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CASE STUDY

HAITI EARTHQUAKE 2010: PSYCHOSOCIAL IMPACTS

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Synonyms

Disaster behavioral health; Disaster health; Disaster mental and behavioral health; Disaster mental health

Overview

At 4:53 PM local time (21:53 GMT) on January 12, 2010, a magnitude 7.0 earthquake devastated the Haitian capital city of Port-au-Prince and surrounding area, killing an estimated 222,570–316,000 persons (Inter Agency Standing Committee, 2010; CBC News, 2011). The Haiti 2010 earthquake is noteworthy among natural disasters that subject the affected human population to intense psychological stressors (Table 1).

Norris and colleagues (2002) posit that disasters that possess two or more of the following four characteristics are likely to create significant mental health consequences for the affected community: (1) large numbers of deaths and/or injuries, (2) widespread destruction and property

damage, (3) disruption of social support and ongoing economic problems, and (4) “human” contribution to the disaster’s causation. By the numbers, the Haiti 2010 earthquake possesses all of these attributes: (1) mass mortality, (2) near-total physical destruction over large areas, (3) social dislocation to a point bordering on societal collapse, and (4) ample evidence of human amplification of the earthquake’s harm (preventable deaths and severe injuries attributable to dangerous and derelict standards for housing construction; uncommonly widespread and brutal interpersonal violence directed against earthquake survivors in the aftermath) (Shultz et al., 2011).

Profiling the Haiti 2010 earthquake will provide insights into the psychologically traumatizing capacity of this exceptional event (Shultz et al., 2011). The psychological consequences of the Haiti 2010 earthquake can be portrayed across five salient dimensions: (1) disaster type, (2) severity, (3) duration, (4) mortality, and (5) scope and social context of psychological impact (Table 2).

Disaster type: event description and disaster consequences

Haiti occupies the western third of the island of Hispaniola, one of the Greater Antilles islands, located between Puerto Rico and Cuba. The Haiti 2010 earthquake occurred south of the east-west trending “strike-slip” fault zone separating the massive North American tectonic plate (to the north) from the Caribbean plate (to the south). Relative to the North American plate, the Caribbean plate “slips” about 20 mm to the east each year. In Haiti, the plate boundary between these two plates presents a more complex scenario; historically, shearing pressures have created an additional fracture along the ragged juncture. The resulting tectonic shard, “the Gonave microplate,” on which Haiti rides, is bracketed by two fault zones running east-west in northern and southern Haiti. The Haiti 2010 earthquake occurred along the Enriquillo-Plantain

Haiti Earthquake 2010: Psychosocial Impacts, Table 1 Haiti 2010 earthquake: disaster stressors

Impact phase stressors	Post-impact phase stressors
Exposure to severe shaking	Exposure to ongoing aftershocks
Exposure to multiple strong aftershocks	Physical injury and personal harm
Physical injury and personal harm	Pain, debility, loss of function
Entrapment in collapsed structures	Loss of limb
Perception of risk of death/extreme harm	Rampant infectious diseases
Panicked flight	Searching for missing loved ones
Loss of loved one	Caring for injured loved ones
Separation from loved ones during event	Grief for lost loved ones
Witnessing harm to others	Lack of access to emergency care
Witnessing death of others	Lack of access to primary medical care
Witnessing grotesque, troubling scenes	Lack of access to mental health care
Damage/destruction of home	Lack of survival needs (food, water)
Displacement from home	Lack of utilities and essential services
Community-wide physical destruction	Lack of sanitation, public health
	Lack of communications
	Lack of transportation
	Lack of personal security
	Rumors of additional shocks to come
	Damage/destruction of home
	Loss of personal possessions
	Displacement
	Living in temporary camps
	Witnessing dead bodies
	Witnessing severely harmed persons
	Witnessing traumatized/bereaved survivors
	Looting and gang activities
	Interpersonal and gender-based violence
	Damage to worksite
	Loss of employment
	Financial hardship
	Damage to place of worship
	Absence of government infrastructure
	Damage to schools
	Earthquake trauma reminders from aftershocks and scenes of destruction
	Family distress

Garden Fault Zone (EPGFZ) to the south. Along the EPGFZ, the plates had been “locked” in position for approximately 250 years, with escalating stress prior to the moment of release. At that moment, 4:53 PM, January 12, 2010, along 65 km of the EPGFZ, the Caribbean Plate jolted violently eastward an average distance of 1.8 m (with amplitudes as large as 4 m in some locales). As precisely described by Calis et al. (2010), the earthquake occurred on a previously unmapped steeply dipping fault that makes a high angle with the Enriquillo-Plantain fault.

With a rupture that was as close as 17 km from downtown Port-au-Prince, Haiti’s capital and major population center, this near-surface earthquake shattered the city and terrified its population. At Moment Magnitude 7.0, the Haiti 2010 earthquake was very intense, but for perspective, the February 2010 earthquake in Maule, Chile, registered Moment Magnitude 8.8, generating 500 times the

energy of its Haitian counterpart. Although the 2010 Chilean earthquake ranks high among the most powerful seismic events, its memory was short lived, whereas the weaker 2010 Haitian earthquake, by decimating a densely packed and structurally vulnerable population, has made its mark on human history and on the psyche of the Haitian people.

The entire nation of Haiti experienced the sensations of ground movement during the initial shock, with millions in the throes of significant shaking. The death toll, in the range of 222,570–316,000 deaths (Inter Agency Standing Committee, 2010; CBC News, 2011), places this event among the deadliest sudden-impact natural disasters on record. More than 300,000 survivors were seriously injured. Among these, an estimated 4,000 survivors sustained amputating injuries. Millions experienced excruciating pain from personal injury, or directly observed gruesome harm or brutal death as buildings toppled, or witnessed piles of decomposing bodies strewn throughout the streets. In the aftermath, with hundreds of thousands of collapsed or uninhabitable dwellings, 1.3 million persons were internally displaced, eventually finding temporary lodging in the myriad impromptu camps that were hastily erected. In the weeks following the earthquake, displaced persons, deprived of secure shelter and personal privacy, were easy prey to looting, gang violence, and gender-based violence including rape. Environmental hazards posed risks for falls, punctures, abrasions, and lacerations. Destruction of infrastructure, leading to absence of clean water, sanitation, and hygienic healthcare services, produced a cascade of untoward outcomes: infectious disease outbreaks, life-threatening wound infections, and malnutrition contributing to preventable deaths among infants and young children. Population-wide vulnerability following the earthquake exacerbated the spread and severity of a raging outbreak of cholera that caused illness in 470,000 persons and killed almost 7,000 in 1 year (CDC, 2011) (Table 3).

Disaster severity and psychological impact

The confluence of multiple physical and psychological consequences distinguishes the Haiti 2010 earthquake as singularly destructive. In a disaster, one of the strongest predictors of the severity of psychological effects is the degree of exposure to the forces of harm (Neria et al., 2008; Shultz et al., 2007, 2012a). The absolute magnitude of the forces of harm largely determines the extent of damage, destruction, displacement, death, and injury, as well as the extent of stress and trauma experienced by the disaster-affected population (Shultz et al., 2011).

At the moment of impact, exposure to the Haiti 2010 earthquake was experienced throughout the nation as ground shaking. Both the objective intensity and the subjective experience of ground shaking relate directly to the distance from the earthquake’s epicenter. Persons closest to the strike zone were subjected to the kinesthetics of extreme shaking, compounded by the multisensory

Haiti Earthquake 2010: Psychosocial Impacts, Table 2 Haiti 2010 earthquake: hazard profile

<i>Disaster type</i>	<i>Definition</i>	Catastrophe/complex emergency
	<i>Initial event classification</i>	Natural disaster/geophysical/earthquake: left-lateral strike-slip faulting at angle with the Enriquillo-Plantain Garden fault system
	<i>Ongoing event classification</i>	Complex emergency: natural disaster followed by infrastructure collapse, massive loss of life, large-scale displacement, and interpersonal violence
	<i>Forces of harm</i>	Strike-slip faulting on a fault associated with a tectonic plate boundary Severe ground shaking Structural collapse of buildings
<i>Magnitude and severity</i>	<i>Moment magnitude</i>	Initial earthquake: M 7.0 First 4 weeks: 16 aftershocks \geq M5.0 First 4 weeks: 59 aftershocks \geq M4.5
	<i>Modified Mercalli Intensity</i>	Epicenter: X (on a 12-point scale: I–XII) MMI intensity generally diminishes as a function of distance from epicenter
<i>Place dimension</i>	<i>Epicenter</i>	A 40-km long rupture; shortest distance is 17 km from Haitian capital of Port-au-Prince
	<i>Hypocenter</i>	Rupture from near surface to 13-km depth
	<i>Geography/geology</i>	The region is near a tectonic plate boundary region separating the Caribbean plate and the North America plate. The main shock mostly represents faulting on an unmapped steeply dipping fault at angle with the Enriquillo-Plantain Garden fault zone (EPGFZ).
	<i>Scale/scope</i>	Intense shaking/destruction throughout southeastern Haiti, particularly in the capital of Port-au-Prince and surrounding areas. Shaking of varying intensity felt throughout entire nation of Haiti (27,750 km ²) and adjoining portions of Dominican Republic on island of Hispanola. Psychological impact extends to Haitian “diaspora” in United States, Canada, Caribbean, responders from many nations
<i>Time dimension</i>	<i>Built environment</i>	Poorest nation in Western Hemisphere Rank 147/182 on Human Development Index 55% below extreme poverty index Widespread structural deficiencies High-density urban crowding
	<i>Initial earthquake strike</i>	January 12, 2010, 16:53 local time (21:53 GMT)
	<i>Duration</i>	Initial earthquake: 15–35 s of strong shaking (estimate)
	<i>Frequency</i>	Strong aftershocks of gradually decreasing frequency over several months (59 aftershocks \geq M4.5 in first 4 weeks)
	<i>Duration of life/health risk</i>	Months: cholera outbreak caused illness in 470,000 with 6,631 deaths through October 2011
	<i>Duration of disruption</i>	Years

experience of structural disintegration occurring in all directions around them. In some areas of particularly intense tumult, “liquefaction” occurred as the sediment lost its weight-bearing properties, causing structures to sink and crumble (Shultz et al., 2011). Punctuating the jarring, disorienting, fear-triggering sensations of tremulousness and vibration, many persons were physically injured, pinned by falling rubble, or entrapped in collapsed structures. Bodily pain, injury, immobilization, trapped confinement, and perceived life threat are psychological stressors (Shultz et al., 2011). Haitian survivors engaged in frenetic, bare-handed scramble to find and extricate family members and neighbors who had disappeared amid the heaving earth and caving debris.

Assuming an earthquake source of given orientation and rupture characteristics, it is possible to estimate the levels of shaking over an area and convert them to ratings on the Modified Mercalli Intensity Scale. The Modified

Mercalli Intensity Scale (MMI) is a 12-point rating scale (I–XII). Each point on the scale is composed of an estimate of shaking intensity and a corresponding description of structural damage. The MMI estimates how strongly an earthquake is felt by people in a geographical area, and the corresponding amount of damage to buildings and dwellings.

For the Haiti 2010 earthquake, the United States Geological Survey (USGS, 2010a) has created a “shakemap” displaying the geographic areas, and estimated population numbers, for each of the MMI categories. For example, more than 1.0 million Haitians experienced violent or extreme shaking (MMI Scale IX or higher), with heavy to catastrophic damage all around. An additional 3.5 million residents experienced strong, very strong, or severe ground shaking (MMI Levels VI–VIII). Together, these data provide clear evidence that almost 4.6 million Haitians experienced ground movement at the level of

Haiti Earthquake 2010: Psychosocial Impacts, Table 3 Haiti 2010 earthquake: disaster consequences

Disaster consequence	Haiti 2010 earthquake description
<i>Exposure to ground shaking</i>	MMI ^a ≥ IX: violent/extreme intensity: 1.0 million persons MMI ^a VI–VII: strong/very strong/severe intensity: 3.5 million persons
<i>Mortality</i>	222,570–316,000 deaths
<i>Bereavement</i>	Millions have lost a primary family member
<i>Morbidity: injury</i>	300,000 injuries requiring medical care 4,000 injuries requiring amputation
<i>Morbidity: infectious disease</i>	Hundreds of thousands of disease cases
<i>Internally displaced persons (IDPs) due to earthquake</i>	1,300,000 earthquake IDPs
<i>Damage to homes</i>	Destroyed homes: 97,000 Severely damaged homes: 188,000
<i>Gender-based violence</i>	High rate of reported rapes and assaults on women
<i>Children without caregiver</i>	Separation from caregiver Earthquake orphans
<i>Lack of access to clean water</i>	Millions of persons
<i>Lack of access to food</i>	Malnutrition risk: 495,000 children and 198,000 pregnant/lactating women
<i>Lack of access to sanitation</i>	Millions of persons

^aMMI: Modified Mercalli Index

Haiti Earthquake 2010: Psychosocial Impacts, Table 4 Haiti 2010 earthquake: persons exposed to ground shaking by MMI level

MMI	Perceived shaking	Estimated population AT MMI level	Estimated population AT or ABOVE MMI level
X–XII	Extreme	118,000	118,000
IX	Violent	908,000	1,026,000
VIII	Severe	2,030,000	3,056,000
VII	Very strong	598,000	3,654,000
VI	Strong	926,000	4,580,000
V	Moderate	6,361,000	10,941,000
IV	Light	7,468,000	18,409,000
I–III	Weak to imperceptible	50,000	18,459,000

Source

United States Geological Survey, 2010a.

MMI VI or higher. The entire Haitian population of approximately 10 million persons experienced some degree of perceptible ground shaking, as did millions more in neighboring Dominican Republic and nearby Caribbean islands (Table 4, Figure 1).

Duration and frequency of psychological stressors

During exposure to threat or overt forces of harm, survival stress responses are activated. Moreover, the frequency of discrete disaster impacts relates to psychological trauma; a sequence of multiple strikes, and exposure to both stress and loss, tends to be more alarming than a single, discrete event (Neria and Litz, 2004). In the case of the Haiti 2010 earthquake, both duration and frequency operated in tandem to exacerbate fear and distress.

While the duration of the initial earthquake was estimated in the range of 15–35 s, repeated strong aftershocks triggered fear reactions and acted as powerful psychological reminders of the initial “mainshock” experience. Aftershocks began immediately. The first powerful aftershock (M 6.0) occurred 7 min after the “mainshock.” The second aftershock (M 5.5) was experienced 12 min later. According to the United States Geological Survey (2010b), in precisely 4 weeks following the earthquake’s origin, 16 aftershocks of magnitude 5.0–6.0, and 43 aftershocks of magnitude 4.5–4.9, occurred close to the original epicenter.

Disaster stress persisted long after the aftershocks tapered. Hardships in the aftermath were severe and prolonged with near-complete destruction of infrastructure, lack of survival supplies, absence of basic services, and sporadic episodes of violence on the streets and in the camps.

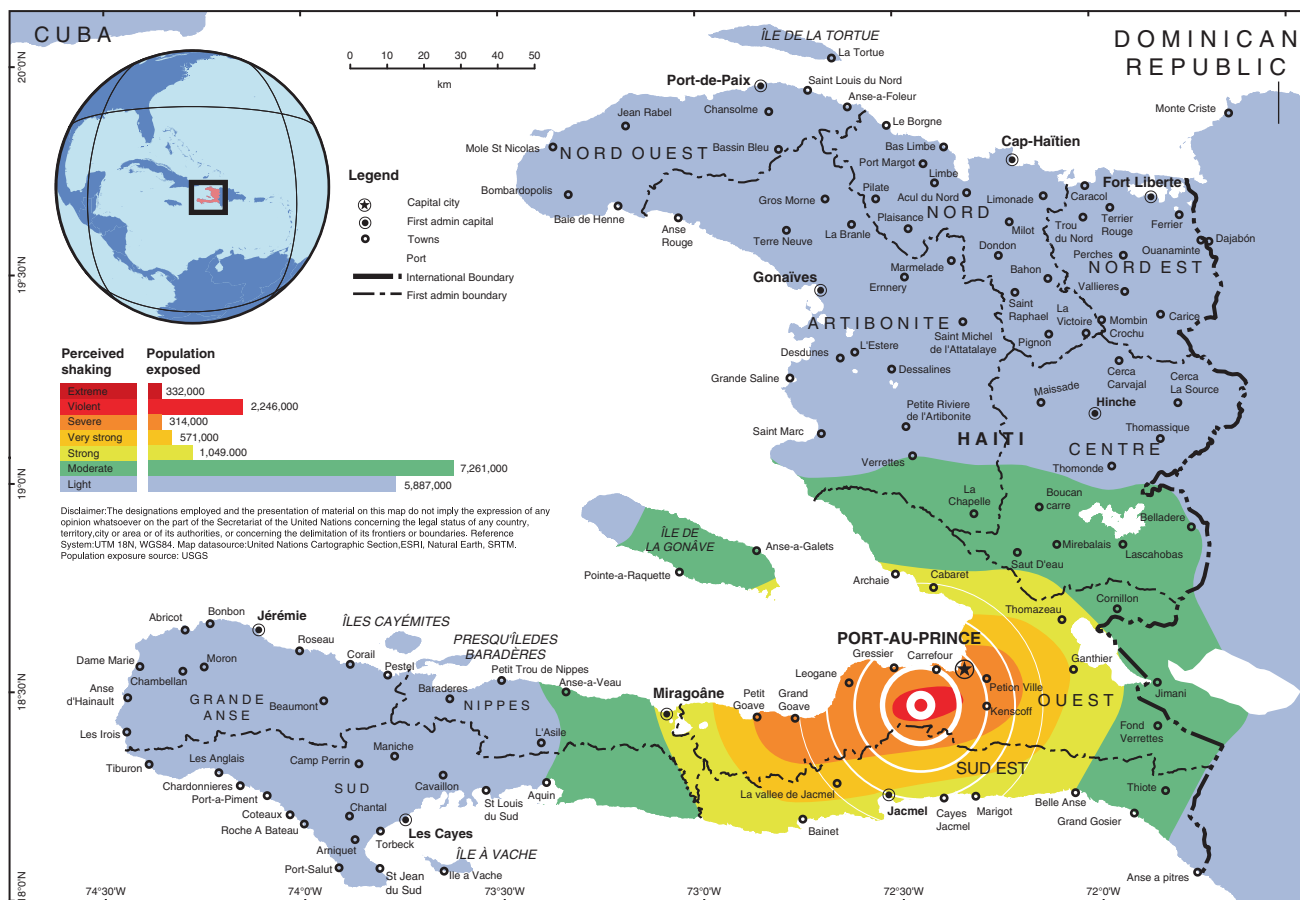
Mass mortality in relation to psychological impact

Sudden, concentrated, mass mortality distinguishes the Haiti 2010 earthquake from past earthquakes of similar magnitude. Most of the deaths occurred instantly or within minutes or hours of the M 7.0 mainshock. Some injured victims suffered a more protracted death over a period of days due to the circumstances of injury, entrapment, lack of access to medical care, or absence of basic survival needs.

Only one earthquake in recorded history significantly exceeded the numbers of deaths experienced in the Haiti 2010 earthquake; an estimated 830,000 persons died in the catastrophic earthquake that leveled Shaanxi, China, on January 23, 1556. Among ground-shaking seismic incidents in modern times, the Tangshan, China earthquake on July 28, 1976, with 255,000 deaths, rivaled the Haiti death toll. On December 26, 2004, a tsunami-generating seismic event killed an estimated 280,000 coastal dwellers distributed across more than one dozen nations encircling the Indian Ocean. Apart from these two earthquakes and the Indian Ocean tsunami, no other earthquake in recorded history has equaled the magnitude of mortality experienced in Haiti on January 12, 2010.

Beyond the exceptional numbers of deaths, a related feature of Haiti 2010 is the geographic concentration of mortality in a densely populated urban capital city and surrounding towns and communities. Large numbers of Haitians lost multiple family members.

Haiti - Population Exposed and Exposure Level OCHA



Visit <http://www.reliefweb.int/haiti> to access this map and other crisis information.

Haiti Earthquake 2010: Psychosocial Impacts, Figure 1 Map of Haiti showing the epicenter of the January 12, 2010, earthquake and population affected.

The Centre for Research on the Epidemiology of Disasters (CRED) in Brussels, Belgium, is a WHO Coordinating Center and serves as the international repository for information on all reported disasters worldwide. CRED maintains an international disaster database dating from 1900 to the present. During the 110 years of tracking international disasters, a total of 1,095 damaging earthquakes have been reported including the early 2010 earthquakes in Haiti and Chile. Collectively, across these earthquakes, 2,323,000 persons were killed. The death toll in Haiti alone accounted for 10% of all earthquake deaths in 110 years of surveillance.

Loss of a loved one in a natural disaster is one of the most psychologically devastating experiences. Traumatic bereavement, leading to complicated grief, is associated with a host of psychiatric disorders including posttraumatic stress disorder (PTSD) and depression (Neria et al., 2007). Complicated (or prolonged) grief disorder (PGD) is a relatively new diagnosis, and different

from normal grief in its extended duration and symptom profile (Horowitz et al., 1997). Correlates of PGD include severe functional impairment, decreased productivity, suicidality, and physical health problems (Neria et al., 2007). Yet to be explored is the interaction between disaster trauma and loss of a loved one (Neria and Litz, 2004); many survivors of the 2010 Haiti earthquake experienced both. More research is needed to fully understand the relations between PTSD and complicated grief, and whether they differ in their risk and protective factors.

Scope and social context of psychological impact

Psychosocial consequences of disasters are wide ranging and pervasive (Shultz et al., 2012a). More persons are affected psychologically than are harmed physically (Shultz et al., 2007). The Haiti 2010 earthquake has psychologically affected not only the persons within the immediate strike zone but the entire Haitian population (10 million persons), the expansive diaspora of Haitian

emigrants to the United States, Canada, and throughout the Caribbean (Shultz et al., 2012b), and large numbers of persons who have engaged in the earthquake response efforts. According to CRED data, only two earthquakes in the past 110 years affected more persons: The Haiti 2010 earthquake provides strong evidence that, in natural disasters, the “psychological footprint” of disaster is larger than the “medical footprint” (Shultz et al., 2007).

Adding to the widespread distress from physical hardships was the public perception of a complete void of national leadership to communicate with the public (INURED, 2010). In a survey conducted in Cité Soleil, Port-au-Prince, the key phrase that captured the population’s sense of despair and abandonment, was, “We are on our own.” This sentiment was repeatedly documented and echoed through the press and research reports. A lead researcher stated, “Failure to rally the country at a time when it is gravely wounded added to the suffering and trauma of the overall population” (INURED, 2010).

Summary

As we have previously stated, “the 2010 Haiti earthquake provides a potent example of the rare catastrophic event where all major risk factors for psychological distress and impairment are prominent and compounding,” (Shultz et al., 2011). In this case example, we have illustrated the links between the descriptors of the event: (1) disaster type, (2) severity, (3) duration, (4) mortality, and (5) scope in relation to the psychological impact. We have attempted to describe how the psychological and physical consequences interplay and synergize in a seismic event of such impact severity marked by quantum loss of life, obliteration of infrastructure, and barbarous hardship in the aftermath. In fact, our detailed assessment of this event became the basis for introducing “trauma signature analysis” (TSIG) to the field (Shultz et al., 2011).

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Cross-references

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- Community Management of Hazards
- Critical Incidence Stress Syndrome
- Disaster Relief
- Disaster Risk Reduction (DRR)
- Earthquake
- Education and Training for Emergency Preparedness
- Emergency Shelter
- Epicentre
- Epidemiology of Disease in Natural Disasters
- Federal Emergency Management Agency (FEMA)
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- Hypocentre
- Indian Ocean Tsunami 2004
- Modified Mercalli (MM) Scale
- Mortality and Injury in Natural Disasters
- Post Disaster Mass Care Needs
- Post-Traumatic Stress Disorder (PTSD)
- Psychological Impacts of Natural Disasters
- Recovery and Reconstruction After Disaster
- Risk
- Seismology
- Tangshan, China (1976 earthquake)