storm damage at home was associated with URS (AOR 1.59, 95% CI 1.15-2.21) and LRS (AOR=1.35, 95% CI 1.01-1.80), while mold growth at home was associated with LRS (AOR 1.47, 95% CI 1.02-2.12). The data indicate that children and adolescents affected by Hurricane Katrina experienced environmental exposures associated with increased prevalence of reported URS and LRS (14).

Disasters and displacement increasingly affect and challenge urban settings. How do pregnant women fare in the aftermath of a major disaster? The effect of pregnancies was investigated in disaster situations. A hypothesis that pregnant women residing in hurricane-prone areas suffer higher health risks was tested. The setting was in Louisiana, the Gulf Coast, U.S., state that continually experiences hurricane impacts. The time period for the analysis was three years following the landfall of Hurricane Andrew in 1992. Low birth weight and preterm deliveries were analyzed before and after landfall, as a whole and by race. Findings support an association between hazards and health of a community and indicate that pregnant women in the affected area, irrespective of race, are more likely to experience preterm deliveries compared to pre-event births. There is a negative health legacy impact in Louisiana as a result of hurricane landfall (15).

ASSESSMENT: over the past quarter of a century, cyclones have significantly affected populations in Southeast Asia, the Western Pacific, and the Americas. Future vulnerability to cyclones will increase because of factors such as population growth, urbanization, increasing coastal settlement, and global warming.

The primary cause of cyclone-related mortality is drowning; in developed countries, male gender is associated with increased mortality risk; in less developed countries, females experience higher mortality.

Future warming may lead to an upward trend in tropical cyclone destructive potential, and in a coastal population a substantial increase in hurricane-related losses in the twenty-first century should be anticipated.

There is repeated multicentennial cycle of tropical cyclone activity, the most recent of which commenced around AD 1700.

Regardless of this uncertainty, flooding by tropical cyclones will increase as a result of accelerated sea-level rise.

Theory and modeling predict that hurricane intensity should increase with increasing global mean temperatures.

On August 24, 2005, Tropical Storm Katrina, induced breaches in the New Orleans levee system resulting in the catastrophic flooding of approximately 80% of that city. Hurricane Katrina is the deadliest hurricane to strike the U.S. since 1928.

Hurricane and community violence exposure increase risk for PTSD symptom trajectory, while peer social support is a protective factor.

Children and adolescents affected by Hurricane Katrina experience increased prevalence of URS and LRS.

White pregnant women in the affected area, irrespective of race, are experiencing more preterm deliveries compared to pre-event births.

Although one biblical verse can be related to cyclone "*The wind goes towards the south, and veers to the north, round and round goes the wind, and on its circuits the wind returns*" (Ecclesiastes 1:6), the primary aim of this study was to analyze humans affected by natural calamities and how the humans cope with these calamities. For this reasons this verse was not analyzed further.

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DEVASTATING TSUNAMI

Tsunami is defined as a huge sea wave that is produced by underwater earth movement or volcanic eruption, causing severe devastation if it reaches land (1).

Few papers have explored the long-term mental health consequences of disaster losses in bereaved, either exposed to the disaster themselves or not. The prevalence and predictors of mental

disorders and psychological distress were examined in bereaved individuals either directly or not directly exposed to the 2004 tsunami disaster. A cross-sectional study of 111 bereaved Norwegians (32 directly and 79 not directly exposed) was conducted 2 years post disaster. A face-to-face structured clinical interview was used to diagnose current PTSD and MDD and a self-report scale to measure PGD. The prevalence of psychiatric disorders was twice as high among individuals directly exposed to the disaster compared to individuals who were not directly exposed (46.9 vs. 22.8 per 100). The prevalence of disorders among the directly exposed was: PTSD (34.4%), MDD (25%), and PGD (23.3%), whereas the prevalence among the not directly exposed was: PGD (14.3%), MDD (10.1%), and PTSD (5.2%). The co-occurrence of disorders was higher among the directly exposed (21.9 vs. 5.2%). Low education and loss of a child predicted PGD, whereas direct exposure to the disaster predicted PTSD. All 3 disorders were independently associated with functional impairment. In conclusion, the dual burden of direct trauma and loss can inflict a complex set of long-term reactions and mental health problems in bereaved individuals. The relationship between PGD and impaired functioning actualizes the incorporation of PGD in future diagnostic manuals of psychiatric disorders (2).

Fourteen months after the 2004 tsunami, mental health outcome was assessed in 187 bereaved relatives, 308 bereaved friends, and in 3,020 non-bereaved Swedish survivors. Of the bereaved relatives, 41% reported PTS reactions and 62% reported impaired general mental health. Having been caught or chased by the tsunami in combination with bereavement was associated with increased PTS reactions. Complicated grief reactions among relatives were almost as frequent as PTS reactions. The highest levels of psychological distress were among those who had lost children. Traumatic bereavement, in combination with exposure to life danger, is probably a risk factor for mental health sequelae after a natural disaster (3).

How PTG, depression and PTS interact and independently predict quality of life (QOL) were investigated in disaster survivors. A total of 58 Norwegian adults who were present in Khao Lak, Thailand at the time of the 2004 Southeast Asia Tsunami completed self-report questionnaires 2 and 6 years after the disaster. The participants reported symptoms of depression and PTS as well as PTG and QOL. Multiple mixed effects regression analyses were used to determine

the independent effects of PTG, depression and PTS on QOL measured 2 and 6 years after the disaster. PTS and depression were negatively related to QOL. PTG was insignificantly related to QOL in a bivariate analysis. However, considerable interaction effects were found. Six years after the tsunami, high levels of PTS were related to lower QOL in participants with low levels of PTG, whereas lower levels of depression were related to higher QOL in participants with high levels of PTG. The findings indicate that PTS and depression are negatively associated with QOL after a natural disaster. PTG may serve as a moderating factor in this relationship (4).



Tsunami Asia Disaster. Oil and acryl and sheep wool on canvas.
Emile Snellen v Vollenhoven. 2004.

The Asian tsunami of December 26, 2004 wreaked havoc along the southeastern coast of India and resulted in devastating losses. The high rates of long-term mental health consequences in adult survivors predicted immediately after the disaster have not been borne out by recent surveys. The psychological impact of the tsunami was examined in survivors with a view to gaining insights into the ethno-cultural coping mechanisms of affected communities and evaluating resilience in the face of incomprehensible adversity. Focus group discussions were conducted 9 months after the tsunami with two groups of fishermen, two groups of housewives, a group of village leaders and a group of young men in four affected villages of Nagapattinam district in Tamil Nadu, India. In spite of incomplete reconstruction of their lives, participants reconstructed meaning for the causes and the aftermath of the disaster in their cultural idiom. Qualitative changes in their social structure, processes and attitudes towards different aspects of life were revealed. Survivors valued their unique individual, social and spiritual coping strategies more

than formal mental health services. Their stories confirm the assertion that the collective response to massive trauma need not necessarily result in social collapse but also includes positive effects. The results suggest that interventions after disaster should be grounded in ethno-cultural beliefs and practices and should be aimed at strengthening prevailing community coping strategies (5).

Frequent and successful use of cognitive reappraisal, an emotion regulation strategy that involves rethinking the meaning of an emotional event in order to change one's emotional response, has been linked in everyday life to positive outcomes such as higher well-being. Whether we should expect this association to be maintained in a strong, temporally and spatially close emotional context is an unexplored question that might have important implications for our understanding of emotion regulation and its relations to psychological functioning. Members of the U.S. Embassy Tokyo community were evaluated in the months following the March 2011 earthquake, tsunami, and nuclear crisis in Japan. Self-reported use of cognitive reappraisal was not related to psychological functioning, but demonstrated success using cognitive reappraisal to decrease feelings of unpleasantness in response to disaster-related pictures on a performance-based task was associated with fewer symptoms of depression and PTS. Emotional reactivity to these pictures was associated with greater symptomatology. The results suggest that situational intensity may be an important moderator of reappraisal and psychological functioning relationships (6).



Tsunami

The 26th December 2004 saw a disaster brought on by massive waves - the Asian Tsunami. Millions of people died or were affected to varying degrees. The mental health aftermath did not only hit the

Tsunami affected areas but it also sent ripples globally. Financial and humanitarian aid was overwhelming. This review brings together the mental health consequences and the global response. It provides a systematic overview of the mental health problems both within the affected areas and globally. It considers different levels and intensities of mental health problems both in affected areas and globally and explores the effects on vulnerable groups. It describes the unprecedented response and highlights the importance of providing culturally and contextually sensitive, integrated and co-ordinated interventions, informed by qualitative and quantitative assessment of needs, urgency and resource availability (7).

Any response to the mental health needs of the affected community following any disaster depends upon a number of factors, including disaster preparedness, existence of mental health services, resources in human and financial terms, along with the magnitude, cause and suddenness of the event. In India, groups of islands in the Bay of Bengal and the coast of Tamil Nadu were very badly hit by tsunami. The survivors needed basic physical and emotional support. The response by two non-governmental organizations is described. Normalization was seen as an important first step. Using a number of training materials, volunteers were trained to deal with the mental health needs of the survivors. A consistent well resourced and accessible mental health network is necessary for appropriate intervention (8).

The prevalence of psychiatric and somatic symptoms and impairment in Sri Lanka 20-21 months after the 2004 Asian tsunami were examined, and coping strategies used by tsunami affected individuals that contributed to post-tsunami adjustment were assessed. Homes from one severely affected area were randomly selected, and adult respondents were sampled utilizing a modified Kish method. Instruments were administered in Sinhala to assess exposure, PTSD, depression, anxiety, somatic distress and impairment. Demographic variables and culturally-relevant coping activities were assessed. The prevalence of clinically significant PTSD, depression and anxiety was 21%, 16% and 30%, respectively. Respondents reported a mean of eight persistent and bothersome somatic complaints, which were associated with psychiatric symptoms and impairment. Thinking that one's life was in danger was the exposure item most strongly associated with symptoms and impairment. The majority of respondents found their own strength,

family and friends, a Western-style hospital and their religious practice to be the most helpful coping aids. The data indicate that a large minority of adults in one area of Sri Lanka reported significant psychiatric and somatic symptoms and impairments 20-21 months after the tsunami (9).

Devastating natural disasters and their aftermath are known to cause psychological distress. Whether the tsunami disaster following the GEJED in March 2011 has influenced suicide rates was examined from March 2009 to February 2014. Tsunami disaster-stricken areas were defined as the 16 municipalities facing the Pacific Ocean in Miyagi Prefecture. Inland areas were defined as other municipalities in Miyagi that were damaged by the earthquake. Suicide rates in the tsunami disaster-stricken areas were compared to national averages. In tsunami disaster-stricken areas, male suicide rates were significantly lower than the national average during the initial post-disaster period and began to increase after two years. Likewise, male suicide rates in the inland areas decreased for seven months, and then increased to exceed the national average. In contrast, female post-disaster suicide rates did not change in both areas compared to the national average. The male suicide rates in the inland areas started to increase earlier compared to the tsunami-stricken areas, which may reflect the relative deficiency of mental healthcare services in the inland areas. Considering the present status that many survivors from the tsunami disaster still live in temporary housing and face various challenges to rebuild their lives, intensive, long-term mental healthcare services in the tsunami-stricken areas should be continued (10).

Children may suffer from PTSD after disaster. There was a severe tsunami following an undersea earthquake off the Sumatra coast of Indonesia. There were 20,000 children in 6 southwestern provinces of Thailand who were possibly affected. The prevalence of PTSD in Thai students were examined in the area affected by the December 26th, 2004 tsunami disaster, Thailand. A total of 1615 surviving students from two schools in Takua Pa district located in Phang-nga Province, Thailand participated in this investigation. Screening was done by using Pediatric Symptom Checklists part II (PSC-II), Childhood Depressive Intervention (CDI) and the Revised Child Impact of Events Scales (CRIES 8). PTSD was diagnosed by child and adolescent psychiatrists by using criteria of DSM-IV. The intervention included psychological first aid, psycho-education, cognitive-behavioral

therapy, medication in severe cases, group support for students, parents and teachers, which was done at 10 days after the tsunami disaster. The prevalence rates of PTSD in the students facing the tsunami disaster were 57.3, 46.1, 31.6, 7.6, 4.5, 3.9 and 2.7% at 6 weeks, 6 months, 1 year, 2 years, 3 years, 4 years and 5 years after the disaster, respectively. Female to male ratio was 1.7: 1. The peak age was 9-10 years old. The top five on the list of symptoms in PTSD were distress with cue, intrusive thought, functioning impairment, startled response, terrified and hyper vigilance. Seven cases (3.1%) diagnosed with partial PTSD, still exhibited a wide range of PTSD symptoms but did not fulfill the DSM-IV diagnostic criteria. The top five on the list of symptoms in partial PTSD were avoiding thought/feelings, terrified, avoiding place/activities, distress with cue and startled response. The findings show that the prevalence of PTSD among tsunami victims was 57.3% at 6 weeks after the disaster. It declined sharply at 2 years after the event. Despite receiving financial, rehabilitation and mental health support, 2.7% of the victims continue to suffer from PTSD 5 years after the disaster (11).

A complex disaster, the GEJED of March 11, 2011, consisted of a large-scale earthquake, tsunami, and nuclear accident, resulting in more than 15 000 fatalities, injuries, and missing persons and damage over a 500-km area. The entire Japanese public was profoundly affected by "3/11." The risk of radiation exposure initially delayed the medical response, prolonging the recovery efforts. Japan's representative medical organization, the JMA, began dispatching JMATs to affected areas beginning March 15, 2011. About 1400 JMATs comprising nearly 5500 health workers were launched. The JMA coordinated JMAT operations and cooperated in conducting postmortem examination, transporting large quantities of medical supplies, and establishing a multiorganizational council to provide health assistance to disaster survivors. These response efforts contributed to the complete recovery of the health care system in affected areas within 3 months, and by July 15, 2011, JMATs were withdrawn. Subsequently, JMATs II have been providing long-term continuing medical support to disaster-affected areas. However, Japan is at great risk for future natural disasters because of its Pacific Rim location. It's rapidly aging population, uneven distribution of and shortage of medical resources in regional communities, and an overburdened public health insurance system

highlight the need for a highly prepared and effective disaster response system (12).

Cooperation between civilian and military forces, including the JSDF enabled wide-ranging disaster relief after the GEJED. Nevertheless, many preventable fatalities occurred, particularly related to an inability to treat chronic disease, indicating the need to plan for the provision of long-term medical aid after natural disasters in stricken areas and evacuation shelters. To assist in this effort, this report 1] provides an overview of the consequences of the medical response to the GEJED, the largest natural disaster ever to hit Japan, focusing on the role and actions of the JSDF; 2] discusses the lessons learned regarding the provision of medical aid and management by the JSDF after this disaster, looking at the special challenges of meeting the needs of a rapidly aging population in a disaster situation; and 3] provides recommendations for the development of strategies for the long-term medical aid and support after natural disasters, especially with regard to the demographics of the Japanese population (13).

The core factors necessary for mental health of disaster workers according to the following experiences were examined: 1] the JSDF disaster relief missions associated with the GEJED and the Haiti peacekeeping deployment associated with the GEJED 2] conformation of the peacekeeping mission units of various countries deployed to Haiti, and 3] JSDF assistance activities to the Japanese earthquake victims. The basic life needs were the major premises for maintaining the mental health of the disaster workers. Food, drinking supplies, medical supplies were particularly crucial, yet overlooked in Japanese worker settings compared with forces of other countries. Conversely, the workers tend to feel guilty (*moushi wake nai*) for the victims when their basic life infrastructures are better than those of the victims. The Japanese workers and disaster victims both tend to find comfort in styles based on their culture, in particular, open-air baths and music performances. When planning workers' environments in disaster settings, provision of basic infrastructure should be prioritized, yet a sense of balance based on cultural background may be useful to enhance the workers' comfort and minimize their guilt (14).

Following the March 11, 2011 GEJED and the Fukushima Daiichi Nuclear Power Plant accident, disaster workers have been working day and night for recovery efforts. A large part of disaster workers,

i.e., Self-Defense Force, police, fire department, and coast guard personnel, were highly acknowledged by the Japanese public for searching nearly 19,000 dead or missing victims. This recognition will be beneficial for their psychological recovery. On the other hand, dentists and government employees took a large role in these mortuary missions, but their work was hardly known to the people. Local government employees became victims of public criticisms. Similar phenomenon has been seen among Fukushima nuclear plant workers. These workers have experienced a whole array of traumatic stress, including near-death work experiences, irradiation fear, loss of their properties and their loved ones. The electric company has been blamed by the public for their disaster responses, so the public portrays these employees as disaster perpetrators. However, this trend is leading to serious discriminations and harassments, and adversely affecting their mental health. The recovery efforts should be completed as soon as possible. However, when people criticize these workers, their burden of psychological trauma will continue to grow, and their recovery process will be impeded. It is crucial for the society to recognize these hard-working people and to show appreciation and support for their dedications (15).

Three cases of lung disorders were caused by drowning in the recent large tsunami that struck following the GEJED. All three were females, and two of them were old elderly. All segments of both lungs were involved in all the three patients, necessitating ICU admission and endotracheal intubation and mechanical ventilation. All three died within 3 weeks. In at least two cases, misswallowing of oil was suspected from the features noted at the time of the detection. Sputum culture for bacteria yielded isolation of *Stenotrophomonas maltophilia*, *Legionella pneumophila*, *Burkholderia cepacia*, and *Pseudomonas aeruginosa*. The cause of tsunami lung possibly is a combination of chemical induced pneumonia and bacterial pneumonia (16).

Six cases of melioidosis were identified in survivors of the 26 December 2004 tsunami who were admitted to Takuapa General Hospital in Phangnga, a region in southern Thailand where melioidosis is not endemic. All 6 cases were associated with aspiration, and 4 were also associated with laceration. The clinical, laboratory, and radiographic findings and the outcomes were evaluated for these 6 patients with those for 22 patients with aspiration-related melioidosis acquired during 1987-2003 in a

melioidosis-endemic region in northeast Thailand. Results of tests for detection of *Burkholderia pseudomallei* in soil specimens from Phangnga and from northeast Thailand were compared. The 6 patients (age range, 25-65 years) presented with signs and symptoms of pneumonia 3-38 days (median duration, 6.5 days) after the tsunami. Chest radiograph findings at the onset of pneumonia were abnormal in all cases; 1 patient developed a lung abscess. *B. pseudomallei* was grown in blood cultures in 3 cases and in cultures of respiratory secretions in 4 cases. Two patients required ventilation and inotropes; 1 patient died. Compared with tsunami survivors, patients with aspiration-related melioidosis in northeast Thailand had a shorter interval (median duration, 1 day) between aspiration and onset of pneumonia; were more likely to exhibit shock, respiratory failure, renal failure, and/or altered consciousness ($p=0.03$); and had a higher in-hospital mortality (64%, 14 of 22 patients, $p=0.07$). These differences possibly are related to the severity of the near-drowning episode, the inhalation of sea water vs. fresh water, the size of bacterial inoculum, and the possible acquisition (among tsunami survivors) of *B. pseudomallei* via laceration. Only 3 (0.8%) of 360 soil samples from Phangnga were positive for *B. pseudomallei* compared with 26 (20%) of 133 samples from northeast Thailand ($p<0.0001$). The data indicate that Tsunami survivors are at increased risk of melioidosis if they are injured in an environment containing *B. pseudomallei* (17).

The spectrum of radiographic findings, frequency, and type of injuries in tsunami victims were determined. From December 2004 to May 2005, all tsunami victims admitted to the hospital were retrospectively identified by a search of medical records. Patients who received radiologic examinations were reviewed for their radiographic findings. A total of 225 tsunami victims were identified. One hundred eight victims received radiologic evaluations on admission that included 350 plain radiographs, 19 ultrasound examinations, 18 computed tomography scans and 3 magnetic resonance imaging scans. Overall positivity rate was 48% (187/390). Most common trauma involved musculoskeletal (102/187, 54.5%). Retained foreign bodies in soft tissues, pneumonia/aspiration, and tsunami sinusitis were found in 22, 28, and 31 patients (9.8, 12.4, and 13.8%), respectively. Imaging played an important role in detection these abnormalities (18).

ASSESSMENT: the prevalence of psychiatric disorders, including PTSD, MDD, and PGD, is high among individuals directly tsunami-exposed disaster. These disorders are associated with functional impairment. The dual burden of direct trauma and loss can inflict a complex set of long-term reactions and mental health problems in bereaved individuals.

The highest levels of psychological distress are among those who had lost children. Traumatic bereavement, in combination with exposure to life danger, is a risk factor for mental health sequelae after a natural disaster.

PTS and depression are negatively associated with QOL after a tsunami.

The 26th December 2004 disaster was brought by massive waves - the Asian Tsunami. Millions of people died or were affected to varying degrees. The mental health aftermath did not only hit the Tsunami affected areas but it also sent ripples globally.

In India, groups of islands in the Bay of Bengal and the coast of Tamil Nadu were badly hit by tsunami. The survivors needed basic physical and emotional support.

In Sri Lanka, a large minority of adults in one area reported significant psychiatric and somatic symptoms and impairment 20-21 months after the tsunami.

In Thailand, the prevalence of PTSD among tsunami victims was 57.3% at 6 weeks after the disaster. It declined sharply at 2 years after the event. Despite receiving financial, rehabilitation and mental health support, 2.7% of the victims continue to suffer from PTSD 5 years after the disaster.

Tsunami is associated with lung disorders caused by drowning, melioidosis, and trauma involving musculoskeletal system, retained foreign bodies in soft tissues, pneumonia/aspiration, and tsunami sinusitis.

Is a tsunami described in the Bible? The verses which describe the destruction of the city of Tyre are mentioned in the section on earthquakes: *"Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure"* (Yehezkel 26:18) could be understood as referring to tsunami.

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NUCLEAR DISASTERS

Since nuclear power plant disasters associated with modern technology usually affect human beings, coping with these disasters were also explored.

Past nuclear disasters, such as the atomic bombings in 1945 and major accidents at nuclear power plants, have highlighted similarities in potential public health effects of radiation in both circumstances, including health issues unrelated to radiation exposure. Although the rarity of nuclear disasters limits opportunities to undertake rigorous research of evidence-based interventions and strategies, identification of lessons learned and development of an effective plan to protect the public, minimize negative effects, and protect emergency workers from exposure to high-dose radiation is important. Additionally, research is needed to help decision makers to avoid premature deaths among patients already in hospitals and other vulnerable groups during evacuation. Since nuclear disasters can affect hundreds of thousands of people, a substantial number of people are at risk of physical and mental harm in each disaster. During the recovery period after a nuclear disaster, physicians might need to screen for psychological burdens and provide general physical and mental health care for many affected residents who might experience long-term displacement. Reliable communication of personalized risks has emerged as a challenge for health-care professionals beyond the need to explain radiation protection. To overcome difficulties of risk communication and provide decision aids to protect workers, vulnerable people, and residents after a nuclear disaster, physicians should receive training in nuclear disaster response. This training should include evidence-based interventions, support decisions to balance potential harms and benefits, and take account of scientific uncertainty in provision of community health care. An open and joint learning process is essential to prepare for, and minimise the effects of, future nuclear disasters (1).

Information about the consequences of human exposure to radiation in the former Soviet Union has recently become available. These data add new insights and provide possible answers to several

important questions regarding radiation and its impact on occupational and public health. The 1986 Chernobyl accident initiated a major and early increase in childhood thyroid cancer that resulted from ingestion of iodine-131 (^{131}I) by young children living in the most heavily contaminated areas of Belarus, Ukraine, and Russia. Insignificant additional cancer or other adverse medical effects have yet been reported in the affected populations and among clean-up workers. Major psychological stress independent of radiation dose has been observed in those people thought to be exposed. During the early days of the atomic energy program in the former Soviet Union, some unfortunate events occurred. The country's first atomic test in Semipalatinsk in 1949 exposed over 25,000 people downwind from the blast to significant doses of fission products, especially ^{131}I . During the late 1940s and the early 1950s nuclear material production facilities were developed near Chelyabinsk in the South Ural Mountains, which resulted in major releases into the environment and significant overexposures for thousands of workers and nearby populations. Chronic radiation sickness was observed early in exposed workers, and increases in leukemia and other cancers were also reported. The series of plutonium inhalation-related lung cancers and fatalities among workers exposed in that first decade appears to be unique. Long-term consequences of chronic radiation sickness and four decades of follow-up are being described for the first time. Villagers downstream from the plant consumed high levels of ^{137}Cs and ^{90}Sr and, it is reported, manifested increases in leukemia from internal and external exposures. Although the 40-year databases for retrospective dosimetry epidemiology studies are just beginning to be integrated and evaluated, preliminary evaluations suggest that there may be graded, significant dose-rate amelioration factors for cancer and leukemia risks in workers and the general population relative to the risk data on the Japanese atomic bomb survivors. Even for plutonium-induced lung cancers in workers, such a dose-rate effect is supposed to be evident. These experiences give us insight into the consequences of protracted radiation at high and low doses and rates. If these findings are validated and confirmed, they can provide information that reduces some of the uncertainties in retrospective radiation dosimetry and radiation risk estimates (especially for low-level, chronic exposures) for activities related to

medicine as well as the handling of nuclear materials and nuclear facility decommissioning, decontamination, and demilitarization (2).

The Chernobyl disaster (also referred to as the Chernobyl accident or simply Chernobyl) was a catastrophic nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in the town of Pripyat, in Ukraine (then officially the Ukrainian SSR), which was under the direct jurisdiction of the central authorities of the Soviet Union. An explosion and fire released large quantities of radioactive particles into the atmosphere, which spread over much of the western USSR and Europe. The Chernobyl disaster was the worst nuclear power plant accident in history in terms of cost and casualties (3).

The Chernobyl nuclear accident of 1986 released large quantities of radioactive material causing heavy contamination in widespread areas of the former Soviet Union. Each summer, several hundred children visit Spain from Chernobyl. The accident, the environmental contamination, the mechanisms of radiation injury and the dose-response relationships are described. The health effects of exposure to ionizing radiation and the health impact of the Chernobyl catastrophe were reviewed. Guidelines for the medical management and evaluation were proposed for children on temporary visits. The health status of adults and especially that of children in Belarus, Ukraine and the Russian Federation has been adversely affected. Chernobyl has given rise to a marked increase in the incidence of papillary thyroid cancer, psychological consequences and socioeconomic disruption. The incidence of other diseases has increased, but not all health problems seen after the nuclear accident can be attributed to radiation. Given the long latency period for diseases induced by radiation exposure, long-term follow-up of all potentially affected individuals is important. Fifteen years after the Chernobyl accident the international community is still learning scientific, medical and humanitarian lessons (4).

The accident that occurred at the Chernobyl Nuclear Power Plant in 1986, released large quantities of radionuclides, among them radioiodine, into the atmosphere, thereby raising public concerns about its influence on thyroid structure and function, especially the development of malignancy. There were even reports about 700 deaths due to thyroid carcinoma in Russian Federation, Ukraine and Belarus, resulting from the accident. The incidence of thyroid cancer was evaluated in different parts of the world, especially in heavily

contaminated countries, as Ukraine and Belarus, and the possible link between radioisotope activity in the thyroid and the development of malignancy. In Minsk, there was 40-fold increase of the incidence of thyroid cancer in the years 1986-1994, in comparison to the period 1977-1985. An increase of the incidence of thyroid cancer has generally been observed in many countries after the Chernobyl accident. There are factors that may have an influence on this phenomenon, especially diagnostic tests, health care, social and environmental factors, like iodine level in water and soil. The results of molecular biology studies, e.g. RET translocation in carcinoma type RET/PTC1 in elderly and RET/PTC3 in children, and expression Ax1 and Gas6 in children were evaluated. Other thyroid diseases, like nodular goitre, cysts, the disturbance of thyroid function and autoimmunity, were possibly linked to the radiation after Chernobyl accident. Data obtained from the regions near Chernobyl showed no increased risk of other types of malignancy (leukaemia, Hodgkin's and non Hodgkin's lymphoma) in 1986-1996 (5).



The nuclear reactor after the disaster. Reactor 4 (center). Turbine building (lower left). Reactor 3 (center right).

As a result of the Chernobyl nuclear power plant accident, massive amounts of radioactive materials were released into the environment and large numbers of individuals living in Belarus, Russia, and Ukraine were exposed to radioactive iodines, primarily ^{131}I . Iodine-131 concentrated in the thyroid gland of residents of the contaminated areas, with children and adolescents being particularly affected. In the decade after the accident, a substantial increase in thyroid cancer

incidence was observed among exposed children in the three affected countries, and compelling evidence of an association between pediatric thyroid cancer incidence and radiation exposure to the thyroid gland accumulated. Both the magnitude and patterns of thyroid cancer risk are generally consistent with those reported following external exposure. Based on data from case-control studies, iodine deficiency appeared to enhance the risk of developing thyroid cancer following exposure from Chernobyl. Other results, however, did not support these findings. Data on adult exposure are limited and not entirely consistent. Similarly, information on thyroid cancer risks associated with in utero exposure is insufficient to draw conclusions. The lack of information on these two population groups indicates an important gap that needs to be filled. Twenty years after the accident, excess thyroid cancers are still occurring among persons exposed as children or adolescents, and, if external radiation can be used as a guide, we can expect an excess of radiation-associated thyroid cancers for several more decades. Since considerable uncertainties about the long-term health effects from Chernobyl remain, continued follow-up of the exposed populations should provide valuable information (6).

Thyroid cancer incidence (follow-up period: 1991-2001) has been analyzed, including persons who were exposed as children at an age between 0 and 17 years and who are living in the Bryansk oblast, the worst contaminated area of Russia after the Chernobyl accident. According to the census of 1989, the population of this oblast comprises 375 thousand people. Thyroid doses from incorporated radioiodine isotopes, both for the thyroid cancer cases and the study population, were determined based on the official methodology approved by the Russian Scientific Commission on Radiation Protection. Between 1991 and 2001, a total of 199 thyroid cancer cases were diagnosed at cancer centers (the so-called oncological dispensaries) of the investigated regions. The performed analysis relies on medical and dosimetric information available from the Russian National Medical and Dosimetric Registry which was established after the Chernobyl accident. Diagnoses were confirmed histologically for 95% of the cases. The analysis revealed significant radiation risk only for those exposed as children at an age of 0-9 years. In this group, the standardized incidence ratio (the national incidence rate was used as a reference) in the considered time period is estimated to be 6.7 (95% CI 5.1-8.6) and 14.6 (95% CI 10.3-20.2) for

girls and boys, respectively. The risk dependence on age at exposure has also been studied. The smaller the age the higher is the risk. For girls whose age at exposure was 0-4 years, the excess relative risk per 1 Gy for the period 1991-2001 was 45.3 (95% CI 5.2-9.953; with internal control) and 28.8 (95% CI 4.3-2.238; with external control), respectively. For boys whose age at exposure was 0-9 years the corresponding excess relative risk per 1 Gy was 68.6 (95% CI 10.0-4.520) and 177.4 (95% CI -276-10(6)), respectively. Dependence of radiation risk on time was studied, with the focus on two follow-up periods 1991-1996 and 1997-2001, respectively. In 1997-2001 the radiation risk is shown to decrease among girls, and increase among boys (7).

Immediately after the accidents in the nuclear power stations in Fukushima on March 11, the Japanese Government ordered the evacuation of the residents within a 20-km radius from the station on March 12, and asked various institutions to monitor the contamination levels of the residents. Hirosaki University, which is located 355 km north of Fukushima City, decided to send support staff to Fukushima. The results of the exposure of 13 individual teams were summarized from March 15 to June 20. The support teams surveyed more than 5,000 people during this period. Almost all subjects had external contamination levels of less than 13 kcpm on Geiger-Müller (GM) survey meter, which is categorized as "no contamination level." The 1(st) team showed the highest external exposure dose, but the 4(th) team onward showed insignificant change. Subsequently, the internal radiation exposure was measured using a whole body counter that indicated undetectable levels in all staff members. Although the measured external radiation exposure dose cannot have serious biological effects on the health of an individual, a follow-up study of the residents in Fukushima and other regions where the radioactive material has spread will be required for a long time (8).

The GEJED was one of the most devastating natural disasters ever to hit Japan. Features of the disaster and the radioactive accident in Fukushima are presented. About 19,000 are dead or remain missing mainly due to the tsunami, but children accounted for only 6.5% of the deaths. The Japanese Society of Pediatric Surgeons set up the Committee of Aid for Disaster, and collaborated with the Japanese Society of Emergency Pediatrics to share information and provide pediatric medical care in the disaster area (9).



Smoke billows from the Fukushima Daiichi plant. Photo from Flickr via daveeza.

Mothers of young children are at high-risk for developing adverse mental health effects following a nuclear accident. Using the Japanese pregnancy registration system, the prefecture of Fukushima launched a population-based survey of women who were pregnant at the time of the Fukushima nuclear accident in order to assess their and their newborns' health. The results of a screen for depressive symptoms were evaluated among new mothers and its association with geographical region and interruption of obstetrical care after the Fukushima nuclear accident, which occurred after the GEJED on March 11, 2011. The survey targeted women who lived in Fukushima prefecture and who had registered their pregnancies between August 1, 2010 and July 31, 2011. Among the 16,001 women targeted, 9,321 returned the questionnaires (response proportion = 58.3%) and data from 8,196 women with singleton live births were analyzed. The main outcome measure was a standard two-item depression screen. Regional radiation levels were determined from the prefecture's periodical reports, and interruption in obstetrical care after the Fukushima nuclear accident was determined from mothers' individual responses to the questionnaire. Among the 8,196 women, 2,262 (28%) were screened positive for depressive symptoms. After adjusting for maternal and infant characteristics, both mothers in Soso, the region in which the nuclear power plant is located, and mothers that had changed obstetrical care facilities were significantly more likely to screen positive for depression. In contrast, mothers in Iwaki and Aizu, regions with relatively low radiation levels, were significantly less likely to screen positive for depression. The findings suggest that improving mental health support for mothers with infants should be a high priority in the acute phase of nuclear disaster

response. In the strategic provisioning of parental support, close attention should be paid to regional variations in negative mental health consequences (10).

PTS symptoms in relation to the population affected by the Fukushima Nuclear Disaster, one year after the disaster were investigated. Additionally, social factors, such as forced displacement, which was hypothesized to contribute to the high prevalence of PTS. Finally, written narratives were collected from the impacted population. Using the Impact of Event Scale-Revised (IES-R), questionnaires were sent to 2,011 households of those displaced from Fukushima prefecture living temporarily in Saitama prefecture. Of the 490 replies; 350 met the criteria for inclusion in the study. The mean score of IES-R was 36.15 ± 21.55 , with 59.4% having scores of 30 or higher, thus indicating a probable PTSD. Insignificant differences in percentages of high-risk subjects were found among sex, age, evacuation area, housing damages, tsunami affected, family split-up, and acquaintance support. The significant predictors of probable PTSD were chronic physical diseases (OR 1.97), chronic mental diseases (OR 6.25), worries about livelihood (OR 2.27), lost jobs (OR 1.71), lost social ties (OR 2.27), and concerns about compensation (OR 3.74). The data indicate that although there are limitations in assuming a diagnosis of PTSD based on self-report IES-R, there was a high-risk of PTSD strongly related to the nuclear disaster and its consequent evacuation and displacement. Therefore, recovery efforts must focus not only on medical and psychological treatment alone, but also on social and economic issues related to the displacement, as well (11).

After the GEJED of 2011, there has been a concern about health problems among children. Therefore, the prevalence of wheeze, eczema symptoms and associated factors among children in areas primarily affected by the disaster were investigated. From 2012 to 2014, the parent-administered questionnaire was distributed to 25,198 children in all 233 public schools in the 13 municipalities of Miyagi Prefecture in northeast Japan. A total of 7,155 responses (mean age 10.5 ± 2.2 years) were received (response rate: 28.4%). The prevalence of allergic symptoms according to the ISAAC questionnaire in 2nd, 4th, 6th, and 8th graders was 12.4%, 9.9%, 9.3%, and 5.6% for wheeze, and 20.1%, 18.0%, 14.0%, and 12.4% for eczema. Younger age, history of hospitalization, and difficulties in children's daily lives as assessed by the SDQ, were significantly and

consistently associated with both allergic symptoms (both $p < 0.05$). Living in a coastal municipality was also associated with eczema symptoms ($p = 0.0278$). The prevalence of eczema symptoms in the 2nd (20.1%) and 8th (12.4%) grades was significantly higher than previously reported in Japan. Living in a coastal municipality was independently associated with eczema symptoms, and psychometric properties were also closely linked to allergic symptoms. The findings are important for understanding the risks of allergic disorders after natural disasters (12).

ASSESSMENT: nuclear disasters, such as the atomic bombings in 1945 and major accidents at nuclear power plants, have highlighted similarities in potential public health effects of radiation in both circumstances, including health issues unrelated to radiation exposure. Since nuclear disasters can affect hundreds of thousands of people, a substantial number of people are at risk of physical and mental harm in each disaster.

The Chernobyl disaster was a catastrophic nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in the town of Pripyat, in Ukraine (then officially the Ukrainian SSR). An explosion and fire released large quantities of radioactive particles into the atmosphere spread over much of the western USSR and Europe. The Chernobyl disaster was the worst nuclear power plant accident in history in terms of cost and casualties.

The accident that occurred at the Chernobyl Nuclear Power Plant in 1986, released large quantities of radionuclides, among them radioiodine, into the atmosphere, thereby raising public concerns about its influence on thyroid structure and function, especially the development of malignancy. Chernobyl has given rise to a marked increase in the incidence of papillary thyroid cancer, psychological consequences and socioeconomic disruption.

Other thyroid diseases, like nodular goitre, cysts, the disturbance of thyroid function and autoimmunity, were possibly linked to the radiation after Chernobyl accident. Data obtained from the regions near Chernobyl showed no increased risk of other types of malignancy (leukaemia, Hodgkin's and non Hodgkin's lymphoma) in 1986-1996.

Twenty years after this accident, excess thyroid cancers are still occurring among persons exposed as children or adolescents, and, if external radiation can be used as a guide, an excess of radiation-

associated thyroid cancers for several more decades we can expect can be expected.

Mothers of young children are at high-risk for developing adverse mental health effects following a nuclear accident.

PTS symptoms were related to the population affected by the Fukushima Nuclear Disaster, one year after the disaster. The significant predictors of PTSD included chronic physical diseases, chronic mental diseases, worries about livelihood, lost jobs, lost social ties, and concerns about compensation.

The prevalence of eczema symptoms was high among children in areas primarily affected by the GEJED. Younger age, history of hospitalization, and difficulties in children's daily lives were associated with allergic symptoms. Living in a coastal municipality was also associated with eczema symptoms.

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COPING STRATEGIES

How do humans cope with natural disasters?

Large magnitude earthquakes in urban environments continue to kill and injure tens to hundreds of thousands of people, inflicting lasting societal and economic disasters. EEW provides seconds to minutes of warning, allowing people to move to safe zones and automated slowdown and shutdown of transit and other machinery. The handful of EEW systems operating around the world use traditional seismic and geodetic networks that exist only in a few nations. Smartphones are much more prevalent than traditional networks and contain accelerometers that can also be used to detect earthquakes. The development of a new type of seismic system, MyShake, harnesses personal/private smartphone sensors to collect data and analyze earthquakes. Smartphones can record magnitude 5 earthquakes at distances of 10 km or less and develop an on-phone detection capability to separate earthquakes from other everyday shakes. The proof-of-concept system then collects earthquake data at a central site where a network detection algorithm confirms that an earthquake is under way and estimates the location and magnitude in real time. This information can then be used to issue an alert of forthcoming ground shaking. MyShake could be used to enhance EEW in regions with traditional networks and could provide the only EEW capability in regions without. In addition, the seismic waveforms recorded could be used to deliver rapid microseism maps, study impacts on buildings, and possibly image shallow earth structure and earthquake rupture kinematics (1).

EEW can reduce harm to people and infrastructure from earthquakes and tsunamis, but it has not been implemented in most high earthquake-risk regions because of prohibitive cost. Common consumer devices such as smartphones contain low-cost versions of

the sensors used in EEW. Although less accurate than scientific-grade instruments, these sensors are globally ubiquitous. Through controlled tests of consumer devices, simulation of an moment magnitude 7 earthquake on California's Hayward fault, and real data from the moment magnitude 9 Tohoku-oki earthquake, demonstrated that EEW could be achieved via crowdsourcing (2).

Regional heavy rainfall is usually caused by the influence of extreme weather conditions. Instant heavy rainfall often results in the flooding of rivers and the neighboring low-lying areas, which is responsible for a large number of casualties and considerable property loss. The existing precipitation forecast systems mostly focus on the analysis and forecast of large-scale areas but do not provide precise instant automatic monitoring and alert feedback for individual river areas and sections. Therefore, an easy method is proposed to automatically monitor the flood object of a specific area, based on the currently widely used remote cyber surveillance systems and image processing methods, in order to obtain instant flooding and waterlogging event feedback. The intrusion detection mode of these surveillance systems is used in this investigation, wherein a flood is considered a possible invasion object. Through the detection and verification of flood objects, automatic flood risk-level monitoring of specific individual river segments, as well as the automatic urban inundation detection, has become possible. The proposed method can better meet the practical needs of disaster prevention than the method of large-area forecasting. It has several other advantages, such as flexibility in location selection, no requirement of a standard water-level ruler, and a relatively large field of view, when compared with the traditional water-level measurements using video screens. The results can offer prompt reference for appropriate disaster warning actions in small areas, making them more accurate and effective (3).

With the increasing climatic extremes, the frequency and severity of urban flood events have intensified worldwide. Image-based automated monitoring of flood formation and analyses of water level fluctuation were proposed as value-added intelligent sensing applications to turn a passive monitoring camera into a visual sensor. Combined with the proposed visual sensing method, traditional hydrological monitoring cameras have the ability to sense and analyze the local situation of flood events. This can solve the current problem that image-based flood monitoring heavily relies on

continuous manned monitoring. Conventional sensing networks can only offer one-dimensional physical parameters measured by gauge sensors, whereas visual sensors can acquire dynamic image information of monitored sites and provide disaster prevention agencies with actual field information for decision-making to relieve flood hazards. The visual sensing method established in this study provides spatiotemporal information that can be used for automated remote analysis for monitoring urban floods. The experimental results suggest that the visual sensing approach may be a reliable way for determining the water fluctuation and measuring its elevation and flood intrusion with respect to real-world coordinates. The performance of the proposed method has been confirmed; it has the capability to monitor and analyze the flood status, and therefore, it can serve as an active flood warning system (4).

Health assessment and epidemic prevention was assessed in earthquake rescue, emergency health and epidemic prevention modewas established for the national earthquake emergency medical rescue team scientifically, and references and consultations were provided for emergency hygiene and epidemic prevention measures in disaster medicine. China National Earthquake Disaster Emergency Search and Rescue Team gathered and evaluated environment, food, drinking water and other health related information around more than 2000 earthquake victims in Baoxing County, Shuangshi Town and Qingren Township from 20th April 2013 to 27th by using methods such as field epidemiological investigations. The national earthquake emergency medical rescue team spread comprehensive evaluation focusing on the local epidemics, find out the starting point of epidemic prevention, and then built reporting system in disaster area. The team also formulated the emergency detection system of food and drinking water and carried out health education (5).

Major earthquakes often result in incalculable environmental damage, loss of life, and threats to health. Tremendous progress has been made in response to many medical challenges resulting from earthquakes. However, emergency medical rescue is complicated, and great emphasis should be placed on its organization to achieve the best results. The 2008 Wenchuan earthquake was one of the most devastating disasters in the past 10 years and caused more than 370,000 casualties. The lessons learnt from the medical disaster relief effort and the subsequent knowledge gained about the

regulation and capabilities of medical and military back-up teams should be widely disseminated. The emergency medical rescue efforts were analyzed after the Wenchuan earthquake. Establishment of a national disaster medical response system, an active and effective commanding system, successful coordination between rescue forces and government agencies, effective treatment, a moderate, timely and correct public health response, and long-term psychological support are all crucial to reduce mortality and morbidity and promote overall effectiveness of rescue efforts after a major earthquake (6).

Performance assessments of EMRRTs, particularly the first responders deployed to the hardest hit areas following major earthquakes, should consider efficient and effective use of resources. The daily technical efficiency of EMRRTs was assessed in the emergency period immediately following the 2010 Yushu earthquake in China. Data on EMRRTs were obtained from official daily reports of the general headquarters for Yushu earthquake relief, the emergency office of the National Ministry of Health, and the Health Department of Qinghai Province, for a sample of data on 15 EMRRTs over 62 days. Data envelopment analysis was used to examine the technical efficiency in a constant return to scale model, a variable returns to scale model, and the scale efficiency of EMRRTs. Tobit regression was applied to analyze the effects of corresponding influencing factors. The average technical efficiency scores under constant returns to scale, variable returns to scale, and the scale efficiency scores of the 62 units of analysis were 77.95%, 89.00%, and 87.47%, respectively. The staff-to-bed ratio was significantly related to global technical efficiency. The date of rescue was related to pure technical efficiency. The type of institution to which an EMRRT belonged and the staff-to-bed ratios were related to scale efficiency. The data provide evidence that supports improvements to EMRRT efficiency and serves as a reference for earthquake emergency medical rapid assistance leaders and teams (7).

China is prone to disasters and escalating disaster losses. Effective disaster mitigation is the foundation for efficient disaster response and rescue and for reducing the degree of hazardous impacts on the population. Vulnerability refers to the population's capacity to anticipate, cope with, and recover from the impact of a hazardous event. HVA systematically evaluates the damage that could be caused by a potential disaster, the severity of the impact, and the

available medical resources during a disaster to reduce population vulnerability and increase the capacity to cope with disasters. HVA team membership, content (disaster identification, probability and consequences), and methods and procedures for an HVA can be tailored to China's needs. Disaster epidemiology evaluates the underlying causes of disasters to achieve effective disaster prevention and reduction. Several recommendations that are already in practice in developed countries, such as the U.S., for future implementation in China and other developing countries are made. An effective HVA plan is crucial for successful disaster preparedness, response, and recovery (8).

Recovery from disaster can take a lifetime, and people looking in from outside might not appreciate the stages of recovery. Little talked about is the stigma, which might attach to the survivors of a disaster, especially if it is a man-made disaster. A Japanese nursing student who visited the area 18 months after the GEJED and tsunami, talked to the people there, and shared her reflections. The experiences of the Fukushima survivors are linked to those of victims of other disasters, whose recovery were impeded by being discriminated against and stigmatized (9).

In order to safely manage nuclear power plants, their workforce should be mentally healthy. The coping strategies of radiation control personnel and nondestructive inspectors engaged in the periodic inspection of nuclear power plants, the effect of the coping strategies on their mental health, as well as any effect based on whether or not they had worked after the nuclear disaster caused by the GEJED and tsunami in March 2011 were examined. A questionnaire survey was administered to 133 technicians attending a certification course, and among them, 104 people were with work experience in radiation control and/or nondestructive inspection. The results indicated that even among workers of the same company who were assigned to similar duties in the periodic inspections of nuclear power plants, the group that had worked at a nuclear plant after the disaster had a tendency to use coping strategies, such as giving up and avoidance-like thinking, which was dissimilar to the group that had not worked at a nuclear plant after the disaster. The former group had higher levels of distress than those who tended to use other coping strategies. The plan-drafting strategy adopted by the group that had not worked after the disaster did not result in stress reduction (10).

A catastrophic undersea megathrust earthquake of magnitude 9.0 off the coast of Japan occurred on Friday, 11 March 2011. The earthquake triggered powerful tsunami waves, and the tsunami precipitated Fukushima nuclear accidents. After the terrible earthquake, many people fled from the nuclear accident and arrived at places far from the nuclear power plant. A story of one measure devised to deal with the problem of the Fukushima nuclear accident at a regional hospital of Fukushima prefecture, Aizu General Hospital, which is located far from the Fukushima nuclear plant. The current situation of Fukushima prefecture is reported after the 2011 GEJED. In the hospital, the countermeasure headquarters was established to supply medical care for those who had been injured by tsunami waves and the Fukushima nuclear accident. Especially, the screening for radioactive exposure using a dosimeter to take decontamination measures for cases of external exposure was extremely important task. Nevertheless, because the accurate knowledge related to radioactive contamination didn't provide, most medical staff fell into confusion. Fukushima prefecture has been 'shrinking' since the nuclear accident. However, today, although some hot spots remain in residential areas, the radioactive contamination is decreasing little by little. Many people in Fukushima Prefecture advance as one, facing forward. Recently, decontamination projects started. Efforts must be continued over a long period (11).

A novel approach uses blood cell change patterns after accidental whole body radiation exposure (to be expected as a consequence of nuclear terrorism) as reliable indicators of effect and as an aid to plan therapeutic measures. There is growing concern about the potential of nuclear terrorism. Several scenarios are being discussed. In all of them one finds elements that mimic the experience gained in assessing and treating humans who were exposed to ionizing radiation in radiation accidents. This experience leads to diagnostic and therapeutic measures laid down in a recently published Manual on the Acute Radiation Syndrome. The European Bone Marrow Transplantation Group together with the Institut de Radioprotection et de Sûreté Nucléaire in Paris and the public university in the city of Ulm, in the South German state of Baden-Württemberg, published a consensus paper to use 'response categories' based on organ-specific gradings of severity as indicators of the severity of health impairments. The implication is obvious: the medical staff confronted suddenly with the challenge of clinically managing an

irradiated person will find all scientifically based recommendations in order to cope with the evolving problems on a scientific-pathophysiology driven approach (12).

The lesson of Hiroshima fosters our current preparations for nuclear war. There are psychological effects, personal and political, of our stockpiling of nuclear weapons. It is suggested that, although the situation is desperate, hope may be found in the beginnings of a public awareness that is fostering the movement against nuclear armaments (13).

The management process of nuclear power plant induced disasters was evaluated. The study sheds light on phases and issues associated with the NPP induced disaster management. This study uses Palo Verde Nuclear Generation Station as study subject and Arizona State as study area. The Radiological Assessment System was used for Consequence Analysis Source Term to Dose of the Nuclear Regulatory Commission, computer software to project and assess the source term dose and release pathway. ArcGIS, a geographic information system to analyze geospatial data, also was used. A detailed case study of Palo Verde Nuclear Power Generation Plant was conducted. The findings reveal that the nuclear power plant induced disaster management process is conducted by various stakeholders. To save lives and to minimize the impacts, it is vital to relate planning and process of the disaster management. The data indicate that number of people who expose to the radioactive plume pathway and level of radioactivity could vary depending on the speed and direction of wind on the day the event takes place. There is a need to address the burning issue of different racial and ethnic groups' unequal exposure and unequal protection to potential risks associated with the nuclear power plant NPPs (14).

Strategies and recommendations for future planning and deployment of field hospitals after earthquakes were examined comparing the experience of 4 field hospitals deployed by the IDF Medical Corps in Armenia, Turkey, India and Haiti. Quantitative data regarding the earthquakes were collected from published sources; data regarding hospital activity were collected from IDF records; and qualitative information was obtained from structured interviews with key figures involved in the missions. The hospitals started operating between 89 and 262 hours after the earthquakes. Their sizes ranged from 25 to 72 beds, and their personnel numbered between 34 and 100. The number of patients treated varied from 1111 to 2400. The

proportion of earthquake-related diagnoses ranged from 28% to 67% ($p < 0.001$), with hospitalization rates between 3% and 66% ($p < 0.001$) and surgical rates from 1% to 24% ($p < 0.001$). The data indicate that in spite of characteristic scenarios and injury patterns after earthquakes, patient caseload and treatment requirements varied widely. The variables affecting the patient profile most significantly were time until deployment, total number of injured, availability of adjacent medical facilities, and possibility of evacuation from the disaster area. When deploying a field hospital in the early phase after an earthquake, a wide variability in patient caseload should be anticipated. Customization is difficult due to the paucity of information. Therefore, early deployment necessitates full logistic self-sufficiency and operational versatility. Collaboration with local and international medical teams can greatly enhance treatment capabilities (15).

ASSESSMENT: large magnitude natural disasters continue to kill and injure tens to hundreds of thousands of people, inflicting lasting societal and economic disasters.

The awareness for the detection, appropriate management, and coping with the disasters is the main priority. New systems operating around the world use traditional seismic and geodetic networks. These systems can provide seconds to minutes of warning, allowing people to move to safe zones.

The seismic waveforms recorders could be used to deliver rapid microseism maps, study impacts on buildings, and possibly image shallow earth structure and earthquake rupture kinematics.

In addition, image-based flood monitoring heavily relies on continuous manned monitoring.

A national disaster medical response system, an active and effective commanding system, successful coordination between rescue forces and government agencies, effective treatment, a moderate, timely and correct public health response, and long-term psychological support are crucial to reduce mortality and morbidity and promote overall effectiveness of rescue efforts in natural disasters.

Deploying a field hospital in the early phase after an earthquake is a wide variability in patient caseload. Early deployment necessitates full logistic self-sufficiency and operational versatility. Collaboration

with local and international medical teams can greatly enhance treatment capabilities.

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SUMMARY

Global climate change will increase the probability of extreme weather events, including heatwaves, drought, wildfire, cyclones, and heavy precipitation that could cause floods and landslides. Such events create significant public health needs that can exceed local capacity to respond, resulting in excess morbidity or mortality and in the declaration of disasters. Human vulnerability to any disaster is a complex phenomenon with social, economic, health, and cultural dimensions.

The numbers of persons killed or disabled because of earthquakes, cyclones, floods and famines have reached record levels in the last decade. Natural disasters result in excess morbidity or mortality. Human vulnerability to any disaster is a complex phenomenon involving social, economic, health, and cultural dimensions.

Biblical texts were examined and verses in which humans were afflicted or coped with natural disasters were studied closely from a contemporary viewpoint. Since nuclear power plant disasters associated with modern technology usually affect human beings, coping with these disasters were also explored.

Noah was the first biblical character afflicted by natural disaster. Noah was warned of the coming flood " *I....do bring a flood of waters upon the earth, to destroy all flesh, wherein in the breath of life, from under heaven; and every thing that is in the earth shall die*" (Genesis 6:17) and told to construct the Ark.. Thanks to the Ark, he and his family, as well as two of all other living creatures, survived the flood.

Floods have affected humans throughout their long existence. Except for Noah, there are no accounts of using large boats or ships in order to survive.

The Bible describes precisely the flooding that covered the whole earth and how one family managed to escape the devastation. Noah was the only human in biblical history who built a huge Ark, so that he and his family, along with a pair of all living creatures survived.

The destruction of Sodom and Gomorrah by earthquake was a devastating event. Lot's and his daughters story shows that even in desperate situations such as destructive earthquakes, human can survive. In this case, Lot and his daughters escaped by fleeing the devastating area. Subsequently in order to continue the human race, Lot's daughters gave birth by incest to two boys.

Here is an example that in case of a devastating earthquake humans can escape simply by leaving the earthquake zone.

The Bible provides a precise description of devastating earthquakes: *"Then the Lord rained upon Sodom and upon Gomorrah brimstone and fire from the Lord out of heaven. And he overthrew those cities, and all the plain, and all the inhabitants of the cities, and that which grew upon the ground. ..the smoke of the country went up as the smoke of furnace (Genesis 19:24,25,28); in the wilderness in which Korah and his 252 supporters perished: "And the earth opened her mouth, and swallowed them up, and their homes, and all the men that appertained unto Korah, and all their goods. They, and all that appertained to them, went down alive into the pit, and earth closed upon them: and they perished from among the congregation. ..all Israel that were round about them fled at the city of them: for they said: Lest the earth swallow us up also.. And there came out a fire ..., and consumed two hundred and fifty men..." (Numbers 16:32,33,35); and a prediction of Tyre devastation: "Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure" (Ezekiel 26:18).*

None of these could have been prevented. The only way to survive was to flee the affected zone.

In JOB's case, a variety of disasters affected this character. His cattle – dozens of sheep, camels, and oxen were slaughtered, and many of his servants were killed. In addition, his family including his sons and daughters perished.

The Bible describes the catastrophic fire that affected JOB *"And there came a messenger unto JOB ..." (1:14). Among various disasters "The fire of God has fallen from heaven, and has burned up the sheep, and the servants, and consumed them..... (The Book of Job: 1:16).*

In addition, the catastrophic wind affected JOB causing the destruction and death *"And behold, there came a great wind from across the wilderness, and smote the four corners of the house, and it fell upon the young men, and they are dead..." (The Book of Job: 1:19).*

Here, JOB's friends supported him, wept, and mourned together over loses. This event shows that good friends are important in coping with various disasters.

After all these calamities, Job remained alone having lost all his property and his family. Fortunately, JOB had friends who supported him. The support of JOB's friends helped him to cope with all the calamities that afflicted him. Here is a psychotherapeutic effect provided by his closed friends.

In spite of all calamities, JOB recovered, regained his property and built a new family with sons and daughters. His life span was indeed long, indicating that he was a happy man with many children, grandchildren and great-grand children.

JOB's case illustrates that even in desperate situations, with many losses human can re-build their lives.

In contemporary times there are a variety of natural disasters. Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide, affecting local businesses, increasing local unemployment, and work disruption. Risk of catastrophic losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores.

There is a large negative impact of the recurrent floods on mental health outcomes and psychological and physical functioning. The psychosocial and mental health impact of flooding is a growing public health concern and improved strategies for minimizing disruption to essential services and financial worries need to be built in emergency preparedness and response systems.

A range of symptoms results from exposure to natural disasters include PTSD, depression and anxiety. Psychological problems affect individuals in communes severely affected by flood, and can exacerbate their physical illness.

After floods, there is an increased risk of disease outbreaks such as hepatitis A, hepatitis E, cholera gastrointestinal disease and leptospirosis, particularly in areas with poor hygiene and displaced populations, dengue fever, pink eye, and dermatitis.

The primary cause of earthquake-related death is trauma due to building collapse and, the very young and the elderly are at increased mortality risk. The distinctive combination of earthquake hazards and vulnerabilities, extreme loss of life, and paralyzing damage to infrastructure predicts population-wide psychological distress, debilitating psychopathology, and pervasive traumatic grief. Natural disasters provoke an increase in mental and medical disorders in survivors, and a substantial proportion of the adult population may experience severe and chronic posttraumatic stress reactions.

Exposure to earthquake has been associated with psychological distress, in particular, the development of PTSD and MDD. PTSD is common after a major disaster. In disaster-stricken areas, post-

disaster male suicide rates decrease during the 24 months following the earthquake.

Children who lost distant relatives or friends are 2.36 times more likely to have internalizing behavior problems. Loss of a child, being directly exposed to the death of family members and property loss during the earthquake, and mental health services utilization after the earthquake are significant predictors for PTSD severity at both assessments.

After earthquake, the levels of QOL of survivors living in prefab houses are low. They feel a certain social isolation and wish to live elsewhere. The earthquake determines a short-term increase in the use of antipsychotics (mostly haloperidol and promazine) and antidepressants (i.e. tricyclics), especially in older women.

Earthquakes are one of the most common natural disasters that lead to increased mortality and morbidity from transmissible diseases, partially because the rodents displaced by an earthquake can lead to an increased rate of disease transmission. Tularemia infection is found in rodents. In addition, there is a potential risk of malaria transmission after earthquake and the presence of malaria transmission vehicle. While the lesions of cutaneous leishmaniasis are less severe after the earthquake than those before the earthquake.

Sandstorm dust is a source of potential triggers of allergic and nonallergic respiratory ailments. Sandstorms are meteorological events and frequently occur in many regions throughout the world. Sandstorms are a main source of long-distance transport of dust, air pollution and cause various health problems. Exposure to sandstorm causes cough, runny nose, wheeze, acute asthmatic attack, eye irritation/redness, headache, body ache, sleep and psychological disturbances.

In fire related disasters, mass burn disasters are among the most difficult disasters to manage, with major burns requiring complex management in a multidisciplinary setting and specialist burns services having limited capacity to deal with large numbers of complex patients.

In landmark fires, casualty counts are great while most victims have fatal injuries and die on the scene or within 24 hours. In most fire disasters, the majority of victims either rapidly dies or has minimal injuries that can be treated and released.

Fireworks are used worldwide to celebrate popular events (e.g. festivals, official celebrations, and weddings). The festival of lights (Diwali) is celebrated with fireworks in India. During this period, many patients from all age groups present to hospital with injuries due to fireworks.

During the period of forest fire activity, ED visits of persons with asthma and chronic obstructive pulmonary disease, sinusitis, upper respiratory infections, and laryngitis increase. A few patients with acute respiratory or eye irritation also visit the emergency rooms.

The traumatic event causes significant, psychopathological changes in the victims. Predisaster life events, postdisaster losses, and escape-oriented coping strategies are associated with higher levels of both PTSD and depression symptoms.

Wind disasters are responsible for tremendous physical destruction, injury, loss of life and economic damage. Tornadoes cause the most severe wind disturbances. Catastrophic winds from tornadoes and downbursts are a major cause of natural disturbance in forests of eastern North America, accounting for thousands of hectares of disturbed area annually. Wind disturbance shows substantial regional variation, decreasing from the mid-west to the east and from the southeast to New England.

Site characteristics such as physiography, soil moisture, and soil depth; density and canopy roughness; and tree characteristics such as size, species, rooting depth, and wood strength, are the factors mostly recognized as influencing damage patterns. The consequences of wind damage to forests, such as change in environmental conditions, density, size structure, species composition, and succession status occur on both immediate (hours-to-days) and long-term (months-to-decades) time scales. Most wind disturbances result in the post-disturbance vegetation being comprised of surviving canopy trees, and varying amounts of sprouts, released understory stems, and new seedlings.

Throughout history, people have suffered from physical symptoms that they have attributed to modern technologies.

The term "Wind Turbine Syndrome" hypothesizes that many symptoms such as headache and dizziness result from wind turbines generating low frequency sound, while health effects are related to wind turbine operation [electromagnetic fields, shadow flicker, audible noise, low-frequency noise, and infrasound], or when

turbines are sited correctly, effects are attributable to a number of subjective variables that result in an annoyed/stressed state.

A specific health condition has been classified as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines.

Wind turbine noise exposure is related to sleep-related problems, headache, tinnitus and vertigo.

A specific health condition has been classified as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines.

Volcanoes pose a threat to almost half a billion people; today there are approximately 500 active volcanoes on Earth, and every year there are 10 to 40 volcanic eruptions. Volcanic eruptions produce hazardous effects for the environment, climate, and the health of the exposed persons, and are associated with the deterioration of social and economic conditions, injuries, transport and communication problems, waste disposal and water supplies issues, collapse of buildings and power outage, the deterioration of water quality, fewer periods of rain, crop damages, and the destruction of vegetation.

Unfavorable effects depend on the distance from a volcano, on magma viscosity, and on gas concentrations. The hazards closer to the volcano include pyroclastic flows, flows of mud, gases and steam, earthquakes, blasts of air, and tsunamis. Among the hazards in distant areas are the effects of toxic volcanic ashes.

There are associations between high vog exposure and visits for medically diagnosed cough, headache, acute pharyngitis, and acute airway problems. Problems of the acute respiratory symptoms suggest asthma and bronchitis, exacerbations of pre-existing lung and heart disease, eyes and skin, as well as psychological effects.

The primary causes of mortality in volcanic eruptions are ash asphyxiation, thermal injuries from pyroclastic flow, and trauma.

Adverse health effects include immediate harm to respiratory health followed by other more serious problems such as mental illness, poor nutrition and violence. A history of asthma, and possibly of bronchitis is risk factors for contracting respiratory problems. Volcanic ash is capable to cause lung inflammation, and exacerbate chronic lung disease.

There is significant increase of emergency department visits for acute respiratory and cardiovascular diseases, and ocular disturbances during the ash exposure time period.

There are numerous accounts of volcanic eruption in the Bible. Since the primary aim of this study was to examine verses in which humans were afflicted or coped with natural disasters, the verses dealing with volcanic eruptions were not explored.

Over the past quarter of a century, cyclones have significantly affected populations in Southeast Asia, the Western Pacific, and the Americas future vulnerability to cyclones will increase because of factors such as population growth, urbanization, increasing coastal settlement, and global warming.

The primary cause of cyclone-related mortality is drowning; in developed countries, male gender is associated with increased mortality risk, whereas females experience higher mortality in less developed countries.

Future warming may lead to an upward trend in tropical cyclone destructive potential, and an increasing coastal population a substantial increase in hurricane-related losses in the twenty-first century should be anticipated.

There is repeated multicentennial cycle of tropical cyclone activity, the most recent of which commenced around AD 1700.

Regardless of this uncertainty, flooding by tropical cyclones will increase as a result of accelerated sea-level rise.

Although one biblical verse can be related to cyclone "*The wind goes towards the south, and veers to the north, round and round goes the wind, and on its circuits the wind returns*" (Ecclesiastes 1:6), the primary aim of this study was to analyze humans affected by natural calamities and how the humans cope with these calamities. For these reasons this verse was not analyzed further.

The prevalence of psychiatric disorders, including PTSD, MDD, and PGD, is high among individuals directly tsunami-exposed disaster. These disorders are associated with functional impairment. The dual burden of direct trauma and loss can inflict a complex set of long-term reactions and mental health problems in bereaved individuals.

The highest levels of psychological distress are among those who had lost children. Traumatic bereavement, in combination with exposure to life danger, is probably a risk factor for mental health sequelae after a natural disaster.

PTS and depression are negatively associated with QOL after a tsunami.

The 26th December 2004 saw a disaster brought on by massive waves - the Asian Tsunami. Millions of people died or were affected to varying degrees. The mental health aftermath did not only hit the Tsunami affected areas but it also sent ripples globally.

The prevalence of PTSD among tsunami victims was 57.3% at 6 weeks after the disaster. It declined sharply at 2 years after the event. Despite receiving financial, rehabilitation and mental health support, 2.7% of the victims continue to suffer from PTSD 5 years after the disaster.

Is tsunami described in the Bible? The verses which describe the destruction of the city of Tyre: *"Now shall the isles tremble in the day of the fall, yea, the isles that are in the sea shall be troubled at the departure. When the wares went forth out the seas, thou didst fill many people; thou didst enrich the kings of the earth with the multitude of the riches of the merchandise. In the time when you shall be broken by the seas in the depths of the waters; the merchandise and all the company are fallen in the midst"* (Ezekiel 26:18, 27:33-34) mentioned in the section on earthquakes, could be understood as referring to tsunami.

Nuclear disasters, such as the atomic bombings in 1945 and major accidents at nuclear power plants, have highlighted similarities in potential public health effects of radiation in both circumstances, including health issues unrelated to radiation exposure. Since nuclear disasters can affect hundreds of thousands of people, a substantial number of people are at risk of physical and mental harm in each disaster.

The Chernobyl disaster was a catastrophic nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in the town of Pripyat, in Ukraine (then officially the Ukrainian SSR). An explosion and fire released large quantities of radioactive particles into the atmosphere spread over much of the western USSR and Europe. The Chernobyl disaster was the worst nuclear power plant accident in history in terms of cost and casualties.

The accident that occurred at the Chernobyl Nuclear Power Plant in 1986, released large quantities of radionuclides, among them radioiodine, into the atmosphere, thereby raising public concerns about its influence on thyroid structure and function, especially the development of malignancy. Chernobyl has given rise to a marked

increase in the incidence of papillary thyroid cancer, psychological consequences and socioeconomic disruption.

Other thyroid diseases, like nodular goiter, cysts, the disturbance of thyroid function and autoimmunity, were possibly linked to the radiation after Chernobyl accident. Data obtained from the regions near Chernobyl showed no increased risk of other types of malignancy (leukemia, Hodgkin's and non Hodgkin's lymphoma) in 1986-1996.

Twenty years after the accident, excess thyroid cancers are still occurring among persons exposed as children or adolescents, and, if external radiation can be used as a guide, an excess of radiation-associated thyroid cancers for several more decades can be expected.

Mothers of young children are at high-risk for developing adverse mental health effects following a nuclear accident.

PTS symptoms are related to the population affected by the Fukushima Nuclear Disaster, one year after the disaster. The significant predictors of probable PTSD are chronic physical diseases, chronic mental diseases, worries about livelihood, lost jobs, lost social ties, and concerns about compensation.

The prevalence of eczema symptoms is high among children in areas primarily affected by the disaster (GEJED). Younger age, history of hospitalization, and difficulties in children's daily lives are associated with allergic symptoms. Living in a coastal municipality is also associated with eczema symptoms.

Large magnitude natural disasters continue to kill and injure tens to hundreds of thousands of people, inflicting lasting societal and economic disasters.

The awareness for the detection, appropriate management, and coping with the disasters is the main priority. New systems operating around the world use traditional seismic and geodetic networks. These systems can provide seconds to minutes of warning, allowing people to move to safe zones.

The seismic waveforms recorders could be used to deliver rapid microseism maps, study impacts on buildings, and possibly image shallow earth structure and earthquake rupture kinematics.

In addition, image-based flood monitoring heavily relies on continuous manned monitoring.

A national disaster medical response system, an active and effective commanding system, successful coordination between

rescue forces and government agencies, effective treatment, a moderate, timely and correct public health response, and long-term psychological support are crucial to reduce mortality and morbidity and promote overall effectiveness of rescue efforts in natural disasters.

TO SUM UP: the Bible gives us precise descriptions of natural disasters and how humans coped with these calamities. These descriptions are relevant to contemporary times since they help us to understand better the nature of disasters and human coping mechanisms. Now, thanks to technological achievements, many natural disasters can be predicted and people can survive by taking appropriate measures.

ABBREVIATIONS

AO	Aortic oscillation
AOR	Adjusted odds ratio
APHC	Adaptation to harsh conditions
BVMT-R	Brief Visuospatial Memory Test-Revised
CBCL	Child Behavior Checklist
CI	Confidence intervals
CLAS	Carnegie Landsat Analysis System
ED	Emergency department
EEW	Earthquake early warning
EMRRTs	Earthquake medical rapid response teams
ENSO	El Niño Southern Oscillation
GAD	Generalized anxiety disorder
GCMs	General circulation models
GEJED	Great East Japan Earthquake Disaster
HRQOL	Health-related quality of life
HSCL-25	Hopkins Symptom Checklist-25
HVA	Hazard vulnerability assessment
ICU	Intensive care unit
IDF	Israel Defense Forces
ISAAC	International Study of Asthma and Allergies in Childhood
JMA	Japan Medical Association
JMATs	Japan Medical Association Teams
JSDF	Japan Self-Defense Force
LMICs	Low- and middle-income countries
MDD	Major depressive disorder
MHPSS	Mental Health Professionals Stress Scale
OR	Odds ratio
PCI	Percutaneous coronary intervention
PCL-C	PTSD scale civilian version
PDO	Pacific Decadal Oscillation
PGD	Prolonged grief disorder
PSQI	The Pittsburgh Sleep Quality Index
PTG	Posttraumatic growth
PTS	Posttraumatic stress
PTSD	Posttraumatic stress disorder
QOL	Quality of life
SCSQ	Simple coping style questionnaire
SDQ	Strengths and Difficulties Questionnaire
SF-36	Short form 36
SMR	Standardized mortality ratio
SSR	Seasonal severity rating
SSRS	Social support rating scale
STEMI	ST-elevation myocardial infarction
WHOQOL-BREF	Short version of the World Health Organization quality of life questionnaire