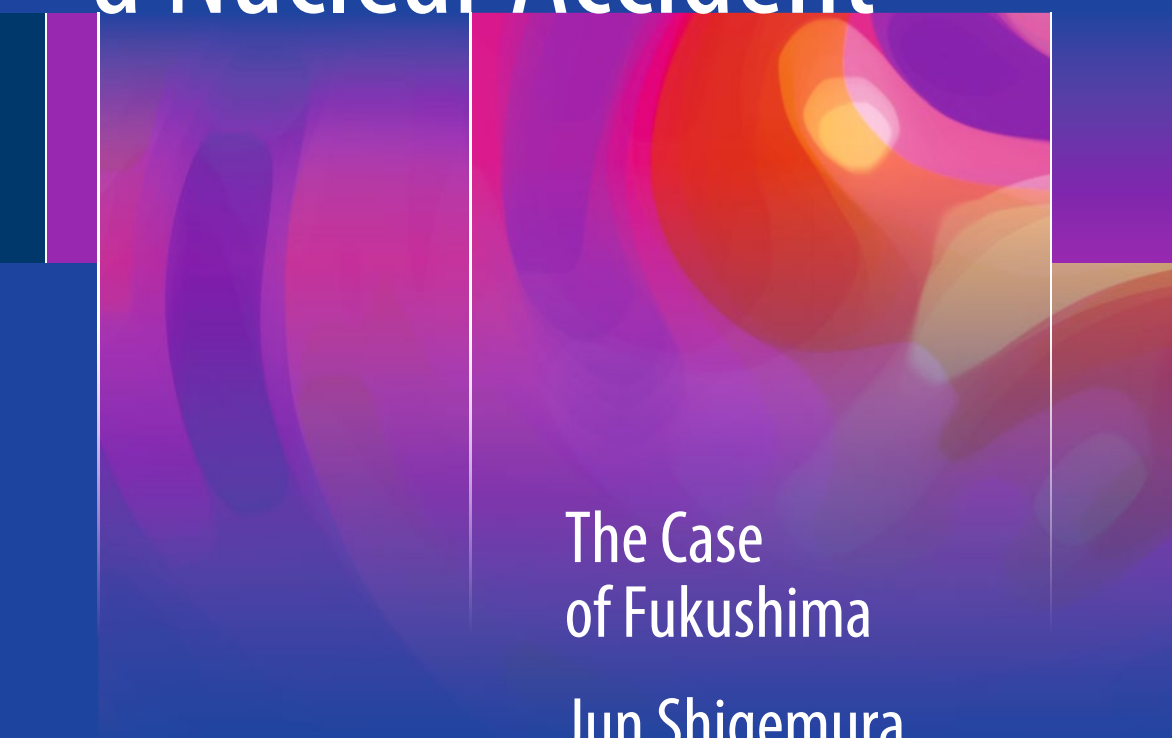
Mental Health and Social Issues Following a Nuclear Accident



The Case of Fukushima

Jun Shigemura
Rethy Kieth Chhem
Editors

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We dedicate this book to the people of Fukushima.

Foreword

This book is an example of what could be called "applied STS". The academic field of Science, Technology, and Society, or sometimes Science and Technology Studies (STS), is now a mature one, having started in the 1970s and spawning a vast literature and dozens of graduate programs around the world. At its points of origin in Europe and North America, however, it has become almost exclusively an academic realm, although it still has engagement with public policy in the Netherlands and parts of Scandinavia. In Asia, by contrast, where it has grown exponentially within the current century, academically organized STS meetings are still making room for professionals in applied fields who became deeply immersed in STS-like questions in the course of the work, often before they even know there is a world of social scientists and humanities scholars interested in issues they face daily. This presents the opportunity for thematically informed but practical dialogue on real-world issues relevant to people's jobs.

This volume grows out of such a deep and lengthy dialogue between a small group of STS scholars and a larger group of Japanese and foreign medical practitioners whose job it is to understand and care for the health needs of Fukushima Prefecture's population in the wake of the 2011 nuclear accident. It began with a meeting at IAEA headquarters in Vienna in 2012, organized by Dr. Rethy Chhem and a group of Japanese doctors, to which I was invited as an interlocutor. As the one social scientist around the table (excepting our host Rethy Chhem, whose degrees span medicine and the humanities), I initially thought I would be out of my depth in discussions about radiation, which was far from my area of expertise. But the issues and concerns raised by the physicians were not overly technical, but more social and political. They were embroiled just then in a crisis of communication and trust between themselves and elements of the Japanese public, and were looking for ways to at once make sense of their experience while moving beyond it to concrete solutions. My own role became that of a facilitator, helping the physicians frame their experiences using a language, and referencing previous cases, which were more familiar in my realm than their own. In the process they

taught me a great deal about radiation while, in return, I shared alternative ways to think through their experiences with the Japanese public.

Over the next 3 years, and a half-dozen more IAEA-sponsored meetings in Vienna and Fukushima, Rethy and I recruited many more STS scholars and many more physicians to join in this extended discussion. Our official work product was a series of internal reports for the IAEA, but unofficially we served to spur real and important dialogue between people who were front-line caregivers on the one hand, and STS scholars normally once-removed from the world of medical practice and policymaking. What started as a series of small, closed workshops in Vienna soon became a series of much larger and more inclusive conferences at Fukushima Medical University, involving medical and nursing students, and with all of the presentations translated into Japanese or English and put online. Taking it a step further, Fukushima Medical University has even established a pilot training program for student–physicians and nurses, which, uniquely in Japan or perhaps the world, consciously incorporates lessons from the "academic" field of STS. Its designers hope that it might be a model for more thoroughgoing reforms in the curricula of Japanese medical schools generally.

The present volume is yet another tangible outcome of these exchanges. Most of the contributors here have been involved in one or more of our discussions in Japan, and the volume as a whole has been very much shaped by the process. While ours is not the last word on Fukushima, it is one very much "from the ground", informed not just by empirical evidence but real exchanges across theory and practice, and across academic and clinical settings.

This project also reflects the personal priorities and values of Dr. Rethy Chhem, who, having bridged clinical practice, humanities scholarship, and public education in his own career, recognized early the value of studying the Fukushima health crisis from an STS perspective. He and his staff in the IAEA's Division of Human Health have been tireless in seeking out and bringing together people who would not ordinarily have met and talked, and distilling the best from their conversations. This book stands as a tribute to his remarkable energy and effort on behalf of the Japanese and global medical communities.

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Preface

This book is the result of a chance encounter between two physicians with diverse sets of expertise: the first, a psychiatrist who deals with mental illness through the exploration of the human mind; and the second, a radiologist who attends to mechanical or technical problems through the visualization of the human anatomy using radiation. Jun Shigemura is a medical practitioner. Rethy Chhem, once a medical practitioner, was, at the time of the Fukushima Nuclear Accident, the director of the Division of Human Health (NAHU) at the International Atomic Energy Agency (IAEA). As a clinical psychiatrist, Dr. Shigemura was not subordinate to additional administrative governance aside from his professional conscience. Dr. Chhem, however, while also abiding by his medical ethos, was strictly bound by the mission of an international intergovernmental organization whose aims were to "accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity".

It was during Dr. Chhem's tenure at the IAEA that the co-editors met at "expert meetings" organized by the IAEA at the Fukushima Medical University (FMU). They shared a passion and commitment to assist the people of Fukushima affected directly or indirectly by radiation leaked from damaged nuclear power plants. Following his tenure with the IAEA, and relieved from the constraints of an institutional mission focused exclusively on matters directly related to safety and regulatory issues surrounding radiation, Dr. Chhem turned his attention to the sociological and psychological consequences of the radiation disaster. Both physicians, like many stakeholders investigating the fallout of this accident, had come to understand that the psychological and social consequences of this disaster generated far more harm than the physical radiation effects experienced by individuals. This observation triggered the desire to produce this book, which is dedicated to those who experienced the social and psychological consequences of the Fukushima nuclear accident.

Mental Health and Social Issues Following a Nuclear Accident: *The Case of Fukushima* aims to improve the global understanding of the impact of nuclear disaster across various dimensions, including (but not limited to) health,

psychological, social, economic, ethical, and behavioral perspectives. On March 11, 2011, at 2:46 p.m. local time, a mega-earthquake struck the islands of Japan. Subsequent aftershocks and tsunamis followed, eventually leading to a series of accidents at the Fukushima Daiichi Nuclear Power Plant of the Tokyo Electric Power Company (TEPCO). The natural disaster precipitated an environmental disaster: the reactors' nuclear meltdown and subsequent release of radioactive materials followed by mandatory evacuations of the surrounding region. It became the second largest nuclear accident since the 1986 Chernobyl disaster and measured Level 7 on the International Nuclear Event Scale.

To date, no fatalities owing to acute radiation exposure have been reported. Still, these events continue to profoundly affect the people of Fukushima Prefecture. Residents continue to struggle with an invisible hazard. The concerns associated with safety, physical, and mental health issues, along with the socioeconomic disruptions, have been massive. Although thousands of workers have already taken part in the clean-up process, it is a process that is expected to continue for decades. The challenges facing the people in Fukushima as they work to overcome this situation are long-term and ongoing.

When Dr. Shigemura was summoned as the first psychiatrist to support the mental health of nuclear plant workers on May 2011, he had little information to address such an overwhelming mission. He looked to the lessons from our past, particularly the 1979 Three Mile Island and the 1986 Chernobyl nuclear disasters. Research that emerged from Chernobyl revealed that the "mental health" impact was the most remarkable long-term public health consequence of the accident. As this accident was much larger than the one at Three Mile Island, and there was a dearth of substantive research available from the shorter-term Chernobyl outcomes (due to the secrecy of the former Soviet Union), it quickly became apparent that multidisciplinary, long-term efforts would be required.

During his tenure at the IAEA, Dr. Chhem initiated an innovative and unprecedented approach within a United Nations organization dealing with nuclear safety. An interdisciplinary framework drawing on Science and Technology Studies (STS) was crafted to analyze and address complex situations related to interactions between science and technology (nuclear in this case) and society (Fukushima Prefecture, Japan, and the global community). The STS approach not only aimed to address the public communication of science and technology, but was also concerned with the interaction between radiation and society. Taking an interdisciplinary approach meant that knowledge was constructed with the collaborative participation of Japanese physicians (involved in the wake of the nuclear accident), social scientists, and educator experts. The interdisciplinary collaboration resulted in the design of a Radiation, Health, and Society curriculum with and for Fukushima Medical University. This book reflects those interdisciplinary conversations between experts from the medical sciences and the social sciences, working together to address the complex issue of radiation fear, resilience, and social recovery in the post Fukushima Nuclear Accident.

The book consists of two parts: Part I: The Social Dimensions of a Compound Disaster and Part II: Mental Health Issues: Challenges for Resilience and Recovery

from the Fukushima Compound Disaster. Contributors include leading scientists in their fields along with healthcare providers supporting the residents of Fukushima across multiple disciplines. The book also includes an intriguing chapter on international collaboration and peer support between victims of the September 11, 2011, terrorist attack in New York City, USA, and victims of the Fukushima nuclear accident. While the limitations of a single book cannot encompass all of the expertise needed for a comprehensive understanding of such complex issues, the chapters offer a broad range of knowledge gathered from both the past and the present. We hope that this work will contribute to the body of knowledge needed to offer some measure of support to all those whose lives have been affected by the Fukushima disaster.

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Rethy Kieth Chhem

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Disclaimer

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Part I
The Social Dimensions of a Compound Disaster

Chapter 1
Godzilla Mon Amour: The Origins and Legacy of Nuclear Fear in Japan

Ryan J. Crowder, Rethy Kieth Chhem, and Azura Z. Aziz

Abstract While investigating the fear of radiation, scholarly concern has often overlooked cinema as a narrative medium of cultural influence and social commentary. In Japan, the 1954 release of *Gojira* (1954)—wherein the titular reptile Gojira (or "Godzilla") is awakened via nuclear testing—signaled the emergence of radiation fear par excellence. Within this article, an investigation of nuclear fear and perceptions in general, coupled with a history of Japanese involvement with radiological technologies in particular, forms the basis for analyzing this seminal film. Subsequently, nuclear fear as showcased in *Gojira* is analyzed, with additional emphasis placed upon the in-film characterization of scientists, as well as the public communication of risk from authorities to society en masse. The chapter will conclude by investigating the extended legacy of *Gojira* and Japanese nuclear fear, particularly regarding the fear of radiation following the Fukushima nuclear accident of 2011, and discuss the film's impact upon public perceptions and fear of radiation effects.

Keywords Nuclear fear • Fukushima accident • Godzilla • Japanese cinema • Public communication

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1.1 Introduction

Prior to the birth of cinema, the story narrative had long since been established as an essential means of conveying knowledge, with the long-term durability of narrative providing a conduit not only between peoples in proximity but generations and civilizations otherwise independent of each other. Recent studies have confirmed this practiced belief of narrative potency: With the structure of narrative similar to the neurological structure of "human memory, knowledge, and social communication," storytelling comprises a superior method of knowledge transfer. Therefore, as natural vessels of communication, the narrative, along with its diverse tellers, has often attained an infectious capacity to educate and influence within human societies [1].

Among its various concerns, the narrative remains a particularly potent tool of conveying fear of the unknown. In such cases, that which exists beyond the known world—fringe territories, shrouded by the vacancy of human exploration—figures heavily, primarily found in fables or parables of ethical teachings and moral duty [2]. Thus, the primordial fears of townsfolk and city dwellers alike would become the creative reservoir for period storytellers, through which the undefined and indefinite at society's edge may be convincingly animated, most conspicuously into terrors of the supernatural.

Evading the "enormous condescension of posterity" [3], we admit that modern advances in learning have left us no more capable of mitigating these fears than previous generations, with discoveries of the twentieth century having only continued to fuel the apprehensions associated with exploration and scientific investigation. This does not suggest, however, that these fears have remained immutable. The grand experiments and discoveries enabled by the sciences have irreversibly altered our perception of the unknown and our associate fears. Perceptions of the natural world, no longer channeled through fable and myth alone, have become actively distorted by experimentation, in many ways becoming increasingly potent in parallel with increases of the scale of these scientific investigations and their consequences. Thus, it is with nuclear technologies, which forward from the mid-1940s would enact far greater fear, in both scope and severity, than the previous centuries combined.

Given the film's concerns arising from the postwar "age of anxiety" [4], it is perhaps appropriate that the idea to become *Gojira* (1954) was born from fear and desperation.[1] En route to Tokyo, following a disastrous film shoot in Jakarta, Tomoyuki Tanaka, producer at the famed Toho Motion Picture Company, required a film concept to replace the failed project. If left abandoned without a viable substitute, the failure would cost both the company and Tanaka greatly [5]. Tanaka's own fear of losing face with Toho executives, coupled with news of the *Lucky Dragon*, a Japanese fishing boat recently irradiated by American nuclear testing in the Pacific Ocean, would converge over the South China Sea where

[1] Here forward referred to as "Godzilla," the American transliteration.

Tanaka would conceive the primordial behemoth *Gojira*, a colossal manifestation of nuclear fear to enrapture audiences until the present day.

Prior to our discussion of Godzilla within the 1954 film, a concise history of nuclear fear in Japan followed by a discussion of nuclear fear and perception in general will be illustrated. The origins of nuclear fear in Japan serve as a background to the subsequent analysis of important elements within the film. This is followed by a discussion of the film's legacy, extending to the present evolution of this fear within Japan, particularly following the Fukushima Daiichi disaster of 2011.

1.2 A Brief History of Nuclear Fear in Japan

Radiation research had begun as a hopeful and publically welcomed enterprise, with experiments over the early twentieth century meeting widespread public admiration—for instance, Marie Curie's groundbreaking work with radioactivity. However, the bodily disfiguration and fatalities of those exposed to high doses of radiation within this formative era, including Curie herself, began to curtail the universal support for this research. The remedial radiological technologies developed by way of this initial research (e.g., X-ray technology) have not lessened this initial motion towards negative perception.

The Second World War was critical to this perception of nuclear technologies in Japan. In the decades preceding *Gojira*, the citizens of Japan witnessed a series of events which would cast radiation, artificial or otherwise, in an entirely negative light. The firebombing of Tokyo in early 1945 was only eclipsed in its disparaging effect on the Japanese psyche by the detonation of nuclear weapons over the Japanese cities of Nagasaki and Hiroshima later that year. Although significant loss of life had already been inflicted upon the Japanese over the previous years of war, the impact of the atomic bombings resulted in physical and psychological damage of unprecedented immensity, irreparably distorting the Japanese psyche over the next decades towards the present. As Palferman discusses, human beings tend to fear technologies that are "unbounded or that have catastrophic potential, imposed on a community, or managed by organizations or individuals that are seen as untrustworthy or incompetent" [6, p. 34]. In the context of Japan, this list of factors reads as if written specifically for nuclear weapons: catastrophically imposed, as they were, during wartime by an enemy combatant. Thus, the latent accumulation of apprehension towards nuclear technology instantly ascended to the forefront of public concern.

The era that followed would be considerably less forgiving to experimentation within the emergent nuclear sciences. The Japanese would view radiation and its antecedent materials as mysterious and harmful, scientists as persons meddling beyond the proper limits of human control, and the entire enterprise of scientific investigation as morally dubious [7, p. 32]. These beliefs were particularly accentuated by the accounts of mutation suffered through radiation exposure, where

seared, fireless wounds fed into ancient beliefs of transmutation to human flesh, elevating alchemist narratives, having long been internalized within the population and cultural ethos, into modernity.

In 1954, the public interest in nuclear technologies peaked once more with the aforementioned *Lucky Dragon* incident. That same year, Russia introduced the AM-1, the world's first nuclear reactor capable of feeding into an energy grid [8]. The former event had a particular effect on the Japanese, being the first instance of irradiation inflicted upon civilians following the atrocities of wartime. Thus, the mentality of the Japanese public as victim of circumstance, having initially formed with unwanted inclusion in the Second World War at the behest of the presiding government, was further emboldened by this accidental irradiation upon the Japanese population. This mentality was visible in two regards: The first by which the Japanese perceived themselves as victims of American military aggression—both during the war and through the cultural influence and media censorship immediately following—and as previously mentioned, as persons involuntarily bound to domestic policy and most directly affected by the disasters originating from government directives. The citizens of Japan, having endured this imperious era, would later seek to produce cultural vessels that encapsulated the anxieties of falling victim to political and technological device. Arguably, the most impactful of these was the motion picture.

With an economy only beginning to gain traction—the Japanese economic miracle still nascent in 1950s Japan—following the devastation of war, financial risk remained significant. Of course, and not unlike other widely marketed artistic productions, the economic nature of cinema is such that the widest viewing audiences are sought. Thus, in order to gain the maximum financial returns, the on-screen narrative must embody a universal attractor: A sentiment ingrained in the intended audience to be exploited equally for its potency and its universality, lest the production fails its original task of achieving economic success. This sentiment would be *nuclear fear*, and, coupled with the success of "monster movies" at home and abroad, the cultural climate would greatly enhance the potential of Tanaka's proposal. Production would begin almost immediately.

Prior to our explication of the film itself, a brief section on nuclear fear and perception as presently understood is required, within which we will shortly illustrate the potency of cinema as a medium of transporting these fears to the audience.

1.3 Nuclear Fear and Perception

In discussing the fears associated with radiation, Weart posits that "the fact is, emotions came first, and the powerful devices themselves came later" [9, p. 30]. Scholarly concerns regarding the fear of radiation, or radiophobia, often adjoins with studies of afflictions caused by real or perceived risk, most apparently post-traumatic stress disorder (PTSD) and depression. Once inscribed in genetics,

through traumatic or repeated exposure, fear necessitates a host of expressions at the physiological (micro) level, eventually manifesting itself in the societal (macro) level. From the approximate locus of fear in the brain's amygdala,[2] the following are characteristic of fear response: human perception of threat of danger, pain, or harm[3]; conditioned response paired to an unconditioned stimulus[4]; organization and coordination of the defensive behavior system to environmental threats; and interpretation of emotional stimuli or people's emotional state [10–13]. To the latter, "macro" cultural terms, the impressions of fear are held within group dynamics or what scholars have recognized as collectivism: a counterbalance to individualism that includes norms, history, and geography, as variables in considering the strength of relationships between individuals in various communal groups. Observations of collectivism traverse the spectrum of collective groupings from families to, in the case of Japan, prefectures and the population en masse. Thus, the complexity of nuclear fear in Japan is such that the individual *within* the collective must be regarded as a vessel of cultural influence, simultaneously containing and promulgating, through their interactions (and intensity of these reactions) with others.[5]

In probabilistic terms, the fear of radiation relative to other possible dangers can be usefully analogized with the fear inspired by the probability of a plane crash when compared with automobile accidents. Often the former (i.e., plane) inspires a degree of fear which far outweighs statistical dangers and yet is often regarded with relatively higher degrees of fear, despite the enormous imbalance of frequency when compared with the latter. This unique convergence of fear can be attributed, above all, to the fact that these fears are far more easily sensationalized by media and pop culture. As the public understands science mainly through "the filter of journalistic language and imagery" [14, p. 2–3], this example illustrates that our focus cannot simply localize on the human carrier, but must encompass the social environment as well.

Not unlike most Westernized cultures, the exploitations of fear are rife throughout Japan. Nuclear fear is simply a categorical division of cultural production—

[2] Internally, the complexity of fear neurocircuitry necessitates the involvement of many brain regions and patterns of communication and information exchange between components. Key components as identified in studies on fear are the amygdala (and its subnuclei), nucleus accumbens (including bed nucleus of stria terminalis), hippocampus, ventromedial hypothalamus, periaqueductal gray, a number of brain stem nuclei, thalamic nuclei, insular cortex, and some prefrontal regions (mainly infralimbic cortex).

[3] Functional neuroimaging studies in humans have shown amygdala activation during fear conditioning and observational fear learning, which suggest that fear is anticipated or predicted in higher-order centers that provide this information to the amygdala or that the human amygdala has more general responses than animal amygdala and is more sensitive to modulation with regard to the context of the fear situation.

[4] For instance, Pavlov's formative experiments with fear conditioning.

[5] See Yamawaki (2012) for a study of Japanese prefectural collectivism as contrasted to individualism. Yamawaki N. Within-culture variations of collectivism in Japan. Journal of Cross-Cultural Psychology. 2012;43:1191–1204.

albeit one which carries considerable psychological, historical, and societal weight. In the body of cultural artifacts, it is cinema that is most often neglected by scholarly concern, a medium that plainly showcases human misgivings about technological productions, particularly those with destructive capacities.

Particular to our interests, cinema has the potent characteristic of reinforcing public perceptions through *visual* information. In the case of *Gojira*, the destructive advances of a giant lizard upon downtown Tokyo inspire extreme fear and anxiety among the in-film citizenry, expressed overtly in the faces of actors and extras populating the sidewalks and street corners, and upon the face of major characters in the film's quieter and more considered moments. These affecting expressions of fear—universal, easily relatable—inspiring a visceral experience among those in attendance of a screening, and enlivening, over and over, the cultural tendency towards Japanese victimization, guilt, and of course (nuclear) fear.

1.4 The A-Bomb Made Flesh: Gojira (1954)

We might very well accept, as Shapiro asserts, that the cultural motif of "restoration of balance and harmony" [15, p. 133] is particularly accentuated in the Japanese context. Viewed longitudinally, along the history of Japanese storytelling, this may prove correct. However, we must remember this restoration of balance is an intrinsic requirement of the narrative: To resolve and return to what Kal Bashir calls the "state of perfection" existing before, or during, the film's opening scenes [16]. However, the apocalyptic narrative of Godzilla departs dramatically from this propensity towards idyllic beginnings, as well as endings for that matter: This "perfect" state, as it were, never resolves and is instead replaced with the anxieties of postwar Japan, manifest in the rhythmic booming of colossal footsteps (i.e., bombing) that accompany the opening titles. Subsequently, in the film's opening scene, the Japanese audiences of the film's 1954 original theatrical run are quickly brought over the Pacific Ocean, where a seafaring vessel is destroyed by a mysterious force—a direct reference to the irradiation of crewmembers aboard the *Lucky Dragon* only months before. These early on-screen events commence a series of historical and cultural references that proliferate throughout the narrative, including the final embodiment of fact and fear in Godzilla itself.

1.4.1 Creature of Modernity

Purposefully hidden until midway through the film, Godzilla initially symbolizes a power of extreme, yet *familiar*, immensity, having developed ill intent towards the Japanese at the behest of destructive scientific experimentation. Nancy Anisfield describes the beast of *Gojira* as a "400′ tall, sexually ambiguous, amphibious prehistoric monster from the Mesozoic era. . .(with). . .radioactive breath,

treacherous taloned feet, and a long and powerful tail. . .released from 100 million years of hibernation by hydrogen testing in the Pacific" [17, p. 54]. The radioactive breath is particularly important, as we find a monster intrinsically infused with the radiological science of its awakening, a nuclear blast generated on command from within, and the fear of a generation weaponized back upon itself [17]. Certainly, the embodiment of nuclear fears within Godzilla is manifold, which, apart from the above, entails perhaps the most obvious emphasis on the monster's relationship with the atomic bomb: a skin texture inspired by "the keloid scars of Hiroshima's survivors" [18].[6]

We must remember it is not the dormant Godzilla's violent nature which inspires its first attack upon awakening, but the fear and anxiety of the Japanese government which, despite warnings by the film's elder scientist (Dr. Yamane), presupposes ill intent and attacks the creature at sea. This on-screen fact provides an obvious analogy to Pearl Harbor, where the Japanese carried out a devastating attack on the unprepared American military, whose entrance into the Second World War was still uncertain. The quote below, famously referring to the American war machine, which had experienced similar dormancy only to soon afterwards enter the Pacific theater of war to combat the Japanese, might easily be mistaken for a dialogue quoted from *Gojira*:

> I fear all we have done is to awaken a sleeping giant and fill him with a terrible resolve. (Marshal Admiral Isoroku Yamamoto)

With the multitude of references transformed into both overt and symbolic features of the creature Godzilla, along with its surrounding context, we can now proceed to discuss the character of scientists as showcased in the film. This subsection will aid in our analysis of the characterization of Japanese nuclear fear in *Gojira*, particularly in that the perceived character of those individual scientists—responsible for interpreting and communicating knowledge to the public—and their interactions with other officials proves essential to the in-film illustration of nuclear fear.

[6] Another quote from the same article reinforces this relationship: "At various points characters talk about surviving the atomic bombings and describe the monster as a child of the H-bomb. And then there's that opening sequence. This isn't "just another monster movie," it's a form of social catharsis. From 1945 to 1952, the American occupying forces enforced official censorship on Japanese films, explicitly forbidding open discussion of A-bomb matters. The thing about censorship is, "open discussion" isn't the *only* kind of discussion. Japanese artists had to deflect their ideas into forms sufficiently transformed to escape censorship. *Gojira* arrived 2 years after the American Occupation ended, and did not face direct censorship on this count—it was free to speak its mind openly, but found the use of metaphor and allegory a more powerful way to address such raw nerves."

1.4.2 Character of Scientists

The decidedly evil and destructive characterization of nuclear technology, as discussed above, forms only one half of the in-film moral dichotomy, providing space for an eventual conquering of "good science" in a narrative and moral sense. While the science that awakens Godzilla is kept deliberately offscreen—referenced only through character dialogue—emergent science and technology is cast as morally neutral, only gaining ethical weight by its eventual use (i.e., consequentialist reasoning). The scientists populating *Gojira* are at once expressed as "human, principled and self-sacrificing" [19], particularly the inquisitive Dr. Yamane, who desperately strives to find a humanitarian means of dealing with Godzilla, and the young Dr. Serizawa, the film's wise young scientist wherein scientific brilliance and moral integrity are present in equal measure.

Following an early reveal to the viewing audience as to the destructive force which Serizawa has discovered (our only hint of its capacities being a scream from the female lead at the experiment's conclusion), the moral and ethical implications of using the device to battle Godzilla become important in the film's investigation into the substantial implications of technology use. Contained within Dr. Serizawa's Oxygen Destroyer is a great moral conundrum over the nature of risk and fear in postwar Japan, the weak optimism of a scientific future, strengthened by scientists, yet far too easily corrupted by political ends. Eventually, and in order to thwart the possibility of the technology becoming a new military force, Serizawa sacrifices himself to destroy Godzilla at the ocean floor using the only model of his invention, a conclusion that neutralizes all artificially induced threats within the film, excluding the ongoing threat of nuclear weapons to which the film returns.

1.4.3 Public Communication of Risk

The final component of *Gojira* critical to our explication of nuclear fear in postwar Japan concerns how public communication of risk is illustrated within the film. While a fictional representation of the discussion and deliberation following a national emergency is demonstrated therein, the social commentary provided is nevertheless important to our understanding of historic reflections upon Japanese society as encapsulated in the arts. In spite of these limitations, the film provides a particularly focused resource for cultural observation, especially within *Gojira* where historic events are crucial to the narrative progression therein. In this case, a single scene provides an abundance of commentary on this issue of public communication, set into motion by Godzilla's impending advance on Japanese land.

The situation enlivened in Godzilla certainly meets the criteria of risk, which Rosa defines as "a situation or an event where something of human value is at stake

and where the outcome is uncertain" [20, p. 56]. Following visual confirmation of Godzilla on the fictional island of Odo, scientists, government officials, and undefined members of the public discuss the possible sources of action to minimize public danger.

> *26:35 Mr Ooyama: "I believe Professor Yamane's report is of such extreme importance that it must not be made public" [applause] "World affairs are fragile enough as it is. If it were to be made public can you imagine the consequences? . . . The improper handling of such a notion would engulf the country in a panic. The government, the economy and international relations would plunge into total chaos."* [21]

As idealized by Mr. Ooyama, along with his supporters, public communication, as such, is a matter of maintaining status quo politics and relations—a specifically paternalistic way of handling the public and its interests. The fact that it is a *female* member of the council that provides the lone voice of dissent (albeit with a few supporters, one of whom is also female) against the proposed moratorium on publicizing Godzilla's existence further accentuates this patriarchal status of governance. This single voice of dissent may also comment upon the dutiful servitude with which Japanese society was bound to the rule of its government and yet, given the government's allowance to inform the public of Godzilla immediately after this meeting, proposes that government directives may prove brittle under even the most isolated pressure. The presupposition that nuclear technology lends itself not only to mass panic but also to secrecy and nondisclosure is apparent within this scene. By extension, although the primary concern in the film is nuclear weapons testing and its aftermaths, these sentiments can be as easily bound to the atomic bombings of 1945 and subsequent nuclear reactor meltdowns of the latter twentieth and twenty-first centuries.

1.5 Legacy

In spite of the technological threats present in *Gojira*, the balancing of scientific morality shifts decidedly towards an optimistic idealism, gravitating towards the potential and benefits science and scientists might offer society. This ideal would continue into the following decades, wherein widespread societal acceptance of technology, including nuclear technology, overtook preceding skepticism, with developing nuclear industries recast as an advantage to the economic strength of Japan. Cultural values would alter greatly in these years as well. The unflinching confrontation with nuclear fears present in *Gojira* would be bordered by years of censorship, first at the behest of the American occupiers and media self-censorship, and in subsequent years by way of taboo and propriety. However, not unlike Godzilla itself, the fear that lay dormant in the Japanese psyche would remain.

The compound disaster of March 2011 on the Japanese mainland would lead to the meltdown of the Fukushima Daiichi nuclear power plant, which, as a nonmilitary, nuclear catastrophe, was comparable to Chernobyl alone in its

severity. The nature of fear consolidation in the mind, as outlined above, removes the particularities of the unique circumstances of its origin to leave a sharply conditioned emotional response: a latent fear existing as potential in the new generations of Japanese. This ingrained fear would descend once more upon the island nation in the weeks and months following the catastrophe, a period of time wherein stress and anxiety amalgamated into psychological trauma. This continuation of nuclear fear was only amplified by a legacy of cultural artifacts, including another 27 Godzilla films following its 1954 introduction [22]. Thus, while childhood exposure to stress and anxiety propagates fear into an individual's adulthood, this expression of fear plights future generations through cultural and genetic pathways and remains deeply embedded in the social fabric of the afflicted populace.

Circulated just after the Fukushima Daiichi accident, the image of an enraged Godzilla superimposed onto an image of a burning Fukushima nuclear power plant, its radioactive breath beaming onto the burning structure, may provide the ultimate illustration of nuclear fear in Japan. The giant lizard, sent from a distant era, providing an unwelcome reminder of the fears buried in wartime memory and the unending apprehension the Japanese hold towards the "nuclear."

Godzilla's transition from a destructive force to a hero of the Japanese nation over subsequent films is also noteworthy. Its eventual capacities to uphold the Japanese way of life—in spite of its nuclear origins and the invariably certain collateral of a destroyed Japanese city in its wake (often Tokyo)—are permitted to overwhelm the original aggression expressed in the first film. The moral weight had once more swung and the Japanese fears are reappointed to foreign monsters, less metaphors than imperious combatants, which Godzilla contends with in the Japanese streets. In recent years, the United States has profited from co-opting the Godzilla archetype to its own ends, making Godzilla a creature bent on destruction alone, with the Japanese origins relatively dampened vis-a-vis its traditional narrative.

1.6 Conclusion

The introduction of Godzilla into the Japanese conscience came at a particularly contentious moment in the history of Japan. The Japanese, having suffered the resounding failure of the Second World War, idealized a reinvention of Japanese culture in its emergent youth: an escape from the horrors and tragedies which beset the wartime generation. These representations of intergenerational strife are apparent within the cultural productions of the age, including *Gojira*, and often complement the continuous reliving of nuclear fear. This intergenerational transition provides the framework for a type of cinema known as "secure horror," where the rejuvenation of society occurs despite the destruction and folly of authorities. In this sense, *Gojira*'s production and screening can be looked at as a cathartic release of accumulated tensions worn by the Japanese from the Second World War

onwards. A production through which subtle social commentary, despite an enormous reptilian centerpiece, affected a generation of postwar inhabitants far more than an explicit depiction of wartime fears may have attained.

The story narrative as a vessel of nuclear fear is a valuable commentary on the cultural management of real or perceived threats within our societies, particularly those directly affected by catastrophe at the hands of foreign aggression or domestic policy. As to the creation of Godzilla as nuclear fear manifest, we may confer with Emerson as to our propensity to animate the world through our particular optic, in which we as humans are:

> *. . .a centre for nature, running our threads of relation through everything, fluid and solid, material and elemental. . .The mass of creatures and of qualities are still hid and expectant. It would seem as if each waited, like the enchanted princess of fairy tales, for a destined human deliverer. Each must be disenchanted, and walk to the day in human shape.* [23]

References

1. Schank RC, Abelson RP. Knowledge and memory: the real story. In: Wyer Jr RS, editor. Knowledge and memory: the real story: advances in social cognition, vol. VIII. Hillsdale: Lawrence Erlbaum Associates; 1995. p. 1–85.
2. Andrews DH, Hull TD, Donahue JA. Storytelling as an instructional method: descriptions and research questions. Interdisc J Probl Based Learn. 2009;3(2):6–23.
3. Thompson EP. The making of the English working class. New York: Pantheon Books; 1963. p. 12.
4. Auden WH. The age of anxiety. New York: Random House; 2011[1947]. p. 1.
5. Roberto JR. Japan, Godzilla, and the atomic bomb: a study into the effects of the atomic bomb on Japanese pop culture. Visagraph Films Int. 2000;1:1–21.
6. Palferman J. A tale of two fears: exploring media depictions of nuclear power and global warming. Rev Policy Res. 2006;23(1):23–43.
7. Weart S. The rise of nuclear fear. Cambridge: Harvard University Press; 2012. p. 32.
8. World Nuclear Association. Outline history of nuclear energy. http://world-nuclear.org/info/Current-and-Future-Generation/Outline-History-of-Nuclear-Energy/. Last modified March 2014. Accessed September 2014.
9. Weart S. Images of nuclear energy: why people feel the way they do. Vienna: IAEA Bulletin; 1991. p. 30.
10. Shin LM, Liberzon I. The neurocircuitry of fear, stress, and anxiety disorders. Neuropsychopharmacol Rev. 2010;35:169–91.
11. Fanselow MS. Neural organization of the defensive behavior system responsible for fear. Psychol Bull Rev. 1994;1:429–38.
12. Alvarez RP, Biggs A, Chen G, Pine DS, Grillon C. Contextual fear conditioning in humans: cortical-hippocampal and amygdala contributions. J Neurosci. 2008;28:6211–9.
13. Olsson A, Nearing KI, Phelps EA. Learning fears by observing others: the neural systems of social fear transmission. Soc Cogn Affect Neurosci. 2007;2:3–11.
14. Nelkin D. Selling science: how the press covers science and technology. New York: W.H. Freeman; 1995. p. 2–3.
15. Shapiro JF. Atomic bomb cinema: illness, suffering, and the apocalyptic narrative. Lit Med. 1998;17(1):126–48.
16. Bashir K. How to structure a successful story: introduction. http://kalbashir.com/index.html. Last modified December 2014. Accessed 5 Jan 2015.

17. Anisfield N. Godzilla/Gojira: evolution of the nuclear metaphor. J Pop Cult. 1995;29 (3):53–62.
18. Turner Classic Movies. Gojira. http://www.tcm.com/this-month/article/384918%7C0/Gojira-Godzilla-.html. Accessed 2 Nov 2014.
19. Tsutsui WM. For Godzilla and country: how a Japanese monster became an American icon. Foreign Affairs. May 27, 2014.
20. Rosa EA. The logical structure of the Social Amplification of Risk Framework (SARF): metatheoretical foundations and policy implications. In: Pidgeon NF, Kasperson RK, Slovic P, editors. The social amplification of risk. Cambridge: Cambridge University Press; 2003. p. 47–79.
21. Tanaka T. Gojira [DVD]. Directed by Ishiro Honda. Tokyo: Toho Company Ltd.; 1954.
22. Toho Kingdom. Godzilla movie list: Toho produced and distributed films. http://www.tohokingdom.com/articles/movie_lists/godzilla_listing.htm. Last modified 2014. Last accessed December 2014.
23. Emerson RW. Representative men. London: George Routledge & Co.; 1850. p. 5.

Chapter 2
Unforeseeable Accidents from the Point of View of the Legal System

Mitsuko Fujino

Abstract The legal system regulating nuclear power generation in Japan had never taken into account the possibility of an accident as severe as the Fukushima accident. There were no countermeasures in place to respond to such an accident, which left people and agencies in confusion in a time of great need. By delaying the provisioning of well-considered countermeasures, Japan has not been able to adopt them properly and in a timely fashion. Even if there had been such proper countermeasures in place, the manner in which the response occurred after the accident made it hard for authorities to gain the trust of citizens. Agencies that regulate power companies and ensure the safety of nuclear power generation are part of the same governmental organisations that promote nuclear power. Therefore, the regulatory organisations had no other choice but to be passive in creating appropriate regulations on nuclear power. The disaster prevention drill that had been held before the accident was of no help in evacuations during this nuclear accident, as only small-scale accidents had been considered in the drill. Evacuation standards and food safety standards were put in place only after the Fukushima accident; simultaneously, the processing of radioactive waste was placed outside the jurisdiction of the Ministry of the Environment. The fact that there were no specific standards for compensation increased the burden and anxiety of victims. It is critical to learn the lessons of Fukushima and create specific legal disaster countermeasures based on the assumption that a severe accident can and will occur again sometime in the future.

Keywords Legal systems • Nuclear emergency preparedness • Response for severe accident • Trust of citizens • Unforeseeable accident

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2.1 Introduction

The national government and local governments, as well as the Tokyo Electric Power Company (TEPCO), were not able to generate proper responses to 'unforeseeable accidents' because the legal system for governing nuclear power generation in Japan had not taken into account the possibility of a nuclear accident as severe as the Fukushima accident. There was significant loss of life, damage and confusion because countermeasures for such a severe accident had not been stipulated in the laws governing nuclear power. Such laws had to be hastily improvised and developed almost as an afterthought after this accident occurred. This lack of foresight made it difficult for authorities to gain the trust of citizens, even when proper countermeasures were put in place after the accident.

Within the legal system of safety regulations, this paper focuses on postaccident nuclear disaster responses, the state of agencies within the nuclear power regulatory organisations, evacuation plans, standards for food safety, processing of radioactive material and standards for compensation regarding damage from nuclear power.

2.2 Promotion of Utilisation of Nuclear Energy and Safety Regulation Under the Same Organisation

Prior to the accident at the Fukushima Daiichi Nuclear Power Plant, the Nuclear and Industrial Safety Agency's (NISA) main mandate was overseeing safety regulations for nuclear power (including postaccident responses) in a dual-check structure that comprised both primary regulations from administrative agents overseeing plant operators and an additional check on those primary regulations. The former regulations were undertaken by NISA and the latter by the Nuclear Safety Commission (NSC).

In 1999, the Japan Nuclear Fuel Conversion Company (JCO) criticality accident occurred at a facility in the village of Tokai, which in 2001 caused the Ministry of Economy, Trade and Industry's (METI) Agency for Natural Resources and Energy (ANRE) to lose oversight of nuclear safety regulations. ANRE was an agency for promoting rather than regulating nuclear energy. Nuclear safety regulations were then placed under the jurisdiction of NISA. NISA was entrusted by the METI minister to regulate nuclear reactor facilities, implement regulatory affairs and make decisions independent of ANRE. The goal of this reform was to separate regulation from promotion, although in actuality, NISA itself was a METI agency (legally speaking, it was a special organ belonging to ANRE, itself an external agency of METI).

The status and functions of NSC had been prescribed in the Atomic Energy Basic Act (Act No. 186 of 1955), which is the basic law for nuclear power safety regulations (Fig. 2.1). Under this act, further legislation was enacted regarding regulations for nuclear source materials, nuclear fuel materials, nuclear reactors

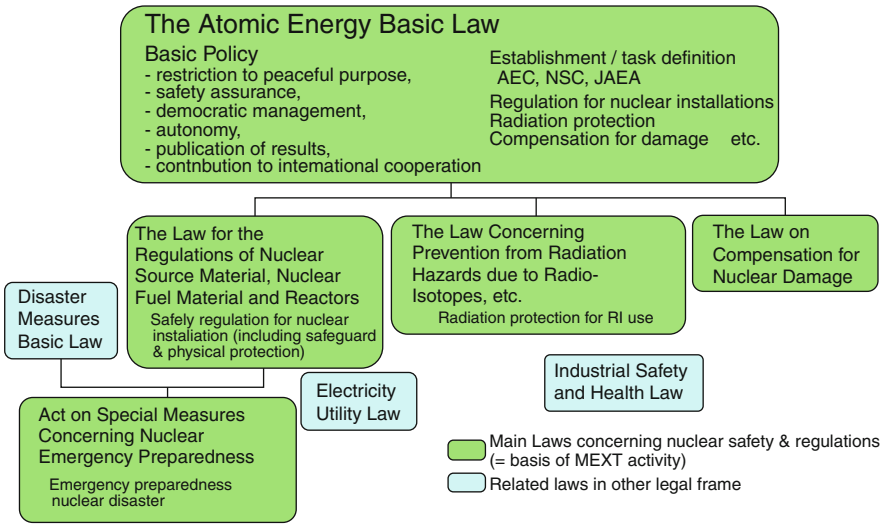

Fig. 2.1 Legal system for nuclear power safety regulations in Japan (Source: MEXT (http://www.mext.go.jp/english/science_technology/1303809.htm))

(the Nuclear Reactor Regulation Act, Act No. 166 of 1957) and for preventing radiation hazards due to radioisotopes (Radiation Hazards Prevention Act, Act No. 167 of 1957). Procedures covering everything from the construction to operation of nuclear power plants were set forth in the Electricity Utilities Business Act (Act No. 170 of 1964). NSC was established under the Cabinet Office according to Article 4 of the Atomic Energy Basic Act in a manner similar to the Atomic Energy Commission (AEC), whose mandate is executing policies for nuclear power research, development and use. Article 5, paragraph 2 of the same act states that 'the Nuclear Safety Commission shall plan, deliberate on and determine matters related to the safety of nuclear power from among the matters related to the research, development and use.'

After the radiation leakage that occurred in 1974 aboard the nuclear-powered ship *Mutsu*, criticism grew over the fact that the AEC, an organisation that promotes nuclear power, had jurisdiction over safety regulations. In October 1978, the NSC split from the AEC and was established as a new agency. With the JCO accident and TEPCO's damage cover-up and data falsification that were uncovered in 2002, the Nuclear Reactor Regulation Act was revised, and NSC's functions and disaster countermeasures were strengthened.

Even prior to the Fukushima accident, the independence of these organisations and agencies had been an issue. NISA was situated within METI, which promotes nuclear energy, thus inhibiting NISA from providing sufficient regulation, not to mention the fact that it was sometimes even charged with promoting nuclear energy. The role of the NSC, which was to monitor NISA regulations, was beginning to become a mere façade [1]. Article 8 of the Convention on Nuclear Safety (ratified by Japan in 1995) demands the effective separation of duties between

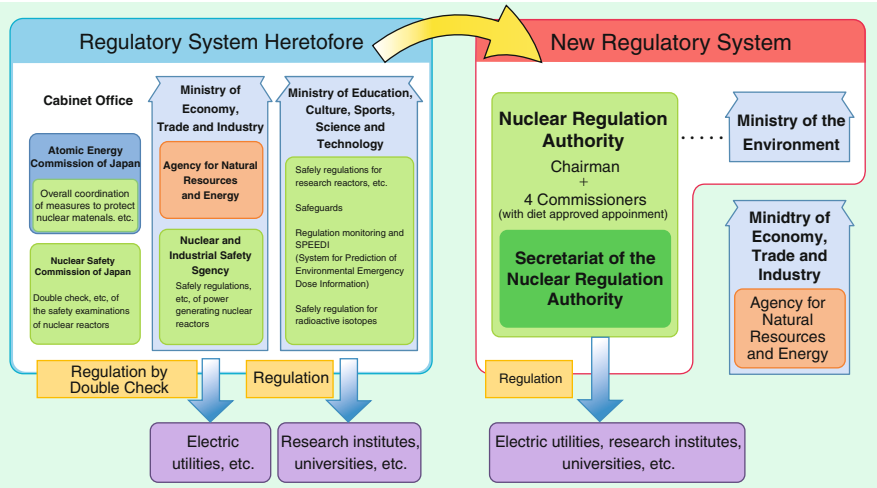

Fig. 2.2 Reform of regulatory agencies for nuclear power safety (Source: NRC (http://www.nsr.go.jp/data/000067218.pdf))

agencies promoting nuclear power use and regulatory agencies. In addition, the International Atomic Energy Agency's Fundamental Safety Principles (1996) also demand the independence of regulatory agencies. Moreover, 'The Efforts towards Ensuring the Safety of Nuclear Power Plants in the Future' compiled by Fukushima Prefecture in June 2005 points out that 'NISA should be separated from METI and its promotion of nuclear power generation' in order to establish a more objective structure and gain the trust of citizens and regions [2].

In October 2012, after the Fukushima accident, the Nuclear Regulatory Commission (NRC) was created as an external agency of the Ministry of the Environment to do away with the negative effects of vertically siloed administrative agencies dealing with nuclear power use and to resolve issues stemming from one organisation being responsible for both nuclear power promotion and regulation (Fig. 2.2). In addition to the work done by the NSC and NISA, the NRC now has jurisdiction over nuclear safety regulations of the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Land, Infrastructure and Transport as well as having jurisdiction over measures that guarantee nuclear non-proliferation.

2.3 Evacuation Plans That Did Not Plan for Severe Accidents

When nuclear power plants were first built in Japan, nuclear emergency responses were based upon the Basic Act on Disaster Control Measures (Act No. 223 of 1961), with 'large emissions of radioactive materials' defined as one type of disaster

falling under this Act by government decree. The disaster prevention structure was created on the basis of the Basic Disaster Management Plan set forth by the Central Disaster Management Council and the 'Disaster Prevention Measures for Nuclear Power Plants and Surrounding Areas', which was a set of disaster response guidelines created by the NSC.

However, the JCO accident in 1999 was serious enough to require evacuation and indoor shelter of residents, which was a first for Japan, and it brought to light the inadequacies of the disaster prevention structure in place at the time. The Act on Special Measures Concerning Nuclear Emergency Preparedness (Act No. 156 of 1999) was enacted after that accident in 1999 as a special provision of the Basic Act on Disaster Control Measures and the Nuclear Reactor Regulation Act [3]. This act clarifies the standards for notifications from plant operators and the declarations of states of emergency by the Prime Minister to ensure rapid initial responses. During nuclear disasters, there exists a possibility that damage unperceivable by the senses might occur; therefore, the act sets forth the role and responsibility of the national government, strengthens partnerships between the national government and local governments and clarifies the responsibilities of plant operators. Article 13 of the act stipulates coordinated disaster prevention drills between the national government, local governments and related plant operators on the basis of the plans set forth by the national government. A disaster response guideline established by the NSC has traditionally only targeted large-scale facilities such as nuclear power plants. This has been revised with a section on 'disaster response for nuclear power facility' that includes fuel-processing operations.

However, the preaccident disaster response guideline has been criticised for not incorporating results from the analysis of the Chernobyl accident [4]. The guideline has set an emergency planning zone (EPZ) of 8 and 10 km from nuclear power plants where disaster responses are focused. This distance was decided upon because 'making a larger EPZ would only have a negligible impact given a drastic reduction in the impact of radiated materials and radiation from nuclear facilities the farther one gets from the source of emissions.' In setting the size of the EPZ, 'even technologically impossible situations were supposed, and an ample distance from nuclear facilities was set.' It was confirmed that outside this perimeter, there would be no need to take shelter indoors or to set up protective measures for evacuees. Relationships with prior accidents were also considered in creating the guidelines [5].

Originally, there were no disaster response plans in Fukushima Prefecture for nuclear disasters. After the Three Mile Island (TMI) accident in 1979, the Prefecture created its first disaster prevention plans, which were later revised. The Prefecture also conducted disaster prevention drills. However, in 2008, the comprehensive nuclear energy disaster prevention drill sponsored by the national government based on Article 13 of the Special Measures Act set the evacuation area to within only a 2-km radius from the nuclear plant and indoor shelter area to within 5 km over 3/16 of the wind compass (72° angle) downwind from the plant (Fig. 2.3).

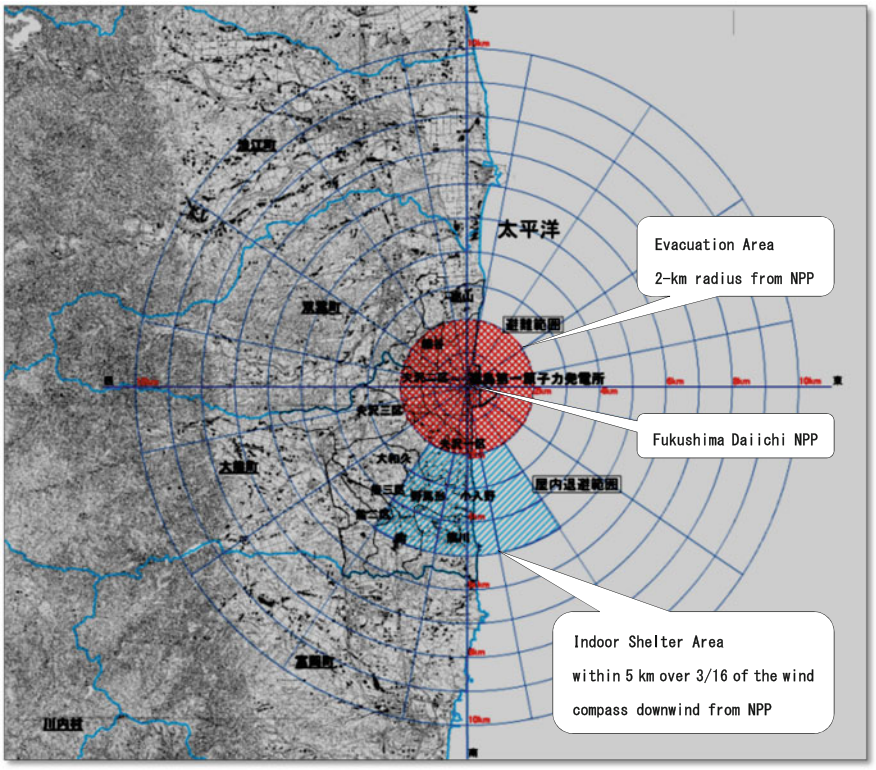

Fig. 2.3 The emergency response area under the 2008 comprehensive nuclear energy disaster prevention drill (Source: METI (http://www.meti.go.jp/committee/materials2/downloadfiles/g81006b02j.pdf))

On 11 March 2011, at 8:50 p.m., the Governor of Fukushima Prefecture issued an evacuation order to the residents in a 2-km radius. Later, the residents in a 3-km radius were ordered to evacuate at 9:23 p.m. by the Prime Minister. On 12 March at 5:44 a.m., the order was extended to the residents living within 10 km and then at 6:25 p.m. to the residents living within 20 km. On 15 March at 11:00 a.m., areas within a 20- to 30-km radius were designated as an indoor shelter zone (Fig. 2.4). For the village of Iitate and other villages that registered high levels of radiation but were outside the restricted area, a deliberate evacuation area and specific spots where evacuation was recommended were established on 22 April 2011, though the confusion continued. As a result, 'in the town of Namie, residents near the nuclear plant were evacuated to a remote location. However, on the 15th, that location was notified of danger, forcing a further evacuation to the city of Nihonmatsu. Unfortunately, this evacuation path followed the direction the radioactive materials were blowing in. Similarly, the town of Tomioka first evacuated to the village of Kawauchi, and from there the residents of that village and those from Tomioka were re-evacuated to the city of Koriyama' [6].

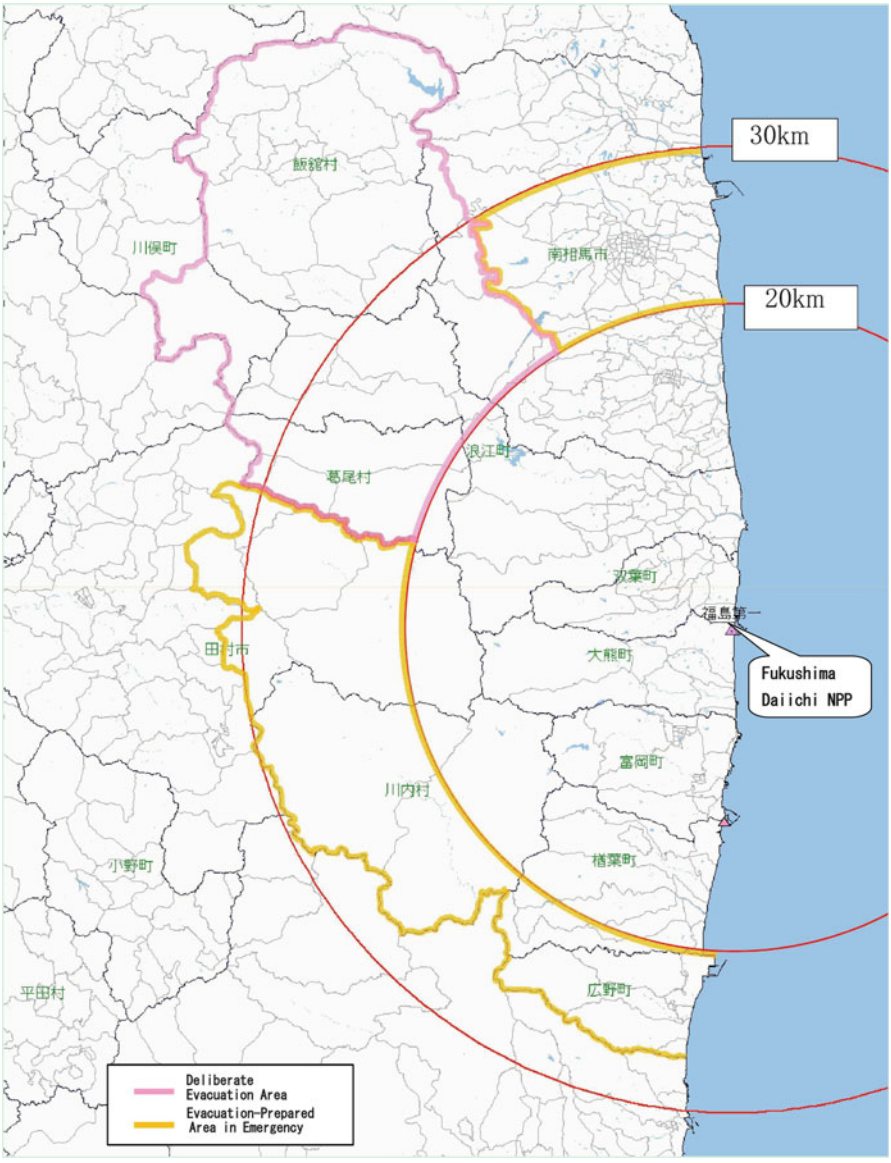

Fig. 2.4 Establishment of deliberate evacuation areas (Source: METI (http://www.meti.go.jp/press/2011/04/20110422004/20110422004-5.pdf))

Evacuations of medical institutions, homes for the elderly, welfare facilities, hospice care patients at home and the severely disabled were fraught with extreme difficulty [7–9]. Of the six hospitals designated as initial exposure medical institutions in times of a nuclear disaster, four had to evacuate all patients in their care. For

hospitals that had conducted disaster prevention drills under the assumption they would be receiving patients, these were completely unforeseen circumstances [10].

The NRC, which was newly created after the accident, decided upon the nuclear disaster response guidelines in October 2012, which they later revised multiple times. To prepare for a large-scale complex disaster and ensure the efficacy of protective measures for residents, evacuation standards were clarified. A Precautionary Action Zone (PAZ) was created to prepare precautionary protective measures. An Urgent Protective Zone (UPZ) was created to prepare urgent protective measures in case of broad evacuations: standards (Operational Intervention Level; OIL) were issued to determine whether such protective measures would be implemented. However, many issues still remain regarding the preparedness for persons having difficulties in evacuating by themselves and the execution of effective disaster prevention drills [11].

2.4 Postaccident Food Safety Standards

The NSC disaster response guideline prior to the Fukushima accident stated that 'intake restrictions would be determined by referencing the results of emergency monitoring, as it takes time for contaminated food and drink to be consumed and there would normally be plenty of time'. Further, a guideline used by the disaster response headquarters to determine whether intake restrictions on food and drink were appropriate determined 'indices for food and drink restrictions'. The NISA website under 'Nuclear Disasters' stated that 'intake restrictions were not implemented' during the TMI accident or the JCO accident [12].

On 17 March 2011, the Ministry of Health, Labour and Welfare (MHLW) set the provisional restrictions as an emergency response to ensure food safety on the ground of the indices for food and drink restrictions determined by NSC. Food with radiation levels above those restriction standards fell under Article 6, paragraph 2 of the Food Sanitation Act (Act No. 233 of 1947), in which case it was decided that the national government would provide direction on shipping restrictions to the governors of the prefectures involved. The government would then 'deem food products conforming to the provisional restrictions as generally having no adverse impact on health'. However, the government found it difficult to gain the trust of citizens with regard to the restrictions. Even when Fukushima Prefecture measured radiation levels and confirmed the safety of seven types of vegetables cultivated in greenhouses as being below standard values and therefore safe for consumption, the market distanced itself from products labelled 'made in Fukushima', and prices of agricultural products from that area dropped to one-fourth of previous years [13].

These provisional restrictions were set as a response to the imminent emergency, without having gone through normal procedures. Thus, standard values for radiation levels based on the Food Sanitation Act were revised and took effect on 1 April 2012 (Fig. 2.5). The new values were set on the basis of international food standards from the Codex Alimentarius Commission. The new standards were set

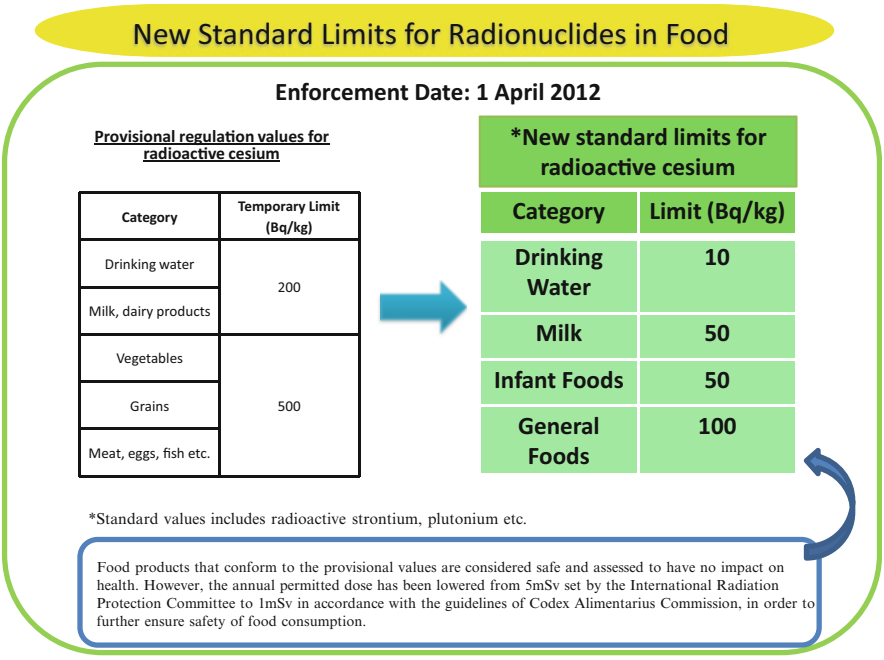

Fig. 2.5 New standards for radioactive substances in foods (Source: MHLW (http://www.sg.emb-japan.go.jp/japaninfo_newfoodstandard.pdf))

lower than the restrictions in other countries for acceptable levels of radiation, and producers worried whether they could meet the new standards. At the same time, there were also producers who expressed concern over the new standards, saying that even if they could meet the standards, consumers might think that 'agricultural products might be only slightly below the standards. . .and we are worried about harmful rumours' [14].

2.5 Environmental Laws and Regulations for Which Radioactive Materials Were Out of Scope

Prior to the Fukushima accident, no environmental laws or regulations dealt with radioactive substances. Article 13 of the Basic Environment Act prior to revision (the amendment was removed after the accident) (Act No. 91 of 1993) stated that 'measures to prevent air pollution, water pollution and soil contamination caused by radioactive substances shall be implemented under the Atomic Energy Basic Act and other related legislation'. Article 2 of the Waste Management and Public Cleansing Act (Act No. 137 of 1970) makes an exception for 'radioactive substances and items contaminated by them', and Article 23 of the Water Pollution

Control Act (Act No. 138 of 1970) likewise provides that the Act does not deal with radioactive substances. Article 52 of the Environmental Impact Assessment Act (Act No. 81 of 1997) states that the Act is not to be applied to 'air pollution, water pollution and soil contamination caused by radioactive substances'.

While radioactive substances were not covered under existing environmental laws and regulations, the Ministry of the Environment, which is responsible for waste management, was compelled to take on the jurisdiction for these substances. With no basis for setting standards for radioactive materials, the Ministry created its own rules. In May 2011, the first Disaster Waste Safety Review Meeting was held. The NSC presented its current thinking on 'assuring safety for processing and disposal of waste that had been impacted by the Fukushima Daiichi Nuclear Power Plant accident'. This thinking was used as a benchmark for developing specific guidelines for processing radioactive waste. This Review Meeting compiled the 'Guidelines for Processing Disaster Waste Thought to be Contaminated by Radioactive Substances' in June 2011, stating that waste would be incinerated or recycled as much as possible and that rather than burying waste when radioactive caesium concentration in the waste exceeded 8000 Bq/kg, the waste would be temporarily stored until the government could confirm the safety of its disposal.

These processing criteria were later reviewed by the Radiation Council and the NSC to become legal standards based on the Act on Special Measures for Dealing with Environment Pollution by Radioactive Materials, which will be described later. However, this Review Meeting was not initially made public, causing criticism that the processing criteria were looser than the clearance level (100 Bq/kg) that determines materials that do not need to be treated as radioactive waste among the waste materials generated in dismantling the nuclear reactor according to [15].

The Act on Special Measures for Dealing with Environment Pollution by Radioactive Materials discharged by the Nuclear Power Station accident associated with the Tohoku district – off the Pacific Ocean earthquake that occurred on March 11, 2011, was enacted in August 2011. The Act set forth measures that are to be established by the national government, local governments, TEPCO and others as well as setting forth measures to eliminate soil pollution caused by radioactive substances. It designated areas of marked environmental pollution as special decontamination zones in which the government would undertake decontamination. Other regions would be decontaminated by the prefectural governor and the heads of local municipalities directed by government ordinance. Materials of 100,000 Bq/kg or higher were to be stored in interim storage facilities in Fukushima Prefecture. The Act on Interim Storage and Japan Environmental Storage & Safety Corporation (Act No. 44 of 2003) was revised in November 2014 and specified that final disposal of waste stored in these interim storage facilities would be implemented outside of Fukushima Prefecture within 30 years.

Many in Fukushima Prefecture were opposed to facilities for incinerating or reducing the volume of waste contaminated by radioactive substances, and it was difficult to gain the trust of residents [16]. In addition, residents from the coastal areas of Fukushima Prefecture where interim storage facilities might be built showed concern that those areas might become final disposal sites [17].

2.6 Setting Compensation Standards Took Time

The Act on Compensation for Nuclear Damage (Act No. 147 of 1961) prescribes liabilities for damages incurred due to nuclear disasters. The act only stipulates the general liability of plant operators for damages in the event of a nuclear disaster. It does not set forth specific standards for that liability. In April 2011, after the Fukushima accident, a Dispute Reconciliation Committee for Nuclear Damage Compensation was created to mediate settlements between plant operators and victims per Article 18 of the Compensation Act. In August 2011, the Nuclear Damage Compensation Dispute Resolution Centre was created by the Dispute Reconciliation Committee to smoothly, speedily and fairly resolve disputes over liability claims by victims against plant operators.

On 28 April, the Committee set forth initial guidelines for damages related to evacuation orders from the government and then published a second set of guidelines on 31 May covering so-called damage caused by harmful rumours or mental damage caused by being forced to live as an evacuee. On 5 August, the Committee established interim guidelines that provided the overall scope of nuclear damage liability. Thereafter, initial supplementary guidelines regarding damages for voluntary evacuees were issued on 6 December, followed by a fourth set of supplementary guidelines on 26 December 2013. In addition, the Dispute Resolution Centre began accepting settlement petitions in September and decided upon 14 comprehensive standards that define issues common to many of the petitions. These steps demonstrated rough estimates of damage compensations for this nuclear accident.

Prior to the Fukushima accident, there had not been any debates over damage compensation for residents, so it required some time to set appropriate standards. This put a large economic burden on residents and caused a great deal of anxiety until they received compensation. On 24 March 2011, the day after shipping restrictions for cabbage were put in place, one farmer committed suicide [18]. Shipping restrictions were also imposed on raw milk, which forced the disposal of dairy cows. One dairy farmer took his own life on 10 June [19].

The Dispute Resolution Centre's comprehensive guidelines provided for compensation of actual costs of evacuation, temporary housing, etc. for voluntary evacuees not under any evacuation order. These guidelines were published on 14 February 2012 [20]. TEPCO received the second set of supplements to the interim guidelines of the Committee, and on 18 September 2014 announced that they would pay compensation for costs related to voluntary decontamination [21]. For those that opted against a voluntary evacuation or voluntary decontamination for economic reasons, these actions were all too late.

2.7 Conclusion

By not having a legal framework in place for the eventuality of a severe nuclear accident, authorities were unable to execute proper measures at the proper time, which in turn exacerbated postaccident chaos. From a legal perspective, for administrative authorities to take proper action based on the principle of law-based administration (which says that administration must be done by lawful authorities in the manner prescribed by law), there must be standards in place beforehand that are as detailed as possible. Setting aside arguments over what to do with nuclear power in the future, there are currently more than 50 nuclear reactors in Japan. Thus, for the time being, the Japanese must coexist with nuclear power. From the Fukushima experience, accident countermeasures that assume the occurrence of another such disaster must be created within the legal system.

There is a proverb in Japan: 'preparedness removes worry'. While there may be a question of how far in advance of an event decisions can be made, putting in place countermeasures to ensure the safety of residents and minimise damage to residents and property is certainly an issue of great urgency.

References

1. Yokodaidou S. Nuclear and Industrial Safety Agency and Nuclear Safety Commission (in Japanese). Hougaku Seminar. 2011;682:13.
2. Fukushima Prefecture. Efforts towards ensuring the safety of nuclear power plants in the future (in Japanese). June 2005. http://www.pref.fukushima.lg.jp/download/1/sonota_H170629_2.pdf. Accessed 15 Jan 2015.
3. METI Nuclear and Industrial Safety Agency, Nuclear Emergency Preparedness Division. Risk management for nuclear power disasters (in Japanese). Houritsu no Hiroba. 2002;55(3):28–35.
4. Matsuno G. Nuclear Emergency Preparedness; in order to deal properly with all nuclear risks (in Japanese). Tokyo: Soueisha & Sanseido; 2007. p. 111.
5. NSC. Nuclear emergency response guideline: disaster response for nuclear power facilities (in Japanese). http://www.nsr.go.jp/archive/nsc/anzen/sonota/houkoku/bousai220823.pdf. Accessed 15 Jan 2015.
6. Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company. Investigation Report, Interim Report. 2012. p. 581. http://www.cas.go.jp/jp/seisaku/icanps/eng/120224Honbun07ng.pdf. Accessed 15 Jan 2015.
7. The Official Report of the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. Tokyo: National Diet of Japan; 2012. chap.4, pp. 29–38. http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/. Accessed 15 Jan 2015.
8. Yasumura S. Evacuation effect on excess mortality among institutionalized elderly after the Fukushima Daiichi Nuclear Power Plant accident. Fukushima J Med Sci. 2014;60(2):192–5.
9. Disaster Prevention Study Group for Those with Disabilities. Collection of disaster prevention advice for those with disabilities (in Japanese). Fukushima: Iwaki Jiritsu Seikatsu Center; 2014.
10. The Official Peport of the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. Tokyo: National Diet of Japan; 2012. chap.4, p. 67 http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/. Accessed 15 Jan 2015.

11. Yamaguchi S. Issues and efforts in preventing nuclear power disasters (in Japanese). National Diet Library Issue Brief. 2013;801:1–13.
12. Nuclear Regulation Authority. Information on former Nuclear and Industrial Safety Agency (in Japanese). http://www.nsr.go.jp/archive/nisa/faq/faq_a09.html. Accessed 15 Jan 2015.
13. Fukushima Minpou. Farmers fears undiminished: confirming safety of seven greenhouse products from Fukushima prefecture (in Japanese). 28 March 2011. http://www.minpo.jp/pub/topics/jishin2011/2011/03/post_182.html. Accessed 15 Jan 2015.
14. Fukushima Minpou. Food standards become stricter starting 1st of April (in Japanese). 1 April 2012. http://www.minpo.jp/pub/topics/jishin2011/2012/04/post_3578.html. Accessed 15 Jan 2015.
15. Kodera S. Issues regarding radioactive contamination and processing of contaminated waste: the Fukushima Daiichi Nuclear Power Plant accident; its impact and countermeasures (in Japanese). National Diet Library Issue Brief. 2012;743:1–13. p. 10.
16. Fukushima Minpou. Neighbouring district also voices opposition to facilities (in Japanese). 10 June 2014. http://www.minpo.jp/pub/topics/jishin2011/2014/03/post_9430.html. Accessed 15 Jan 2015.
17. Fukushima Minpou. Residents in the county of Futaba have mixed emotions about interim storage facilities (in Japanese). 3 March 2014. http://www.minpo.jp/pub/topics/jishin2011/2014/06/post_10153.html. Accessed 15 Jan 2015.
18. Fukushima Minpou. Survivors in the city of Sukagawa settle with TEPCO (in Japanese). 2 June 2013. http://www.minpo.jp/pub/topics/jishin2011/2013/06/post_7300.html. Accessed 15 Jan 2015.
19. Fukushima Minpou. TEPCO suit by dairy farm survivors in the city of Soma seeks 126M yen (in Japanese). 31 May 2013. http://www.minpo.jp/pub/topics/jishin2011/2013/05/post_7288.html. Accessed 15 Jan 2015.
20. Nuclear Damage Compensation Dispute Resolution Centre. Decision regarding comprehensive criteria (in Japanese). 14 February 2012. http://www.mext.go.jp/component/a_menu/science/detail/__icsFiles/afieldfile/2012/12/20/1329129_001.pdf. Accessed 15 Jan 2015.
21. TEPCO. Press release. On compensation for costs related to voluntary decontamination (in Japanese). 18 September 2014. http://www.tepco.co.jp/cc/press/2014/1242022_5851.html. Accessed 15 Jan 2015.

Chapter 3
Report on Fukushima Counseling Support Professional Team: Interdisciplinary Team Approach for Psychosocial Care of Evacuees

Akiko Yagi

Abstract The Great East Japan Earthquake brought enormous pain and sorrow, but it tested resilience and tenacity among the people in Japan at the same time. In Fukushima, certified social workers, care managers, medical social workers, physical therapists, psychiatric social workers, and occupational therapists promptly assembled right after the disaster to help people at the evacuation centers and the affected areas maintain their dignity and prevent deterioration of their health and functioning. The unique interdisciplinary Counseling Support Professional Team ("the Team") formed in Japan gives inspiration to all helping professionals about what can be done during the disaster. In this article, two themes are presented that may facilitate a successful intervention relative to the psychosocial aspect of evacuees in order to help readers prepare for similar situations. The first theme maps out the conditions that are unique to Fukushima, and the other explores what has been learned from the experience.

Keywords Disaster • Social work • Rehabilitation • Interdisciplinary team • Long-term care

3.1 Introduction

After the Great East Japan Earthquake, a huge tsunami hit the coastal area of Fukushima, as well as Iwate and Miyagi, and caused the (presumed) deaths of 1814 people in Fukushima as of March 11, 2015. In addition to the deaths, the severe accident at Fukushima Daiichi Nuclear Power Plant, known as F1 (daiichi means "the first" in Japanese), resulted in very serious and long-term effects on the people in Fukushima. The radioactive substances such as cesium-134 and cesium-137 fell widely in Fukushima Prefecture following several explosions at the F1;

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residents were forced to evacuate without knowing how long it would be before they would return home or if they ever could.

Certain groups of people tended to be more vulnerable in the face of this disaster, in particular, senior citizens (over 65 years of age). It has been well discussed in Japan that the need for nursing care increased significantly after the disaster, due to stress from the experience of the disaster itself and poor living conditions during and after the evacuation [1, 2], as was also seen during and after the Kobe Earthquake of 1995. There have been quite a few studies done on issues of psychological impact and intervention after the Great East Japan Earthquake and reports on psychosocial approach in Miyagi and Iwate [3–7]. In this chapter, we discuss the psychosocial needs of those who were affected by the earthquake, tsunami, and F1 disaster and the support provided to them by counseling and rehabilitation professionals.

3.2 The Case of Fukushima

3.2.1 Pre-disaster: What Was Fukushima Like Before the Disaster?

Fukushima is the third largest of the 47 prefectures in Japan. It is 133 km (83 miles) in length from north to south, 166 km (103 miles) in width from east to west, and has an area of 13,781 km^2 (5321 sq. mi.). There were more than two million people living in Fukushima at the time of the disaster [8], and it is ranked at 40th of the 47 prefectures in terms of population density. Fukushima City, the capital, is in the northern region of the prefecture and is approximately 300 km north of Tokyo. F1 is located in the midpoint of the coastal line along the Pacific Ocean. It is approximately 250 km northeast of Tokyo and approximately 80 km southeast of Fukushima City.

Fukushima is known for its abundant natural resources, with good water and clean air, and its major industries are agriculture, forestry, and fishery. Given the nature of these industries, many of those who live in Fukushima have a very strong attachment to the land and the ocean; they claim that they are only borrowing the land and the ocean from their ancestors, and their mission is to pass them onto their descendants. Just as in other parts of the country, these primary industries are heavily supported by the older populace, whereas the younger people have gone to the big cities; thus, the local community is left with the twin issues of an aging citizenry and depopulation.

There are several licenses and certificates available in Japan to professionals who are specialized in working with people to provide psychosocial support. Certified social workers (CSWs) and psychiatric social workers (PSWs) are nationally licensed and are specialized in ensuring people's welfare and advocacy, with an emphasis on mental health for PSWs. Care managers (CMs) are certified by each

prefecture, and they monitor proper administration of long-term care insurance and manage numerous services for their clients, who are mostly seniors. Medical social workers (MSWs) are certified by a professional association, and they work at medical institutions; many of them also retain certification as CSWs and/or PSWs. Physical therapists (PTs) and occupational therapists (OTs) are nationally licensed, and they assist rehabilitation of their clients by enabling them to regain their social function.

In Fukushima, MSWs have had a long history of being very active in the medical field, and many of them belonged to the professional associations of CSWs and PSWs as well, which is quite different from the other parts of Japan. Many CMs in Fukushima also had a medical background and held MSWs. The Fukushima Care Manager Association and the Fukushima Association of Certified Social Workers happened to share their headquarter offices and communicated very closely on a daily basis. In addition to the overlap and tight network of social workers, they had a close working relationship with PTs and OTs at hospitals and other facilities. Therefore, there was a good basis for an interdisciplinary network, yet no formal collaborative activities were held among associations before the disaster.

3.2.2 Upon Disaster – Panic and Chaos

At 2:46 pm on March 11, 2011, a big earthquake of magnitude 9.0 hit the northeast part of Japan, and a tsunami struck the Pacific coast soon after. Many buildings were severely damaged, as was F1. The government directed an immediate evacuation for all locals within a 3 km radius of F1, which was soon expanded to 20 km on the 12th after F1 had a hydrogen explosion on both March 12th and 14th. Approximately 100,000 people of 13 municipal governments were ordered to evacuate. There were a substantial number of people who voluntarily evacuated, with more than 154,000 evacuees in total within and out of Fukushima Prefecture at one point.

Although evacuation took place along the Pacific coast in Iwate and Miyagi as well, circumstances were very different in Fukushima. Since most of the evacuees had to move because of the F1 accident, they were forced to escape from radioactive contamination, which is invisible, and they did not know how serious the damage would be. Many of them did not suffer from the tsunami but had to leave everything behind intact, which caused what was called "ambiguous losses" [3]. Lack of information and delayed communication around the F1 accident also caused panic and distrust toward government agencies and the Tokyo Electric Power Company, known as TEPCO. It made the evacuees' situation even more complex, politically and practically; the issue of safety became a matter of trust rather than scientific fact, and as an example, their compensations from the accident varied greatly depending on whether they were damaged by the tsunami or the F1 accident. People from Fukushima also faced tremendous stigma through ignorance about radiation [3]. Many experienced discrimination during the evacuation

because of fear of radiation contamination; many were turned away from entering facilities once they were found to be Fukushima locals, and some cars with Fukushima license plates were vandalized in parking lots.

Municipal governments were extremely confused as to how to deal with the unprecedented disaster in which they had lost most of their infrastructure, including their employees. They had to adjust to serve their residents who were dispersed both within and out of Fukushima. They also had to interact with unfamiliar local communities where the environment and culture were quite different.

Social workers and paramedical professionals immediately tried to check on clients and prioritize the urgency of their needs. They assessed the safety of their facilities and determined whether they would continue providing services or not. Mobile phones did not work because many antennae were damaged, so they used public phones and written notes to communicate and share information. Since they were affected by the disaster as well, they needed to check on themselves as survivors at the same time.

3.2.3 Post-disaster: Phase 1 – Getting Together

By the end of March, approximately 2500 evacuees from a few villages and townships had relocated to Big Palette Fukushima, a public convention center in Koriyama City (Fig. 3.1), including the municipal offices of Kawauchi Village and Tomioka Town [9]. Most of the evacuees had gone through multiple relocations before landing in Big Palette Fukushima and were already exhausted. Hallways were filled with evacuees, and it was simply impossible to grasp who was where. Some put cardboards up to create walls, and some slept on the floor in the hallways. Physical space between people was very limited, and it required fitness and strength to get around; many evacuees were not physically able to move. Many older evacuees quickly lost their health and became drastically frail because of aspiration and malnutrition. Public health nurses from the municipal governments were aware of the needs, but it was impossible for them to respond. Municipal employees and professionals suffered from the disaster and became evacuees themselves (Fig. 3.2).

Many social workers and other paramedical staff from different organizations volunteered on-site and struggled with witnessing the situation. They also realized that their support was highly inefficient because of difficulties in coordinating information among different organizations, which put the evacuees in the position of having to answer the same types of questions repeatedly. The chaos made referrals even among themselves overly complicated (Fig. 3.3).

In early April, municipal governments began to relocate their evacuees within and out of Fukushima Prefecture. At the same time, each evacuation center began to show different types of needs. The office of Long-term Care Insurance of Fukushima Prefecture contacted the Fukushima Care Manager Association to assist the evacuees who were in need of long-term care. The Fukushima Association of

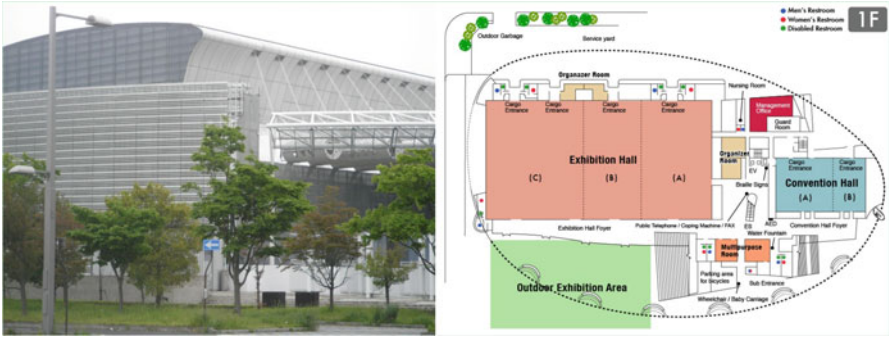

Fig. 3.1 Outside and the floor map of Big Palette Fukushima, Koriyama City (Reproduced from [10])

Fig. 3.2 Evacuees on the floor with cardboard walls, with very limited space (Reproduced from [12])

Fig. 3.3 Social workers and paramedical professionals struggled at Big Palette Fukushima (Reproduced from [10])

Certified Social Workers, Fukushima Association of Medical Social Workers, Fukushima Physical Therapy Association, Fukushima Association of Psychiatric Social Workers, and Fukushima Association of Occupational Therapists got involved as well. Luckily, Big Palette Fukushima is located in Koriyama City in Kenchuu, where the headquarter offices of associations of both CSW and CM were at the time of the disaster, and it was also accessible for other associations. These six associations decided to approach as an interdisciplinary team to provide comprehensive, timely, and appropriate support and named themselves as the Counseling Support Professional Team ("the Team"). Each association contributed 100,000 yen, and their first collaborative action was a hazard map at Big Palette Fukushima [10, 11].

3.2.4 Post-disaster: Phase 2 – Getting Down to Business, Locally Unique Operation to Meet Needs, Prefecture-Wide Networking for Effective Support

The Team supported the evacuees by making referrals for long-term nursing care, providing information on medical care, and offering emotional support. They listened to the evacuees' issues such as properties left behind, fears and anxiety from uncertainties, as well as living conditions and interpersonal problems at the evacuation centers. They also indirectly supported professionals and municipal workers by supporting their residents. They emphasized networking and collaboration with other organizations in order to offer effective services and utilized mailing lists for communication and exchanging the latest information.

In early May, a supplementary budget was approved by the Diet for constructing a mutual support system in the communities to assist those affected by the disaster, including support services provided by CMs, public health nurses, and other counseling professionals [12].

In late May, the Fukushima Prefecture set up a contract with the Team for "dispatching the Counseling Support Professional Team to assist seniors and other residents of temporary housing facilities affected by the disaster in Fukushima Prefecture." All volunteer work by social workers and paramedical professionals going forward was considered an official project.

Immediately following the disaster, those whose health was deteriorating drastically became more ill because they did not receive proper care in timely fashion at the evacuation centers. Under the long-term care insurance system in Japan, nursing care requires a long-term care plan made by CMs and assessment and certification done by municipal governments. Because of the disaster and evacuation, many municipal government offices were too fragmented to function, and they were unable to respond to the urgent needs at the evacuation centers. This contract, then, temporarily allowed the Team to certify long-term care plans and provide services within a day or two.

The Team came up with the "Big Palette Fukushima Rule," which included the following responsibilities: (1) accept new applications for long-term care insurance on behalf of municipal governments, (2) administer temporary certifying assessment, (3) submit assessment form to Office of Long-Term Care Insurance of Fukushima Prefecture via fax, (4) receive the result of the review from the office, (5) have municipal governments check the result and activate it as the official document endorsed by the office, and (6) create care plans and install services.

In addition to the activities at Big Palette Fukushima, the Team was available for other services. In order to use the Team's support, municipal governments and other organizations placed requests for dispatch. The Team sent social workers and paramedical professionals whose expertise matched the needs. The services included needs assessment, networking professionals and other service providers, consultation with and assistance with the use of existing services, care for caregivers, and care for service providers and municipal employees. The Team made referrals to respective association's members, and the services would be provided.

Social workers and paramedical professionals of the Team went out into the communities, identified hidden needs, and referred them to the next step by mobilizing their expertise. They also created an inventory of the issues and needs and gave it back to the local organizations so that they would be incorporated as a part of their regular services on an ongoing basis.

As customary, Fukushima Prefecture is divided into seven areas, Sousou (coastal north), Iwaki (coastal south), Kenpoku (north), Kenchuu (central), Kennan (south), Aizu (inland), and Minami-Aizu (inland south), so the Team was required to physically cover a vast area. The evacuees in each area presented different needs, and the composition of professionals varied greatly per area. In order to maximize resources, the Team agreed to remain flexible in terms of local operation, and they agreed to exchange information vigorously so that the knowledge and experience would be shared by the entire Team.

The Team's mission was to enhance communities' shift from survival to reconstruction by managing medical, welfare, and nursing services for the evacuees. Examples of the needs identified by the Team were significant deterioration of physical function, mental status, and cognitive capacity; needs for medical care; and other administrative assistance for adequate services. Once the individuals with needs were recognized, the area leaders of the Team connected them with professionals such as physical and occupational therapists, mental support team, CMs, public health nurses, medical social workers, certified social workers, and other municipal functionaries. When individuals agreed to utilize services, the Team assisted them by facilitating and coordinating services, such as assisting with care plans, arrangements with facilities, mental health support, and advocacy. The Team provided supportive counseling and needs assessment to assist individuals from a psychosocial perspective (Fig. 3.4).

Fig. 3.4 Overview of Fukushima Counseling Support Professional Team

3.2.5 Post-disaster: Phase 3 – Beyond the Disaster, Regain Autonomy and Self-Determination

In June of 2011, there were approximately 21,900 evacuees and just under 600 evacuation centers within the Fukushima Prefecture [13]. The prefecture hoped for a smooth transition from evacuation center to temporary housing, followed by reintegration of people's lives toward independent living. In their road map, the goal was for all evacuation centers to be closed by October of 2011. Governments built temporary housing in different parts of Fukushima Prefecture, some of which were far away from the evacuation centers. In order to supply housing facilities for the evacuees in a timely fashion, the municipal governments introduced the idea called "deemed temporary housing," where the evacuees were able to find their own apartment and receive subsidies. Many evacuees had a hard time deciding where to move, since they were far away from their own communities, and they did not know much about the new neighborhood. Those who moved to the deemed temporary housing became dispersed and submerged in the new community but detached from their old community and isolated. The Team supported the evacuees throughout the transition by providing ongoing needs assessment, referral, and information and offering emotional support and advocacy (Fig. 3.5).

Fig. 3.5 Distributing relief supplies for winter (Reproduced from [12])

Once the evacuees had settled at the temporary housing, the Team's action shifted from individual support to group and/or milieu intervention. The Team offered services such as health promotion classes through consultation, physical training, and recreational activities. The Team also got involved with community activities including distributing relief supplies and sponsoring events such as social gatherings and mini lectures.

The Team preferred to offer support via the mechanism by which the evacuees would try something new and thus gain empowerment, rather than the situation wherein evacuees passively wait for help. The Team also deliberately had the evacuees be actively involved and encouraged the shift from being supported to supporting each other. When the Team planned a cookout for the evacuees of the temporary housing, for example, they asked the evacuees to participate in preparation, cooking, and clean up (Fig. 3.6).

"Salon" is a type of activity that has been commonly implemented in Japan over the last 20 years for seniors, those with disabilities, and for child-rearing mothers, where members of these groups gather to connect with each other in the community. There were many such salons running within the facilities of temporary housing to build and enhance community among the evacuees. The Team dispatched social workers and paramedical professionals to assist in the operation of these salons.

In late December of 2011, the last two evacuation centers in Fukushima were closed, and all the evacuees had been transitioned to temporary housing.

In January of 2012, the function of certifying long-term care plans was upgraded, and the Team became one of the official certifying bodies. In fiscal year 2011, four

Fig. 3.6 Cookout at the temporary housing (Reproduced from [12])

municipal governments, Katsurao Village, Namie Town, Tomioka Town, and Futaba Town, made requests of the Team to certify 160 of their residents who had been relocated to 11 different municipal areas all over the Fukushima Prefecture. In fiscal year 2012, demand increased, and Kawauchi Village in addition to four municipal governments from previous year requested certification for 232 of their residents.

By that time, the needs of the evacuees had become more diversified, and the Team began to provide creative and versatile types of support, in addition to assisting salons. In Kenpoku, in the north, a nonprofit organization that runs a program called Coffee Time, later joined by "Aoba Kai (green leaves club)" for vocational training, requested support from the Team [14]. These programs were originally located in the evacuated zone and were moved to the area complete with the members and the staff. The PSWs were dispatched once a month for individual consultations. During the consultations, PSWs found that the service providers themselves were also affected by the disaster, and were going through their own transitions just like the other evacuees. They lived apart from their families in temporary housing where they knew nobody, and they were trying to function as service providers. For the Team to be effective, the goal of support should be to maintain activities for the evacuees who were affected, for the service providers who also were affected, and for the members of the local community where the evacuees had moved [14].

In Kenchuu, in the central area, the Team established a social worker's office in two of the temporary housing units. The Team had assisted in the move from the evacuation center to the transitional housing and continued to provide support. Issues brought into the office included inadequate care for chronic medical conditions, mental health concerns, and those who behave well yet have difficulties in expressing themselves about their problems with others. These social workers provide comprehensive support by making referrals for adequate care and also provide supportive counseling directly.

In Kennan, in the south, OTs provided health promotion classes at the temporary housing twice a month per Futaba Town's request. These started as a small group

Fig. 3.7 Social workers' office in the temporary housing (Reproduced from [12])

activity and have grown to be a bigger group, through structured attempts to keep the class going. The age of the participants ranged from those in their 50s to those in their 80s, representing the characteristics of the evacuees in temporary housing, and it was a challenge for the OTs to come up with a selection that was suitable for all age groups (Fig. 3.7).

Aizu, which is inland, is the furthest from the coastal area where most of the evacuees originally lived, and the climate and culture are considered significantly different; compared with the coastal area where the weather is very mild and people tend to be casual and easy going, Aizu has extreme weather with heavy snow and is known for a very traditional value system. The process of transition and adjustment for the evacuees was substantial. In Aizu, the Team led health promotion classes and salons in collaboration with local organizations. The Team also cosponsored a presentation called "How to make it through the winter," for those who were not used to extremely heavy snow.

In Sousou, in the coastal north, an overwhelmed public health nurse of Minami-Soma City asked for help of the Team to check on the evacuees at a temporary housing complex. The Team called up and dispatched 40 social workers and paramedical professional for door-to-door visits to check on health and mental health status and living conditions of the evacuees at over 210 temporary housing (Fig. 3.8).

In Iwaki, in the coastal south, PTs created and distributed DVDs on Kizuna Taisou (bonding exercise) with high-intensity exercises designed to enhance mobility and agility of the evacuees. The Team also created a brochure for long-term care insurance, to raise the evacuees' awareness and encourage them to consult professionals if necessary.

Fig. 3.8 Team members got together (Reproduced from [12])

3.3 Review and Discussion

3.3.1 Transfer of Knowledge for Future Learning

Included in the six professional groups are more than 6000 active members in Fukushima Prefecture. Out of these, 591 members signed up for the Team: 269 care managers, 92 certified social workers, 91 medical social workers, 40 psychiatric social workers, 97 physical therapists, and 70 occupational therapists [12]. With these committed professionals, in the fiscal year 2011, there were 69 coordination meetings and 175 services provided by a total of 1159 staff visits, to a total of 4361 evacuees. In the fiscal year 2012, there were 39 coordination meetings and 206 services provided by 1107 staff visits to 2311 evacuees.

This enormous amount of work became possible partly from the official endorsement and acknowledgement by the government but relied heavily on the commitment and passion of each social worker and paramedical professional. As an example, in Coffee Time and Aoba Kai, 27 sessions were supported by 8 out of 60 PSWs in Kenpoku. Out of eight PSWs, three of them were in their 20s, three in their 30s, and two in their 50s. This shows that the work effort was heavily concentrated on specific PSWs who were relatively young and inexperienced. According to the study done by the Fukushima Association of Psychiatric Social Workers,

many social workers had difficulties finding time away from their own work, were not confident enough to get involved, and did not have the time and energy because of their own experiences, despite the fact that many of them wanted to [14].

As we commemorate the fourth anniversary of the disaster, the circumstances around the people of Fukushima have changed drastically and have become even more complex. A few municipal governments declared to return to their old communities, and a few more have begun preparing to return. Some residents returned to their old neighborhoods but not too many. Compensation for many residents will be terminated, since they will no longer be ordered to evacuate. However, the majority of the evacuees have not planned to return [15]; the original communities no longer have enough infrastructure including medical facilities, and these evacuees have difficulty visualizing what their lifestyles would be like. Reconstruction assistance housing has finally become available, but there have not been enough applications; those who wanted to be on their own have already built their own houses, and those who wanted to rent would not be able to afford the rentals. With the complexity still surrounding housing issues, many families have been torn apart; some mothers and children have moved away from Fukushima, while some fathers remain in Fukushima for work and administrative reasons, and some families have moved into separate apartments in cities that are much smaller than their houses in coastal areas.

The Team agreed to continue providing support until all the evacuees could move out of temporary housing [16]. Yet, the Team's activity has changed significantly. Some of the activities in Iwaki and Aizu, for example, were absorbed as part of the municipal governments' project. Kenpoku began to cosponsor salons with a municipal government of Iitate Village to support the evacuees of deemed temporary housing, which tended to be left out of the services. Kenchuu created a booklet with CD-ROM called "Senmonshoku no Chiebukuro (Pearls of Wisdom of Professionals)" which contains information on medical and psychosocial self-help tips for the evacuees. Kennan dispatched paramedical professionals for the municipal government's health checkup, per request.

Since most of the social workers and paramedical professionals and their workplaces were affected by the disaster themselves, the Team started and maintained its unrestricted nature and protected its members from overly committing themselves. This type of relaxed structure suits short-term interventions, yet more structure is required as the operation continues long term. It is easy for helping professionals to overly devote themselves to rescue and recovery missions. However, a disaster like the Great East Japan Earthquake is so immense that it can easily burn out the good will and energy of social workers and paramedical professionals, especially as it remains an ongoing effort. It is, therefore, critical to come up with a structure that is sustainable as a system and feasible for each contributor.

3.4 Keys to Effective Approach

A mission of this chapter is to offer guidance to readers so that they might prepare themselves for similar situations by sharing the experience in Fukushima. There are a few key tips to ensure the success of this type of team approach. One is the condition Fukushima uniquely had with regards to the base for communication and working relationships before the disaster, and the other is something learned from the experience:

1. Ongoing networking and communication among different professionals and communities.

   As I have discussed earlier in this chapter, professionals in Fukushima Prefecture happened to have had prior close working relationships and personal contact for a long time, although they never had official collaboration before the disaster. Even in the era of digital and intellectual technology, once the electricity is out, everything becomes analog. Electronic communication (cell phone, computers) is disrupted and networking returns to its classic mode, i.e., face-to-face meetings and handwritten memos on the whiteboard. Knowing each other personally makes the collaborative effort much easier. For social workers, networking is within their scope of practice, so it is important that they fully utilize their skills for the sake of the communities. For other professionals, social workers can be very useful for networking purposes and may be encouraged to reach beyond the boundaries of their profession as an investment for the future.
2. Reorganize and restructure the services.

   The Team was clear from the beginning that their mission was to assist communities in shifting from survival to reconstruction and that they would have in place local organizations who could get involved for ongoing service delivery. They were able to meet the needs of the community with the amount of effort that the Team could afford when the Team began the activities. As the evacuation process became prolonged, the Team also continued to support the evacuees beyond the period they had expected. The Team itself has gone through some transitions in modality of services, which were necessary for the Team. For longer periods of assistance, it will be critical to have a more structured system that includes secretarial personnel who can not only organize ongoing services but also design systems as the need arises.

References

1. Ueda K. The great earthquakes and long-term care insurance. In: Ohara M, Sakai A, editors. Disaster nursing: basics to remember. 2nd ed. Tokyo: Nanzando; 2012. p. 78–81.
2. Ueda K. The reality and measures of the deaths related to the great earthquakes. In: Ohara M, Sakai A, editors. Disaster nursing: basics to remember. 2nd ed. Tokyo: Nanzando; 2012. p. 44–50.

3. Maeda M, Oe M. Disaster behavioral health: psychological effects of the Fukushima nuclear power plant accident. In: Tanigawa K, Chhem RK, editors. Radiation disaster medicine. Switzerland: Springer; 2014. p. 79–88.
4. Matsumoto S, Yamaoka K, Inoue M, Muto S, Teikyo Ishinomaki Research Group and Health and Life Revival Council in the Ishinomaki district. Social ties may play a critical role in mitigating sleep difficulties in disaster-affected communities: a cross-sectional study in the Ishinomaki area, Japan. Sleep. 2014;37(1):137–45. doi:10.5665/sleep.3324.
5. Uenoya K, editor. Introduction to disaster social work: learning from practice in affected area [Saigai social work: hisai-chi no jissenchi kara manabu]. Tokyo: Chuuou Houki; 2013.
6. Japanese Association of Social Workers in Health Services. The Great East Earthquake and the baton of assistance of medical social workers I. Tokyo: Japanese Association of Social Workers in Health Services; 2012.
7. Japanese Association of Social Workers in Health Services. The Great East Earthquake and the baton of assistance of medical social workers II. Tokyo: Japanese Association of Social Workers in Health Services; 2013.
8. Fukushima Prefecture. Census of Fukushima Prefecture. 2012.
9. Publishing Committee of a Journal of Big Palette Fukushima evacuation center. Be alive and stay alive: a journal of Big Palette Fukushima evacuation center. Fukushima: Publishing Committee of a Journal of Big Palette Fukushima evacuation center; 2011.
10. Yoshida M. Report on activities of Fukushima Care Manager Association. For the forum on reconstruction assistance for the Great East Japan Earthquake by Japan Care Manager Association. September 3, 2011.
11. Fukushima Physical Therapy Association. The record documentation about the support activities at disaster sites. 2012.
12. Fukushima Counseling Support Professional Team. Report on activities of Fukushima Counseling Support Professional Team, 2011 to present. 2013.
13. Fukushima Prefecture. Tentative roadmap for assisting evacuees within Fukushima Prefecture. July 22, 2011.
14. Kanno N. Assistance for sufferers in Fukushima: assistance for evacuated service providers. For the 49th National Conference of Japanese Association of Psychiatric Social Workers, and the 12th Academic Conference of Japanese Psychiatric Social Workers. June 15, 2013.
15. NHK news. Survey on return home plan. http://www3.nhk.or.jp/news/genpatsu-fukushima/20141114/0511_point.html (2014). Accessed 13 Jan 2015.
16. Fukushima Counseling Support Professional Team. Minutes of representative meeting. September 25, 2014.

Chapter 4
Societal and Ethical Aspects of Radiation Risk Perception

Deborah Helen Oughton

Abstract This chapter provides an overview of some of the societal and ethical factors that influence risk perception. There is a tendency to assume that public aversion or fear of radiation risks is primarily due to a misunderstanding of the probabilities of harm, but risk perception is complex and shaped by a number of issues, many of which have important ethical relevance. These include autonomy and respect for personal control; justice and the distribution of risks and benefits; and community values and societal impact. The chapter gives examples of ways in which respecting these factors can improve risk management. With respect to control, in addition to a fundamental ethical respect for dignity, there is an important psychological link between coping and stress. Hence, management practices that enable personal control and empowerment could be beneficial for exposed populations. The consideration of justice with regard to the distribution of risks and benefits include awareness of the challenges of discrimination and victimisation as well as the need for the protection of the vulnerable members of society, such as children and the elderly. Community and societal impacts extend the notion of well-being to encompass not only individual physical health but also mental health and societal well-being. This raises particular challenges and issues for health surveillance and thyroid screening initiatives. A holistic approach to radiation risk management would consider both the reduction of the risks of physical harm and measures to address psychological heath and societal recovery.

Keywords Risk perception • Ethics • Autonomy • Dignity • Personal control • Discrimination • Community • Societal values

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4.1 Introduction: Public and Expert Perceptions of Risk

Many people have suggested that fear of radiation and the resultant psychological stress lie behind the major health impacts seen in the populations affected by both the Fukushima and Chernobyl and other nuclear accidents [1–3] and that these effects are far greater than the direct health impacts of the radiation exposure. This aversion has been linked to public misunderstanding and put forward as evidence of an irrational perception of the risks associated with radiation exposure. The public accepts risks associated with driving cars, drinking alcohol or eating seafood containing heavy metals, but rejects the relatively low risks associated with radiation exposure. People also tend to be more tolerant towards natural radiation exposures (e.g. radon) or medical uses of radiation than man-made sources [4]. Similar accusations of irrationality have been made against the public perception of biotechnology and genetically modified organisms. Other experts have suggested that the fear is fuelled by poor communication, mismanagement of radiation risks or media hype [5, 6].

It is true that people misunderstand the probabilities; however, numerous studies of the psychological and psychometric factors that influence risk perception show that the situation is more complex than this alone. Public or lay perceptions of risk vary widely between people and can differ from the calculated, technical approach to the assessment of risks. Whereas an expert will often tend to rank risks as being synonymous with the size or probability of harm, risk tolerance or aversion is dependent on many additional characteristics [7, 8]. Many of the characteristics have strong psychological as well as societal and ethical relevance (such as control, voluntariness and distribution of risks and benefits). The conclusion is that it is a mistake to dismiss public anxiety towards radiation risks as being “irrational” or “wrong” [9].

4.2 Factors Impacting on Risk Perception

4.2.1 Autonomy, Personal Control and Consent

People tend to be less tolerant of risks that are imposed without their choice or personal control. The phenomenon applies to a range of different risks and actions, such as driving a car compared with flying. Personal control is closely related to the fundamental ethical value of autonomy (i.e. respect for the free will of individuals), dignity, integrity and individual rights. It is also linked to the requirement for free informed consent within medical ethics.

Radiation risks represent a class of environmental risks over which people feel a particular lack of control [7] and particularly those associated with exposures following accidents. The public is dependent on information from authorities or media and has little personal choice or control over the situation. They have to deal

with the risks from the exposure, and in addition, they must cope with the effects of the measures imposed to reduce exposure such as relocation, bans on agriculture or access to amenities. The latter represents decisions taken at central level. They are disruptive and infringe upon liberty and free choice. Control could be part of the reason why people are less concerned over medical radiation exposures (which are largely voluntary and for an obvious personal benefit).

Uncertainties are an important aspect of radiation risk perception, particularly linked to long-term consequences of a nuclear accident. After the earthquake and tsunami, the survivors outside of contaminated areas could start the process of rebuilding their life. The situation was more ambiguous and uncertain for those affected by the nuclear accident. In general, after a nuclear accident, the time for recovery is longer, and the feeling of helplessness greater than after most chemical or natural catastrophes [4]. The levels of contamination can be initially very unclear, and the long-term risks associated with the onset of a detrimental effect, in this case cancer, can take decades. Anxiety is raised by the lack of answers to questions such as: how long before I can return home—if at all? Do I want to? The immediate devastation and loss of lives may be far worse from the earthquake and tsunami, but the uncertainties, protracted duration of the problems and lack of autonomy can be greater in the case of a radiation incident.

With respect to risk management, measures that increase personal control and understanding such as provision of dosimeters or counting equipment and participation in decision-making are considered positive and can help populations in coping with disaster. Provision of counting equipment and independent monitoring are methods that have been successfully applied in Chernobyl-affected communities. A study carried out in Belarusian villages concluded that the approach not only resulted in reducing exposures with minimal social and psychological side effects but was also more economically cost-effective than the standard "top-down" management procedures [10]. A stakeholder study following up on Norwegian farming communities most affected by Chernobyl fallout indicated that access to local food monitoring stations was particularly important [11].

The interest for access to personal dosimeters and information on personal doses has been widespread in Japan following Fukushima [12, 13]. When combined with access to experts to help interpret results, such actions can help empower populations. Ethically, procedures that involve the populations themselves can help promote the principle of informed personal control over radiation risks.

Informed consent is also important for workers that might be exposed to chemical and/or radiation risk. This is particularly significant if lower-paid workers are employed to carry out remediation or decontamination, as it has been suggested that the necessary conditions for free informed consent are often violated for these groups [14]. Both ethically and legally, most people would agree that affected persons have a right to some form of compensation for damages, either those resulting directly from the disaster or as a result of remediation. Experience from Chernobyl illustrates the problems of compensation in promoting the "victimisation" of affected populations [15–17]. Similar challenges were seen with

compensation after Fukushima [18, 19], with various reports of resentment between different groups.

4.2.2 Distribution of Risks and Benefits

While the actual costs, risks and benefits may vary with the environment and even between members of the same community, it is universally accepted that these criteria have significance to the fundamental ethical values of equity, justice and fairness [20]. The doses received by individuals due to the Fukushima accident varied widely. The risks of exposure also varied with additional factors such as age, because children are deemed to be more vulnerable to the effects of ionising radiation. Furthermore, the consideration of risks and benefits goes beyond direct exposure and must include such aspects as the consequences of the radiation contamination on lifestyle for different members of the community. So, for example, some lost their livelihood, while others were able to continue more or less as before the accident. Linked to the issue of consent discussed above, it has been suggested that the less advantaged members of society often bear a disproportionate burden after accidents [14, 21]. Examples after Fukushima include the situation for the elderly evacuees and particularly those living in temporary housing who experience greater isolation from family and communities [22].

The potential for increased health risks from radiation in children mean that the risk perceptions go beyond consideration for personal risks, as is seen by anxiety over thyroid cancer in Fukushima populations [23, 24]. The fear that your child could be affected in the future can overshadow any personal concern [25]. These concerns extend to pregnant women, as exemplified by the rise in voluntary abortions after Chernobyl [26]. This may seem irrational, since many other activities have a statistically greater probability of harming children, such as traffic or even other sources of exposure to radiation. The explanation is in part due to feelings of blame, guilt and responsibility and questioning—have I really done enough to reduce the chance of my child being harmed? Even with strong epidemiological evidence to the contrary, if a child gets cancer or a baby is born with a disability, the parents will always wonder if this was due to the radiation exposure.

Concerns for children create challenges for health surveillance and particularly thyroid screening of children. While parents may, understandably, request screening of exposed children, the procedure can lead to unnecessary surgery, and without a carefully thought communication plan, it may actually raise anxiety. Many of the ethical challenges are well known from other cancer screening programmes. The basic principle is that screening should do more good than harm, but difficulties arise from overdiagnosis, ensuring informed consent of participants, whether or not the screening will reduce the disease of casualty rates and “making healthy people sick” [27]. There are also problems with control groups, since screening large numbers of unexposed populations for diseases with very low incident rates can

be hard to justify. This is arguably of particular importance for effective communication of the results from screening of Fukushima children.

Finally, it is important to consider the concept of distributive justice such that some measures to reduce exposures could result in an equitable distribution of cost and dose reduction, such as investment by taxpayers to reduce activity concentrations in public areas, while others are less equitable, for example, when a reduction of dose to the majority is only possible at the expense of a higher dose, cost or welfare burden, on a minority (e.g. banning all farm production in a small community).

4.2.3 Community Values and Societal Consequences

The Chernobyl and the Fukushima accidents are both examples of disasters that resulted in a wide range of social and economic consequences. In Chernobyl, many of the evacuees lost their jobs, social network and connection to places of particular community or historical value like graveyards or places where they played as children [25]. Resettlement and long-term evacuation in Fukushima have changed the social structure of the villages and city districts. After Chernobyl, the Gomel region lost about 43 % of its population between 1986 and 2000, and demographic parameters, like mortality and birth rate, changed dramatically as elderly people in particular did not want to leave their villages, while young people did. The emigration of young people impeded the whole social and economic development of the region, including a shortage of teachers and doctors [16]. Similar demographic changes have been seen after Fukushima, with young families more likely to evacuate and less likely to return. In some cases, this led to splitting of families with, usually, mother and children leaving and fathers remaining to work [22, 28]. These lead in turn to a variety of social and health effects such as alcoholism, obesity and depression in affected populations [3, 29].

The economic costs of accidents are complex and wide-reaching. However, as one stresses the small physical risks, actual or potential radioactive contamination of food is one of the fastest ways of losing consumer trust. This means that the economic and social impact of a radiation accident can be enormous and overshadow the actual health risks. It might be easy to attribute this to yet another example of public irrationality, but people's livelihoods and income depend on consumer choice. Stress, ill health and even suicide can accompany job loss and bankruptcy. Loss of consumer trust can have profound consequences both for a range of industries (particularly food or tourist industries) and for the local identities of people and groups [30, 31]. This has been well documented in Fukushima with price drops for produce from the entire region, including areas not affected by the accident, as well as impacts on tourism [32, 33]. Negative economic side effects can arise from rural breakdown and stigma of contaminated communities. Discrimination and stigmatisation of the Hiroshima and Nagasaki *hibakusha* and their children have an important historical dimension in Japan [34] and are particular

concerns for Fukushima evacuees. TEPCO workers also cited discrimination as one of the main causes of psychological stress [35]. In addition to experienced prejudice, concerns of the populations affected by Fukushima Daiichi accident include worries about whether their children would be able to find partners or marry in the future and reports of discrimination against Fukushima children after moving to new schools [36].

The aftermath of an accident can also be economically beneficial to parts of the community, for example, through generation of local employment opportunities. This may lead to some sections of the population making a profit from remediation (such as selling or hiring equipment), which can lead to further social inequity and division. As a parallel case, this was seen in the aftermath of the foot-and-mouth outbreak in the UK, when a minority of the affected communities made a large profit from the disaster [37]. Likewise, after hurricane Katrina, price increases in certain commodities led to outrage and calls for legislation to prevent such profit-making [38].

4.3 Risk Management

Doctors and public health workers can be expected to be confronted with a variety of views, perceptions and concerns associated with the public's perceptions of risks following a disaster. Medical workers need to recognise that risk perception is complex and that many members of the public will have concerns that go beyond their personal risk of harm. Radiation risks are a particularly challenging type of risk. Three important lessons learnt from previous accidents will be discussed.

Don't assume that the public's aversion to radiation is due to misunderstanding. There is a tendency for experts to simply repeat the size of the health risks, compare them with lower background or higher medical exposure and assume that any residual fear of radiation or remaining aversion to the risk is fuelled by phobia, irrationality, inappropriate thinking patterns and psychological problems of the patient (for a rebuttal of this view see [9]). Many people would be concerned at the radiation exposure to their child from a CT scan, but be willing to accept the risk on the basis of the perceived benefit. Communication can be aided by putting the exposures into perspective with other risks, including other radiation exposures, but explaining everything in terms of natural or medical exposures will not relieve all concerns. Some people can be reassured by comparisons, but others are seeking different types of information, such as short-term cancer risks for children rather than lifetime cancer risks for whole populations, or advice on what can be done to reduce personal exposure. Communication therefore needs to be tailored to different needs and provided through different media and sources. Resources should be directed towards finding out what the public know and what they want to learn about. Experts

are often good at telling what they know, but they should also try to listen to what the public are actually asking for.

Recognise the importance of personal control and public participation. Actions that can help people and communities gain control over their lives (i.e. information on actions that can be taken to reduce exposure) are an important part of coping with disaster [10, 15, 39]. Choice, control, familiarity, closeness and numerous other social and psychological factors play an important role in shaping perceptions towards hazards. Measures that take these factors into consideration may stand a greater chance of success. So, for example, centralised office and desktop assessment of exposures and risks should be supplemented by individual measurements and personal assessments for those people who request this type of information. Medical staff can play a role in gathering and interpreting data and providing advice. Personal measurements can be an important stimulus to dialogue and communication between the public and experts and not only in the most affected areas. People may also need reassurance in areas that have been declared clean.

Realise that technical solutions are not enough on their own. Recognising the enormous social and ethical consequences of a nuclear or chemical accident means that coping with that disaster needs to go beyond simple decontamination and reduction of the physical risks [4, 15, 40–42]. For nuclear accidents, this will require a multidisciplinary approach where the technical, medical and radiation protection experts need to work with communication and social scientists [41, 42]. For some, medical check-up and health surveillance might help to relieve anxiety [43], but these also need to be combined with a careful communication plan. Furthermore, psychological support and mental health should receive particular attention [44]. The need for stakeholder engagement is recognised in all areas of risk assessment and management as an important mechanism of public empowerment [45]. In practice, this would mean that discussions of coping with disaster should be extended to a wider group of stakeholders and experts, including medical professions, but also consumer organisations, farmers, fishermen and so forth, many of whom have relevant technical and lay knowledge [46].

4.4 Conclusion

Public reaction to disasters is the result of complex and intrinsic features of risk perception, many of which have strong ethical and societal relevance. A holistic approach to disaster management should integrate economic, ecological and health measures. Historically, management of the health effects of radiation has focused almost exclusively on the direct deterministic and stochastic effects of exposure and neglected mental health and social impacts. Disaster management needs to embrace a definition of health that includes mental health and societal consequences. Risk management strategies should be designed to accommodate the varied needs. For

nuclear accidents, it is not sufficient to simply focus on the dose reduction aspects of radiation protection as societal aspects will play a major role in how individuals cope with and communities recover from the disaster. Engaging with the affected population with regard to increasing their understanding and personal control and involving them in decision-making processes respect people's fundamental right to shape their own future. In addition to increasing trust and compliance, such approaches can lead to significant improvements in the effectiveness and acceptability of disaster management in communities.

References

1. International Atomic Energy Agency. The international Chernobyl Project: technical report. Vienna: IAEA; 1991. http://www-pub.iaea.org/books/IAEABooks/3756/The-International-Chernobyl-Project-Technical-Report. Accessed 14 Dec 2014.
2. Brumfiel G. Fukushima: fallout of fear. Nature. 2013;493(7432):290–3.
3. Yasumura S. Overview of the Fukushima health management survey. Meeting report. 2014. http://www.fmu.ac.jp/radiationhealth/workshop201402/presentation/presentation-1-2-e.pdf. Accessed 10 Dec 2014.
4. Oughton DH, Howard BJ. The social and ethical challenges of radiation risk management. Ethics Policy Environ. 2012;15(1):71–6.
5. Jaworowski Z. Radiation risk and ethics. Phys Today. 1999;52(9):24–9.
6. Ng KH, Lean ML. The Fukushima nuclear crisis reemphasises the need for improved risk communication and better use of social media. Health Phys. 2012;103:307–10.
7. Slovic P. Perception of risk from radiation. Radiat Prot Dosimetry. 1996;68(3–4):165–80.
8. Drottz BM, Sjöberg L. Risk perception and worries after the Chernobyl accident. J Environ Psychol. 1990;10:135–49.
9. Drottz-Sjøberg BM, Persson L. Public reaction to radiation: fear, anxiety, or phobia? Health Phys. 1993;64(3):223–31.
10. Dubreuil GH, Lochard J, Girard P, Guyonnet JF, Le Cardinal G, Lepicard S, et al. Chernobyl post-accident management: the ETHOS project. Health Phys. 1999;77(4):361–72.
11. Liland A, Oughton D, Bay-Larsen I, Eikelmann IM, Solheim-Hansen H, Skuterud L. Norwegian testing of the EURANOS framework for post-accident rehabilitation preparedness. Radioprotection. 2010;45(5):S215–24.
12. Hayano R, Tsubokura M, Miyazaki M, Satou H, Sato K, Masaki S, Sakuma Y. Internal radiocesium contamination of adults and children in Fukushima 7 to 20 months after the Fukushima NPP accident as measured by extensive whole-body-counter surveys. Proc Jpn Acad Ser B. 2013;89(4):157–63.
13. Naito W, Uesaka M, Yamada C, Ishii H. Evaluation of dose from external irradiation for individuals living in areas affected by the Fukushima Daiichi nuclear plant accident. Radiat Prot Dosimetry. 2015;163(3):353–61.
14. Shrader-Frechette K. Nuclear catastrophe, disaster-related environmental injustice, and Fukushima: prima facie evidence for a Japanese 'Katrina'. Environ Justice. 2012;5(3):133–9. doi:10.1089/env.2011.0045.
15. Oughton DH, Forsberg EM, Bay I, Kaiser M, Howard B. An ethical dimension to sustainable restoration and long-term management of contaminated areas. J Environ Radioact. 2004;74(1–3):171–83.
16. United Nations Development Programme (UNDP). The human consequences of the Chernobyl nuclear accident – a strategy for recovery. 2002. http://www.undp.org/dpa/publications/chernobyl.pdf. Accessed 14 Dec 2014.

17. International Atomic Energy Agency. Chernobyl's legacy: health, environmental and socio-economic impacts. Vienna: The Chernobyl Forum IAEA;. 2005. http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf. Accessed 14 Dec 2014.
18. Organisation for Economic Cooperation and Development (OECD). Japan's compensation system for nuclear damage. OECD. 2012. http://www.oecd-nea.org/law/fukushima/7089-fukushima-compensation-system-pp.pdf. Accessed 14 Dec 2014.
19. Dispute Reconciliation Committee for Nuclear Damage Compensation. Supplement to the interim guidelines on determination of the scope of nuclear damage resulting from the accident at the Tokyo Electric Power Company Fukushima Daiichi and Daini nuclear power plants (concerning damages related to voluntary evacuation, etc.). 6 Dec 2011. http://www.mext.go.jp/b_menu/shingi/chousa/kaihatu/016/houkoku/__icsFiles/afieldfile/2012/01/18/1315180_1.pdf. Accessed 3 Jan 2015.
20. Oughton DH. Ethical values in radiological protection. Radiat Prot Dosimetry. 1996;68:203–8.
21. Shrader-Frechette K. Environmental justice: creating equality, reclaiming democracy. New York: Oxford University Press; 2002.
22. Nuclear Regulatory Authority (NRA), Japan. Practical measures for evacuees to return to their homes. 2013. http://www.nsr.go.jp/english/library/data/special-report_20140204.pdf. Accessed 9 Oct 2014.
23. United Nations Scientific Committee on the Effects of Atomic Radiation. UNSCEAR's assessment of levels and effects of radiation exposure due to the nuclear accident after the 2011 Great East-Japan earthquake and tsunami. UNSCEAR. 2014. http://www.unscear.org/unscear/en/fukushima.html. Accessed 28 Jan 2015.
24. McCurry J. Fukushima's children at centre of debate over rates of thyroid cancer. The Guardian. 9 March 2014.
25. Bay IA, Oughton DH. Social and economic effects and their interactions. In: Smith J, Beresford NA, editors. Chernobyl: catastrophe and consequences. Berlin: Springer; 2005. p. 239–62.
26. Knudsen LB. Legally-induced abortions in Denmark after Chernobyl. Biomed Pharmacother. 1991;45(6):229–31.
27. Plutynski A. Ethical issues in cancer screening and prevention. J Med Philos. 2012;37:310–23.
28. National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. The official report of The Fukushima Nuclear Accident Independent Investigation Commission. Executive summary. Tokyo: The National Diet of Japan; 2012.
29. Yasumura S, Hosoya M, Yamashita S, Kamiya K, Abe M, Akashi M, et al. Study protocol for the Fukushima Health Management Survey. J Epidemiol. 2012;22(5):375–83. doi:10.2188/jea.JE20120105.
30. Flynn J, Slovic P, Kunreuther H. Risk, media and stigma: understanding public challenges to science and technology. London: Earthscan; 2001.
31. Bowley G. Stocks end lower as traders focus on Japan crisis. New York Times. 15 March 2011.
32. IAEA. The Fukushima Daiichi accident, Technical volume 5, Post-Accident Recovery; 2015. p. 148. STI/PUB/1710. ISBN 978-92-0-107015-9. http://www-pub.iaea.org/books/IAEABooks/10962/The-Fukushima-Daiichi-Accident
33. Future from Fukushima: Revitalization data and plan. http://www.pref.fukushima.lg.jp.e.od.hp.transer.com/site/portal/list281.html. Accessed March 2015.
34. Hersey J. Hiroshima. New York: Knopf; 1985.
35. Shigemura J, Tanigawa T, Saito I, Nomura S. Psychological distress in workers at the Fukushima nuclear power plants. J Am Med Assoc. 2012;308(7):667–9.
36. International Commission on Radiological Protection (ICRP). Reports from ICRP dialogue initiatives. ICRP. 2014. www.icrp.org/page.asp?id=189. Accessed March 2014. See especially dialogue reports 4, 6, and 8.
37. DEFRA. Surveys of the economic impact of Foot and Mouth Disease in six districts. London: Department for Environment, Food and Rural Affairs (DEFRA); 2002. http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/fmd/documents/fmd6districts.pdf. Accessed 3 Mar 2014.

38. Sandel M. Justice: what is the right thing to do? New York: Farrar, Straus and Giroux; 2010.
39. International Commission on Radiological Protection (ICRP). Principles for intervention for protection of the public in a radiological emergency. Annals of the ICRP 63. Oxford: Pergamon Press; 2006.
40. Howard BJ, Liland A, Beresford NA, Anderson KG, Cox G, Gil JM, Hunt J, Nisbet A, Oughton DH, Voigt G. A critical evaluation of the STRATEGY project. Radiat Prot Dosimetry. 2004;109(1–2):63–7.
41. Howard BJ, Liland A, Beresford NA, Anderson KG, Crout NMJ, Gil JM, Hunt J, Nisbet A, Oughton DH, Voigt G. The STRATEGY project: decision tools to aid sustainable restoration and long-term management of contaminated agricultural ecosystems. J Environ Radioact. 2005;83(3):275–95.
42. Oughton DH. Social and ethical issues in environmental remediation projects. J Environ Radioact. 2013;119:21–5.
43. Morrey M, Allen P. The role of social and psychological factors in radiation protection after accidents. Radiat Prot Dosimetry. 1996;68:267–71.
44. Bromet EJ. Emotional consequences of nuclear power plant disasters. Health Phys. 2014;106: 206–10.
45. United Nations Economic Commission for Europe. Public participation. The Århus Convention on access to information, public participation in decision-making and access to justice in environmental matters. (adopted June 1998, ratified October 2001). 2001. www.unece.org/env/pp/welcome.html. Accessed 6 Apr 2014.
46. Wynne B. Sheepfarming after Chernobyl: a case study in communicating scientific information. Environ Sci Policy Sustain Dev. 1989;31(2):10–39. doi:10.1080/00139157.1989.9928930.

Chapter 5
Thinking Across Disaster

Kim Fortun and Alli Morgan

Abstract This chapter describes aspects of the Fukushima disaster that were foreshadowed by other disasters, demonstrating the potential of comparative disaster studies. While acknowledging the way disasters are always unique, emerging from complex drivers that produce cascades of interlaced effects, this chapter highlights recurrent patterns across disaster. This chapter encourages development of comparative disaster literacy alongside development of logistical plans for disaster – so that those involved are able to "read" patterns in disaster as they unfold.

Disasters are always unique, resulting from multiple failures (organizational, technological, educational, etc.), producing cascades of effects (ecological, biological, emotive, conceptual, etc.) – all forcefully shaped by context. Yet there are also patterns across disaster that when recognized can orient disaster mitigation, preparedness, immediate response, and long-term recovery. The Fukushima nuclear plant disaster is no exception. Its tragic unfolding has been both unique and illustrative of patterns that recur across disaster. Building on other chapters in this volume, this chapter will identify dimensions of the Fukushima disaster that were foreshadowed by other disasters, pointing to structural similarities. This chapter will conclude with a call for disaster education that exposes students and professionals across disciplines to case studies that illustrate structural similarities across disasters, enhancing their capacity to anticipate, analyze, and respond to disaster.

Keywords Fukushima • Disaster studies • Disaster education

5.1 Anticipating Disaster

Very early on December 3, 1984, while people still slept, introduction of water to a large storage tank of methyl isocyanate – a component of the pesticide Sevin – led to the total loss of the contents of the tank to the atmosphere, in what is now termed a "worst-case scenario" in Bhopal, India. The toxic gas cloud from the Union

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Carbide plant moved over the sleeping city, first over the very poorest communities living adjacent to the plant. People awoke thinking their neighbors were burning chili peppers. They had no evacuation plan; most ran into the night – into the plume of gas. At least 4000 died; many claim that the immediate death toll was 10,000 or more. Over a half a million people were categorized as exposed. Many still have health problems today that they attribute to gas exposure or to exposure to continuing pollution from the old plant grounds.

The Bhopal disaster continues to be referred to as "the world's worst industrial disaster." But it is not beyond comparison. The Bhopal disaster had a unique constellation of causes and a unique cascade of impacts. Yet there are also patterns that we see again in Fukushima and other disasters. And Bhopal, like Fukushima and other disasters, was shaped by structural conditions.

Across disaster, for example, confidence in a technical resource – pesticides or nuclear power, for example – often undercuts recognition of associated risks. Disaster is insufficiently anticipated. The promise of economic development and food self-sufficiency in India through the chemical-intensive agriculture of the "Green Revolution" laid ground for the Bhopal disaster, for example, undercutting recognition of the risks of producing and storing pesticides. And this promissory logic continues to undercut disaster response. In attempting to retain and encourage foreign investment in India – by companies like Union Carbide – the Indian Supreme Court in 1989 accepted an out-of-court settlement of the Bhopal case that many argue took better care of the company than of gas leak survivors.

Similarly, in Japan, it is clear that the promise of nuclear power as an energy source undercut recognition of associated risks. Hospitals and medical staff in Fukushima prefecture report being almost completely unprepared for disaster, for example. It was assumed that there would never be problems with the nuclear power plants in the region. Deeply institutionalized overconfidence in the safety of nuclear power in Japan was carried and exacerbated by Japan's media ecology. Public relations researcher Patricia Swann describes how reporting on the nuclear aspects of the disaster had a homogenous tone and lacked substance due to close ties between major Japanese media outlets and TEPCO (Tokyo Electric Power Company), as well as the exclusion of foreign correspondents, freelance journalists, and other "outsiders" not belonging to one of Japan's "reporters' clubs" from official press conferences. Swann argues that close ties between industry, government, and media eliminated incentives for reporters to ask challenging questions for fear of losing access to government officials. TEPCO's 20 billion yen annual advertising budget that benefits the very newspapers that employ these journalists compounded the issue [1].

Tight relations between government and potentially hazardous industries also bias risk assessment in many disaster contexts. Historian Jeff Kingston has written extensively on this in Japan, describing a "nuclear village" that has bound together elected officials, bureaucrats, academics, journalists, and people in the nuclear industry. "This is a village without boundaries or residence cards," Kingston writes, "an imagined collective bound by solidarity over promoting nuclear energy. If it had a coat of arms, the motto would be 'Safe, Cheap, and Reliable'." [2].

Japan's nuclear village has been sustained by a revolving door between industry and government, referred to with the Japanese term *amakudari*, or descent from heaven, in which senior government officials migrate to high-paid positions in the private sector, including the nuclear industry [3]. Even after the Fukushima disaster, these ties have continued to bind. Kingston reports, for example, that the Nuclear Regulation Authority, an administrative group established in September 2012 to ensure nuclear safety in Japan, was chaired by a vocal pronuclear expert and comprised of several former members of the now defunct Nuclear and Industrial Safety Agency (NISA) – which came under scrutiny after allegations that the agency influenced public hearings on the use of nuclear energy [2], for example.

The problems of a revolving door between companies and the government agencies responsible for regulating them were also a flash point in the 2010 BP Deepwater Horizon disaster, resulting in the disbanding of the US Minerals Management Service due to conflicts of interests and associated regulatory failures [4]. After the Fukushima disaster, Princeton University physicist and policy expert Frank von Hippel published an editorial in the New York Times arguing that "it could happen here." Von Hippel said that "nuclear power [in the United States] is a textbook example of the problem of 'regulatory capture' – in which an industry gains control of an agency meant to regulate it" [5].

Disaster warning systems also complicate the anticipation of disaster, through the false security that comes with the assumption that these systems will work without fail. Despite having the world's densest concentration of seismographic monitoring and a population familiar with earthquake drills, Japan did not anticipate the scope of the March 2011 earthquake. For example, the Japan Meteorological Agency's early warning system functioned properly, but in doing so only alerted those close to the epicenter of the quake, mirroring some of the communication failures seen in the 2010 Chilean tsunami warning system [6]. The system was further challenged by the frequent aftershocks [7]. A misplaced faith in Japan's newly completed tsunami barriers also undercut anticipation of the devastating flooding that would occur – mirroring the misplaced faith in the levees that failed in New Orleans in 2005 during Hurricane Katrina.

Another early warning system, the System for Prediction of Environmental Emergency Dose Information (SPEEDI), also failed in the wake of the Fukushima Daiichi meltdown. Designed to predict the spread and intensity of radiation release, the system was put into emergency mode at the plant upon TEPCO's declaration of a nuclear emergency, ready to inform evacuation decisions. What wasn't anticipated was the loss of power at Fukushima Daiichi, rendering the on-site measuring devices useless. The SPEEDI data, which without power consisted of only the meteorological data predicting which way the theoretical radiation would travel, was not released for several days out of fear of "public confusion" [8]. As in many other disasters, plans for disaster failed to anticipate the multiple kinds of system failures that would almost certainly occur.

The complexity of the technical systems implicated in many disasters also makes anticipation of disaster difficult. Sociologist Charles Perrow pointed to this long ago in his seminal book *Normal Accidents* (1984). The industrial systems

Perrow describes – nuclear power plants, chemical processing plants, and air transport networks – are made of a tangle of technical systems, which are so tightly coupled that it must be considered "normal" to have runaway incidents that exceed what experts can understand much less control [9]. The problem is exacerbated when technical systems are shaken by environmental conditions, as happened in Hurricane Katrina and in the Fukushima disaster. During Hurricane Katrina, one dimension of the disaster was flooding of petrochemical processing facilities, resulting in massive contamination of water and soil [10].

It is also possible to be prepared for the wrong disaster. Anthropologist David Bond provides a compelling example of this in his study of the BP Deepwater Horizon disaster in the Gulf of Mexico in the summer of 2010. Bond reports that after the Exxon Valdez disaster in 1989, the US National Oceanic and Atmospheric Administration (NOAA) committed to being better prepared for ocean oil spills. And they were better prepared in the summer of 2010, when British Petroleum's Deepwater Horizon platform blew up and began gushing oil into the deep sea. NOAA was prepared, for a surface oil slick as in the Exxon Valdez case – not for a spill gushing up from a mile under the sea, out of control [11]. The operational and conceptual demands were markedly different.

NOAA's misdirected preparation for the BP Deepwater Horizon disaster points to a recurrent paradox in disaster contexts: the way planning can actually undermine effective response. Immediate response to disaster always involves a multitude of actors with varying fields and levels of expertise. While disaster management plans may establish roles and responsibilities for these actors to assume, disaster rarely unfolds as these plans anticipate. And the very existence of such plans can undermine attunement to actual conditions at hand.

5.2 Unfolding Disaster

Health care professionals often face special challenges in disaster contexts, and this certainly was the case in the unfolding of the Fukushima disaster. Like other first responders, healthcare professionals must decide how long, if given a choice, they will remain in a hazardous zone. Health care professionals must also play a lead role interpreting available information on the hazards they are working within; such information is often patchy, contradictory, or from an array of sources, not all of which would conventionally be considered legitimate. Healthcare professionals have to use this information to make decisions for themselves and are often expected to explain it to others, many with limited health knowledge, most all beset with anxiety.

Health care professionals in hospitals affected by disaster also face considerable technical challenges that often make practicing at usual standards of care next to impossible. In the wake of Hurricane Katrina, for example, hospitals were left without electricity, forcing the few remaining medical staff to hand-ventilate and monitor critically ill patients, isolated by floodwaters from any chance of rescue.

Without air conditioning, plumbing, food, or adequate medical supplies, physicians were forced into difficult decisions regarding maintaining their patients' lives. Most notable is the alleged case of a physician administering a fatal dose of narcotic to several patients out of "compassion" [12].

Physicians responding to the Fukushima disaster also faced technical and operational challenges. Due to shortages of both medical supplies and staff, physicians at Nippon Medical School were tasked with obtaining water, medication, food, and gasoline and with assisting the evacuation of 300 inpatients from Iwaki Kyoritsu Hospital, for example. While initially attempting to follow official evacuation protocols, the group eventually resorted to physicians driving ambulances themselves. The Disaster Medical Assistance Team (DMAT) was unable to assist because the government had given evacuation priority to hospitals within the 30-km exclusion zone and the Iwaki City government would not support the mission due to fear of radioactive contamination [13].

Access to health records was also a problem in the Fukushima disaster, as in other disasters. Paper records for patients undergoing treatment for chronic illnesses were destroyed, posing particular problems for patients evacuated from hospitals or living in shelters. And it was difficult to access and create electronic health records for acute patients. Responders in Fukushima developed novel methods to combat these issues – creating a cloud-based electronic health record system in the immediate medical response, for example [14, 15].

Throughout, healthcare professionals, in particular, have to communicate – to individual patients, as they are accustomed to, but in the intensified environment of disaster, and also to groups of people, the press, and government officials, far less familiar audiences. Communication is even more difficult when people experience and respond to the disaster through legacy social and cultural forms, often highly charged. Histories of racial divide in the American South proved to impact both immediate and more long-term recovery efforts in the wake of Hurricane Katrina, for example, with the "randomness" of natural disaster providing an ideal environment for racial and class differences to manifest in devastating ways [16].

Legacy social and cultural forms also played out in the unfolding of the Fukushima disaster. Radiation fear was high, and radiated bodies were stigmatized, a legacy of the A-bomb disasters in Hiroshima and Nagasaki. People caught up in the Fukushima disaster made sense of it *through* these forms, and healthcare professionals had to contend with this. Physicians' history-taking techniques thus needed to address not only past medical history but also family and cultural history, examining historically codified belief systems surrounding radiation, mental health, trust in authorities, and a host of other issues. Enduring impacts of cultural history were demonstrated after the Fukushima disaster in a study that showed markedly higher incidence of PTSD among people whose grandparents were living around Hiroshima or Nagasaki when the atomic bombs were dropped – regardless of their geographic distance from the Fukushima Daiichi nuclear plant itself [17].

Communication, particularly in disaster contexts, thus requires attention to social dynamics and cultural legacies. Healthcare professionals must also attend

to what historian Brett Walker terms "industrialized human bodies" – bodies forcefully imprinted by the industrial landscapes they habit, making it difficult to disentangle injuries to humans and to landscapes [18].

Across disaster, too, new health threats often emerge long after conditions seem to have stabilized. In Bhopal, for example, years after the gas leak, it has become increasingly clear that chemical waste ponds on the abandoned plant site are leaking into local drinking water, possibly contributing to birth defects and other problems in the community. Around Fukushima, too, it will be important to remain vigilant to new and newly recognized hazards, especially given continuing instabilities at the Fukushima Daiichi facility [19].

This, in turn, leads to a need – across disasters – to build organizations that provide long-term care to disaster survivors and leadership in efforts to characterize and respond to the changing needs of disaster-impacted communities. Women and other particularly vulnerable groups need to become involved in disaster planning. In Bhopal, where most gas-affected women had extremely restricted involvement in the public sphere before the gas leak, this was a particular challenge. But they have led efforts to develop job programs and have been strong voices in the call for corporate and government accountability for the disaster. Integration of vulnerable groups in disaster planning and response has also been a challenge in the wake of the Fukushima, as documented by the Japanese Gender and Disaster Network [20].

5.3 In the Long Wake of Disaster

Disaster is often defined as a sudden event that disrupts normal functioning of a community or society; often, disasters are also cast as intricately unique and bounded in time. Research across disaster contexts, however, confirms that disasters are extremely enduring. They continue, often without end. Often, recovery efforts come to be talked about as "second disasters" [21].

One basic challenge is in accounting for losses. At the 30th anniversary of the Bhopal disaster, for example, gas leak survivors were again in court, arguing that the morbidity, disability, and mortality figures used in earlier legal settlement of the case were incorrect, grossly underrepresenting the impact of the gas leak on families in Bhopal.

Economic indices of the magnitude of disaster can also be misleading. Debarati Guha Sapir, director of the Brussels-based Centre for Research on the Epidemiology of Disasters (CRED), emphasized this speaking at the Harvard School of Public Health in 2012. CRED maintains two major global disaster databases, which chart a dramatic rise in disasters since the 1950s. Sapir warned against relying upon financial losses as a measure of a disaster's impact as those figures are often provided by insurance companies. And in poor, developing nations, this is even more complicated, as very little is insured. "While the Japan earthquake and tsunami in 2011 amounted to $210 billion in losses, 57.4 percent of the $366 billion in disaster losses globally that year, the Haiti 2010 earthquake would have registered low on that scale, because so many of the 225,000 dead had little of value.

Using analysis of economic losses is fraught with misunderstanding," Sapir said [22].

The influence of commercial interests on what counts as "recovery" in disaster is also important to recognize. WHO Director General Margaret Chen addressed this as a general challenge in a 2013 speech about new challenges facing public health [23]. Chen said she was particularly troubled by industry efforts "to shape the public health policies and strategies that affect their products. When industry is involved in policy-making, rest assured that the most effective control measures will be downplayed or left out entirely. . . In the view of WHO, the formulation of health policies must be protected from distortion by commercial or vested interests."

Commercial interests always complicate disaster recovery over the long term. As seen in Hurricane Katrina, for example, former government officials were given first priority in attaining "no-bid" contracts for rebuilding efforts [24]. Other pressures and politics also produce complications. Recovery in the wake of the Chernobyl disaster was caught up in the breakup of the Soviet Union, for example. The Ukrainian government, striving to demonstrate that they were more responsive to victims than Soviets had been, dramatically lowered what was considered acceptable levels of radiation exposure. This made thousands more Ukrainians eligible for compensation – and set in motion a mass effort to be labeled "terminally ill," which had a macabre appeal in a context with few other economic opportunities. Anthropologist Adriana Petryna describes this brutal paradox in her masterful book *Life Exposed*: *Biological Citizens After Chernobyl*. Petryna's main argument is that recovery schemes produce much more than health and wealth; they also produce ways of being and relating – to governments, to family and friends, and to the future [25]. The lesson is sobering, with clear implications for other disaster contexts. Recovery schemes in Fukushima, Bhopal, the Gulf of Mexico, and elsewhere need to be built with Chernobyl's "biological citizens" in mind.

5.4 Toward Disaster Literacies

Disaster always has many dimensions, and many types of knowledge are needed to make sense of and respond to it. Further, information in disaster contexts is almost always contested and politically charged. High capacity for using different sources of information, and a diversity of knowledge forms, is thus critical in disaster contexts. Cultivating this capacity should be a high priority in disaster education and planning, leveraging what historian of science Evelyn Keller has termed "explanatory pluralism" to grasp complex phenomena [26].

Education and planning can also leverage what has been learned from past disasters. As described in this chapter and in the disaster studies research literature, there are recurrent dynamics and challenges across disaster contexts – in the lead-up to disaster, in the dynamics and experience of disaster, and in disaster recovery initiatives [27]. Awareness of these dynamics and challenges, acquired by working

through different disaster cases, provides a kind of disaster literacy that improves capacity to "read" new disasters as they unfold. Educational programs that teach students and professionals about diverse disasters – and their similarities – are thus an important aspect of disaster preparedness.

Students can learn to map factors that contribute to community vulnerability, for example, and factors that contribute to community ductility – the ability to change without being fractured. Students can also learn how to map stakeholders in disaster and what empowers and disempowers them. This kind of mapping is learned through repetition. It helps students analyze particular disasters and anticipate factors of relevance in unfolding disasters.

Students can also learn about dynamics that cut across disaster in role-playing exercises. In staged debates, for example, students can argue the positions of different stakeholders on questions such as these: Should the USA (or Japan or Germany) expand nuclear power generation? Should people be allowed to return to evacuated areas in Chernobyl (or New Orleans or Fukushima prefecture)? These staged debates enhance students' capacity to understand people in positions different than their own (because they must argue as others would argue). They also learn about the *types* of arguments made to justify particular risks, particular ways of accounting for problems (e.g., chemical or radiation exposure), particular ways of organizing disaster relief, etc. This can help them understand and anticipate the types of arguments often used as disasters unfold, making better sense of the habits and vesting interests in play. These staged debates also enhance students' capacity to think on their feet and communicate complex information.

A key challenge is to prepare for disaster knowing that disaster always involves dealing with the unexpected. Students and working professionals can be prepared for disaster through planning that lays out in advance how (and when) evacuations should proceed, how patient care should be prioritized, how food and water will be moved into devastated areas, etc. Comprehensive planning is critical, and coordinated work toward this by different professional groups should be seen as a core responsibility of those groups. Given the historical record of disaster and evidence that many types of disaster are likely to increase (e.g., due to increased incidence of severe weather events associated with climate change), disasters should not be seen as surprises or anomalies.

Nonetheless, "comprehensive preparedness for disaster" is an oxymoron. It is impossible to be fully prepared for disaster.

The unexpected dimensions of disaster are not, however, beyond the reach of education and capacity building. Investment in disaster literacy – the capacity to make optimal sense of a disaster as it unfolds by thinking comparatively – is a way to both plan and recognize the limits of planning. Such investment is demanding for students, educational institutions, and professional organizations. But the need for it has become ever more clear, especially with the Fukushima case.

References

1. Swann P. Cases in public relations management: the rise of social media and activism. 2nd ed. New York: Routledge; 2014. p. 605.
2. Kingston J. Critical issues in contemporary Japan. Oxon: Routledge; 2014. p. 328.
3. Colignon RA, Usui C. Amakudari: the hidden fabric of Japan's economy. Ithaca: Cornell University Press; 2003. p. 252.
4. Salazar K. Change of the name of the Minerals Management Service to the Bureau of Ocean Energy Management, Regulation, and Enforcement [Internet]. 2010. http://www.doi.gov/deepwaterhorizon/loader.cfm?csModule=security/getfile&PageID=35872. Accessed 31 Mar 2015.
5. Von Hippel FN. It could happen here. The New York Times [Internet]. 2011 Mar 23. http://www.nytimes.com/2011/03/24/opinion/24Von-Hippel.html. Accessed 31 Mar 2015.
6. Schiermeier Q. Model response to Chile quake? Nat News. 2010;464(7285):14–5.
7. Cyranoski D. Japan faces up to failure of its earthquake preparations. Nat News. 2011. 471 (7340):556–7.
8. Lochbaum D, Lyman E, Stranahan SQ. The Union of Concerned Scientists. Fukushima: the story of a nuclear disaster. New York: The New Press; 2014. p. 322.
9. Perrow C. Normal accidents: living with high risk technologies. Princeton: Princeton University Press; 1984. p. 463.
10. Santella N, Steinberg LJ, Sengul H. Petroleum and hazardous material releases from industrial facilities associated with Hurricane Katrina. Risk Anal. 2010;30(4):635–49.
11. Bond D. The science of catastrophe: making sense of the BP oil spill. Anthropol Now. 2011;3 (1):36–46.
12. Lugosi CI. Natural disaster, unnatural deaths: the killings on the life care floors at Tenet's Memorial Medical Center after Hurricane Katrina. J Health Biomed Law. 2006. 2:195.
13. Koyama A, Fuse A, Hagiwara J, Matsumoto G, Shiraishi S, Masuno T, et al. Medical relief activities, medical resourcing, and inpatient evacuation conducted by Nippon Medical School due to the Fukushima Daiichi Nuclear Power Plant accident following the Great East Japan Earthquake 2011. J Nippon Med Sch. 2011. 78(6):393–6.
14. Venkatraman S, Bala H, Venkatesh V, Bates J. Six strategies for electronic medical records systems. Commun ACM. 2008;51(11):140–4.
15. Nagata T, Halamka J, Himeno S, Himeno A, Kennochi H, Hashizume M. Using a cloud-based electronic health record during disaster response: a case study in Fukushima, March 2011. Prehosp Disaster Med. 2013. 28(4):383–7.
16. Elliott JR, Pais J. Race, class, and Hurricane Katrina: social differences in human responses to disaster. Soc Sci Res. 2006. 35(2):295–321.
17. Ben-Ezra M, Palgi Y, Soffer Y, Shrira A. Mental health consequences of the 2011 Fukushima nuclear disaster: are the grandchildren of people living in Hiroshima and Nagasaki during the drop of the atomic bomb more vulnerable? World Psychiatry. 2012. 11(2):133.
18. Walker BL. Toxic archipelago: a history of industrial disease in Japan. Seattle: University of Washington Press; 2010. p. 240.
19. Nair M. Bhopal gas tragedy – a social, economic, legal and environmental analysis [Internet]. Rochester: Social Science Research Network; 2005. Report No.: ID 1977710. Available from: http://papers.ssrn.com/abstract=1977710. Accessed 5 April 2015.
20. Japan Women's Network for Disaster Risk Reduction. Disaster risk reduction: a Japanese women's perspective on 3/11 [Internet] 2013. Available from: http://www.preventionweb.net/english/professional/publications/v.php?id=32983. Accessed 5 Apr 2015.
21. Fortun K. Advocacy after Bhopal: environmentalism, disaster, new global orders. Chicago: University of Chicago Press; 2001. p. 436.
22. Powell A. Disaster by the numbers [Internet]. Harvard Gazette. 2012 [cited 2015 Apr 5]. Available from: http://news.harvard.edu/gazette/story/2012/04/disaster-by-the-numbers/

23. Chan M. WHO | WHO Director-General addresses health promotion conference [Internet]. WHO. 2013 [cited 2015 Apr 5]. Available from: http://www.who.int/dg/speeches/2013/health_promotion_20130610/en/
24. Hogan MJ, Long MA, Stretesky PB. Campaign contributions, lobbying and post-Katrina contracts. Disasters. 2010. 34(3):593–607.
25. Petryna A. Life exposed: biological citizens after Chernobyl. Princeton: Princeton University Press; 2002.
26. Keller EF. Making sense of life: explaining biological development with models, metaphors, and machines. Cambridge: Harvard University Press; 2002. p. 402.
27. Fortun K, Frickel S. Making a case for disaster science and technology studies [Internet]. An STS forum on the East Japan Disaster. https://fukushimaforum.wordpress.com/online-forum-2/online-forum/making-a-case-for-disaster-science-and-technology-studies/. Accessed 31 Mar 2015.

Part II
Mental Health Issues: Challenges for Resilience and Recovery from Fukushima Compound Disaster

Chapter 6
Emotional Consequences of Three Mile Island and Chernobyl: Lessons Learned for Fukushima

Evelyn J. Bromet

Abstract The psychosocial consequences of the Three Mile Island (TMI) and Chernobyl nuclear power plant accidents are regarded as their biggest public health effect. This chapter reviews the specific evidence about the mental health impact of these enormous events and the unique role of damaging health risk perceptions stemming from perceived radiation exposure. The short- and long-term mental health consequences range from general distress in the form of anxiety and depressive symptoms to clinical depression and anxiety disorders, posttraumatic stress disorder (PTSD), and medically unexplained physical symptoms. The two most vulnerable groups after TMI and Chernobyl were mothers of very young children residing near the facilities and cleanup workers. The group of greatest concern, namely, children and adolescents raised in the shadows of these events, were not significantly impacted psychologically, socially, or cognitively. The mental health of older adults was not studied. Early findings from Fukushima suggest that anxiety and depression are major issues among the affected population. The elements needed for well-designed, inclusive, multidisciplinary studies of the psychological aftermath of Fukushima are discussed.

Keywords Three Mile Island • Chernobyl • Mental health • Cleanup workers • Mothers

6.1 Introduction

The TMI accident in 1979 and Chernobyl catastrophe in 1986 were vastly different events, with TMI classified by the International Atomic Energy Association as a level 5 accident (limited release of radioactive material) and the Chernobyl explosion classified as a level 7 (major) accident. Both occurred during the night, both involved human error, and both generated an intangible and frightening exposure

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(radiation). In addition, after these events, there was contradictory (TMI) or incomplete (Chernobyl) disclosure by authorities about what occurred, leading to a collapse of trust in official information and government officials, widespread rumors about adverse or bizarre effects on plants and animals, and claims that the accidents would cause hundreds (TMI) to many thousands (Chernobyl) of deaths. In both cases, the official consensus was that mental health was the biggest public health consequence of the accident [1, 2]. Yet, in contrast to this consensus, psychiatry researchers, radiation scientists, and mental health providers made little to no efforts to design interventions to mitigate the mental health consequences of these terrifying accidents. The costs of ignoring mental health after TMI and Chernobyl extend beyond mental health per se because psychiatric impairment is associated with mortality, morbidity, decreased productivity, and diminished quality of life [3].

6.2 Context of the Accidents

6.2.1 TMI

The accident at TMI began in the early morning of March 28, 1979, and evolved into a partial meltdown of the core and a small (0.4–1 terabecquerel) release of radioiodine primarily inside the reactor itself [4]. The average exposure dose to the two million people within 50 miles of the plant was estimated to be 0.015 mSv. Nevertheless, on March 30, the Governor of Pennsylvania issued an advisory for pregnant women and preschool children to evacuate the 5-mile area surrounding the plant, which was later extended out to 20 miles. In fact, 144,000 people, just under half the population, left. Most families returned to the area within 2 weeks [5]. Over the next several months, scientists and government officials publicly disagreed about the magnitude of the release and the potential for an increased incidence of cancer. The President's Commission report concluded that 1–2 excess cancers were possible (though unlikely), while antinuclear scientists claimed that the death toll would exceed 300 cases. In the long term, no increase in cancer morbidity or mortality attributable to the TMI accident was found [6], and the Commission's conclusion proved to be correct.

6.2.2 Chernobyl

The Chernobyl accident occurred 7 years later, in the early hours of April 26, 1986, and resulted in a massive explosion and complete meltdown, with extensive contamination in parts of Ukraine, Belarus, and Russia [2]. Potassium iodide prophylaxis was given to 5.4 million people. Approximately 135,000 people were

permanently evacuated from the 30-km zone in the first months. Over time, that number grew to 350,000. The average exposure received by evacuees was 350 mSv. During the initial evacuation, pregnant women were urged to have abortions, although they were not told why, and most reportedly complied. By the end of the summer of 1986, 134 emergency personnel developed acute radiation syndrome, and 31 died. In all, more than 600,000 men and women were brought to Chernobyl to "liquidate" the consequences of the accident. The physical health aftermath of the accident included an increase in cataracts and suicide among liquidators and an increase in thyroid cancer among young children from drinking contaminated milk. To date, there have been 4,000 cases of thyroid cancer in children out of 18 million exposed, including 9 deaths. The highest-risk group for thyroid cancer is the age group in utero to 4 years [2, 7]. Responsibility for monitoring the long-term health consequences, particularly health problems among the liquidators, became complicated after the Soviet Union collapsed in 1991, when the economies of the independent republics were in shambles.

6.3 Research Contexts of the Accidents

In the USA, prior to 1979, disaster studies were anecdotal, were based on convenience samples, such as litigants, and utilized nonstandard questionnaires. In general, disaster studies, like community mental health research done at the time, focused on psychiatric symptom severity. In 1979, only one American study had administered a diagnostic interview with a community sample [8]. For that study, conducted in New Haven, Connecticut, Weissman and colleagues trained social workers to administer the lifetime version of the Schedule for Affective Disorders and Schizophrenia (SADS-L) [9]; diagnosis was operationalized using the Research Diagnostic Criteria [10]. The New Haven study showed that diagnostic interviews were acceptable and could be administered reliably to non-patient samples. Then in 1980, the American Psychiatric Association published the third edition of the *Diagnostic and Statistical Manual for Mental Disorders* [11], which for the first time provided operational definitions of common psychiatric disorders like depressive and generalized anxiety disorders, as well as codifying posttraumatic stress disorder (PTSD). A structured interview to assess common DSM-III disorders in community samples was published the following year [12]. Thus, TMI occurred just before these major breakthroughs in nosology and assessment and at a time when disaster research was outside the purview of epidemiology.

When Chernobyl occurred, no foundation existed for conducting systematic research on mental health, let alone on the psychiatric and medical consequences of a disaster. Indeed, there was no tradition of population-based health studies in the former Soviet Union and no tradition of random sampling and personal interviews. DSM-III was unknown. There was no system of outpatient mental health or substance abuse care. People with schizophrenia were put in psychiatric hospitals, and alcoholics were managed by the prison system. To complicate matters,

psychiatry was often used as a means of social control, and stigma against people with mental illness was rampant.

Thus, both situations required pushing the envelope in terms of research methods, and both proved to be catalysts for developing psychiatric epidemiologic studies of disasters more broadly. Currently, there are many epidemiologic studies of disaster survivors after both natural and environmental catastrophes [13, 14].

6.4 Mothers of Young Children in the Aftermath of TMI and Chernobyl

6.4.1 TMI

The Behavioral Health Task Force report to the President's Commission on the Accident at Three Mile Island indicated that in the immediate aftermath, there were acute psychological effects on mothers of young children and newborns [15]. There was also compelling evidence from non-disaster studies that women with small children in high threat stressful conditions had an elevated rate of depression [16]. Thus, in the summer of 1979, when the National Institute of Mental Health asked us to evaluate the psychological effects of the accident, we focused on mothers of young children living near TMI. Since the study was designed before DSM-III and its new PTSD diagnostic category, we tested whether TMI mothers had higher rates of major depression and generalized anxiety disorders as defined by the Research Diagnostic Criteria [10] as well as greater psychological symptom severity than controls.

The TMI sample included approximately 400 mothers living within 10 miles of TMI, almost all of whom had evacuated the area for about 2 weeks. We were not allowed to access vital statistics records, and thus the sample was identified from birth announcements in local newspapers, which was a universal practice at the time. In addition, we selected a comparison sample of approximately 180 mothers residing near a nuclear power plant in Western Pennsylvania. The mothers were interviewed with the SADS-L [9] by social workers and psychologists at 9, 12, 30, and 42 months post-TMI. At the 30- and 42-month points, we added a comparison group of 175 mothers living near a coal-fired plant. The undamaged reactor at TMI was restarted in 1986 after a long court battle. At that time, we mailed questionnaires on mental health and risk perceptions to the TMI sample. We also mailed similar questionnaires to the TMI sample at the 10th anniversary in 1989. The response rate to the mail-out questionnaires was about 50 %. (For details, see [17].)

Early on, as expected, the rates of depression/anxiety disorder and depressive and anxiety symptoms were significantly higher in the TMI mothers compared to the other groups. By the 30-month point, the symptom rates of the TMI mothers remained steady, but the rates in the comparison women increased as a consequence

of the high unemployment that suddenly rocked the communities in Western Pennsylvania where the comparison groups lived [17, 18]. At the 10th anniversary, rather than symptom rates declining with time, as suggested by the few population-based studies conducted after TMI [15, 19–21], the symptom rates remained stable and higher than expected [22]. Moreover, risk perceptions, which were not significantly related to mental health early on, became important correlates of mental health at the later time points [22, 23].

6.4.2 Chernobyl

The Chernobyl study of maternal mental health was conducted in Kiev (Ukraine) 11 and 19 years after the accident. Prior to this, two methodologically rigorous studies had shown that mothers of young children were a high-risk group in areas contaminated by radiation in Russia [24] and Belarus [25]. Thus, we selected 300 evacuee mothers (80.7 % came from Pripyat, the city near Chernobyl built for employees and their families) and 300 mothers whose child was in the same homeroom as the evacuee children (comparison group) [26]. The evacuee mothers were randomly selected from a sampling frame of evacuee families in Kiev with children who were in utero to age 15 months at the time of the accident. The comparison families were in Kiev when the accident happened, though most sent their children to live with relatives in other parts of the Soviet Union in the summer of 1986. At the 19-year point, we added a population-based comparison group [27].

The measures and interviewer training materials were translated and back-translated into Russian and Ukrainian following the procedures outlined by the World Health Organization. All interviews were conducted face to face by trained interviewers. Demographically, the Chernobyl mothers were similar to the TMI mothers in age (average age of 37 at the 11-year point), marital status (most were currently married), and family size (average of two children). More of the Kiev women had education beyond high school [28].

Overall, the evacuee mothers were more symptomatic on every measure compared to Kiev mothers [26, 29, 30]. Specifically, they endorsed more symptoms of depression, anxiety, PTSD, and somatization than comparison women. The biggest factor that accounted for these differences was the negative risk perceptions of the evacuee mothers and being told by a doctor that their health problems were linked to Chernobyl [29, 30].

6.4.3 Comparison of TMI and Chernobyl Mothers

At year 10, the TMI mothers completed the anxiety, depression, and anger subscales of the Symptom Checklist-90 [31]; at year 11, the Kiev mothers completed the Russian version of the same measures [32]. Symptoms occurring in the past

2 weeks were rated on a 5-point scale (0 = not at all distressed, 4 = extremely distressed). The anxiety subscale contained ten items; in a US normative sample of women, one standard deviation above the mean was 0.74. The depression subscale contained 13 items (one standard deviation = 0.78), and the hostility subscale had 6 items (one standard deviation = 0.66). There were no normative data for the SCL-90 in Ukraine. Thus, the one standard deviation mark from the US normative data was used to create high- and low-symptom groups.

In both sites, mothers were asked to rate their health. In the TMI study, the scale was excellent, good, fair, or poor. In Kiev, after piloting, the scale was excellent, good, moderate, bad, and very bad, reflecting cultural differences in modal responses to this question.

Two risk perceptions were also assessed in both studies: do you believe that the accident affected your health? Do you believe that the accident affected your children's health? The response options for TMI mothers were "yes, unsure, no" (yes and unsure were compared to no), while for Chernobyl, the options were "yes very, yes somewhat, and no" (yes very was compared to somewhat or no; almost no one endorsed the "no" option).

Figure 6.1 shows that more evacuee mothers scored in the high range on the depression, anxiety, and hostility symptom scales compared to TMI mothers, and Kiev classmate comparison mothers were midway between the two groups. Similarly, while approximately 10 % of TMI mothers rated their health as fair or poor, 38.5 % of evacuees and 23.2 % of Kiev controls rated their health as poor/very poor. The same pattern was found for the two risk perception items, with fewer TMI mothers expressing concern compared to evacuees and Kiev controls being midway between the two.

In spite of these overall differences, the relationships of health risk perceptions to psychological symptom scores and subjective health ratings were remarkably

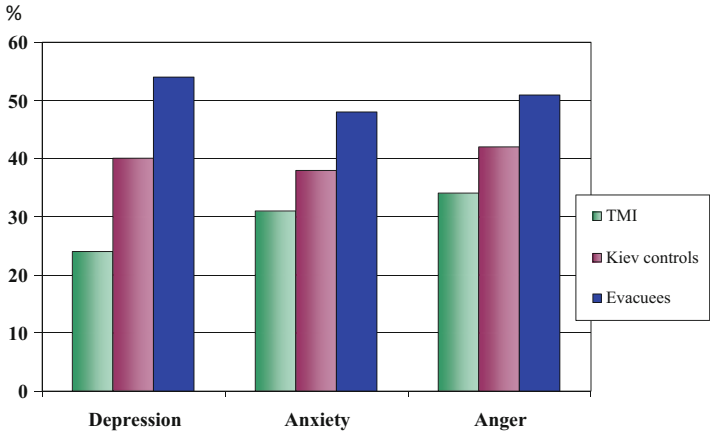

Fig. 6.1 Percent with high depression, anxiety, and anger symptoms in TMI, Chernobyl evacuee, and Kiev mothers 10–11 years after each accident

similar in the TMI, evacuee, and Kiev comparison groups. That is, mothers who believed that their health or their children's health was adversely affected by the accident had a two- to threefold increased odds of having high anxiety, depression, and anger and poor subjective health than those who were less concerned [28]. These parallel results were all the more striking because of the substantial differences between the TMI and Chernobyl mothers in exposure severity and socioeconomic circumstances.

The TMI and Chernobyl findings, combined with results of long-term assessments of A-bomb survivors [33–37], support the hypothesis that the mental health consequences of Fukushima will follow a similar pattern. Indeed, recent short-term evidence from the Fukushima Health Management Survey [38–40] is consistent with the TMI and Chernobyl reports.

6.5 TMI Workers and Chernobyl Liquidators

6.5.1 TMI

The President's Commission conducted an extensive analysis of the mental health of TMI employees [41]. Compared to workers at a nearby power plant in Eastern Pennsylvania, TMI workers showed increased demoralization, especially nonsupervisory workers. Following on this study, we assessed depression and anxiety in TMI workers during the first 4 years (9, 12, 30, and 42 months) following the accident. A total of 170 TMI workers and 160 workers at a nuclear plant in Western Pennsylvania were interviewed with the measures described above for TMI mothers [17]. At the 30- and 42-month points, we added a sample of 159 coal-fired plant workers from Western Pennsylvania. Although there were short-term differences in the expected direction, they were attributable to working conditions rather than to the TMI accident. Moreover, there were no long-term differences among the three groups of workers. The vast majority of TMI workers did not perceive the situation as dangerous.

6.5.2 Chernobyl

Chernobyl liquidators have been the subject of numerous local studies suggesting that highly exposed workers developed long-term cognitive impairments [42]. However, these findings have not been confirmed by international investigators. Moreover, the cohorts were convenience samples that do not provide generalizable data, the test conditions of liquidators and controls were not uniform, and, most

importantly, the analyses did not consider alternative explanations for the deficits observed, such as alcoholism, extreme fatigue, and fatigability.

In contrast to the ambiguity of findings about cognitive functioning, the adverse mental health consequences of serving as a liquidator are compelling. The long-term emotional toll of working as a liquidator was first reported by Rahu and colleagues [43] who found a higher than expected rate of suicide in the 5,000 liquidators from Estonia relative to the general population for the period 1986–1993 (standardized mortality ratio = 1.52; 95 % confidence interval = 1.01–2.19). Rahu and colleagues later confirmed their finding in an extended period of follow-up [44].

We subsequently conducted structured diagnostic interviews with 295 Ukrainian liquidators 18 years after the accident [45]. They had been assigned to work at Chernobyl between 1986 and 1990. None had a history of acute radiation syndrome. Their mental health was compared to 397 geographic matched men who had not served as liquidators. The control group lived in the same region as the liquidators and had participated in a national survey of mental health using the same structured interview. The diagnostic interview was a Russian and Ukrainian translation of the WHO Composite International Diagnostic Interview (CIDI) developed for use by the World Mental Health Survey Consortium [46]. Compared to controls, significantly more cleanup workers had major depression (18.0 % vs 13.1 %), suicide ideation (9.2 % vs 4.1 %), and severe headaches (69.2 % vs 12.4 %). Their odds of PTSD in the past year were 3.5 times higher than that of the controls. Most importantly, liquidators with depression and PTSD had substantially more work loss days compared to controls with these disorders and men in both groups without these disorders [45].

Liquidators also completed an exposure and symptom questionnaire. Those in the highest exposure category (working on the roof or in the industrial site during April–October 1986) had significantly greater somatization and PTSD symptom severity than liquidators with moderate (other workers on site in 1986–1987) and low (workers first sent to Chernobyl from 1988 to 1990) levels of exposure.

The Fukushima workers' experiences are more similar to those of the Chernobyl liquidators than TMI workers. The findings by Shigemura et al. [47, 48] indicate that TEPCO workers at the stricken Daiichi plant report significantly more psychological impairment on multiple measures than similar workers at an unaffected nuclear power plant in the same region. These kinds of symptoms, particularly PTSD symptoms, often become chronic and persistent. The workers also reported substantial stigma and slurs directed toward them, and these reports were significantly correlated with distress and PTSD symptom severity [47].

6.6 Children After TMI and Chernobyl

Our research after TMI and Chernobyl found no psychiatric, social, academic, or cognitive differences between exposed children and controls as toddlers (TMI) [49], at age 11 (TMI and Chernobyl) [26, 50] and at age 19 (Chernobyl) [51]. Other international studies of Chernobyl-affected groups who immigrated to other countries also found no relationship of radiation exposure and neuropsychiatric functioning [42]. On the other hand, local studies have produced findings showing impairments in highly exposed children, and northern European studies without direct data on radiation exposure have also suggested that Chernobyl had a neuropsychological impact (for review, see [42]). Since the highest exposure of Chernobyl children was lower than the lowest exposure of young A-bomb survivors who developed cognitive impairments, it seems unlikely that meaningful decrements associated with radiation exposure would exist. The discussion, however, remains open.

6.7 Lessons for Fukushima

Risk perception research has shown that exposure to radiation accidents and events, whether actual or perceived, is among the most feared and pernicious of risk perceptions. As noted earlier, at the 20th anniversary of the Chernobyl accident, the Chernobyl Forum concluded that the mental health impact was the biggest public health effect of the accident [2]. Previously, after the TMI accident, the President's Commission on the Accident at Three Mile Island had come to the same conclusion [1]. It is already becoming evident that mental health is a major component of the public health impact of Fukushima as well [52]. It is also likely that the effects will be long lasting given the devastation of the triple disaster. The evacuation zone covered 50,000 people living within 20 km of the facility and other communities found to have high levels of contamination. Thus, the relative and absolute magnitude of the psychological impact of the Fukushima nuclear plant accident cannot be overstated.

The World Health Organization (WHO) defined health as *a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*. The WHO estimates that disorders like depression, anxiety, and PTSD, which occurred after these nuclear power plant accidents, will be the second leading cause of disability in the industrialized world in the year 2020 [3]. After World War II, when epidemiology shifted its focus from infectious diseases to chronic physical and mental disorders, a large number of population-based studies were conducted that consistently showed that poor mental health leads to increased mortality, medical morbidity, and impaired quality of life [3]. The implications for the design of effective intervention and prevention programs are obvious. Health-care providers need to be knowledgeable about both medical and psychiatric conditions,

and integrated treatment programs are critical. It is noteworthy that each event – TMI, Chernobyl, and Fukushima – occurred in regions where integrated care was not the norm and mental health was barely acknowledged as a co-occurring diagnostic condition worthy of treatment.

TMI families moved back to their homes. Chernobyl families were resettled in other cities. The early adjustment period was fraught with difficulties stemming from stigma toward the evacuees, fear by local residents and local medical providers that the evacuees were contaminated, resentment by local residents who had waited for years to move into the new apartments given to the evacuees, and special benefits accorded to evacuees. Eventually, however, the evacuees, especially their children, became integrated into their new communities. The situation in Japan is more complex, given the stigma expressed toward A-bomb survivors that became redirected toward evacuees [53] and Fukushima plant workers [47]. The triple catastrophe occurred during a difficult economic period in Japan. Some evacuees wish to return to Fukushima after their villages are decontaminated, but jobs in these communities are scarce. Some evacuee families are separated because husbands' jobs are far from home. Still other evacuees prefer not to return to their villages and towns, particularly younger people who more easily found jobs in their new communities. Others fear moving back because of lingering concerns about radiation and distrust of official safety reports [54].

Many elderly people in nursing homes died during the evacuation and in the first 9 months after the disaster started [55]. The rates of alcoholism and suicide in older residents of Fukushima are higher than in other parts of Japan [52], though the suicide rate was higher even before March 2011. Unfortunately, after TMI and Chernobyl, there were no English-language publications on the psychological and alcohol sequelae among older people. There are anecdotal reports that some older people have moved back into the exclusion zone around Chernobyl, but no hard data about this population. Thus, there is little guidance about what to expect in the longer term after Fukushima.

Consistent with TMI and Chernobyl, mothers of young children are emerging as one of the most vulnerable populations [56]. It is important that obstetrician/gynecologists and pediatricians be aware of the signs of psychological distress in mothers and given basic tools for managing these symptoms and referral sources if the problems persist. Since many women do not spontaneously talk about mental health concerns, it is important for their medical physicians to ask about mental health directly. Even a short symptom questionnaire administered in the waiting area would alert the physician to co-occurring psychological issues that need to be addressed during the visit. In our Chernobyl sample, the association between distress severity and number of diagnoses (anemia, cataracts, thyroid, immune system problems, arthritis) among mothers was .42 ($p < 0.001$). Together, mental and physical health problems are also more strongly associated with disability than either one alone.

Mental health literacy extends beyond physicians, however. Raising awareness about and destigmatizing mental health problems need to be done at the level of the general population and community leaders and officials. Shortly after the

Fukushima accident, Japanese psychiatrists asked organizations like the World Psychiatric Association to provide information about psycho-education and treatment for the psychological sequelae of traumatic events [57]. To the extent that medical professionals, particularly non-psychiatrist physicians and nurses, interact with local community leaders and residents around these issues, rather than doing so through mental health specialists, the messages will be more readily received. At the conclusion of our Chernobyl research, we held a "town hall meeting" with all of the participants where we presented the findings and addressed their questions. It was striking that the highlight of the event was the report by the hematologist in our research group. Even though the findings were contrary to local rumor, the community perceived him as "on their side" and trusted that he was not engaging in more of the misinformation that had been gone on for years. Physicians have little to no experience in these kinds of settings. It is therefore important that they learn the skills they need to make such presentations and handle questions and answers and communicate more effectively to large groups. Communication is a dialogue. Physicians are trained to deliver information. Learning to handle challenging questions from informed, and sometimes misinformed, community members and journalists, is a critical skill in the twenty-first century and in post-disaster circumstances. Indeed, communication has become a pivotal issue for physicians and scientists as a result of Fukushima [58].

Long-term mental health research can provide critical information for identifying high-risk populations and for targeting interventions. Suggestions for developing and implementing such studies include:

1. *Multidisciplinary teams of medical and mental health specialists in equal partnership with members of the community*. This enables the acquisition of data that reflect issues of local concern. In addition, it facilitates the success of the study in all respects, including conceptualization, design, field work, analysis, and appropriate and timely communications of the findings to the study participants. Creating teams allows for the development of trust and the sharing of experiences that will be reflected in every aspect of the study. It is also important to be aware of personal biases and resentments among team members who were affected by the disaster so that the study and analysis are systematic and balanced. Consensus-driven research, according to Raphael and Ma [59], is an important element to understanding the complexity of the risk perceptions, responses, and other sociocultural risk and protective factors.
2. *Ongoing stakeholder dialogue meetings in open forums to discuss research and general mental health issues*. These meetings are critical to maintaining trust and can facilitate the success of the next generation of studies designed to investigate longer-term health and mental health issues. From a participant's perspective, how one study treats respondents reflects on scientists in general, not just on the specific study. Moreover, no matter how well conceived and designed the study, if the results are primarily published in scientific journals, rather than shared with local communities, eventually people begin to feel like "guinea pigs." It becomes a delicate balance not to bias respondents' information for future

studies while sharing the purpose and findings of current studies. But it is the balance that is critical to think through. The verbal and nonverbal communication and language at these meetings are also important elements of successful communication and maintenance of trust.

3. *Community education*. Most investigators focus on the questions to be asked and the response options of the measures. In fact, field studies are opportunities for one-on-one active listening, responding to concerns, and education about radiation and about mental health. This means that interviewers and raters need a tool kit and proper training to handle questions knowledgeably. Studies that rely on mail-out questionnaires can include boxes for respondent questions and concerns. The Fukushima Medical University surveys included such boxes, and a public health nurse was trained to call respondents and discuss their concerns on the phone [38].
4. *Use of social media*. Younger populations are engaged in social media activities. Investigators should also have an active presence on social media sites in order to promote the importance of their research and to communicate results more broadly [58]. To the extent that social media attracts opinionated and angry constituents, it is all the more important to engage this population using a medium with which they are comfortable. These interactions can also be used to educate people about what constitutes "good" versus "bad" science.
5. *Improving participation rates*. Response rates in disaster studies are often very low, and this means that the results are not generalizable to the original target population [60]. Response rates of comparison groups are often lower than affected groups. In Fukushima, as a consequence of the decaying level of trust in scientists and other authority figures, it has been especially challenging to obtain reasonable response rates (60 % or more). It is thus important to build trust before launching a study. It is also reasonable to consider including incentives for participation. One incentive is a free physical examination, thyroid test, and blood tests along with timely feedback of the results. Another incentive is financial rumination or a meaningful gift. If the study is being conducted face to face, then the other critical element is the training of the interview staff on the importance of a high response rate and on motivational interviewing. The interviewers should also learn how best to handle resistance and convert reluctant individuals. This is important to monitor so that interviewers who do not obtain an adequate response rate are retrained or reassigned.
6. *Communication*. As noted in many reports, the disaster at the Fukushima Daiichi facility was followed by misinformation, untruths, half-truths, and contradictory information by the scientific community. All of this was updated minute by minute on television, in social media, in newspapers, and on the radio. It was often the case that scientists with the best communication skills were those passing along erroneous, alarmist information, while scientists with the best understanding of radiation communicated primarily with one another, talked to the public using incomprehensible jargon, or were dismissive of the public's concerns. Communicating science is a skill. It requires understandable language, knowing one's audience, anticipating questions, and showing sincere respect for

people's concerns. Before the presentation to the respondents after the Chernobyl study, the American and Kiev investigators met for an entire week to discuss our presentations. The Kiev investigators were reluctant to present the comparisons of evacuee and control children because the absence of significant differences was contrary to official dogma reported in the media. In the end, the hematologist, who was the most concerned, gave out his phone number so that parents who wanted further testing could receive it free of charge. When the meeting concluded, the hematologist, who was surrounded by parents who wanted further tests, was smiling with the audience, and the atmosphere was exceptionally congenial.

6.8 Conclusion

Solid epidemiologic data on mental and physical health and risk perceptions are needed after toxic disasters, and especially after Fukushima, a triple catastrophe, and ongoing nuclear power plant disaster. The studies must be unbiased and built on a foundation of trust with the affected community. The information can then be used to develop and locate needed interventions. It is thus important that multidisciplinary studies be designed and conducted in collaboration with community leaders and that the concerns of the affected population are incorporated. If research is to have translational value, the data must be inherently reliable, valid, and generalizable. Research gives a voice to affected populations, and that voice is heard at local, regional, and international levels. Nuclear power plant disasters have long-term consequences and thus require long-term investments in research to understand the evolving needs of populations who found themselves in the wrong place at the wrong time.

References

1. Kemeny JG. Report of the President's Commission on the Accident at Three Mile Island. New York: Pergamon Press; 1980.
2. Chernobyl Forum: 2003–2005. Chernobyl's legacy: health, environmental and socio-economic impacts. Vienna: International Atomic Energy Agency (IAEA); 2006.
3. Murray CJL, Lopez AD, editors. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Cambridge, MA: Harvard University Press; 1996.
4. Whitcomb RC, Sage M. Nuclear reactor incidents. In: Noji EK, editor. The public health consequences of disasters. New York: Oxford University Press; 1997. p. 397–418.
5. Houts PS, Cleary PD, Hu T-W. The Three Mile Island crisis: psychological, social, and economic impacts on the surrounding population. University Park: The Pennsylvania State University Press; 1998.
6. Hatch MC, Beyea J, Nieves JW, Susser M. Cancer near the Three Mile Island nuclear plant: radiation emissions. Am J Epidemiol. 1990;132:397–412.

7. Bard D, Verger P, Hubert P. Chernobyl, 10 years after: health consequences. Epidemiol Rev. 1997;19:187–204.
8. Weissman MM, Myers JK. Affective disorders in a U.S. urban community. Arch Gen Psychiatry. 1978;35:1304–11.
9. Endicott J, Spitzer RL. A diagnostic interview: the schedule for affective disorders and schizophrenia. Arch Gen Psychiatry. 1978;35:837–44.
10. Spitzer R, Endicott J, Robins E. Research diagnostic criteria: rationale and reliability. Arch Gen Psychiatry. 1978;35:773–82.
11. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 3rd ed. Washington, DC: APA Press; 1980.
12. Robins LN, Helzer JE, Croughan J, Ratcliff KS. National Institute of Mental Health diagnostic interview schedule: its history, characteristics, and validity. Arch Gen Psychiatry. 1981;38:381–9.
13. Norris FH, Friedman MJ, Watson PJ. 60,000 disaster victims speak: part I. Summary and implications of the disaster mental health research. Psychiatry. 2002;65:207–39.
14. Goldmann E, Galea S. Mental health consequences of disasters. Annu Rev Public Health. 2014;35:169–83.
15. Dohrenwend BP. Psychological implications of nuclear accidents: the case of Three Mile Island. Bull N Y Acad Med. 1983;59:1060–76.
16. Brown G, Harris T. Social origins of depression. New York: The Free Press; 1978.
17. Bromet EJ, Parkinson DK, Dunn LO. Long-term mental health consequences of the accident at Three Mile Island. Int J Ment Health. 1990;19:48–60.
18. Dew MA, Bromet EJ, Schulberg HC. A comparative analysis of two community stressors' long-term mental health effects. Am J Community Psychol. 1987;15:167–84.
19. Prince-Embury S, Rooney JF. Psychological adaptation among residents following restart of Three Mile Island. J Trauma Stress. 1995;8:47–59.
20. Cleary PD, Hours PS. The psychological impact of the Three Mile Island incident. J Human Stress. 1984;10:28–34.
21. Davidson LM, Fleming R, Baum A. Chronic stress, catecholamines, and sleep disturbance. J Human Stress. 1987;13:75–83.
22. Dew MA, Bromet EJ. Predictors of temporal patterns of psychiatric distress during 10 years following the nuclear accident at Three Mile Island. Soc Psychiatry Psychiatr Epidemiol. 1993;28:49–55.
23. Dew MA, Bromet EJ, Schulberg HC, Dunn LO, Parkinson DK. Mental health effects of the Three Mile Island nuclear reactor restart. Am J Psychiatry. 1987;144:1074–7.
24. Viinamäki H, Kumpusalo E, Myllykangas M, Salomaa S, Kumpusalo L, Kolmakov S, et al. The Chernobyl accident and mental wellbeing – a population study. Acta Psychiatr Scand. 1995;91:396–401.
25. Havenaar JM, Van den Brink W, Van den Bout J, Kasyanenko AP, Poelijoe NW, Wholfarth T, Meijler-Iljina LI. Mental health problems in the Gomel region (Belarus): an analysis of risk factors in an area affected by the Chernobyl disaster. Psychol Med. 1996;26:845–55.
26. Bromet EJ, Goldgaber D, Carlson G, Panina N, Golovakha E, Gluzman SF, et al. Children's well-being 11 years after the Chernobyl catastrophe. Arch Gen Psychiatry. 2000;57:563–71.
27. Guey LT, Bromet EJ, Gluzman SF, Zakhozha V, Paniotto V. Determinants of participation in a longitudinal two-stage study of the health consequences of the Chornobyl nuclear power plant accident. BMC Med Res Method. 2008;8:8–27.
28. Bromet EJ, Litcher-Kelly L. Psychological response of mothers of young children to the Three Mile Island and Chernobyl nuclear plant accidents one decade later. In: Havenaar JM, Cwikel J, Bromet EJ, editors. Toxic turmoil: psychological and societal consequences of ecological disasters. New York: Plenum; 2002. p. 69–84.
29. Adams RE, Bromet EJ, Panina N, Golovakha E, Goldgaber D, Gluzman S. Stress and well-being in mothers of young children 11 years after the Chornobyl nuclear power plant accident. Psychol Med. 2002;32:143–56.

30. Adams RE, Guey LT, Gluzman SF, Bromet EJ. Psychological well-being and risk perceptions of mothers in Kyiv, Ukraine, 19 years after the Chornobyl disaster. Int J Soc Psychiatry. 2011;57:637–45.
31. Derogatis L. Symptom Checklist-90-Revised: administration, scoring, and procedures manual-II. Towson: Clinical Psychometric Research; 1983.
32. Tarabrina N, Lazebnaya E, Zelenova M, Lasko N. Chernobyl clean-up workers' perception of radiation threat. Radiat Prot Dosim. 1996;68:251–5.
33. Honda S, Shibata Y, Mine M, Imamura Y, Tagawa M, Nakane Y, et al. Mental health conditions among atomic bomb survivors in Nagasaki. Psychiatry Clin Neurosci. 2002;56:575–83.
34. Kim Y, Tsutsumi A, Izutsu T, Kawamura N, Miyazaki T, Kikkawa T. Persistent distress after psychological exposure to the Nagasaki atomic bomb explosion. Br J Psychiatry. 2011;199:411–6.
35. Lifton RJ. Death in life: survivors of Hiroshima. New York: Random House; 1967.
36. Ohta Y, Mine M, Wakasugi M, Yoshimine E, Himuro Y, Yoneda M, et al. Psychological effect of the Nagasaki atomic bombing on survivors after half a century. Psychiatry Clin Neurosci. 2000;54:97–103.
37. Yamada M, Izumi S. Psychiatric sequelae in atomic bomb survivors in Hiroshima and Nagasaki two decades after the explosions. Soc Psychiatry Psychiatr Epidemiol. 2002;37:409–15.
38. Yasumura S, Hosoya M, Yamashita S, Kamiya K, Abe M, Akashi M, et al. Study protocol for the Fukushima Health Management Survey. J Epidemiol. 2012;22:375–83.
39. Yabe H, Suzuki Y, Mashiko H, Nakayama Y, Hisata M, Niwa S, et al. Psychological distress after the Great East Japan Earthquake and Fukushima Daiichi Nuclear Power Plant accident: results of a mental health and lifestyle survey through the Fukushima Health Management Survey in FY2011 and FY2012. Fukushima J Med Sci. 2014;60:57–67.
40. Ngoma AM, Goto A, Suzuki Y, Tsutomi H, Yasumura S. Support-seeking behavior among Japanese mothers at high-risk of mental health problems: a community-based study at a city health center. Fukushima J Med Sci. 2012;58:117–26.
41. Kasl SV, Chisholm RF, Eskenazi B. The impact of the accident at the Three Mile Island on the behavior and well-being of nuclear workers: Part II: job tension, psychophysiological symptoms, and indices of distress. Am J Public Health. 1981;71:484–95.
42. Bromet EJ, Havenaar JM, Guey LT. A 25 year retrospective review of the psychological consequences of the Chernobyl accident. Clin Oncol. 2011;23:297–305.
43. Rahu M, Tekkel M, Veidebaum T, Pukkala E, Hakulinen T, Auvinen A, et al. The Estonian study of Chernobyl clean-up workers: II. Incidence of cancer and mortality. Radiat Res. 1997;147:653–7.
44. Rahu K, Rahu M, Tekkel M, Bromet E. Suicide risk among Chernobyl cleanup workers in Estonia still increased: an updated cohort study. Ann Epidemiol. 2006;16:917–9.
45. Loganovsky K, Havenaar JM, Tintle N, Tung L, Kotov RI, Bromet EJ. The mental health of clean-up workers 18 years after the Chornobyl accident. Psychol Med. 2008;38:481–8.
46. Bromet EJ, Gluzman SF, Paniotto VI, Webb CPM, Tintle NL, Zakhozha V, et al. Epidemiology of psychiatric and alcohol disorders in Ukraine: findings from the Ukraine World Mental Health Survey. Soc Psychiatry Psychiatr Epidemiol. 2005;40:681–90.
47. Shigemura J, Tanigawa T, Saito I, Nomura S. Psychological distress in workers at the Fukushima nuclear power plants. JAMA. 2012;308:667–9.
48. Shigemura J, Tanigawa T, Nishi D, Matsuoka Y, Nomura S, Yoshino A. Associations between disaster exposures, peritraumatic distress, and posttraumatic stress responses in Fukushima nuclear plant workers following the 2011 nuclear accident: the Fukushima NEWS Project study. PLoS One. 2014;9(2):e87516.
49. Cornely P, Bromet E. Prevalence of behavior problems in three-year-old children living near Three Mile Island: a comparative analysis. J Child Psychol Psychiatry. 1986;27:489–98.

50. Bromet E, Hough L, Connell M. Mental health of children near the Three Mile Island reactor. J Prev Psychiatry. 1984;2:275–301.
51. Bromet EJ, Guey LT, Taormina D, Carlson GA, Havenaar JM, Kotov R, et al. Growing up in the shadow of Chornobyl: adolescents' risk perceptions and mental health. Soc Psychiatry Psychiatr Epidemiol. 2011;46:393–402.
52. Yamashita J, Shigemura J. The Great East Japan Earthquake, tsunami, and Fukushima Daiichi nuclear power plant accident: a triple disaster affecting the mental health of the country. Psychiatr Clin North Am. 2013;36:351–70.
53. Ben-Ezra M, Shigemura J, Palgi Y, Hamama-Raz Y, Lavenda O, Suzuki M, et al. From Hiroshima to Fukushima: PTSD symptoms and radiation stigma across regions in Japan. J Psychiatr Res. 2015;60:185–6.
54. Zhang H, Yan W, Oba A, Zhang W. Radiation-driven migration: the case of Minamisoma City, Fukushima, Japan, after the Fukushima nuclear accident. Int J Environ Res Public Health. 2014;11:9286–305.
55. Yasumura S, Goto A, Yamazaki S, Reich MR. Excess mortality among relocated institutionalized elderly after the Fukushima nuclear disaster. Public Health. 2013;127:186–8.
56. Yoshii H, Saito H, Kikuchi S, Ueno T, Sato K. Report on maternal anxiety 16 months after the great East Japan earthquake disaster: anxiety over radioactivity. Glob J Health Sci. 2014;6:1–10.
57. Suzuki Y, Kim Y. The Great East Japan earthquake in 2011; toward sustainable mental health care system. Epidemiol Psychiatr Sci. 2012;21:7–11.
58. Ng KH, Lean ML. The Fukushima nuclear crisis reemphasizes the need for improved risk communication and better use of social media. Health Phys. 2012;103:307–10.
59. Raphael B, Ma H. Mass catastrophe and disaster psychiatry. Mol Psychiatry. 2011;16:247–51.
60. Weisaeth L. Importance of high response rates in traumatic stress research. Acta Psychiatr Scand. 1989;355 Suppl 80:131–7.

Chapter 7
3/11 and 9/11: A Multifaceted Investigation of a Survivor Exchange Program

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Abstract The 3/11 "triple disaster" created unique and unprecedented challenges for residents of the Tohoku area. However, the general issues of coping with a large-scale disaster and its aftermath are universal. Using a combination of quantitative and qualitative survey methods, this chapter will discuss the effects of an exchange program on visiting 9/11 survivors from the United States and their Japanese hosts. In 2012, docents from the 9/11 Tribute Center traveled to Japan on a mission of community outreach together with representatives from New York-area Rotary Clubs and a major medical center. They visited 3/11 survivors to share their own experiences of tragedy and recovery, and met with school communities, evacuees in temporary housing, and local Rotarians. Two subsequent trips took place in 2013 and 2014. We assessed the impact of these visits in 2014 by administering a survey to Japanese Rotarian hosts that included demographic information, measures of the trip's significance, and the Posttraumatic Growth Inventory. We also conducted interviews with participants from the US and Japanese trip volunteers. We will report on the quantitative results of this survey and discuss the responses of the Rotarian hosts as well as the respondents' comments on how the outreach mission impacted them. To the best of our knowledge, this study is the first of its kind to

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explore exchanges between survivors of different disasters. The chapter draws implications for ongoing post-3/11 outreach efforts in Japan and for post-disaster outreach in general, and fills a void in the disaster global mental health literature.

Keywords 3/11 • 9/11 • Posttraumatic growth • Disaster mental health • Psychological first aid

7.1 Introduction

Disasters are ultimately psychological events. Survivors of disaster naturally experience a myriad of psychological and psychiatric reactions to disasters. These include short-term emotional, cognitive, and behavioral responses that are more likely adaptive, normal, and transient rather than disorder-based. In the longer term, disaster survivors can develop disorders such as PTSD, Major Depression, and Alcohol Use Disorders, and other problems less typically associated with trauma (i.e., psychosis) as well as resilient reactions that can even foster personal ("posttraumatic") growth [1].

Guidelines for how to address the psychological aspects of disaster are available and include a range of supportive, psychotherapeutic, pharmacological, and community-level interventions [2–4]. In guidelines issued by the United States-based National Institute of Mental Health for acute response to catastrophic events, recommended interventions include many that are socially rather than technically based, including psychological first aid, fostering but not forcing social interactions, enabling natural supports, and offering "therapy by walking around" [3]. Guidelines for psychological first aid specify that a key element is helping "establish brief or ongoing contacts with primary support persons or other sources of support, including family members, friends, and community helping resources" [4]. Child-focused psychological first aid consists of three basic principles, "listen, protect, and connect," the latter speaking to the particularly healthful nature of social connections for children following trauma [2].

Outreach constitutes a particular form of social intervention following disasters. As its name suggests, outreach entails "the act of reaching out" and often involves "the extending of services or assistance beyond current or usual limits" [5]. Community outreach was an important element of the mental health response to the 9/11 terrorist attacks in New York City but may suffer from lack of a systematic approach to coverage of a given community [6]. Organized peer-to-peer outreach efforts within natural social networks are in particular considered to have been an important element of reaching special populations with psychological needs that might otherwise have been overlooked by other post-9/11 efforts [7].

The intuitive appeal of psychologically-based outreach to disaster-affected communities therefore draws some support from the scientific literature. However, it stands on a very limited evidence base, as do most so-called "psychosocial" interventions [8]. The need for a broader, and longer-term, approach to the mental health needs of disaster-affected communities that takes into account the general

community beyond those identified as having psychiatric illness awaits further study [9].

7.2 Background on United States-Japan Survivor Exchange Trips

Sadako Sasaki, a survivor of the atomic bombing of Hiroshima, is famous today for the cranes she folded when she was suffering from leukemia caused by radiation exposure. The origami cranes have become a powerful symbol of her wish for peace, and in 2007 Sadako's brother gave one of her original cranes to the 9/11 Tribute Center in New York City. This demonstration of sympathy and support from Japan to the United States was reciprocated in 2012 when representatives from the 9/11 Tribute Center donated a crane sculpture made of recovered World Trade Center steel as one of the first international monuments to 3/11 (Fig. 7.1). The steel crane, which sits in Kaisezan Park, Koriyama, Fukushima Prefecture, was unveiled during an outreach trip in which 9/11 survivors met with Tohoku residents affected by 3/11 to demonstrate support and share their stories of recovery and personal growth.

This community outreach mission was the product of a collaborative effort involving multiple organizations in the United States and Japan. Shortly after 3/11, the Japanese Medical Society of America and Mount Sinai Hospital, a

Fig. 7.1 Crane sculpture made of recovered World Trade Center steel, 2012

major medical center in New York City, became involved with mental health outreach by partnering with Fukushima Medical University in Fukushima City. With financial and logistic support from Rotary Clubs in both countries, as well as several other foundations and corporations, three outreach missions took place in October 2012, August 2013, and July 2014.

The trip itineraries included conferences with local and global experts discussing 3/11, extracurricular school programs with children affected by the disaster, dialogues at temporary housing shelters, attending local Rotary meetings to interact with the community leaders, and special services at national temples and shrines to foster appreciation of the spiritual significance of 3/11. Trip members visited towns in all three prefectures affected by 3/11 (Miyagi, Fukushima, and Iwate). The first trip also included an American schoolgirl who aided in outreach to schools by delivering written messages and origami Empire State Buildings from her New York City classmates.

Participants on the second and third trips returned to many of the same places as the first trip in order to provide a sense of continuity. Members of this collaboration also published a children's storybook based on the story of Sadako and her cranes, *Message on a Wing*, which captures how the crane provided a vehicle for Japanese and Americans to console each other after 9/11 and 3/11 without any need for translation. More than 10,000 copies were distributed to all elementary schools and public libraries in Fukushima Prefecture, and English-language versions went to several schools in the United States to promote mutual understanding of 9/11 and 3/11 (Fig. 7.2).

The most recent outreach mission in July 2014 was the subject of this study. Seven docents from the 9/11 Tribute Center joined two physicians from Mount

Fig. 7.2 Sharing *Message on a Wing* with children in Iwate, 2013

Fig. 7.3 Participants on outreach trip, 2014

Sinai (R.Y. and C.K.), three medical students (P.P., T.P., and D.A.), and three Rotary Club members to visit areas affected by 3/11 and speak with residents and local Rotarians (Fig. 7.3).

7.3 Impact of the Survivor Exchange Trips on Japanese Rotary Club Members

In the first part of this study, we administered a survey to Japanese Rotarians that included demographic information, ratings of the trips' significance, and the Posttraumatic Growth Inventory (PTGI) [10, 11]. The survey incorporated a free-response section where Rotarians could elaborate on the trips' significance if they chose to do so. Local Rotary Club members helped arrange the logistical details of the trip and led us around their towns, pointing out areas damaged by the disaster and introducing us to survivors, mental health workers, and other Rotarians; we relied on these same people to publicize, distribute, and collect the surveys and also to spread the message about the outreach effort to neighboring communities. In several instances, Rotarians helped to arrange local media coverage on television and in newspapers.

We collected surveys both from Rotarians who had direct contact with the trip members and from Rotarians belonging to other local clubs that did not meet with the trip members. Those who were unable to turn in the surveys in person faxed them back anonymously to a central office.

We collected 122 responses from members of ten different Rotary Clubs in Miyagi, Fukushima, Saitama, and Nara prefectures. Eighty respondents (66 %) were members of clubs that were visited on the 2014 mission (Kesennuma, Koriyama West, Nara, Saitama, and Sendai); the remaining 42 respondents were

members of other clubs in the Koriyama area and served as a control group. The respondents were 89 % male, and 78 % were 50 years of age or older. Forty-seven percent had been active in their clubs for over 10 years. Seventy-two percent of the club members in Miyagi and Fukushima prefectures reported being involved in 3/11 relief efforts at some point since the disaster, and nearly half of those reported current involvement. Eighteen of the 122 people who responded (15 %) elaborated on their feelings about the outreach effort in the free-response section.

To assess their familiarity with the project, we asked respondents if they knew how many trips had occurred, including the current 2014 visit. Using a 0–4 scale, with 0 being insignificant and 4 being the most significant, respondents rated the value of the trips to themselves, to their Rotary Clubs, and to their communities, as well as relative to other post-3/11 outreach efforts that they may have experienced. Finally, the Rotarians rated their opinion of the long-term sustainability of the visits on the same 0–4 scale. Data were analyzed using chi-square, t-tests, and repeated-measures ANOVA in SPSS version 22.

Rotarians whose clubs had been visited on the current trip were significantly more likely to be familiar with the project and recall correctly how many trips had occurred than Rotarians whose clubs had not been visited ($\chi^2(1, N = 114) = 10.72$, $p = 0.001$). These Rotarians were also statistically more likely than those who were not visited to rate the trips' significance higher on every measure: to themselves ($p = 0.004$), to their clubs ($p = 0.002$), to their communities ($p = 0.007$), and in comparison to other post-3/11 efforts ($p = 0.008$) (Table 7.1). They also agreed more strongly that the trips were sustainable ($p = 0.002$) and strengthened bonds between survivors of different disasters ($p = 0.023$). Recalling the correct number of trips was also significantly associated with an increased impact rating to the respondents' Rotary Clubs ($p = 0.024$) and their cities ($p = 0.021$).

The Rotarians' PTGI responses were analyzed by examining individual subset scores in the categories "Relating to Others," "New Possibilities," "Personal Strength," "Spiritual Change," and "Appreciation of Life" [10]. The Rotarians' PTGI subset scores were not associated with whether their club had interacted with the 9/11 trip, whether their club was in a region affected by the triple disaster, or whether they had become involved in 3/11 relief (Table 7.2). Those who remained involved also had higher scores in the subcategories "Relating to Others" ($p = 0.01$)

Table 7.1 Rotarian trip impact scores

	Club interacted with 9/11 trip		
	Yes ($n = 78$)	No ($n = 40$)	t value
Personal significance	3.38 (0.84)	2.87 (0.95)	2.98, $p = 0.004$
Rotary significance	3.48 (0.75)	2.93 (0.97)	3.16, $p = 0.002$
Community significance	3.33 (0.89)	2.85 (0.95)	2.73, $p = 0.007$
Significance vs. other efforts	3.18 (0.86)	2.73 (0.88)	2.69, $p = 0.008$
Feel visits are sustainable	3.32 (0.80)	2.70 (1.09)	3.19, $p = 0.002$
Feel visits deepen bonds	3.19 (0.84)	2.80 (0.94)	2.31, $p = 0.023$

The values given are means (on a 0–4 scale), with standard deviations in parentheses

Table 7.2 Rotarian PTGI subset scores

	Club interacted with 9/11 trip		
	Yes	No	*t* value
Relating to others	3.01 (1.02)	3.00 (1.05)	0.09, $p = 0.93$
New possibilities	2.94 (1.13)	2.71 (1.10)	1.02, $p = 0.31$
Personal strength	2.66 (1.12)	2.51 (1.04)	0.67, $p = 0.50$
Spiritual change	2.16 (1.33)	1.80 (1.18)	1.41, $p = 0.16$
Appreciation of life	3.38 (0.99)	3.48 (1.05)	0.50, $p = 0.62$
	Club in affected region		
	Yes	No	*t* value
Relating to others	3.05 (1.00)	2.80 (1.14)	0.92, $p = 0.36$
New possibilities	2.91 (1.14)	2.64 (1.05)	0.92, $p = 0.36$
Personal strength	2.70 (1.03)	2.11 (1.36)	1.66, $p = 0.11$
Spiritual change	2.01 (1.26)	2.22 (1.47)	0.60, $p = 0.55$
Appreciation of life	3.48 (0.99)	3.00 (1.01)	1.84, $p = 0.07$
	Involved in 3/11 relief		
	Yes	No	*t* value
Relating to others	3.10 (1.05)	3.03 (0.66)	0.21, $p = 0.84$
New possibilities	2.96 (1.10)	2.56 (1.08)	1.05, $p = 0.30$
Personal strength	2.67 (1.08)	2.67 (1.17)	0.02, $p = 0.99$
Spiritual change	2.12 (1.29)	2.50 (1.17)	0.85, $p = 0.40$
Appreciation of life	3.48 (0.95)	3.33 (1.08)	0.44, $p = 0.66$
	Continuing involvement in 3/11 relief		
	Yes	No	*t* value
Relating to others	3.34 (1.08)	2.83 (0.96)	2.56, $p = 0.01$
New possibilities	3.30 (1.11)	2.61 (1.04)	3.32, $p = 0.001$
Personal strength	2.77 (1.16)	2.54 (1.05)	1.05, $p = 0.30$
Spiritual change	2.34 (1.42)	1.80 (1.17)	2.09, $p = 0.04$
Appreciation of life	3.65 (1.08)	3.26 (0.89)	2.11, $p = 0.04$

The values given are means (on a 0–5 scale), with standard deviations in parentheses

and "New Possibilities" ($p = 0.001$). A repeated measures mixed ANOVA revealed that, although there were no differences in the level of any posttraumatic growth (PTG) domains between those who had an interaction and those who did not, survivors reported a significantly higher level of PTG in the domain of "Appreciation of Life," followed by "Relating to Others" and "New Possibilities" ($p < 0.001$). They reported significantly lower levels of PTG in the domains of "Spiritual Change" and "Personal Strength."

The written responses of the Japanese Rotarians shed light on the numerous ways in which this survivor exchange program had a positive impact on those who participated. First, the Japanese Rotarians found this to be a significant learning experience. One person wrote, "It is very important and meaningful to globally exchange disaster experiences. Please continue." Another said of the trips, "I did not know much about them before, but I was very moved by those who spoke to us."

These comments underscore the educational value of this survivor interchange. Such a dialogue between the two groups can expand cultural horizons and broaden understanding.

Several Rotarians noted the importance of offering support. One wrote of the visitors from the United States, "they are here to support us with strong enthusiasm" and another, "We have to help each other in times of need." A Rotarian elaborated on the concept of "otagaisama," or the idea of lending a helping hand to one's fellow man, a crucial concept in Japanese culture: "Otagaisama. . .is very appropriate and I am deeply touched by their efforts. My dental office was destroyed, but I visited at least 88 shelters. I am finally opening my new office but will continue to support those in shelters." This last comment speaks to the necessity of long-term support; by alluding to the future, this Rotarian emphasizes that his job is not over and he will continue to provide assistance where it is needed. Indeed, several other Rotarians remarked that the issues created by 3/11 are far from solved. One person wrote, "Fukushima had nuclear power plant issues on top of the tsunami and we are greatly affected by this. We deeply appreciate international support." Another alluded specifically to mental health treatment and the need to sustain it in the wake of a disaster.

A common theme from the survey comments was that the 9/11 and 3/11 disasters were unique, but their aftermaths presented similar challenges. In one person's words, "similar situations bring people together. This makes [the trips] very significant." Another person wrote, "regardless of the cause, disaster always brings tragedy. We always need to support each other and I would like to continue such efforts." This extended to children as one Rotarian commented, "international bonds of friendship are very appealing and something to be taught to our children." Fittingly, both adults and children from throughout the trip requested to keep in touch via e-mail and social networking websites.

It is noteworthy that the Rotarians focus on similarities rather than differences. On the surface, 9/11 and 3/11 have very little in common other than occurring on the same day of the month: while 3/11 was a natural disaster, 9/11 was a man-made one; while cleanup workers were celebrated and praised after 9/11, they were appreciated and yet shunned and stigmatized after 3/11 [12]. But as this particular Rotarian put it, "disaster always brings tragedy." No matter the circumstances, there is something universal in a story of loss.

Perhaps because of this universality, several Rotarians emphasized that disaster survivors have the capacity to help one another: "There are unique sentiments shared only by those who experienced disasters. Please continue this support program." One conclusion we can draw is that these survivor exchanges have the ability to transcend cultural, linguistic, and socioeconomic barriers, allowing people to connect in spite of their myriad differences.

Although almost all of the responses were uniformly positive, one Rotarian cast doubt on the ability to compare disasters of such disparate origin. This Rotarian posed a question relating to the aftermath of the tragedies: "Many people are in shelters after 3/11, but did people have to live in shelters after 9/11?" This question

raises several important points. With any disaster, there will be specific incidents and experiences that set it apart from others. Even two large earthquakes in the same country, such as the Great Hanshin Earthquake of 1995 and the Great East Japan Earthquake of 2011, had markedly different consequences: the Great Hanshin Earthquake caused 5,200 deaths and more than 30,000 injuries, presenting an enormous challenge to rescue teams, whereas the Great East Japan Earthquake caused approximately 16,000 deaths and 6,000 injuries [13, 14]. Similarly, survivors of the same disaster might have highly different experiences (e.g., the former included the massive fire and the latter included the tsunami) and face different obstacles. While in some ways this points to the limitations of survivor exchange programs, it also suggests that much can be gained from sharing and underscores the importance of fostering communication between survivors of different disasters.

7.4 Impact of the Survivor Exchange Trips on Trip Participants

Although the primary objective of volunteering is to help others, several trip members from previous years' outreach missions noted how their interactions changed them as well. The second part of our study sought to explore the particular characteristics of the volunteer group's "change" and its possible impact on their respective communities. Our hope was that this would shed light on the therapeutic benefits of disaster volunteerism in general.

We individually interviewed 18 American and Japanese trip members using a questionnaire consisting of six open-ended questions. Interviewees included those from both the current and previous two trips. For several volunteers, the 2014 trip marked their second or third iteration. Interviews took place during the trip in a variety of face-to-face settings or over the phone. Responses took an average of 15 min and were both recorded and written down for further review. Supplemental data included past e-mail correspondence and interview transcripts from the first and second trips in 2012 and 2013. We performed qualitative analyses according to a methodology previously used regarding the 9/11 experiences of first responders [15]. Three coders individually read through the transcripts for overarching themes. The coders then met to discuss themes that overlapped among their individual conclusions.

On the whole, volunteer responses touched on the following topics: healing, spirituality, cultural differences, loss, psychiatry, children, communicating and relating, misfortune, and disasters. On the topic of healing, docents expressed a deeper understanding of the harmful effects of isolation on recovery. When the 2012 trip's docents first recognized this pattern, many felt unsure about their abilities to establish a human connection in a Japanese community that, as they believed, takes pride in not showing negative emotions; despite their initial

anxieties, repeat docents noticed a positive change with those they encountered multiple times. Docents felt this demonstrated how the survivor exchange network required repetition to create a lasting impact.

Several docents described the trip as spiritually enriching: "I now feel that everything I [do] has meaning," noted one docent upon her return. Another docent said, "The trip on the whole made me more motivated and revitalized to continue work at home and to apply experiences from Japan. I feel more spiritually and mentally fit to do so after having served on the trip." Interestingly, past docents observed how increased spirituality helped them to gain a better understanding of their 9/11 survivor narrative going forward. Outside of work, some docents noticed that they forged more meaningful, "in-the-moment" relationships. One docent described it as follows:

> [T]he trip to Japan helped me to move on from 9/11. It renewed my feeling that we're all on the planet together and that I should keep my eyes on the big picture and empathize with people going through terrible experiences. I realized that these connections we make are the good things in life. The trip renewed my faith in how relationships play such a large role in recovery. I felt spiritually more strong. . .and energized to work as curator again.

Docents felt as though they developed increased cultural competence through their interactions with 3/11 survivors. Initially, volunteer translators had felt skepticism about whether Americans could bridge the cultural gap given the difference between how much Japanese and Americans express themselves. In the end, they realized that survivors could overcome cultural differences to discuss the similarities between the two disasters. Through these discussions, American and Japanese volunteers alike mentioned a greater understanding of other people's cultures and challenges.

Docents also described how they developed new perspectives about loss. They remarked that the trip helped them shift away from the belief that people who witness different disasters have fundamentally different experiences. A past docent summarized this:

> A loss is a loss. . .Even for emergency service workers, we think of Japan as a [stable] country that doesn't need the world's help [in times of disaster]. I think that the world does need to be engaged in Japan's recovery for the lessons that it can give us and for the times that the Japanese have reached out to help other places in the world, including New York.

To this end, docents began to promote greater activism in global mental health and disaster psychiatry. A docent expanded upon this by saying, "I learned [at the International Atomic Energy Association conference at Fukushima Medical University] that whatever happened at the power plant was not only a local problem but a global problem—one that scientists and doctors should be working harder at fixing and preventing. I now feel that this is a serious issue that deserves more interest and is more encouraging of others in this line of work."

Many docents found their interactions with children to be highly informative and one of the most rewarding aspects of the trip. One docent stated:

> [The children's] expressions were like they had no concerns at all about [being displaced]. Until you asked them what are they feeling. Their concerns were that their friends were

> moving away and how sad they were. I got the feeling of isolation. [The parents'] concerns were about their children's future; what's going to happen to their children?

Docents alluded multiple times to the children's openness and their parents' deep concern for them, especially regarding radiation risks. They viewed these interactions as rejuvenating amidst the discussions of disaster and loss, and cited these visits as their favorite aspect of the trip.

Nearly all respondents commented on the dynamics of communication. Both Japanese and American volunteers expressed concern about their ability to connect with a culture completely unlike their own. To their surprise, however, past and present volunteers noticed how language had been the least of their issues and discussed how other factors facilitated communication and improved relations between Japanese and Americans. Many agreed on the importance of having enthusiastic and highly competent translators: one docent stressed, "It's not just repeating what you say, it's repeating how you said it, and our volunteers did that." Docents noted that beyond translation, simple gestures such as smiling also had a huge impact. Repeat docents felt delighted by their second trip because of the increased participation of what once had been a silent group. Men who had previously been quiet began to open up. For most docents, completion of their trip made them less scared to overcome language and cultural barriers if that meant making a difference.

Misfortune served as the common thread tying together 9/11 docents and 3/11 survivors. Through the survivor exchange network, docents wanted to share stories that touched upon the theme of "taking something bad and making something good with it." As one docent put it, "Though I am only one person, I feel that I may have somehow helped someone there look at life in a more positive way." Volunteers emphasized their psychological benefit as well. For instance, several reported feeling less panicked when hearing about disasters. "Having seen 3/11 tsunami victims, coming back to Hurricane Sandy didn't seem all that bad," said one docent. When another was asked about her dislocation after Hurricane Sandy, she responded that she felt surprisingly "grateful."

Finally, docents noticed a change in the way they viewed disasters. They discussed how joining the trip helped them to expand their perspectives or horizons beyond their previous volunteer work: "The trip also made me take pause and reflect upon myself," one docent remarked, "not only as a leader and mentor with a goal of helping others overcome personal loss and tragedy, but as an educator that inspires others to make a difference." Translators also noted a similar opportunity for Japanese victims and volunteers. Several expressed interest in incorporating what they had learned about disaster psychiatry into their vocational work as public speakers, firefighters, and radio show hosts.

These comments tell a story of how volunteers changed both mentally and spiritually. Perhaps more importantly, they illustrate a ripple effect within their communities. Volunteers' resolve to help abroad grew into a resolve to educate at home. After returning to the United States, several trip members developed a passion for disaster volunteerism, along with a desire to demonstrate why and

how their prior outreach had been effective. As one docent put it, "Maybe the best thing that we can do as a result of this trip is to become spokespeople back in the United States for a more global approach to this idea of person-to-person [contact]. . .a combination of personal interaction but also big-picture action."

7.5 Discussion

Both the responses of the Japanese Rotarians and those of the 9/11 Tribute Center docents underscore the importance of direct outreach; through person-to-person contact and repetitive visits, disaster survivors can share experiences with one another and offer support, including to schoolchildren. The surveys distributed to the Japanese Rotarians provided one way to measure the trips' efficacy and determine which aspects of it were most valuable. It is noteworthy that the Rotarians whose clubs had been visited gave the trip's significance higher ratings and found them beneficial to themselves, their clubs, and their cities. These Rotarians were also more likely to describe the trips as sustainable and agreed that they strengthened bonds between survivors. Their open-ended comments echoed this sentiment: they emphasized that "there are unique sentiments shared only by those who experienced disasters" and that these encounters led to meaningful interactions between the groups of survivors.

The responses of the docents were similar in many ways to those of the Japanese Rotarians. The docents viewed the trips as an opportunity to reflect on what they had gone through themselves, as well as the differences and unexpected similarities between the disasters and their aftermaths. Although communication was initially a concern for many involved, docents and Japanese Rotary members noted that their common disaster experiences helped mitigate cultural or language barriers.

One difference between the two groups is the emphasis placed on religion and spirituality, which was also demonstrated as a low level of PTG in the Spiritual Change domain of the PTGI. This may reflect the different roles of religion and spirituality in Japanese and American culture. Although elements from Buddhism and Shintoism are integral in Japanese culture, belonging to a religious organization in the Western sense is uncommon [10, 16, 17]. Many of the American docents alluded to the spiritual impact of the trip and said that the activities they engaged in "renewed their faith." The Japanese Rotarians, on the other hand, focused more on the importance of helping one's fellow man and passing on these messages to the next generation, which was confirmed as a high level of PTG in the domains of Appreciation of Life and Relating to Others.

Surprisingly, the PTGI scores of the Japanese Rotarians were not associated with whether their clubs had interacted with the 9/11 trip, whether their club was in a region affected by the triple disaster, or whether they had become involved in 3/11 relief, though higher scores were associated with continuing involvement in the relief effort. There are several possible explanations for these findings. First, the PTGI measures long-term changes and may not be the best tool to assess a specific

intervention. Additionally, the Rotarians completed the PTGI immediately after their interactions with the 9/11 trip members, which may have been too soon. Even if the encounters did lead to increased compassion for others, for example, this likely did not happen instantaneously. Individuals may interpret the PTGI questions differently and the 5-point answer choices could also lead to variable responses. The high level of interpersonal variability and variety of interpretation and experience underscores the importance of qualitative research in this setting.

The success of this outreach program may be partially attributable to the fact that it meets many of the basic objectives of psychological first aid. Psychological first aid is designed for early interventions following major traumatic events, but in the case of a multipart disaster such as 3/11 with lingering effects and still-displaced populations, the trauma is in many ways still ongoing. Specifically, psychological first aid helps to "establish human connection in a nonintrusive, compassionate manner," "calm and orient emotionally overwhelmed and distraught survivors," "support positive coping and empower survivors to take an active role in recovery," and "facilitate continuity and ensure other sources of support when leaving." This last point underscores one of the major hallmarks of the program: the repeated trips facilitate continuity and foster a sense of order and stability.

7.6 Conclusion

In this two-part study, we have attempted to gauge the impact of post-3/11 outreach efforts on both the 3/11 "recipient" community and the 9/11 "donor" community. The outreach efforts consisted largely of peers from among 9/11 survivors as well as health and mental health professionals and students, including a school-age child. The recipients included children as well as adults in the 3/11 community. This cross-cultural study, although with a limited number of samples, suggests potential benefits for all involved. It also suggests that the yield of such efforts may be better gauged in qualitative terms—not because qualitative data is easier to capture than quantitative data, but because the good will and compassion of such efforts may simply not be quantifiable. Just as the 9/11-3/11 outreach trips amount to complex stories unto themselves that we have tried our best to convey here, so too may their effects best be told in words and story rather than numbers and statistics.

In addition, we believe this study suggests the great untapped potential of explicitly involving outreach, especially in the form of peer support, in sustained disaster response. We traditionally think of disaster relief as involving the deployment of supplies and professionals into disaster-affected communities. But, we propose that such a view overlooks as inexpensive and natural of a resource for recovery as exists—the human reflex to comfort and to gather in the face of adversity. These trips require considerable logistical planning and, indeed, resources. But such expertise should be considered an essential part of any relief

effort, especially in the long term as material needs abate and psychological and spiritual ones rise to the fore.

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References

1. Katz CL. Disaster psychiatry: good intentions seeking science and sustainability. Adolesc Psychiatry. 2011;1(3):187–96.
2. Schreiber M, Gurwitch R, Wong M. "Listen, protect, and connect—model & teach": psychological first aid for children. The Ready campaign. 2006. http://www.ready.gov/sites/default/files/documents/files/PFA_SchoolCrisis.pdf. Accessed 15 Jan 2015.
3. National Institute of Mental Health. Mental health and mass violence: evidence-based early psychological intervention for victims/survivors of mass violence. 2002. http://www.nimh.nih.gov/health/publications/massviolence_34410.pdf. Accessed 15 Jan 2015.
4. Brymer M, Jacobs A, Layne C, Pynoos R, Ruzek J, Steinberg A, et al. Psychological first aid: field operations guide. 2nd ed. National Child Traumatic Stress Network and National Center for PTSD. 2006. http://www.ptsd.va.gov/professional/manuals/manual-pdf/pfa/PFA_V2.pdf. Accessed 15 Jan 2015.
5. "Outreach". Merriam-Webster Online Dictionary. 2015. http://www.merriam-webster.com/dictionary/outreach. Accessed 15 Jan 2015.
6. Pandya A. A review and retrospective analysis of mental health services provided after the September 11 attacks. Can J Psychiatry. 2013;58(3):128–34.
7. Hardiman ER, Jaffee EM. Outreach and peer-delivered mental health services in New York City following September 11, 2001. Psychiatr Rehabil J. 2008;32(2):117–23. doi:10.2975/32.2.2008.117.123.
8. North CS, Pfefferbaum B. Mental health response to community disasters: a systematic review. JAMA. 2013;310(5):507–18. doi:10.1001/jama.2013.107799.
9. McFarlane AC, Williams R. Mental health services required after disasters: learning from the lasting effects of disasters. Depress Res Treat. 2012;2012:970194. doi:10.1155/2012/970194.
10. Taku K, Calhoun LG, Tedeschi RG, Gil-Rivas V, Kilmer RP, Cann A. Examining posttraumatic growth among Japanese university students. Anxiety Stress Coping. 2007;20(4):353–67. doi:10.1080/10615800701295007.
11. Tedeschi RG, Calhoun LG. The Posttraumatic Growth Inventory: measuring the positive legacy of trauma. J Trauma Stress. 1996;9(3):455–71.

12. Shigemura J, Tanigawa T, Saito I, Nomura S. Psychological distress in workers at the Fukushima nuclear power plants. JAMA. 2012;308(7):667–9. doi:10.1001/jama.2012.9699.
13. Fukushima GS. The great Hanshin earthquake. Japan Policy Research Institute.1995. http://www.jpri.org/publications/occasionalpapers/op2.html. Accessed 15 Jan 2015.
14. Emergency Disaster Countermeasures Headquarters. Damage situation and police countermeasures associated with 2011 Tohoku district of the Pacific Ocean Earthquake. National Police Agency of Japan. 2015. http://www.npa.go.jp/archive/keibi/biki/higaijokyo_e.pdf. Accessed 15 Jan 2015.
15. Bills CB, Dodson N, Stellman JM, Southwick S, Sharma V, Herbert R, et al. Stories behind the symptoms: a qualitative analysis of the narratives of 9/11 rescue and recovery workers. Psychiatr Q. 2009;80(3):173–89. doi:10.1007/s11126-009-9105-7.
16. Miller AS. A rational choice model of religious behavior in Japan. J Sci Study Relig. 1995;34 (2):234–44.
17. Tange C. Relationship between religiosity and attitudes toward death. Bull Grad Sch Ed Hu Dev Nagoya. 2004;51:35–49.

Chapter 8
Psychosocial Responses to Disaster and Exposures: Distress Reactions, Health Risk Behavior, and Mental Disorders

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Abstract Disaster events cause a range of mental and physical health effects. Nuclear exposures result in unique psychological responses by affected individuals and communities. Planning, preparation, response, and recovery are enhanced by a focus on population health management, integration of relevant community and cultural variables, and effective use of risk communication.

Keywords Disaster • Nuclear • Mental health

8.1 Introduction

Mental health is an essential aspect of healthcare, including disaster response, and a substantial part of the global challenge of healthcare [1]. Although most people will show resilience in the face of disasters, these and other types of extreme events also result in distress reactions, health risk behaviors, and mental disorders (see Fig. 8.1), collectively termed "psychosocial" responses for the purposes of this chapter. These events affect a wide range of individuals, including direct victims and their families, surrounding community members, and first responders [2]. Disasters that result from intentional acts or technological failures ("human-made

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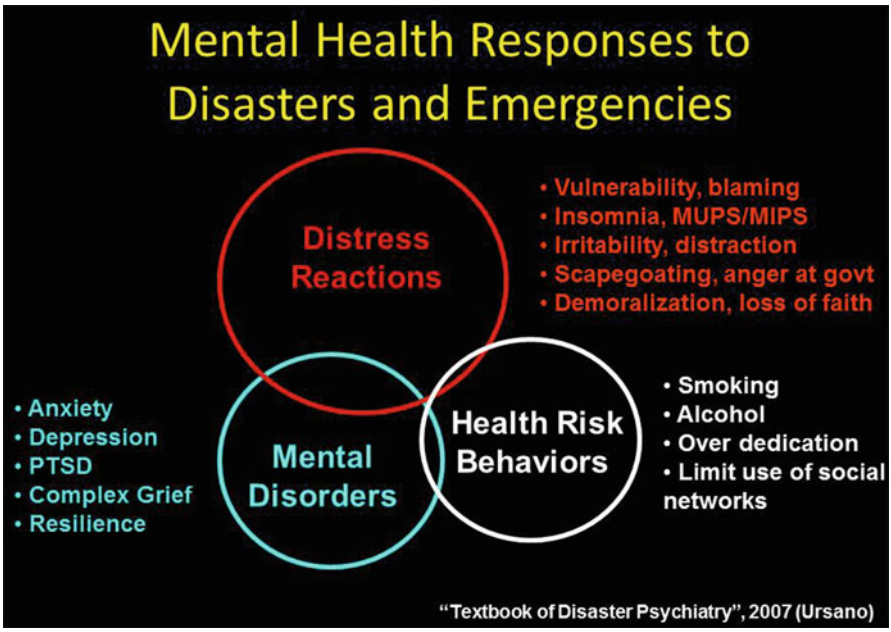

Fig. 8.1 Mental health responses to disasters and emergencies

disasters"), such as a nuclear exposure, often produce the most severe psychological symptoms [3]. Community planning, training and education for responders, and credible and timely communication from leaders and trusted authorities are important aspects of managing psychosocial response to nuclear exposures.

Knowledge of psychosocial responses to disaster comes from extensive observation of community behaviors following natural and man-made disasters [4]. In addition, there is evidence from recent and historical nuclear accidents and the field of bioterrorism that enhance our understanding of how individuals and communities specifically respond to fears of exposure to chemical, biological, radiological, and nuclear material [5, 6]. Patterns of psychosocial response are influenced by community and cultural characteristics. The response of community leaders and technical experts to a disaster can influence the distress and behaviors of disaster communities, both positively and negatively.

Nuclear accidents have two characteristics that are of importance to understanding their unique psychosocial response. First, these incidents are heavily influenced by human factors. Second, nuclear accidents involve uncertain exposure to hazards not well understood by the general population. Very few people understand the risks posed by nuclear material and contamination. Usually anything nuclear or associated with radiation is seen as an ominous threat that generates responses out of proportion to actual danger. Credible and accurate risk communication is essential to disaster recovery. Community responses to past nuclear exposures, including World War II, Three Mile Island, Chernobyl, and Fukushima, demonstrate that psychosocial consequences were greater than the actual illnesses and injuries

directly attributed to radiation or contamination. Understanding community response to nuclear accidents offers valuable information to assist governments, community leaders, and healthcare personnel.

8.2 Psychosocial Responses to Disasters

8.2.1 Distress Reactions, Health Risk Behaviors, and Mental Disorders

In the immediate aftermath of a disaster, distress reactions predominate. Individuals feel a sense of vulnerability and often engage in blaming, scapegoating, and expressions of anger at government and other leaders perceived as responsible. Demoralization and a loss of faith may also occur. Many individuals experience insomnia, irritability, and feelings of distractibility [7]. Some individuals present to healthcare settings with physical symptoms as a manifestation of psychological distress [8]. Symptoms such as headache, dizziness, nausea, fatigue, and weakness are common in the wake of a disaster even when an identifiable physical disorder cannot be found [9]. These are normal reactions to an extraordinary event. Planning for these distress reactions requires ensuring adequate resources to respond to individuals with distress symptoms in a timely and supportive manner and triage at emergency care settings to enable management of other physical and mental disorders.

In addition to distress responses, several health risk behaviors are known to increase following disasters. Increased use of alcohol, caffeine, and tobacco are common coping mechanisms and often represent self-medicating of distress symptoms [10]. Reduced use of social activities and self-imposed travel restrictions occur as well and may result in decreased access to social support networks and adverse economic impacts on the larger community [11]. Following disasters, intimate partner violence and overall levels of violence may increase as family distress and community concern about resources are increased [12].

Some individuals develop mental disorders following a disaster. The most widely studied of these disorders (but not the only one) is posttraumatic stress disorder (PTSD) [13]. Many studies suggest that approximately 10–20 % of those exposed to a traumatic event will develop PTSD, though many more individuals will experience milder symptoms, which can persist and become problematic over time [14]. The course of PTSD varies with some individuals recovering and some showing symptoms long after the initial incident (See Fig. 8.2). Posttraumatic stress disorder is not the only trauma-related disorder nor perhaps the most common [15]. People exposed to disaster are at increased risk for depression [16], generalized anxiety disorder, panic disorder, and increased substance use [17]. In some studies, suicide rates have also been shown to increase although this is not universal [18].

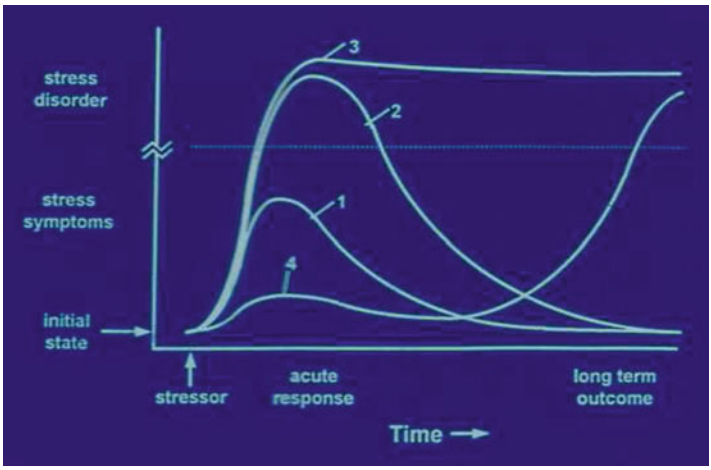

Fig. 8.2 Traumatic stress responses over time. Line 1 represents acute stress symptoms that resolve with time; 2 depicts ASD that also resolves; 3 is ASD that progresses to PTSD; and 4 shows delayed onset PTSD

8.2.2 Unique Aspects of Nuclear Exposures

Nuclear incidents can affect very large numbers of individuals and involve technological failures or be the result of man-made errors leading to exposures. They result in unique psychosocial responses related to the uncertainty of an invisible and mysterious chemical agent along with fears of permanent contamination (See Table 8.1). The inability to see and touch radiation and its depiction in books, movies, and other popular media as a frightening and inescapable force cause nuclear spills to produce adverse psychosocial responses that significantly exceed the actual health risks [6]. While many people have preconceptions about the impact of nuclear material, information and education are important aspects of population health management. In the aftermath of nuclear exposure, open and honest communication from government officials and leaders involved in managing the incident is critical in building trust and alleviating psychological distress [19].

World War II introduced the world to the extraordinary psychosocial effects of large-scale nuclear exposure that resulted from the use of atom bombs during war. Atomic bomb survivors in Japan experienced a chronic fear of long-term contamination, increased worry about their physical well-being, and an ongoing sense of harm and bodily deterioration despite extensive education about the science and medical impact of nuclear exposure [20]. Many years after the incident, these

Table 8.1 Unique psychosocial responses to nuclear exposure

Contamination fears
Chronic focus on bodily symptoms
Poor perception of self health
Long-term distress and worry
Mistrust in authority

individuals continue to attribute new physical symptoms to nuclear exposure despite medical reassurance these symptoms were unrelated.

In more recent history, accidents at Three Mile Island, Chernobyl, and Fukushima have further demonstrated the widespread and long-lasting psychosocial effects that occur in the aftermath of a nuclear exposure. The accident at Three Mile Island was a partial nuclear meltdown that occurred in 1979 in one of the two Three Mile Island nuclear reactors in the United States. It was the worst accident in US commercial nuclear power plant history. Nearly 1 year later, incident responders had elevated levels of distress [21]. Following the restart of the reactor 6 years after the incident, local residents reported increased anxiety and worry, specifically due to fear of cancer and loss of trust in the authorities [22]. For nearly 10 years post-incident, Three Mile Island residents were found to have increased levels of distress and persistent elevation in blood pressure when compared to similar people who were living at greater distance from the incident [23].

Chernobyl, the site of a nuclear power plant explosion in 1986, was the most disastrous nuclear accident until the incident at Fukushima in 2011. The Chernobyl incident resulted in feelings of helplessness regarding long-term health as well as decreased fertility rates, the latter suggesting a more negative future outlook on life [19]. Research also revealed high levels of general psychological distress and persistent focus on physical symptoms, not unlike the experience of World War II survivors documented by Lifton [24]. Nearly a quarter century after the events at Chernobyl, those who served as first responders, cleanup workers, and mothers who had small children at the time of the incident continue to experience elevated levels of depression, anxiety, and posttraumatic stress and report themselves as having poor health [25]. The lack of trust held by citizens in government and authorities appears to have played a major role in the development of long-term health effects following Chernobyl, demonstrating the importance of the relationships between government and citizens in affecting population health [26].

The disaster at Fukushima in 2011 was a unique hybrid event that included a tsunami, earthquake, and subsequent nuclear exposure. In addition to an increase in depression, anxiety, and PTSD, increased rates of delirium and psychosis were reported in the early aftermath of the disaster, most notably in those who were displaced from their home [27]. In the 7 months following the event, suicide rates were reported as increased among females in disaster-stricken areas [28]. Similar to other historical nuclear disasters, increased anxiety and distress were associated with fears of exposure and contamination, suggesting the need for education of both citizens, and relief workers remain as critical aspects of managing a nuclear exposure [29].

Because of the unique psychological and medical challenges that result from a nuclear exposure, advance planning for these types of catastrophic events is important to aid governments, responders, and victims [30]. Effective planning and preparedness may represent our best hope for reducing adverse psychosocial consequences.

8.3 Psychosocial Stages of Disaster Response

Governments and organizations that plan for and respond to disaster events need an understanding of the emotional and behavioral responses to disaster events. Often, there are phases to this response (See Fig. 8.3). Individuals or communities do not progress through these phases at exactly the same time or the same order. However, an understanding of the psychosocial factors that predominate in each phase (See Table 8.2) is helpful for policy development, response planning, and the training and education of personnel that deliver services to disaster victims [3, 31].

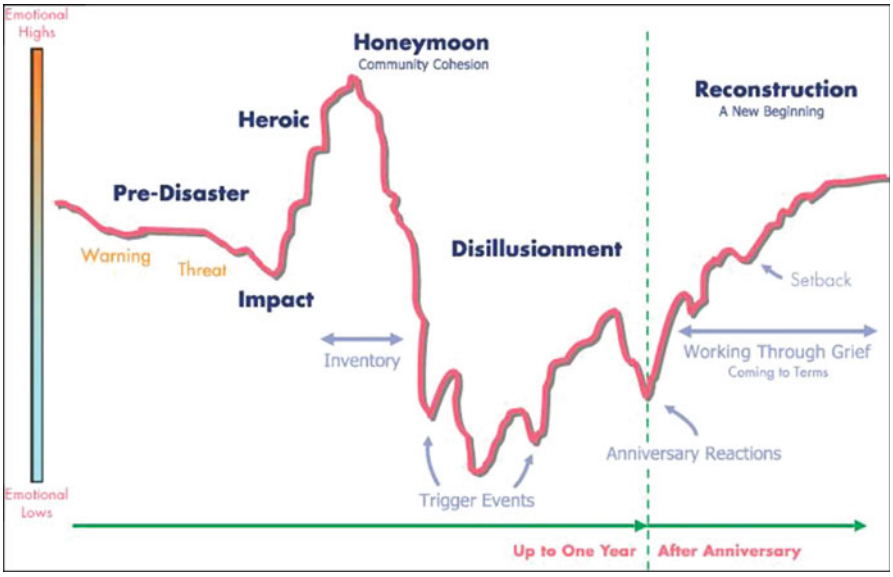

Fig. 8.3 Phases of a disaster

Table 8.2 Psychological and behavioral symptoms during disaster phases

Pre-disaster	Vulnerability, worry, remorse
Impact	Fear, confusion, numbness, disbelief
Heroic	Flashbacks, hyperarousal, anger, irritability, physical symptoms
Honeymoon	Collaboration, hope, optimism, openness to mental healthcare
Disillusionment	Disappointment, resentment, fatigue
Reconstruction	Acceptance, finding meaning, posttraumatic growth

8.3.1 Phases of a Disaster

A *pre-disaster* phase begins when an event is anticipated or advanced warning is given. This phase is highlighted by feelings of vulnerability and worry about safety. Individuals who do not heed advanced warnings to take recommended actions, such as sheltering in place or evacuation, may also experience significant remorse and feelings of responsibility for subsequent injury to loved ones or damage to property.

The *impact* phase occurs immediately after an acute event and consists of strong emotions, including feelings of disbelief, numbness, fear, and confusion. During this time, if the scope of a disaster broadens, the psychological effects typically increase. The *impact* phase may be brief, such as an earthquake. It can also be very long as in a slow-rising flood or an undetected radiological leak. Duration will affect both the response and the impact. In addition, the response of a population is affected by the culture and history of communities. Incorporating cultural understanding of communities and their values, leadership, and support systems is an important element of effective planning and response efforts.

Next is the *heroic* phase. This phase often lasts days to weeks in situations involving a short event period, but may be extended in disasters that occur over a longer period of time. Injury of loved ones or separation of family members can increase anxiety and worry and decrease the energy available for immediate problem solving. This phase is frequently accompanied by the initial appearance of assistance from outside communities, government agencies, or other countries. Disaster victims begin to adapt to the new environment and outsiders appear in the disaster community. Convergence begins during this phase, as people come into the disaster zone looking for family, friends, and even pets from which they have been separated. There is also a gathering of displaced individuals who have fled their homes. Intrusive symptoms (distressing recollections of explosions, fire, building collapse, and others, in the form of flashbacks or nightmares) emerge during this phase. Hyperarousal is also common, where individuals constantly feel tense and irritable. Physical symptoms, such as fatigue, dizziness, headaches, and nausea, along with anger, irritability, and social withdrawal, may also emerge. During this phase, personnel providing mental health interventions recognize the normal range of emotions and behaviors and respond to disaster victims with empathy, caring, and support for basic elements of living.

The *honeymoon* phase often follows. This coincides with more extensive availability of government and volunteer assistance and community bonding as a result of sharing the catastrophic experience as well as the giving and receiving of assistance. Survivors are often more hopeful during this phase and experience an optimism that the help they will receive will make them whole again and restore their lives to "normal." Governments can use this time to build positive relationships with affected communities by ensuring basic needs are met for food, water, and shelter and that resources are distributed equitably. In addition, clear and effective communication about what type of aid will be provided assists with setting expectations and helping reduce uncertainty. Providing disaster response workers

with items necessary to live and work safely and effectively can reduce the diversion of resources intended for victims. Disaster workers who are specifically aiding with psychosocial issues are most likely to be perceived as helpful during this phase, be readily accepted by community members, and develop a foundation from which to provide assistance in the difficult phases ahead.

Commonly, a *disillusionment* phase follows this honeymoon. Disillusionment is marked by feelings of disappointment and resentment, as disaster assistance agencies and volunteer groups begin to withdraw from the community. The magnitude of individual and collective loss may be realized. Hopes for aid and restoration of the pre-disaster emotional and physical environment may not be fully met. Individual and community economic losses may add to an already stressed population. The sense of community is weakened as individuals focus on their personal needs or the extent to which these needs are still unmet. Resentment may surface as survivors receive unequal compensation for what they perceive to be equal or similar damage and issues of social justice emerge. In addition, neighboring communities less impacted by the disaster often return to life as usual, which can discourage and alienate those who were more severely impacted. During this phase, survivors may become physically exhausted due to the enormity of multiple demands, including financial pressures, family discord, bureaucratic hassles, and a lack of free time for recreation or self care. Long-term displacement and loss of familiar home and surroundings can be a particularly challenging stressor. Health problems and exacerbation of preexisting conditions emerge due to ongoing stress and fatigue. Governments can anticipate difficulties as disaster assistance begins to diminish and provide survivors with anticipatory guidance in advance. Unity among formal and informal community leaders in anticipating and communicating upcoming changes or transitions is helpful. The disaster "anniversary" experience may occur during this phase and can be a critical opportunity for leaders to support disaster victims. This can be done through memorializing and creating meaning from the devastating events that have occurred. Failure to effectively address a disaster anniversary experience can further demoralize survivors, enhance feelings of frustration, and exacerbate underlying psychosocial distress.

The final phase often seen is that of *reconstruction* which may last for years. Survivors attempt to rebuild their lives and social and occupational identities by returning to old jobs or finding new work. They will also rebuild homes and resume or establish new social ties and emotional support systems. For some survivors, this phase is marked by an acceptance of new circumstances, including the changes and losses that have occurred. Individuals who are able to find meaning may experience posttraumatic growth, ultimately emerging from the disaster event with an increased sense of personal strength.

Individuals may progress through these phases at variable rates. Persons involved in planning and delivering care to victims of disasters may observe that individuals show emotional symptoms over different timelines in response to the same event. Moreover, depending on the severity of the trauma, available resources, coping skills, as well as subsequent disasters or other types of setbacks, individuals may develop persistent symptoms requiring prolonged treatment. Anger

may be directed at caregivers and community leaders if these important factors are not sufficiently accounted for in medical and psychosocial response plans.

8.4 Managing Individuals and Populations Concerned About Nuclear Exposure

Because of the unique nature of a nuclear exposure, it is important for healthcare personnel to understand how radiation impacts the human body, basic facets of triage, early medical interventions, and the psychosocial aspects of how individuals respond to nuclear events.

8.4.1 Medical Aspects of Nuclear Exposure

A nuclear event can result in external as well as internal exposure to radioactive material. Material on clothing can be removed by undressing or showering with water. Radioactive material that has entered the body is much harder to remove [32]. Unlike chemical and biological exposure, a radiation event is not immediately life-threatening unless there are other injuries (such as trauma or burns) or the dose received is in a range that is always fatal [33]. In most situations, a person injured or contaminated by radiation poses no significant risk to healthcare personnel. An exception would be if a radiation source was planted and concealed on a patient and the treatment provider has sufficient contact to receive a large dose [32].

Early radiation signs and symptoms can be nonspecific and often resemble those of a viral illness, usually starting within 72 h of an acute exposure. These signs and symptoms include fever, headache, nausea, vomiting, diarrhea, abdominal pain, loss of appetite, fatigue, weakness, rapid heart rate, swelling of glands in the face, and reddening of the skin. Many of these are nonspecific and resemble those accompanying common viral illnesses. As a result, small-scale or unknown radiation exposures often result in patients being misdiagnosed with a viral illness or other self-limiting illness [32, 33]. In a large-scale nuclear incident, healthcare personnel should maintain a much lower threshold for initiating a full evaluation for possible radiation injury. In addition, some of the signs and symptoms of early radiation exposure may be confused with those that accompany distress reactions and mental disorders.

All radiation exposure is thought to increase the lifetime risk of cancer with no set point at which cancer begins. This "linear, no threshold" theory drives the occupational exposure standard of keeping radiation exposure "as low as reasonably achievable" (or ALARA). Whether "linear, no threshold" is valid is the subject of much debate. Some areas of the world have very high background radiation levels with no increase in the cancer incidence [32].

8.4.2 Assessment of Those Presenting with Concerns for Nuclear Exposure

Individuals typically experience varying levels of radiation exposure and at different periods of time after a nuclear incident. Some will have received no exposure. Others may have received a dose of radiation that is only associated with late effects such as cancer risk or cataract development. If there has been a high-dose exposure, acute illness or death can follow after only a few days to weeks. These individuals may also have adverse psychosocial responses in addition to signs and symptoms of radiation exposure [3].

Triage of large groups of people may be necessary [34]. This starts with broadly delivered, repeated, and updated public health messages from a trusted and credible source or officials about who should seek care. The objective is to categorize exposure or contamination risk so that individuals can take appropriate action. The message should state the geographic boundaries within which individuals could be at risk of radiation injury. Individuals beyond such boundaries can be informed to avoid seeking medical attention for radiation concerns alone, unless other medical emergencies occur. Those contaminated or very close to the event will need a medical assessment of radiation dose received, since early treatment of radiation injury enhances long-term survival unless the dose was very high [33]. When thorough evaluation reveals no evidence of exposure, individuals should be promptly informed of this fact to help decrease worry and anxiety [35].

Competent and confident medical response, triage, and assessment will likely decrease the incidence and severity of adverse psychosocial effects [29]. When individuals express concerns about radiation exposure, it is important to assure them that their concerns are being taken seriously. When people do not feel their concerns are being taken seriously, they may exaggerate symptoms or return frequently for evaluations, placing increased demands on already limited healthcare resources.

8.4.3 Factors Affecting Presentations for Medical Treatment

For unknown exposures, clinical symptoms, including distress and worry, will drive presentations for care, either within the initial phase of illness (first 72 h) or after effects of radiation have manifested as an illness. If there are few cases, or if the cases present at different times to different facilities, determining the cause of the illness may prove difficult.

For known exposures involving relatively few people, medical evaluation may be within the capacity of many community hospitals. However, for a larger-scale nuclear exposure, the number seeking care may be large, and the health issues more complicated. When nuclear exposure is accompanied by explosion or fire, victims may seek care for life-threatening trauma or burns. In a densely populated area,

potentially thousands of people may need triage. Life-threatening non-radiation injuries should be addressed first. When radiation injury alone becomes acutely life-threatening, the dose will have been too high to allow survival, even with intensive treatment [33].

8.4.4 Common Psychosocial Responses Following Exposure

Large-scale nuclear exposure events result in a range of psychosocial responses that are similar to other disasters [36] including somatic concerns and belief that they are contaminated or exposed even when little data may support the concern. Although many people will be resilient, some will experience a range of transient and mild stress reactions. Some victims of nuclear exposure will experience more long-term and disabling psychological symptoms [37, 38]. The reestablishment of societal order and organization with the passage of time may help; and early focus on normal and adaptive functioning may speed recovery.

Emotional symptoms may include shock, anger, despair, emotional numbing, terror, guilt, grief or sadness, irritability, helplessness, loss of interest in activities, and dissociation [39]. Cognitive effects may include impaired concentration and decision-making, memory problems, disbelief, confusion, distorted thinking, decreased self-esteem and motivation, self-blame, intrusive thoughts and memories, and worry. Social and interpersonal impairment, alienation, withdrawal, conflict, work problems, and educational impairment may result. Somatic complaints may include fatigue, disturbed sleep, headaches and other pain symptoms, and gastrointestinal problems [32, 40]. When these symptoms have no detectable medical cause, they are often referred to as medically unexplained physical symptoms (MUPS). These can be very resistant to intervention [41].

8.5 Community Impact and Responses

Much of our knowledge about community responses comes from populations exposed to natural disasters. As described earlier, response to a natural disaster often follows a pattern of initial social support mobilization followed by deterioration in social support [3]. However, in nuclear events, patterns change. The honeymoon phase can be diminished or absent as outside groups may be reluctant to respond to affected areas out of fear of exposure or contamination [42]. In contrast to a natural disaster, the expectation of accountability or blaming will be stronger following nuclear accidents given the inherent human factors involved in causing the event.

8.5.1 Evacuations and Community Disruption

Following a large nuclear incident, entire communities are often evacuated. The Chernobyl accident resulted in more than 200,000 people permanently relocated. In Fukushima, approximately 380,000 individuals were relocated following the nuclear disaster [36]. Individuals who are immediately displaced may not achieve permanent housing for several years, and families and communities will live with uncertainty for a long time. Following nuclear disasters, entire communities may cease to exist, and their members are scattered among evacuation centers with similarly displaced and highly stressed groups of evacuees. This decreases the ability of victims to reduce stress by seeking connections with community members. Groups forced to cohabitate in relocation centers may have preexisting social or cultural conflicts, and new communities who do not know each other often have fears of safety. Ten years after Chernobyl, there was a prolonged tendency toward uncertainty and mistrust of government, even in communities not heavily contaminated, and tendencies to attribute symptoms and illness to radiation exposure or contamination [43].

8.5.2 Stigma Surrounding Individuals with Nuclear Exposure

Unlike natural disasters, victims of nuclear events are often stigmatized in many ways. The most common reason victims face stigma is the fear that they bring nuclear contamination with them out of the evacuation zone. This occurred to evacuees following both the Chernobyl and Fukushima nuclear disasters. In an attempt to reduce stigma following the Goiania disaster, more than 8000 people applied for certification from the Brazilian government asserting that they were free of contamination [44]. They did so in order to overcome discrimination in boarding commercial flights and securing hotel reservations. Similar to past disease epidemics [6], families of victims of nuclear events find it difficult to bury their dead following the event due to fear of radiation from the body or contamination of soil and groundwater. Following Goiania, protesters blocked the burial of victims in the local cemetery [44]. Those displaced from their homes and neighborhoods also find themselves competing for existing resources, community services, and employment. While struggling with the loss of their homes and communities, displaced persons have been housed in temporary structures or must compete for available permanent housing. All familiar community services previously available are no longer accessible, and those displaced must either attempt to establish new services or compete for existing services in their new communities.

It is clear that anxiety concerning radiation exposure and its consequences can have a significant and lasting effect on communities and may persist for years, often generations beyond the event. Adults born 25 years after the Chernobyl incident

still showed significant anxiety over effects of radiation exposure [45]. Research on communities affected by contamination disasters indicates that families have difficulty perceiving homes and communities as safe or desirable, leaving them disconnected from familiar surroundings and resources [46]. The anxiety for victims of nuclear disasters is often compounded by distrust of and hostility toward government and scientific experts. In technological disasters, the distress over loss is increased by the knowledge that the cause is man-made. In the case of Three Mile Island, distrust of authorities was very high after the accident and remained high even after other measures of distress had normalized [47].

Nuclear events impact individual physical and mental health, family and community cohesion, and even the culture of a nation. These impacts may last beyond individual lifetimes.

8.6 Leadership Communication About Disaster Exposure and the Impact on Psychological Health of a Population

Effective leadership is critical to all disaster preparedness, response, and recovery. The positive impact of successful leadership and the negative effects of inadequate and failed leadership are well documented [48–52]. It is also a consistent theme noted in popular nonfiction literature concerning extraordinary events [53–55].

Effective leadership in disasters is a complex task. It requires an array of skills demanded by few other roles. An effective leader in this context needs to integrate and balance the science of the disaster event, complex and changing real-world response, political realities, and compassion. Leaders must be able to communicate effectively within their own organizations, across organizational boundaries, and with a wide variety of diverse elements of the population [51]. The ability to communicative effectively in disaster situations of all types is a key characteristic of successful leaders.

8.6.1 Risk Communication During and After Exposure

The importance of effective communications before, during, and following disasters and other extreme events is well documented [56–58]. Effective communication is actually an important and helpful behavioral health intervention. "Better than any medication we know, information treats anxiety in a crisis" [59]. Communications inform people in ways that influence potentially life-changing behavioral choices. Do I evacuate or shelter in place? Should I go to get my child at school or go to a shelter? Effective communication can promote self-efficacy and provide anticipatory guidance to assist in positive outcomes. It can also manage hyperarousal to

reduce stress-related cognitive problems. Leaders, policy makers, and disaster responders can gain much from collaboration with communications experts.

Effective communication, related to health factors in disaster and emergencies, has an evidence base, and helpful methods for implementation are available [58, 60]. It is important that leaders understand the complexity of effective risk and crisis communication. Leaders can help their communities by incorporating communication scenarios into disaster planning activities. Anticipating what information will be needed to prepare instructional messages before a disaster event, such as a nuclear exposure, can be of value to communities.

It can be challenging to communicate effectively during a disaster or other public health emergency. Some of the strategies may not seem intuitive. For example, many communication strategies are based on changes in how people think and process information during times of stress. Because of these changes, it is important to repeat messages, limit the number of messages presented, and reduce the reading level at which messages are crafted. It is helpful to provide directions and instructions that are simple and specific. Other strategies (See Table 8.3) are more general such as the importance of telling the truth and avoiding false assurances. When information is unavailable or unknown, saying, "I don't know" can build trust and credibility. When this occurs, it is also helpful to commit to finding out the answers and then doing so in a timely manner.

In preparing and implementing crisis communication strategies, leaders should avoid relying too heavily on the written and spoken word. A great deal is communicated, quite powerfully, through behavior that is witnessed, symbols and rituals that promote shared goals, and photographs as well as video images. Communication can be enhanced by understanding the impact of these alternate forms of communication and linking them appropriately and creatively with more traditional written and spoken word. Social media has become an extremely important and impacting mechanism of communication with important behavioral health implications and potential.

Leaders and experts who are not traditionally considered part of the medical, public health, or behavioral health leadership can be enlisted to further behavioral health goals. Consider, for example, the earth sciences, especially seismology. In the aftermath of earthquakes, seismologists nearly always appear in the media.

Table 8.3 Elements of effective risk communication during and after disasters

Repeat important messages
Limit the total number of messages presented
Lower the reading level at which messages are crafted
Provide directions and instructions that are simple and specific
Tell the truth
Avoid false assurances
Say "I don't know" when information is unavailable or unknown
Commit to finding answers and do so in a timely manner

What they say, and how they say it, can have a powerful psychosocial impact [61] as well as providing expert information about earthquakes themselves.

There are special challenges in appropriately addressing risk and crisis communication when nuclear events are involved. Important lessons have been learned concerning communications shortcomings in both Fukushima [62–64] and Chernobyl [65]. In both cases, there were significant risk and crisis communication shortcomings that impacted risk perception. This resulted in a suboptimal official and public response and increased adverse short- and long-term psychosocial consequences.

8.6.2 Misunderstanding of Panic and Impact on Leadership Decision-Making

The term *panic* is widely used in common speech and in the media. It is used to cover a broad, yet poorly specified range of both emotion and behavior. The wide and unscientific use of the term has led to a number of false and, ultimately, dangerous assumptions. Panic – meaning disorganized behavior – is not common in disasters. Common misperceptions have resulted in disaster and emergency preparedness and response based on misunderstanding rather than real experience and evidence. There is a common misconception that panic is widespread and easily triggered [66, 67]. An assumption that panic will often and easily occur can lead to poor preparedness and response planning and execution [68]. Leaders should know about the nature and dynamics of community fear, concern, and distress (and other far more common anxiety-related consequences) and prepare and respond accordingly. Effective leaders communicate accurate information effectively. When this occurs, all benefit. Providing accurate information and assurances consistent with the principles of evidence-based risk and crisis communication enhances the perception of leaders by the public. It also promotes appropriate pro-social behaviors in the impacted population.

8.7 Conclusion

Disasters produce a range of psychosocial responses including distress reactions, health risk behaviors, and mental disorders. In many cases, fear of nuclear exposure causes a range of psychological and physical symptoms that exceed actual health risk. Community responsiveness, cohesion, communication, and leadership all play an important role in enhancing adaptive behaviors and emotional recovery after a nuclear event. Governments and community leaders that understand the psychosocial nature of disaster phases can anticipate needs and plan accordingly. Training and education for all personnel who write policy, plan and coordinate activities, or

directly respond to disasters, allow for a better understanding of unique and diverse disaster-specific, psychosocial issues [69].

There is growing worldwide recognition that psychosocial issues are an integral part of health, specifically disaster preparedness and response. Recommendations made to the United Nations in support of the Hyogo Framework for Action 2, which provides guidance to the international community on disaster risk management, observed that a fundamental aspect of managing the well-being of a population following a disaster is to ensure that psychosocial issues are treated as an integral part of healthcare [70].

The visible nature of physical injuries often leads those managing a disaster to prioritize these and can result in delayed care or a failure to identify the significant psychosocial effects of the event that invariably occur. Historical experience of nuclear exposures demonstrate that psychosocial effects are generally far more common and experienced over a much longer period of time than observable physical injuries or associated medical conditions. Ensuring that psychosocial concerns are anticipated in response to a nuclear disaster allows governments, community leaders, and healthcare personnel to more effectively prepare for and respond to the event, which decreases the negative impact on an affected population.

Timely and accurate ongoing communication from credible, trusted sources is an essential aspect of managing disasters and particularly important in response to nuclear accidents. An appreciation of the unique cultural aspects and variations in communication style will enhance the ability of leaders to effectively inform and partner with all those affected by a nuclear event.

References

1. Kessler RC, Angermeyer M, Anthony JC, de Graaf R, Demyttenaere K, Gasquet I, de Girolamo G, Gluzman S, Gureje O, Haro JM, Kawakami N, Karam A, Levinson D, Medina-Mora ME, Oakley-Brown MA, Posada-Villa J, Stein DJ, Tsang CHA, Aguilar-Gaxiola S, Alonso J, Lee S, Heeringa S, Pennell B, Berglund P, Gruber MJ, Petukhova M, Chatterji S, Ustun TB. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative. World Psychiatry. 2007;6:168–76.
2. Center for the Study of Traumatic Stress. http://centerforthestudyoftraumaticstress.org (2006). Accessed 1 Dec 2014.
3. Ursano R, Fullerton C, Weisaeth L, Raphael B. Textbook of disaster psychiatry. 1st ed. Cambridge: Cambridge University Press; 2007.
4. Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty K. 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. Psychiatry. 2002; 65:207–39.
5. Panzer AM, Butler AS, Goldfrank LR. Preparing for the psychological consequences of terrorism: a public health strategy. Washington, DC: The National Academic Press; 2003.
6. Ursano RJ, Norwood AE, Fullerton CS. Bioterrorism: psychological and public health interventions. 1st ed. Cambridge: Cambridge University Press; 2004.

7. Mellman TA, Kulick-Bell R, Ashlock LE, Nolan B. Sleep events among veterans with combat-related posttraumatic stress disorder. Am J Psychiatry. 1995;152(1):110–5.
8. Rundell JF, Ursano RJ. Psychiatric responses to trauma. In: Ursano RJ, Norwood AE, editors. Emotional aftermath of the Persian Gulf war veterans, communities, and nations. Washington, DC: American Psychiatric Press; 1996. p. 43–81.
9. Ford CV. Somatic symptoms, somatization, and traumatic stress: an overview. Nord J Psychiatry. 1997;51(1):5–13.
10. Vlahov D, Galea S, Resnick H, Ahern J, Boscarino JA, Bucuvalas M, Gold J, Kilpatrick D. Increased use of cigarettes, alcohol, and marijuana among Manhattan, New York, residents after the September 11 terrorist attacks. Am J Epidemiol. 2002;155:988–96.
11. Rubin GJ, Brewin CR, Greenberg N, Simpson J, Wessely S. Psychological and behavioural reactions to the bombings in London on 7 July 2005: cross sectional survey of a representative sample of Londoners. BMJ. 2005. doi:10.1136/bmj.38583.728484.3A.
12. Harville EW, Taylor CA, Tesfai H, Xiong X, Buekens P. Experience of Hurricane Katrina and reported intimated partner violence. J Interpers Violence. 2011;26:833–45.
13. Ursano RJ, Goldenberg M, Zhang L, Carlton J, Fullerton CS, Li H, Johnson L, Benedek D. Posttraumatic stress disorder and traumatic stress: from bench to bedside, from war to disaster. Ann N Y Acad Sci. 2010;1208:72–81.
14. Goldmann E, Galea S. Mental health consequences of disasters. Annu Rev Public Health. 2014;35:169–83.
15. Fullerton CS, Ursano RJ. Posttraumatic stress disorder: acute and long term responses to trauma and disaster. Washington, DC: American Psychiatric Press; 1997.
16. Miguel-Tobal JJ, Cano-Vindel A, Gonzalez-Ordi H, Iruarrizaga I, Rudenstine S, Vlahov D, Galea S. PTSD and depression after the Madrid March 11 train bombings. J Trauma Stress. 2006;19:69–80.
17. North CS, Tivis L, McMillen JC, Pfefferbaum B, Spitznagel EL, Cox J, Nixon S, Bunch KP, Smith EM. Psychiatric disorders in rescue workers after the Oklahoma City bombing. Am J Psychiatry. 2002;159:857–9.
18. Kolves K, Kolves KE, De Leo D. Natural disasters and suicidal behavior: a systematic literature review. J Affect Disord. 2013;146:1–14.
19. Havenaar JM, Rumyantzeva GM, van den Brink W. Long-term mental health effects of the Chernobyl disaster: an epidemiologic survey in two former Soviet regions. Am J Psychiatry. 1997;154:1605–7.
20. Lifton RJ. Death in life survivors of Hiroshima. New York: Random House; 1967.
21. Houts PS, Miller RW, Tokuhata GK. Health-related behavioral impacts of the Three Mile Island nuclear incident, Parts I, II, III. Harrisburg: Department of Health; 1981.
22. Prince-Embury S, Rooney JF. Psychological symptoms of residents in the aftermath of the Three Mile Island nuclear accident and restart. J Soc Psychol. 1988;128:779–90.
23. Baum A, Gatchel RJ, Schaeffer MA. Emotional, behavioral, and physiological effects of chronic stress at Three Mile Island. J Consult Clin Psychol. 1983;51:565–72.
24. Ginzburgh HM. The psychological consequences of the Chernobyl accident—findings from the International Atomic Energy Agency study. Public Health Rep. 1993;108:184–92.
25. Bromet EJ, Havenaar JM, Guey LT. A 25 year retrospective review of the psychological consequences of the Chernobyl accident. Clin Oncol. 2011;23:297–305.
26. Havenaar JM. After Chernobyl: psychological factors affecting health after a nuclear disaster. PhD Dissertation, Universiteit Utrecht; 1996.
27. Yamashita J, Shigemura J. The Great East Japan earthquake, tsunami, and Fukushima Daiichi Nuclear Power Plant accident. Psychiatr Clin North Am. 2013;36:351–70.
28. Orui M, Harada S, Hayashi M. Changes in suicide rates in disaster-stricken areas following the Great East Japan Earthquake and their effect on economic factors: an ecological study. Environ Health Prev Med. 2014;19:459–66.
29. Matsuoka Y, Nishi D, Nakaya N, Sone T, Noguchi H, Hamazaki K, Hamazaki T, Koido Y. Concern over radiation exposure and psychological distress among rescue workers following the Great East Japan Earthquake. BMC Public Health. 2012;12:249–53.

30. McCutchen SR, McGeary M, Benjamin GC. Assessing medical preparedness to respond to a terrorist nuclear event: workshop report. Washington, DC: The National Academic Press; 2009.
31. Substance Abuse and Mental Health Services Administration: Disaster Technical Assistance Center. http://www.samhsa.gov/dtac (2015). Accessed 2 Jan 2015.
32. Mickelson AB (senior editor). Medical consequences of radiological and nuclear weapons. Borden Institute, Office of the Surgeon General: Falls Church, VA 2012.
33. Goans RE. Medical management of radiological casualties. 3rd ed. Canada: QuickSeries; 2009.
34. Engle CC, Locke S, Reissman DB, DeMartino R, Kutz I, McDonald M, Barsky AJ. Terrorism, trauma, and mass casualty triage: how might we solve the latest mind-body problem? Biosecur Bioterror. 2007;5:155–63.
35. Blakely WF. Early biodosimetry response: recommendations for mass casualty radiation accidents and terrorism. In: 12th International Congress of the International Radiation Protection Association. 2008. http://www.irpa12.org.ar/PDF/RC/RC_12_fullpaper.pdf. Access 24 Dec 2014.
36. Bromet EJ. Emotional consequences of nuclear power plant disasters. Health Phys. 2014; 106:206–10.
37. Ursano RJ, Norwood AE, editors. Trauma and disaster responses and management. Washington, DC: American Psychiatric Publishing; 2003.
38. Vyner HM. The psychological dimensions of health care for patients exposed to radiation and the other invisible environmental contaminants. Soc Sci Med. 1988;27:1097–103.
39. Kukihara H, Yamawaki N, Uchiyama K, Arai S, Horikawa E. Trauma, depression, and resilience of earthquake/tsunami/nuclear disaster survivors of Hirono, Fukushima, Japan. Psychiatry Clin Neurosci. 2014;68:524–33.
40. Collins DL. Behavioral differences of irradiated persons associated with the Kyshtym, Chelyabinsk, and Chernobyl nuclear accidents. Mil Med. 1992;157:548–52.
41. Engel CC, Adkins JA, Cowan DN. Caring for medically unexplained physical symptoms after toxic environmental exposures: effects of contested causation. Environ Health Perspect. 2002; 110 Suppl 4:641–7.
42. McCormick LC, Tajeu GS, Klapow J. Mental health consequences of chemical and radiologic emergencies: a systematic review. Emerg Med Clin North Am. 2015;33:197–211.
43. Koscheyev VS, Leon GR, Gourine AV, Gourine VN. The psychosocial aftermath of the Chernobyl disaster in an area of relatively low contamination. Prehosp Disaster Med. 1997; 12:41–6.
44. Petterson JS. Perception vs. reality of radiological impact: the Goiania model. Nucl News. 1988;3:84–90.
45. Masunaga T, Kozlovsky A, Lyzikov A, Takamura N, Yamashit S. Mental health status among younger generation around Chernobyl. AMS. 2013;9:1114–6.
46. Kaniasty K, Norris FH. Social support in the aftermath of disasters, catastrophes, and acts of terrorism: altruistic, overwhelmed, uncertain, antagonistic, and patriotic communities. In: Ursano RJ, Norwood AE, Fullerton CS, editors. Bioterrorism: psychological and public health interventions. New York: Cambridge University Press; 2004. p. xii, 363 p.
47. Dohrenwend BP. Psychological implications of nuclear accidents: the case of Three Mile Island. Bull N Y Acad Med. 1983;59:1060–76.
48. McCarroll JE, Vineburgh NT, Ursano RJ. Disaster, disease and distress: resources to promote psychological health and resilience in military and civilian communities. 2013. www.CSTSOnline.org. Accessed 31 Dec 2014.
49. Flynn BW. Community and organizational responses to disaster. In: Kaufman R, Edwards R, Mirsky J, Avgar A, editors. Crisis as an opportunity: organizational and community responses to disasters. Lanham: University Press of America; 2011. p. 1–15.
50. Flynn BW, Lane CF. Integrating organizational and behavioral health principles to promote resilience in extreme events. In: Cooper C, Burke R, editors. International terrorism and threats

to security: managerial and organizational challenges. Cheltenham: Edward Elgar Publishing; 2008. p. 185–218.
51. Marcus LJ, Dorn BC, Henderson JM. Meta-leadership and national emergency preparedness: a model to build government connectivity. Biosecur Bioterror. 2006;4:128–34.
52. Bushnell P. Leadership in the wake of disaster–salient lessons from the Nairobi, Kenya US Embassy bombing, 1998. In: Ursano RJ, Fullerton CS, Norwood A, editors. Terrorism and disaster: individual and community mental health. Cambridge: Cambridge University Press; 2003. p. 31–40.
53. Fink S. Five days at Memorial: life and death in a storm-ravaged hospital. New York: Crown Publishers; 2013.
54. Ripley A. The unthinkable: who survives when disaster strikes. New York: Three River Press; 2008.
55. Giuliani R. Leadership. New York: Hyperion; 2002.
56. Meredith LS, Shugarman LR, Chandra A, Taylor SL, Howard S, Beckjord EB, Parker AM, Tanielian T. Analysis of risk communication strategies and approaches with at-risk populations to enhance emergency preparedness, response, and recovery – final report, Rand working paper. 2008. http://www.rand.org/pubs/working_papers/WR598.html. Accessed 31 Dec 2014.
57. Vineburgh NT, Benedek DM, Fullerton CS, Gifford RK, Ursano RJ. Workplace resources for crisis management: implications for public-private sector planning, policy and response to disasters. J Public Health Policy. 2008;3:378–88.
58. Covello VT. Best practices in public health risk and crisis communication. J Health Commun. 2003;8 Suppl 1:5–8.
59. Saathoff G, Everly Jr GS. Psychological challenges of bioterror: containing contagion. Int J Emerg Ment Health. 2002;4:245–52.
60. Covello VT. Risk communication, radiation, and radiological emergencies: strategies, tools, and techniques. Health Phys. 2011;101:511–30.
61. Lamontagne MM, Flynn BW. Communications in the aftermath of a major earthquake: bringing science to citizens to promote recovery. Seismol Res Lett. 2014;85:561–5.
62. Ng KH, Lean ML. The Fukushima nuclear crisis reemphasizes the need for improved risk communications and better use of social media. Health Phys. 2012;103:307–10.
63. Robertson AG, Pengilley A. Fukushima nuclear incident: the challenges of risk communication. Asia Pac J Publ Health. 2012;24:689–96.
64. Perko T. Importance of risk communication during and after a nuclear accident. Integr Environ Assess Manag. 2011;7:388–92.
65. Van Der Pligt J, Midden CJH. Chernobyl: four years later: attitudes, risk management and communication. J Environ Psychol. 1990;10:91–9.
66. Ursano RJ, Fullerton CS, Norwood AE, Holloway HC. Weapons of mass destruction and pandemics: global disasters with mass destruction and mass disruption. In: Ursano RJ, Fullerton CS, Weinsaeth L, Raphael B, editors. Textbook of disaster psychiatry. Cambridge: Cambridge University Press; 2007. p. 247–64.
67. Aguirre BE. Emergency evacuations, panic and social psychology. Psychiatry J Interpers Biol Process. 2005;68:121–9.
68. Mawson AR. Understanding mass panic and other collective responses to threat and disaster. Psychiatry. 2005;68:95–113.
69. Flynn BW, Morganstein JC. Curriculum recommendations for disaster health professionals: disaster behavioral health. Center for the Study of Traumatic Stress. 2014. ncdmph.usuhs.edu/Documents/BehavioralHealthRecommendations-201401.pdf. Accessed 10 Jan 2015.
70. Tomita H, Ursano RJ. Breakout session 3 summary: psychosocial/mental health concerns and building community resilience. Disaster Med Public Health Prep. 2014;8:363–5.

Chapter 9
Psychosocial Challenges of the Fukushima Nuclear Plant Workers

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Abstract The Great East Japan Earthquake and the Fukushima Daiichi nuclear disaster posed major psychological challenges to the nuclear plant workers. The workers had experienced multiple and complex traumatic exposures or "stressors," including a series of workplace chaos (e.g., plant explosion, nuclear meltdown, and radiation exposure), local victim and grief experiences, and extensive societal criticism owing to public criticism toward the electric company. Studies have shown experience of such discrimination and stigma to be a key element to the workers' mental health. As time passed by, these experiences have led to a wide range of mental/behavioral consequences, along with increase in number of retirees and personnel shortages. In the case of Fukushima, the mental health support system was not originally developed as a top-down program, and it took months to launch an official project. In order to provide prompt and comprehensive support in future events, pre-disaster planning and education will be important in designing health-care delivery and surveillance programs. The decommissioning process is

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expected to take decades, and it is important that the workers maintain their physical and mental health. A long-term health support system will be a key element to achieve this goal. Collaborations with the media may be helpful in order to improve their mental health by reducing stigma and enhancing social recognition and respect of the workers.

Keywords Disaster mental health • Occupational mental health • Stigma • Discrimination • Public health

9.1 Condition of Workers During the Accident and Its Immediate Aftermath

On March 11, 2011, at 2:46 pm local time, the Great East Japan Earthquake shook the islands of Japan. After the mega-earthquake, waves of tsunamis eventually followed, subsequently leading to a series of accidents at the Tokyo Electric Power Company (TEPCO) Fukushima Daiichi Nuclear Power Plant (henceforth referred to as "Daiichi") accident. Daiichi was severely damaged by the tsunamis reaching as high as 14–15 m [1]. Electric power was completely lost, the reactors became uncontrollable, and hydrogen explosions followed at four of the six reactors. Accidents at reactor nos. 1, 2, and 3 escalated to nuclear meltdown, release of radioactive materials into the environment, mandatory evacuation of the surrounding region, and radiation health concerns among the affected people. TEPCO Fukushima Daini Nuclear Power Plant (henceforth referred to as "Daini"), which was located 12 km south of Daiichi, was also damaged by the earthquake and the tsunamis as high as 7 m. Their power supply remained intact, and thus nuclear meltdown due to decay heat was avoided.

Approximately 11,000 workers, including about 1850 TEPCO full-time employees, had been working for the Daiichi and Daini plants at the time of the disaster. About 90 % of the workers were residents of Fukushima [2]. These workers, along with external support personnel, literally risked their lives to respond to this horrific disaster. Fortunately, no one reported acute radiation health effects from the accident; however, two young Daiichi TEPCO workers and a Daini contractor died from the tsunami waves. Ms. Tomoko Yamamoto, a Daini nurse, confessed in her interview as follows:

> When the first explosion occurred on March 12, we had to respond to numbers of casualties. . . . They had high radiation exposure. . . . They had to take off their clothes until their radiation level had decreased. Some of them had high radiation level on their hair even though they had wiped them. So they had to use hats or towels to cover their heads, and for some, we cut their hair. We were out of water so we could not wash them.
>
> The Daiichi employees had worked without rest or sleep, with only water and biscuits. Some of them blacked out on their way (from Daiichi) to the treatment room. One worker did not sleep for two days and lost consciousness with his protective mask on. We had to give intravenous fluids to five exhausted workers at the same time. [3]

Table 9.1 Complex stressors of Fukushima nuclear plant workers

Work-related experience
Earthquakes and tsunamis
Plant explosions
Radiation exposure
Extreme overwork
Victim experience
Mandatory evacuation
Property loss
Family dispersion
Grief experience
Colleagues
Families
Friends
Social backlash
Public criticism
Discrimination
Harassments
Guilt as "perpetrators"

Dr. Tanigawa (coauthor) has been a part-time occupational physician of the Daiichi and Daini since 1991. It was not until April 16, 2011, however, when he was approved to make his first site visit since the accident occurred. Upon this visit, he directly encountered the immense and complex stressors that these workers had been facing. The stressors fell into four main categories (Table 9.1). Firstly, their experience of trauma at the workplace was overwhelming. Many of them were dealing with earthquakes, tsunamis, plant explosions, and possible radiation exposure. A substantial number of these workers said they literally thought they were going to die; in a newspaper interview, Dr. Tanigawa reported, "the workers are in the front line of a battlefield" [4]. The late Mr. Masao Yoshida, the Daiichi director during the disaster, later reflected, "I was thinking about faces of people who will die with me" [5]. Secondly, as the vast majority of the workers were local people, their personal lives had also been substantially affected by the disaster through property losses or evacuation. Thirdly, the workers had to overcome their own grief experiences resulting from the disaster, in particular, the loss of their loved ones, their families, and their colleagues. Lastly, the workers were facing severe discrimination and bashing from the public. As reported in the *Tokyo Shimbun*, "when a worker took their day off and went to evacuation shelters to see his family, evacuees had their finger and said "*Tohden*" (TEPCO) and made slanderous statements to him" [6].

After the disaster, the Daiichi workers had to spend their time off within the Daiichi building or in the Daini gymnasium. Some workers had to respond to the continuous recovery efforts; some employees had no time to return to their home between shifts; other workers had lost their homes and were unable to find a new place to live. They were working continuously, slept on floors or chairs, and were

unable to use showers and had to share their linens. The workers had limited variety of food and had been eating canned/vacuum-packed foods for over a month.

Since the disaster, I had imagined the struggles of the workers and had hoped that someone, probably from the government or the electric company, must have been providing ample mental health care to the hardworking heroes. This was not the case, however, and the mental health support system had yet to be implemented. In order to provide mental health support to these workers, Dr. Tanigawa and I agreed to collaborate; on May 6, 2011, I became the first mental health professional to enter the Fukushima plant after the disaster [7].

Upon speaking with the workers, we learnt about their stressors. A significant majority of them said, "I thought I was going to die" and showed a wide variety of posttraumatic stress responses including intrusive flashbacks, avoidance of their plant, hypervigilance toward aftershocks, fear of irradiation, and dissociative episodes. Grief was a major issue in their workplace along with their personal lives. The workers were severely discriminated against and harassed by the local residents. One man said that his neighbors saw him in TEPCO uniform and verbally abused him. Another worker reported that a real estate company refused to rent his family a house; another employee added that his neighbor insulted him for parking his car near the neighbor's home.

With knowledge of these experiences, we conducted a study 2–3 months after the disaster examining the mental health status of 1495 full-time TEPCO workers (Daiichi, $n = 885$; Daini, $n = 610$). The data showed the workers had experienced essentially these four stressors. About half ($n = 470$, 53.1 %) of the Daiichi and a quarter ($n = 153$, 25.1 %) of the Daini workers had life-threatening experiences; about two-thirds of the whole group ($n = 999$, 66.8 %) had their homes evacuated. Two to three out of ten workers (Daiichi, $n = 378$, 25.3 %; Daini, $n = 117$, 19.2 %) had high posttraumatic stress responses (PTSR; ≥ 25 on the Japanese version of the Impact of Event Scale-Revised [8]). In multivariate analysis, those with discrimination/slur experiences, compared with those without, were two to three times more likely to have high PTSR (Daiichi: adjusted odds ratio, 2.17; 95 % confidence interval, 1.43–3.30, $p < 0.001$; vs. Daini: adjusted odds ratio, 2.70; 95 % confidence interval, 1.47–4.96, $p = 0.001$) [9].

An in-depth study [10] examined the pathway from nuclear disaster exposures, distress during and immediately after the event (peritraumatic distress; PD), to posttraumatic stress to PTSR. For both Daiichi and Daini groups, PTSR was highly associated with PD (Daiichi: adjusted β, 0.66; $p < 0.001$; vs. Daini: adjusted β, 0.67; $p < 0.001$). While most disaster-related variables were likely to be associated with PD (and not with PTSR), discrimination/slur experience was associated with both PD and PTSR (Daiichi: adjusted β, 0.11; $p < 0.001$; vs. Daini, adjusted β, 0.09; $p = 0.005$).

9.2 Condition of Workers During the Recovery Phase

The nuclear plant decommissioning process is expected to take decades, and the workers face increasing challenges to stabilize the situation. However, ongoing cleanup problems, such as leaks of irradiated water, put the workers in a tough position. Adverse public responses to the nuclear plant workers include, but is not limited to, scapegoating, discrimination, and stigmatization; "the public turned hostile toward the nuclear industry and TEPCO, or "Tohden" in Japanese, became a dirty word [11]." This social dynamic has led to self-stigmatization for these workers, and they try to mask their social identity to the public to avoid stigma [12]. The workers typically say, "I don't want my neighbors to see my TEPCO uniform," "in community activities, I can't say who I work for," or "I can't write my profession when I have to turn in documents."

As time went by, the workers' distress evolved into chronic stressors and a variety of consequences. Some suffered from psychiatric disorders (e.g., depression, posttraumatic stress disorder, adjustment disorder), while others have had maladaptive behavioral changes, such as increased alcohol or tobacco use. A large majority of the workers had to struggle with decreased work motivation, resulting in increased errors and accidents. The number of injured workers has been on the rise. In fiscal year (FY) 2014, the number of Daiichi workers who suffered injuries was 64, double of that in FY 2013. Among them, 15 suffered heat stroke, 13 had injuries from falling, and another 13 had their bodies caught in the machinery [13]. In January 2015, a series of fatal accidents occurred at Daiichi and Daini [14].

Furthermore, a significant proportion of workers have chosen to quit their jobs. In FY 2012, over 700 TEPCO employees retired. This number was nearly 1.5 times higher than that of FY 2011 (465 workers) [15]. About 40 % of them were in supervisory positions, and TEPCO offered a temporary bonus (100,000 Japanese yen or approximately 833 US dollars) to supervisors in order to stop this trend [16].

Radiation exposure is also a substantial issue among these nuclear plant workers. The Japanese law designates the accumulative radiation dose limit of radiation workers as either 50 millisievert (mSv) per year or 100 mSv per 5 years; a dose threshold for emergency work is 100 mSv. Immediately after the Fukushima accident, the government temporarily raised this threshold to 250 mSv among emergency workers. Radiation exposure is not only related to their health consequences but also their working environments. If the workers' radiation dose exceeds the limit, they are mandated to leave frontline work and instead work off-site. However, this measure results in not only exacerbation of personnel shortages but also adjustment issues to the workers' new jobs and contractor layoffs.

In the first year after the disaster, the workers' accumulated radiation exposure was prominent, especially among TEPCO workers (vs. contractors). Among 21,125 workers (3416 TEPCO employees and 17,709 contractors), 174 workers (150 TEPCO employees and 24 contractors) exceeded a dose of $\geq$100 mSv with

Table 9.2 Accumulated radiation exposure dose distribution among Fukushima Daiichi nuclear plant workers (March 2011–December 2014, adapted from [17])

	March 2011–March 2011 ($N = 21{,}125$)				April 2012–March 2013 ($N = 13{,}741$)			
	TEPCO ($n = 3416$)		Contractors ($n = 17{,}709$)		TEPCO ($n = 1625$)		Contractors ($n = 12{,}116$)	
Radiation dose (mSv)	*n*	%	*n*	%	*n*	%	*n*	%
Above 250	6	0.2	0	0	0	0	0	0
200–250	1	0	2	0	0	0	0	0
150–200	26	0.8	2	0	0	0	0	0
100–150	117	3.4	20	0.1	0	0	0	0
75–100	186	5.4	65	0.4	0	0	0	0
50–75	257	7.5	258	1.5	1	0.1	0	0
20–50	630	18.4	2660	15.0	62	3.8	675	5.6
10–20	491	14.4	2892	16.3	129	7.9	2000	16.5
5–10	376	11.0	2557	14.4	266	16.4	1875	15.5
1–5	589	17.2	4621	26.1	579	35.6	3326	27.5
1 or less	737	21.6	4632	26.2	588	36.2	4240	35.0
Maximum dose (mSv)	678.8		238.4		54.1		43.3	
Average dose (mSv)	25.1		10.1		4.4		5.9	
	April 2013–March 2014 ($N = 14{,}746$)				April 2014–December 2014 ($N = 18{,}187$)			
	TEPCO ($n = 1692$)		Contractors ($n = 13{,}054$)		TEPCO ($n = 1623$)		Contractors ($n = 16{,}564$)	
Radiation dose (mSv)	*n*	%	*n*	%	*n*	%	*n*	%
Above 250	0	0	0	0	0	0	0	0
200–250	0	0	0	0	0	0	0	0
150–200	0	0	0	0	0	0	0	0
100–150	0	0	0	0	0	0	0	0
75–100	0	0	0	0	0	0	0	0
50–75	0	0	0	0	0	0	0	0
20–50	31	1.8	629	4.8	5	0.3	604	3.7
10–20	95	5.6	2067	15.8	17	1.1	1651	10.0
5–10	195	11.5	1897	14.5	130	8.0	2340	14.1
1–5	670	39.6	3739	28.6	573	35.3	5015	30.3
1 or less	701	41.4	4722	36.2	898	55.3	6954	42.0
Maximum dose (mSv)	41.9		41.4		24.2		39.9	
Average dose (mSv)	3.2		5.5		1.7		4.3	

Abbreviations: *TEPCO* Tokyo Electric Power Company, *mSv* millisievert

a maximum of 678.8 mSv. From FY 2012, the radiation dose has been controlled so that it will not exceed 50 mSv, but this control makes it harder for the employer to select already limited on-site workers (Table 9.2) [17].

9.3 Reflections About Radiation Workers' Mental Health

9.3.1 Health Service System for the Nuclear Plant Workers

Many lessons can be learned from the Fukushima disaster on worker health support systems during nuclear plant emergencies. The establishment of a mental health service system for nuclear plant workers was a challenging bottom-up process. Before the disaster, mental health services to Daiichi and Daini plant workers were provided by a part-time psychiatrist from Minamisoma, a city located 30 km north of Daiichi. After the disaster, however, the main road between Minamisoma and Daiichi was blocked, hampering the efforts of this doctor to enter the restricted area. After Dr. Tanigawa made his first on-site visit after the disaster in mid-April 2011, he spoke about the lack of mental health professionals to treat nuclear plant workers and the urgent needs of worker care in the media.

Since the disaster, I had imagined the struggles of the workers and had hoped that someone, probably from the government or the electric company, must have been providing ample mental health care to the hardworking heroes. I was surprised, however, that it was not the case and that Dr. Tanigawa had to speak through the media to launch a support project. I immediately called him; we agreed to collaborate and, on May 6, 2011, Dr. Tanigawa and I visited the Fukushima plant. In a twist of fate, I happened to be the first mental health specialist to enter the plant after the disaster and had to create a novel mental health support system [7].

After my first visit, Dr. Tanigawa and I began to negotiate with a variety of people such as the governors, officials, and TEPCO Headquarters' representatives. I work for the National Defense Medical College, a medical school for the Japanese Ministry of Defense. My college bosses (Soichiro Nomura and Yoshino Aihide) urged the college and the ministry officials to establish an official mental health support team. After a series of repeated discussions, the Prime Minister's Cabinet ordered the Ministry of Defense to form a mental health support team for nuclear plant workers on June 24, 2011 (i.e., over 3 months after the disaster). We eventually entitled this project as the Fukushima NEWS Project (NEWS, Nuclear Energy Workers' Support) and have since continued to provide support to TEPCO Daiichi and Daini workers.

A similar bottom-up process was also observed in health-care services inside the nuclear plant. Immediately after the disaster, TEPCO full-time occupational physician (Dr. Akira Tsuyuki) and nurses (Ms. Tomoko Yamamoto among others) were the only on-site medical staff to respond to the Daiichi and Daini workers. The Daiichi treatment room was disabled owing to tsunamis, so a temporary medical treatment room was immediately set up at Daini to respond to workers of Daiichi and Daini. They literally worked endlessly to respond to Daiichi explosions and subsequent chaos, and external medical support was not provided for nearly a month. When Ms. Yamamoto was asked what her most distressing experience was, she said, "We didn't have staff to take turns with us. I was in the plant on a

24-hours-a-day basis for 20 days in a row, but we did not have rotating staff or external support teams, so we had to find them on our own" [3].

These experiences show that the Fukushima workers' mental health service was first formed as a bottom-up process and evolved into a top-down system. The service started from a mere private phone call between two physicians, and the team professionals were not selected by a registration list, if any. This experience highlights a potential of providing ample, comprehensive, and prompt mental health (or any other health) services immediately after the disaster by a top-down process. Development of a highly trained health-care response team system might be helpful in order to realize this. Such a service will also be critical to prevent burnout of local health-care providers, who are also likely to be disaster victims.

9.3.2 The Roles of Mental Health Professionals in Support of Nuclear Plant Workers

The workers' well-being was severely challenged by the Great East Japan Earthquake and the Daiichi accident. Multiple social roles were added to the workers, including workplace trauma victim, local survivor, the bereaved, and a target of social backlash.

This phenomenon made it a challenge for mental health professionals to provide interventions. Traditional clinical roles of psychiatrists or psychologists (e.g., patient vs. doctor setting) were not enough in planning mental health-care programs to this population. The professionals had to implement the fundamentals of disaster mental health and had to create strategies for the primary, secondary, and tertiary tiers of care [18]. These strategies required multidisciplinary efforts; related fields included, but are not limited to, public health, radiology, occupational health, sociology, history, anthropology, and politics. In general, mental health professionals are not trained to take on this sophisticated task. Likewise, non-mental health workers are not trained to tackle the complex dynamics between their discipline and mental health.

In order to prepare for future events, it will be of importance to emphasize comprehensive and multidisciplinary efforts in professional education courses as well as development and implementation processes [19]. In the case of Fukushima, worker surveillance programs will be important to understand their long-term consequences, to establish effective interventions [20], and to ascertain the associations between multiple disciplines [19].

9.3.3 Public Criticism and the Role of Media

In public health crises, mass media play a large role in sending out public messages. This point is especially emphasized in "imperceptible" disaster responses, such as CBRNE (chemical, biological, nuclear, radiological, and explosive agents) attacks, toxic exposures, and pandemics [18, 21]. Media can potentially send out information related to safety, health, and behavioral decisions. On the other hand, media reports can get sensational (so-called media hypes) and stigmatize the affected people and/or organizations [22]. Although it is beyond the scope of this chapter, discrimination and stigmatization issue is an ongoing matter for all the people affected by this disaster [23].

Clear, accurate, and consistent information exchange is an essential component between health-care workers, leaders, governments, media, and the general public [18] in order to disseminate adaptive knowledge to the crisis. Not all health-care professionals, let alone mental health professionals, are trained to perform these risk communication roles, such as collaborating with the media, sending public health messages, and promoting public decision-making processes.

Given this principle, we hypothesized that collaboration with the media might be helpful to increase the respect and to decrease the stigmatization of the nuclear plant workers. The disseminated information included their research data [9, 10] as well as the "voices" of the workers. Among the media headlines were "Life as a Fukushima cleanup worker – radiation, exhaustion, public criticism" [24] and "Why Japan's 'Fukushima 50' remain unknown [25]." In fact, two nonfiction novels [5, 26] reported the workers' horrific life-threatening experiences, work ethics, and struggles under their own names. Although anecdotal, such information might be helpful for the public to better understand what the workers had been through.

9.4 Conclusion and Messages

The workers at the Fukushima Daiichi and Daini nuclear power plants risked their lives in order to stop the plants that were damaged by the tsunami. The destruction of Daiichi resulted in nuclear meltdown and radiation release, although the situation could have been worse if the workers had not attempted to confront it. However, the psychosocial price to these heroic efforts was profound. A large majority of the workers were also local victims of this disaster and had to cope with bereavement issues. Furthermore, owing to post-disaster societal dynamics, the extent of societal criticism was excessively higher than appreciation for their sacrifices.

In the case of Fukushima, a mental health support system for the workers was developed in a bottom-up fashion. In order to provide prompt and comprehensive support in future events, top-down leadership as well as multidisciplinary efforts

will be crucial. Pre-disaster planning and education may be essential to formulate health-care delivery and surveillance systems.

Decommissioning efforts will continue for decades to come. It is important for the nuclear plant workers to maintain their physical and mental well-being as well as the dignity they deserve. Collaborations with the media may be helpful for the public to learn the inner struggles of the workers and to understand the importance of support and respect to them.

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References

1. Nihon Keizai Shimbun. Tsunamis of Fukushima Daiichi high as 14-15 meters: three times higher than the expected (in Japanese). 9 April 2011. http://www.nikkei.com/article/DGXNASDG0904K_Z00C11A4000000/. Accessed 3 Feb 2015.
2. Asahi Shimbun Digital. Overwork beyond limit, parents missing: an e-mail from TEPCO plant worker (in Japanese). 26 March 2011. http://www.asahi.com/special/10005/TKY201103260360.html Accessed 3 Feb 2015.
3. Shigemura J, Tanigawa T, Nomura S. Support challenges of disaster workers and supporters following the Great Eastern Japan Earthquake (in Japanese). Jpn J Trauma Stress. 2011;9(2):141–7.
4. Ehime Shimbun. A harsh site: with feelings of struggle (in Japanese). Ehime Shimbun. 21 April 2011.
5. Kadota R. A man who was on the brink of death: Masao Yoshida and the Fukushima Daiichi Nuclear Plant's 500 days [Shi no fuchi wo mita otoko: Yoshida Masao to Fukushima Daiichi Genpatsu no 500 nichi] (in Japanese). Tokyo: PHP Institute; 2012.

6. Tokyo Shimbun. Stress measures are needed for on-site workers (in Japanese). 20 April 2011.
7. Shigemura J, Tanigawa T, Nomura S. Launch of mental health support to the Fukushima Daiichi Nuclear Power Plant workers. Am J Psychiatr. 2012;169(8):784.
8. Asukai N, Kato H, Kawamura N, Kim Y, Yamamoto K, Kishimoto J, Miyake Y, Nishizono-Maher A. Reliability and validity of the Japanese-language version of the impact of event scale-revised (IES-R-J): four studies of different traumatic events. J Nerv Ment Dis. 2002;190 (3):175–82.
9. Shigemura J, Tanigawa T, Saito I, Nomura S. Psychological distress in workers at the Fukushima nuclear power plants. JAMA. 2012;308(7):667–9.
10. Shigemura J, Tanigawa T, Nishi D, Matsuoka Y, Nomura S, Yoshino A. Associations between disaster exposures, peritraumatic distress, and posttraumatic stress responses in Fukushima nuclear plant workers following the 2011 nuclear accident: the Fukushima NEWS Project study. PLoS One. 2014;9(2):e87516.
11. The Japan Times. Stigmatized workers quitting TEPCO in droves. 21 July 2014. http://www.japantimes.co.jp/news/2014/07/21/national/stigmatized-workers-quitting-tepco-droves/. Accessed 3 Feb 2015.
12. Maeda M, Oe M. Disaster behavioral health: psychological effects of the Fukushima nuclear power plant accident. In: Tanigawa K, Chhem RK, editors. Radiation disaster medicine: perspective from the Fukushima nuclear accident. Heidelberg: Springer; 2014. p. 79–88.
13. The Wall Street Journal Japan. Fatal accidents and heat strokes double: Fukushima Daiichi workers in fiscal year 2014 (in Japanese). 30 April 2015. http://jp.wsj.com/articles/JJ11402660348253583726717706602482617899648 Accessed 30 Apr 2015.
14. World Nuclear News. Tepco resumes work after contractor deaths. 3 February 2015. http://www.world-nuclear-news.org/RS-Tepco-resumes-work-after-contractor-deaths-0302155.html. Accessed 3 Feb 2015.
15. Yahoo! Japan news. TEPCO retirees exceed 700 people: 1.5 times high (in Japanese). 16 April 2013. http://news.yahoo.co.jp/pickup/6076901. Accessed 3 Feb 2015.
16. Nihon Keizai Shimbun. TEPCO pays 100,000 yen to supervisors in order to stop increase of retirees (in Japanese). 19 July 2013. http://www.nikkei.com/article/DGXNASDD1905C_Z10C13A7EB2000/. Accessed 3 Feb 2015.
17. Tokyo Electric Power Company. Press release: evaluation of the exposure dose of workers at the Fukushima Daiichi Nuclear Power Station: accumulated exposure dose distribution by fiscal year. 30 January 2015. http://www.tepco.co.jp/en/press/corp-com/release/betu15_e/images/150130e0304.pdf. Accessed 3 Feb 2015.
18. Ursano RJ, Norwood AE, Fullerton CS, Holloway HC, Hall M. Terrorism with weapons of mass destruction: chemical, biological, nuclear, radiological, and explosive agents. In: Ursano RJ, Norwood AE, editors. Trauma and disaster responses and management. Arlington: American Psychiatric Publishing; 2003. p. 125–54.
19. Chhem RK, Aziz AZ, Clancey GK. Radiation disaster medicine curriculum revisited in a post-Fukushima context. In: Tanigawa K, Chhem RK, editors. Radiation disaster medicine: perspective from the Fukushima nuclear accident. Heidelberg: Springer; 2014. p. 109–19.
20. Crane MA, Cho HG, Landrigan PJ. Implications of the World Trade Center Health Program (WTCHP) for the public health response to the Great East Japan Earthquake. Ind Health. 2014;52(1):5–12.
21. Shigemura J, Harada N, Tanichi M, Nagamine M, Shimizu K, Katsuda Y, Tokuno S, Tsumatori G, Yoshino A. Rumor-related and exclusive behavior coverage in Internet news reports following the 2009 H1N1 influenza outbreak in Japan. Disaster Med Public Health Prep (in press). 2015;9:459–63.
22. Glik DC. Risk communication for public health emergencies. Annu Rev Pub Health. 2007;28:33–54.
23. Ben-Ezra M, Shigemura J, Palgi Y, Hamama-Raz Y, Lavenda O, Suzuki M, Goodwin R. From Hiroshima to Fukushima: PTSD symptoms and radiation stigma across regions. J Psychiatr Res. 2015;60:185–6.

24. McCurry J. Plummeting morale at Fukushima Daiichi as nuclear cleanup takes its toll. The Guardian online version. 15 October 2013. http://www.theguardian.com/environment/2013/oct/15/fukushima-nuclear-power-plant-cleanup. Accessed 3 Feb 2015.
25. Wingfield-Hayes R. Why Japan's 'Fukushima 50' remain unknown. BBC News. 14 December 2012. http://www.bbc.co.uk/news/world-asia-20707753. Accessed 3 Feb 2015.
26. Kyodo News, Takahashi H. Memories of station blackout: Fukushima Daiichi Nuclear Power Plant testimonies, the truth of 1,000 days [Zendengen soushitsu no kioku: shougen, Fukushima Daiichi Genpatsu—1000 nichi no shinjitsu] (in Japanese). Tokyo: Shodensha; 2015.