

**GEJE Bento Boxes:
Key Findings and Lessons
from the Greater Portland
"Community Resilience in Japan"
Study Mission
[April 20 - 28, 2017]**

Trip Purpose: to see firsthand the impact of the Great East Japan Earthquake and tsunami (GEJE) on 3.11.2011 and how Japanese authorities have responded to reconstruct, revitalize local economies, and prepare for future disasters.

Organizer: Greater Portland, Inc.

Delegation Profile: State, Coastal, Portland area local and regional government resiliency leaders, emergency managers and urban planners; representatives from PGE, NW Natural, Port of Portland, business owners, PSU and OSU.

Report prepared by the Regional Disaster Preparedness Organization - August 2017



Areas of Exploration / Capabilities

Reviewed:

- Community Resilience
- Recovery Planning and Long-Term Vulnerability Reduction
- Housing Recovery /Community Redevelopment
- Economic Recovery
- Risk Assessment and Hazard Mapping
- Critical Transportation Response and Infrastructure Systems Recovery
- Public Information and Warning
- Operational and Logistics Coordination and Situational Assessment
- Mass Care / Sheltering; Medical & Public Health Services

This report is dedicated to the memory of the GEJE victims and the survivors, who've inspired us to become more resilient.



TRAVELOGUE

The delegation, in whole or in part, traveled to Tokyo, Sendai, Higashi-Matsushima, Rikuzentakata, and Kesennuma.

Clockwise (from upper left): high level briefings at the Tokyo American Club; (upper right) National Research Institute for Earth Science and Disaster Resilience; (center right) Tohoku University International Research Institute for Disaster Science; Sendai Airport (post-disaster/post recovery); (lower middle) Hagashi-Mitsushima Smart City; (lower left) new Rikuzentakata City Hall; and stop at new Rikuzentakata shopping center during full town tour.



Access to the full trip itinerary is available on the RDPO website @ <https://www.portlandoregon.gov/rdpo/article/641531ta>



Note: This project, subsidized by the Ministry of the Environment, is an "independent and distributed low carbon energy society creation" initiative conducted by the Low Carbon Society Promotion Association.



3-11-11: Three Primary Disasters

2:46 PM Local Time: 9.0 Magnitude Earthquake
Tsunamis: first wave started hitting the coast 20 – 30 minutes after the initial EQ; multiple waves for two days. Run-up heights up to 128 feet and up to six miles inland.
Fukushima Daiichi Nuclear Power Plant – level – 7 nuclear meltdown/radiation release

The Fourth Disaster: the displacement of 470,000 Japanese in the impacted region created a humanitarian crisis (secondary deaths, shortages of food, water, poor sanitation/hygiene, etc.)



Fatalities/Missing: around 18,500
Housing destruction and displacement of people: 130,000 houses lost; 270,000 severely damaged; initially, 470,000 people in shelters
Economic Loss: \$250 Billion (costliest disaster ever; major disruption to supply-chains; GDP, industrial production, exports down)



Local Governments Overwhelmed:

- Impacts in 62 municipalities in 6 prefectures (3 worst: Iwate, Miyagi, and Fukushima)
- 221 public officials died or remain missing in 17 municipalities in hardest hit municipalities
- Large municipal building damage and loss



消防庁舎 (東側・4月13日)

More Cascading Impacts:

- Fires: oil refineries
- Debris: 20 million tons (130 million cubic yards), including radioactive soil.
- Land displacement: 250 miles of coastline dropped 2 feet; Honshu Island moved 8 feet east
- 24,000 hectares of farmland flooded; coastal fishing disrupted
- Disruption to public services: energy/electricity, communications, transportation, water/wastewater systems

**TRIP FINDINGS AND LESSONS BY SUBJECT
AREA**

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Community Resilience

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Public Information and Warning

**Operational and Logistics Coordination
and Situational Assessment**

**Mass Care / Sheltering; Medical & Public
Health Services**

F = FINDINGS

L = LESSONS

I = LINKS TO MORE INFORMATION

COMMUNITY RESILIENCE

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Culture of Preparedness - Though the Japanese were not prepared for the magnitude of the Tsunami, the majority of people took action as they had been prepared to do so.

Government Continuity of Operations Planning - local governments lost staff and buildings, impairing their capacity to coordinate local relief efforts. High occurrence of "survivor's guilt."

Strong social capital / mutual aid (i.e., horizontal connectivity) – the collective underpinning of Japanese society spurred many heroic efforts on the part of ordinary community members helping each other. Impacted local governments were (and still are) aided significantly by other local governments and the private sector (based on relationships / mutual aid). Resettlement policy tearing away at social cohesion in some communities.

"Social risk positions" - the elderly, women, people with chronic illness, and other vulnerable people disproportionately negatively impacted during and after GEJE.

Vertical connectivity / political capital: communities whose local officials had or have developed strong relationships with Central Government officials have tended to be further along in recovery / reconstruction.

Domestic and International NGOs played key roles, raise funds/bring resources, and often know how to engage communities in post-disaster planning and program development better than government.

Autonomous Community Action: Higashi-Matsushima City has a unique regional mutual assistance program that includes a relief supply stockpile warehouse and eight autonomous organizations that can run their own disaster relief /evacuation centers.

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GEJE response efforts reinforced that 90% of the time people will be saved by their neighbors: advancing Citizen Corps Programs and other programs that build / reinforce social cohesion while educating on disaster risks and how to prepare to mitigate impacts, will likely lead to fewer deaths and suffering post-disaster.

Government resilience: individual staff and local units of government need to plan for the unimaginable / worst case scenario and prepare accordingly. Psycho-social programming is needed not just for communities but for first responders, too.

Community resilience / readiness, as well as recovery and reconstruction: disaster impacts the most vulnerable people and economies the hardest. Disaster management programs must account for the needs of vulnerable populations, including those with access and functional needs. Engaging the whole community, with special attention on vulnerable communities, in pre- and post-disaster program phases contributes to better, more sustainable outcomes.

Partnership / Collaboration / Mutual Aid: local governments should build and maintain relationships horizontally and vertically, as well as with private sector and civil society organizations (both local/domestic and international), which can boost capacity to implement /coordinate effectively in relief, recovery and reconstruction phases. Outreach programs should promote community-based planning ("Map Your Neighborhood") and post-disaster community mutual aid and autonomy (community self-reliance initiatives).

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[https://openknowledge.worldbank.org/handle/10986/18864;](https://openknowledge.worldbank.org/handle/10986/18864)

<https://www.usnwc.edu/getattachment/ec85983b-05d3-4a5d-96aa-2e27c33ea967/The-JMSDF-s-Resilient-Power-for-Civil-Society--Les.aspx>

RECOVERY/RECONSTRUCTION PLANNING & LONG-TERM VULNERABILITY REDUCTION

Multi-Phased Recovery/Reconstruction Planning: First year devoted to damage assessments, new hazard mapping, establishing the national system and plan (Reconstruction Agency and Act; design council; financing/grant mechanisms; national vision and core principles; new land-use / zoning policies; spatial planning; etc.); at local level, first year devoted to basic rebuilding concepts and strategies. In years 2-4, prefectural and municipal governments developed own reconstruction plans largely mirroring national reconstruction plan. While the hope has been to complete reconstruction by 2020, the reality is that many towns will take much longer. Community engagement and consensus decision-making approaches used in local planning processes.

Varied progress of reconstruction along the impact zone depending upon initial impact and resulting degree of redesign of coast and resettlement plans, access to labor (in short supply for the massive needs in Tohoku and in building for the 2020 Olympics), success in securing reconstruction grants for projects, etc. Local governments have to manage much larger budgets and incorporate new temporary staff and technical staff (planners, engineers, financial and project managers, etc.) seconded on mutual aid arrangements.

Tsunami long-term vulnerability reduction (LTVR): Pre-GEJE tsunami walls and floodgates slowed down the GEJE tsunami, giving some extra time for evacuation; post-GEJE sea walls and flood gates now more resilient to massive tsunamis, though would only slow down the 1,000-year. Concepts of infrastructure that “fail gracefully” and “easy clean-up and repair”. Zoning/land use to protect lives and infrastructure (but may impact coastal livelihoods and community cohesion).

Earthquake long-term vulnerability reduction: Overall, earthquake damage to existing infrastructure minimal compared to the massive impact of “1,000-year” tsunami. Decades of building code improvements, each wave following a major disaster, such as 1985 Kobe earthquake. In 2000, the country's building codes were revised to incorporate specific requirements and mandatory checks for earthquake resistance.

Energy reliance: prioritize protection of existing infrastructure/design to high standards (EQ top); renewable energy (especially solar) investments exploding.

Sendai Airport resilience: investing millions in EQ-resilient runways worked.

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Recovering and reconstructing following a

catastrophic disaster is complex, expensive and requires years if not decades. Pressure to rebuild fast when people and businesses start taking flight.

Pre-disaster recovery planning efforts would do well, *inter alia*, to: determine/envision the local structure and capacity needed for recovery / reconstruction (governance and staffing/contracting models; alternate operational facilities; budgetary and financial management system needs for increased resource/grant management); potential zoning and land use changes; etc. Important to build a bridge between current local development and sustainability planning and hazard mitigation and pre-disaster recovery planning efforts. Build relationships now!

Multi-faceted LTVR: Community resilience/disaster readiness, smart zoning laws/land use, disaster resistant building codes, and hazard research-risk assessments all work hand-in-hand with **long-term infrastructure resilience investments** (especially those built to standards above just life-safety).

Resettlement as a recovery/reconstruction strategy needs to understand/mitigate for negative impacts to livelihoods and community cohesion.

Community engagement /consensus, though time-consuming, is a critical element of reconstruction planning efforts to ensure more durable results.

<https://www.portlandoregon.gov/rdpo/article/656249>

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HOUSING RECOVERY AND COMMUNITY REDEVELOPMENT

Temporary Housing: 110,000 people in three prefectures without shelter; most moved into emergency evacuation centers while the authorities prepared subsidized temporary housing for them. About 53,000 prefabricated housing units, called *kasetsu*, were built in accordance with a national emergency disaster housing law. The 1947 law states that residents will not stay in these units for more than two years (aimed to discourage people from remaining indefinitely). Six years after the GEJE: 35,000 people, many over 50 years old, still live in these cramped makeshift apartments.

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Lottery was used to assign temporary housing; often split up existing communities and especially hard on vulnerable populations (and yet local authorities said can't think of a better method in phased temporary housing availability situation).

While the emergency housing law was not updated post-GEJE, some methods besides building temporary shelters were used, including identifying existing vacant houses and apartments (government subsidized rent).

Government subsidies for temporary housing: established in the '70s for a growing population and does not seem to work well for aging population of people in a protracted reconstruction context.

Rikuzentakata: building on higher ground, smaller "whole communities" of single-family housing, public housing, schools, government facilities, hospitals, and commercial buildings. Fracturing of old complete communities mentioned. Public housing not filling fast. **Delays in both temporary and permanent housing** caused a significant level of population flight. And these people are not likely returning.

HigashiMatsushima (H-M): "safe collective relocation" into single family housing and public housing on tsunami-resistant sites. H-M modelled reuse of debris rubble into post-disaster reconstruction. H-M "Intelligent Disaster Prevention Eco-Town" (or Smart City): example of new community that incorporates solar on all houses, has back-up generator for emergencies and is built to withstand earthquakes and tsunamis.

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Housing recovery: Best to take a **holistic approach** during reconstruction, emphasizing rebuilding lives and inclusive, healthy, economically vibrant communities, and not just houses. Housing recovery is one aspect of whole community reconstruction (houses, public services/infrastructure, jobs, businesses, schools, health care, parks/recreation, etc.)

Temporary housing: advisable to work out types, location/land needs, subsidies, and exit strategies (i.e., transition to permanent housing) during pre-disaster recovery planning to minimize post-disaster flight of renters and homeowners whose current housing is impacted. For our region, developing relationships with HUD staff and understanding federal post-disaster housing policies pre-disaster is important.

Permanent housing: Great opportunities to build back better, using renewable energy, recycling debris, utilizing higher standard of building design and materials, etc.. Pre-disaster: promote seismic retrofitting and earthquake insurance for homeowners/building owners.

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<https://www.usatoday.com/story/news/world/2016/03/08/5-years-later-japan-still-struggles-recover-tsunami-disaster/81431884/>

http://www.mext.go.jp/component/english/_icsFiles/afieldfile/2014/03/20/1343756_01.pdf

ECONOMIC RECOVERY

National economy impacts: in 2011-2012, GDP and exports down, global supply chain disruptions, increased national debt. Overall, national economy is resilient and growing. Emphasis on growing renewable energy sector and also investing in own and other countries' infrastructure - mutually beneficial economic impact. GEJE-impacted larger businesses fared better on whole than small- to medium-sized largely because of solid business continuity plans, a major factor in their resilience.

Smaller coastal communities with aging populations and economies based on fisheries, agriculture and tourism have had a harder time recovering and transitioning their economies to more sustainable models than larger cities (e.g., Sendai) that had pre-disaster growing populations and economies.

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Recovery Economic bubble: reconstruction has injected hundreds of millions of dollars into governments / local economies, which helps create jobs and supports local businesses, while completing reconstruction projects.

Rikuzentakata: reduced population; reduced tax base. Workforce shortages. Business flight due to protracted reconstruction. Created some temporary facilities (containers) for small businesses; new sea wall and Miracle Tree memorial and replanting coastal pine forest, and new hotels/restaurants intended to help restart tourism. Hope of advancing "disaster tourism" strategy.

"Japan as One" work project: local governments in disaster zone could access job creation funds. In Rikuzentakata, jobs were created to transform disaster debris into key chain souvenirs for sale. International NGOs like Mercy Corps devoted funds and technical resources to support small business recovery in GEJE impacted coastal towns.

Suisen Shuzo Saké Brewery: destroyed during the GEJE and rebuilt one year later. Now produce "Kibo" (key-bo) sake. Stretched out to export markets/distributors, including Sake One in Oregon. Port of Portland will soon be serving Kibo at some of

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<https://www.theguardian.com/public-leaders-network/2017/feb/02/japan-fukushima-tsunami-tomatoes-fish-hula-dancing>

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Communities with **high populations of vulnerable people and weak economies** tend to face the biggest recovery challenges.

The kind of **economic impact analysis ECONorthwest has proposed to the RDPO**, building on DOGAMI's enhanced earthquake impacts hazard mapping project for our region, promises to provide an accurate picture of the current resilience of Portland metropolitan region-based businesses and key economic sectors in the face of a major disaster. This information can then guide further economic resilience-building strategies (e.g., COOP planning) to mitigate post-disaster business flight/economic collapse.

Economic recovery /resilience must be integrated into a holistic approach that also incorporates housing recovery, recovery of infrastructure/basic services (water, wastewater, transportation, police, fire, etc.) and social resilience.

Maintaining existing sources of income and retaining/creating jobs are crucial during reconstruction.

Pre-disaster recovery planning should include visioning/planning for post-disaster temporary relocation of businesses (land, temporary facilities); designing programs/projects to infuse capital and technical support to recovering businesses; developing strategies/policies for maximizing the use of local companies and workers in traditional recovery and reconstruction projects (e.g., construction, engineering); etc.

Opportunities to expand sustainable energy post-disaster. This would include solar, wind, micro-grid. et. al. businesses.

RISK ASSESSMENT-HAZARD MAPPING

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Hazard maps were developed by **all municipalities** in the disaster-hit areas pre-GEJE, and served as important tools for designing evacuation procedures and educating the public on risk. Unfortunately, the GEJE far surpassed the level of inundation the original maps indicated.

Post-disaster updates: Because the magnitude of the GEJE and tsunami far exceeded the pre-disaster estimates, the Japanese government has been revising its methods of assessing earthquake and tsunami hazards, combining historical evidence, topographical and geological studies, and predictions and forecasts based on scenarios for events of low probability but high impact.

In addition to huge investments in structural measures (e.g., reinforced buildings and seawalls), and early-warning systems, the Japanese government and its research institutions produce **cutting-edge risk assessments and hazard maps**; all of these measures are supported by sophisticated technology for data collection, simulation, information, communication, and by scenario building to assess risks and to plan responses (such as evacuations) to hazards.

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A constant **commitment to updating risk assessments and hazard maps**, using the latest information and technology, can help ensure mitigation action and response plans are up-to-date and supported/executed.

Communicating accurate information about hazards and risks to communities is critical to helping them make appropriate decisions. Still, the GEJE showed that these tools should not be solely relied on -- i.e., they do not predict exact impacts.

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<https://openknowledge.worldbank.org/handle/10986/16146>

CRITICAL TRANSPORTATION AND INFRASTRUCTURE SYSTEMS RECOVERY

Most infrastructure damage was due to tsunami not the earthquake: infrastructure within five miles of the coast, including water-wastewater systems, electric utilities (including Fukushima nuclear accident), critical government buildings (city halls, police, fire stations, hospitals, etc.), roads, etc., often severely impaired or wiped out. Roads remained but were subsumed by mountains of mixed debris. Temporary sites for local government operations used; hospital patients relocated to other hospitals in less impacted areas or outside the region.

Mass specialty team, ministerial staff, U.S. Military and mutual aid deployments (staff from other prefectures), private sector partners, and other local volunteers, together with air, sea and land transportation equipment and fuel, aided in relief supply delivery; clearing debris and supporting search and rescue, medical evacuation, infrastructure recovery, limited alternate power generation, etc.

Opening up emergency transportation routes: 97% of mixed debris moved from North-South highway and intersecting roads to impacted areas in just seven days under "Operation Teeth of the Comb," supporting movement of people and supplies.

Electric Utilities recovery: power interrupted to 4.6 million customers; three days later, power restored to 80% of affected customers that could receive power; six weeks to recover electricity for heavily impacted areas. [Fukushima nuclear accident led to temporary shut down of other nuclear plants due to high public concern.]

Communications recovery: two weeks to restore mobile phones (satellite phones available before then but not reliable).

Other infrastructure recovery: Train Lines (including bullet trains) resumed service in six weeks; 14 Ports reopened in five days ; water and wastewater systems: restored for 90% of residents in one week; natural gas restored within seven weeks.

Vehicle, Fuel, Generators, etc.: while some of these items came with the first waves of help, shortages hampered relief operations in the first few days until roads opened. Some communities post-disaster have included contingency planning and storage of these items.

Sendai Airport: Port of Portland senior leaders discovered that while the airport had been severely flooded by the tsunami and debris, an all out effort by U.S. Air Force 353rd Special Operations Group, together with local volunteers, returned the airport to enable relief flights to land just six days after the Tsunami.

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Success stories in opening up roads and restoring basic services quickly are largely due to **pre-disaster government and private sector investment in resilient infrastructure and ability of the national government to mount massive response and recovery operations by land, air and sea.**

It's not enough to have planned emergency transportation routes in advance of a **massive debris-generating event.** You must forecast debris, plan for how to clear the roads and who is going to clear them (state and local public works departments will need to coordinate well and rely on mutual aid and other outside assistance).

The kind of **earthquake impact mapping** the RDPO is doing with the help of DOGAMI can assist in identifying which emergency routes will be impacted and the anticipated type, volume and location of debris that will need to be pushed aside. Operational planning and exercising should follow.

Fuel contingency planning, investing in energy redundancies and government COOP continue to be critical lessons in mega-disaster preparedness. The Japan experience reinforced that we need to do more to **prepare communities for realistic post-earthquake utility and other service recovery timeframes.**

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<http://airlinegeeks.com/2017/05/03/when-the-water-subsided-sendai-airports-recovery-six-years-later/>

PUBLIC INFORMATION AND WARNING

Community readiness information: Japanese are educated from school-age onward about major hazards and drill frequently. Post-GEJE: increased emphasis on a massive earthquake hitting Tokyo within the next 30 years. As such, Tokyo Metropolitan Government invested \$20 million in a [practical, highly graphic disaster preparedness manual](#), which has been distributed to more than 7 million Tokyo households.

Natural hazards signage everywhere (i.e., in case of an earthquake or tsunami) – the ‘what you need to know and the what you need to do.’

Japan has the most advanced earthquake early-warning and tsunami systems in the world, and yet the GEJE overwhelmed the systems and calculations of both the magnitude of the earthquake and the massiveness of the tsunami were underestimated. People could not imagine what was to come. Still, warnings issued by the Japan Meteorological Agency, which were disseminated through TV, radio, and on the ground, prompted massive evacuations. Special warning systems for trains resulted in no accidents.

F **Numbers of lives lost and injuries could have been much worse** had those living in the impact zone not heeded the warnings and practiced what they’d been taught in drills.

Government public information during response was often late or inaccurate in communicating status of disaster, location and availability of emergency services, and relief supplies (downed cell phones and internet combined with poor operational coordination were contributing factors).

Massive use of social media (e.g., twitter and Facebook) and other internet tools (e.g., Google Crisis Response) contributed to search and rescue / family reunification, traffic reports, igniting worldwide relief contributions;

Digital reader boards and posters at train stations and other public venues and an associated public education campaign used to effect positive electricity conservation behaviors during Summer 2011 post-GEJE related rolling blackouts.

L **Communicating risks** clearly and widely helps the public make timely decisions to protect themselves.

Social media use post-GEJE was massive and will be similar if not more post-Cascadia Subduction Zone earthquake. Important to have a communications strategy that makes use of appropriate media to deliver critical messages and to crowd source actionable information. Important to continue training Public Information Officers to best communicate through and utilize social media and exercising with Virtual Operational Support Teams.

Culture of Preparedness: Public information is only one ingredient in advancing individual and community preparedness; perhaps best to embed disaster readiness (information, drills) into the K-12 school system (in our region, let kids influence parents as they did with recycling).

Spreading a better understanding of the nature and limitations of risk assessment among local authorities and communities can help improve individual and collective decision-making. Since early warning systems can fail, it will be important to educate the public on their strengths and limits of ShakeAlert as it becomes part of our earthquake warning tools in our region.

Telling the public the truth about recovery and reconstruction timeframes can help government manage public expectations. Communicating recovery times for services also important to manage expectations.

I [Japan's Early Warning Systems](#)
[Disaster Preparedness Tokyo \(Bosai: Let's Get Prepared\)](#)
[Use of Social Media post-GEJE](#)

OPERATIONAL COORDINATION, COMMUNICATIONS AND SITUATIONAL ASSESSMENT

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Highly organized central disaster management coordination system under the Prime Minister, with clear roles and fast activation of all key cabinets and specialty teams (e.g., Japan Civil Defense Forces, Emergency Fire Response Teams, Inter-prefectural Emergency Police Units, Disaster Medical Response Teams, Technical Emergency Control Forces and Japan Red Cross) for search and rescue / family reunification, life-sustaining support, emergency medical services, logistics, communications, damage assessment and emergency transportation route clearance. Many of these self-coordinated or found ways of collaborating.

Operational coordination in the impacted zone had mixed performance results: coordination among governments (national, prefectural, and local), civil society organizations (CSOs), and private entities was often poor—or at least not optimal. Some good coordination examples were in road clearance, food aid, medical services, and search and rescue. Local governments, whose facilities in some cases were wiped out by the disaster, had little experience working with other organizations on a large scale, and they received insufficient support from the central government in managing the new forms of cooperation. Coordination with national and international relief agencies and donors offering exceptional assistance was simply not up to the unprecedented task.

Destroyed / damaged communications and energy infrastructure further impaired operational coordination and situational assessment. Insufficient communications back-ups was the norm!

Corporate technology support for internet access and situational assessment: Microsoft provided information and communication technology in impacted areas, which helped provide internet access at evacuation and recovery centers. Google provided Crisis Response, which includes tech support and key Google resources and tools such as [Google Maps](#), [Google Earth](#), [Google Person Finder](#), and [Google Fusion Tables](#).

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Local governments ill-prepared for the level of outside assistance often seen post-disaster, may get swept under the tide when the event occurs. Important to anticipate as many of these eventualities as possible, build relationships with partners where practical, and plan and exercise catastrophic event coordination scenarios in normal times. How can local governments in our region team up to steer outside relief aid (volunteers, donations) as it comes, with an eye to equity?

Local and international civil society organizations and the private sector play indispensable roles in disaster management. Civil society organizations have the advantage of flexibility and speed in reaching and caring for affected communities. Both the private sector and non-profit sector can bring important resources to bear.

Information and Communications Technology: Redundancies are critical. Partnerships with corporations like Google, Microsoft and others can contribute online tools for situation assessment and internet access when systems go down. But wouldn't it be better if Portland and other cities in the region invested in a resilient, free Wi-Fi capability before a major earthquake event occurs?

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<http://documents.worldbank.org/curated/en/266521468038359512/pdf/793720BRI0drm000Box377374B00Public0.pdf>

Mass Care / Sheltering, Medical & Public Health Services

Evacuation Shelters were inadequate: many people situated in the previously accepted safe zone were wiped out by tsunami; some towns turned to using large facilities (e.g., school gymnasiums) where privacy and inadequate materials /supplies for sleeping, feeding and provision of water and healthcare became instant issues, and remained inadequate for weeks at some locations (no cholera, but high instance of dehydration, skin and respiratory illness; deaths among those with chronic conditions - no meds / dialysis support). Needs of women and vulnerable groups were not well-met. Underlying misconception that basic public health needs -- water, sanitation and food -- are less important than medical needs (or that local govt. should provide, but they were impaired). Some examples of self-governance were demonstrated, such as shelter clients governing their own shelters.

Impaired medical and public health system supported by mutual aid response: tsunami caused high losses of medical and public health workers, hospital and other facilities and medical records.

Deployment of 300 DMATs and thousands of other medical and public health workers (including Red Cross) key to medical/health relief operations. Many chronically ill needed to be evacuated; complicated by debris-blocked roads and inadequate air evacuation support.

Shortages of food and water at hospitals (for patients and workers)

Less Trauma, More Chronic Conditions to Treat: few trauma injuries caused by earthquake; due to older age of disaster impacted, higher incidences of chronic conditions such as hypertension and diabetes. (DMATs were not trained to support these conditions.) Loss of medication and medical records worsened the situation. Many sub-acute symptoms were attributed to the contaminated sludge of the tsunamis and the poor living environment at the evacuation centers. People with **mental health conditions** and the disabled were also underserved and had to take flight to be treated. High rates of suicide, especially men and mentally ill. Six years after the disaster: 1 in 4 people living in impacted zone showing signs of depression.

Disease surveillance system break down: public health relied on event-based surveillance, resulting in an incomplete picture of disease incidence.

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International humanitarian standards for mass care (i.e., SPHERE) could prove valuable guidance for ensuring local standards for water, sanitation, food and other standards for displaced people, including vulnerable populations, are planned for and met. Clean/potable water is, as it has been demonstrated to be in countless disasters, still the most important substance to prevent disease and deaths post-disaster.

Support self-governance / engagement of vulnerable groups in mass shelters whenever possible.

Continuity of Operations / Trauma-Medical Surge Plans: health and public health systems, along with emergency medical services, need to ensure that both continuity of operations plans for all partners in the system (including smaller clinics, long-term health facilities, dialysis centers, etc.), together with surge plans, incorporate mega-disaster scenarios and that the two are exercised together to identify and address planning and preparedness gaps (e.g., food for workers). Policy and planning for people with prescription meds is critical to reduce deaths and suffering.

Use equity lens in planning, training and investing in equipment and supplies for mass care and sheltering and public health and health system response and recovery to ensure vulnerable populations, including people with disabilities, chronic illness, and others with access and functional needs (e.g., language, cultural, gender-specific) are addressed. Preparing for post-disaster immediate and protracted behavioral health needs requires more attention and resources.

[Mental Health:](http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1819.2011.02270.x/full)

<http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1819.2011.02270.x/full>

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