THE TOHOKU DISASTERS: PRELIMINARY FINDINGS CONCERNING
THE POST DISASTER HUMANITARIAN LOGISTICS RESPONSE

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Thanks, the authors.

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ABSTRACT

This paper describes the preliminary findings of the research conducted by the authors on the humanitarian logistic efforts after the cascading disasters that descended on the Tohoku region after the Great East Japan Earthquake of March 11th, 2011. Using a combination of in-depth interviews with participants in the relief efforts, meta analyses of news accounts, the authors identified a list of preliminary findings, policy implications and suggestions for improvement.
1. INTRODUCTION

The extreme and sudden nature of disasters poses significant challenges to the organizations involved in the delivery of critical supplies to assist those impacted. This is because: (1) infrastructure and communication systems may have been impacted and unable to fully function; (2) large (and dynamic) volumes of critical supplies must be transported; (3) there is a short timeframe to respond and prevent loss of lives and property; and, (4) there is a huge amount of uncertainty about what is actually needed, where is it needed, and what is available at the site; among other complications (1). These characteristics set post-disaster humanitarian logistics (PD-HL) apart from both commercial logistics and the various forms of longer term humanitarian logistic endeavors, e.g., distribution of medicines in crisis regions, as they that take place in less chaotic environments. Most notably, PD-HL differs in terms of: (1) objectives pursued; (2) nature and origination of the commodity flows transported, (3) knowledge of demand, (4) decision making structure, (5) periodicity / volume of logistic activities, and (6) state of the supporting systems (e.g., transportation and communications). For more information see (2).

Unfortunately, the realities of PD-HL response are not yet well understood. The reasons for this are three-fold: (1) the relatively low occurrence of disasters; (2) the extremely small size of the professional and research PD-HL communities; and (3) the ephemeral nature of the operations and data. As a result of these factors, the level of knowledge about PD-HL possessed by outsiders to the response process is appallingly small. Adding to the problem, only a handful of the PD-HL cases have been systematically studied (e.g., Katrina, Port au Prince), mostly by team members. For that reason, the disaster research community is only starting to scratch the surface of such complex subject. In this context, the research discussed in the paper is important to the nascent field of PD-HL and disaster research because it provides evidence-based insight into actual/emerging PD-HL practices, and lessons both positive and negative that ought to be learned to update plans and response procedures.

The fundamental objectives of this paper are to: (1) discuss the impacts on the PD-HL response produced by the cascading disasters in the Tohoku region; (2) describe how the PD-HL system responded to the disaster; (3) identify how the persistent nuclear threat has impacted the overall PD-HL effort; and (4) document lessons learned, both positive and negative. This topic has long been identified as a critical research issue by the Federal Emergency Management Agency (FEMA), that highlighted that the need to “…improve the distribution of critical assets and goods in a catastrophic event…” (3).

The paper discusses the preliminary findings concerning PD-HL identified by an international team that—with funding from the National Science Foundation and the Japanese Science and Technology Agency (JTA)—set to study the PD-HL after the Tohoku disasters. A companion paper, entitled “Tohoku
Disasters: Institutional Framework for Disaster Response in Japan” studies the institutional aspects that framed the overall response to the disasters. The findings discussed here, though preliminary as they are part of ongoing research, were deemed robust and important enough for publication. The paper has five sections, in addition to this introduction, that discuss in sequence: the cascading disasters, methodology, preliminary findings, policy implications, and research conclusions.

1. THE CASCADING DISASTERS

On March 11th, 2011 a 9.0 earthquake struck 130 km east of the city of Sendai in the East Coast of the Island of Honshu, Japan. Lasting about five minutes, the earthquake—referred to as the Great East Japan Earthquake (GEJE)—produced violent shaking that damaged untold number of roads and buildings. Providing testimony of Japan’s seismic design and construction practices, physical damage was kept to a minimum; and loss of lives by the earthquake was relatively low considering its intensity. However, the earthquake led to the shutdown of ports, airports, subways, and rail systems (4).

Immediately after the earthquake, tsunami alerts were issued throughout the Japanese coast. In most cases, the warnings indicated tsunami waves of 6-7m height which, in some cases, was within the design range of the tsunami protection infrastructure. Local citizens, well trained after years of emergency drills, moved to higher ground following pre-established evacuation routes. Regrettably, significant numbers of people—with fresh memories of the false alarms following the February 22nd and March 9th (with 7.3 magnitude) earthquakes—decided to ignore the tsunami warnings. As expected by the authorities, tsunami waves struck the Eastern seaboard of Japan. Unfortunately, the waves were much higher than anticipated as tens of villages and cities and hundreds of small communities were hit by waves towering in excess of 12-16 m, with a reported maximum of 39 m in Northern Japan (5). There was also confusion about the arrival time of the tsunami, which may have led people to believe that the danger had passed (5) when in fact, the tsunami was on its way.

The Japanese people have been preparing for this scenario for decades. Local governments had organized tens of thousands of emergency drills throughout the country, and had invested heavily on seismic resistant structures and tsunami protection infrastructure and systems. The latter includes a huge network of tidal gauges to collect real time wave height data, sophisticated information technology systems that process the wave height data and issue automatic warnings in case of danger, and an estimated 8,800 miles of seawalls and breakwaters to protect life and property (6).

In the Tohoku region, the most critical pieces of infrastructure are the: Sendai Airport, Port of Sendai, Tohoku Motorway, Joban Expressway, Routes 4, 6, and 45, the East-West arterials connecting the Tohoku Motorway to the coastal areas, Fukushima Daiichi Nuclear Plant, and Onagawa Nuclear Plant.
In addition, there are hundreds of miles of populated areas in which both agriculture and human habitation takes place. The level of protection against tsunamis was uneven. In most of the populated areas, seawalls—not as effective as breakwaters and certainly much less effective than tsunami breakwaters—were the main form of protection. The airport at Sendai, located about one km from the coast behind a 4 m seawall, was deemed to be in a safe area (5). The Fukushima Nuclear complex had a double layer of protection: the reactors had been located at the top of a 6 m bluff facing the sea and a two-wing breakwater protected the facilities. In contrast, the Port of Sendai has two sets of breakwaters including a massive deep water tsunami breakwater located 3 km from the port.

These critical facilities experienced different levels of damage. The airport, though flooded did not experience irreparable damage, and was back in operation within six days after the disaster (8). The port’s infrastructure was in acceptable shape, though hundreds of containers were piled up by the waves requiring significant clean-up. More importantly, the piers were not damaged though gantry (ship) cranes needed repairs (a very different situation than what happened in Port au Prince, where both piers and cranes were completely destroyed by the earthquake, removing a crucial component of the logistic system). The port was opened to receive relief supplies on March 18th (9) and for commercial traffic on March 29th (7).

The Fukushima nuclear complex did survive the earthquake, and went into the automatic shutdown established in the emergency procedures. Unfortunately, the tsunami waves overtopped both the breakwater and the bluff, flooding the emergency generators that provided the electricity to run the water pumps needed to cool the nuclear reactors. The crisis that followed—that culminated with the release of radioactive material—impacted the response in rather dramatic ways as it deterred the convergence of volunteers and materials to the disaster site. As a result, local responders had to undertake the bulk of the work, without the assistance of the massive help (e.g., volunteers and governments) that typically comes from the outside and provide both manpower and expertise. The deterrent effect of the nuclear crisis had on both people and material convergence sets the Tohoku disasters apart from the most recent events (one would need to go back to Chernobyl to find a precedent); as in most disasters once the physical phenomenon that produced them fades away, the response process can start in earnest.

Four specific features make the Tohoku disaster an event without precedents in disaster history: severity and pervasiveness of the danger, geographic coverage with both widespread and localized damage, and persistence over time. First, in terms of severity, the earthquake and tsunami are among the strongest on record, while the nuclear crisis is only topped by Chernobyl. Adding to the complexity, the pervasiveness of the (invisible) nuclear threat—and the fact that it conjures images from Hiroshima, Nagasaki, and Chernobyl—sends a powerful deterring signal to potential responders outside the area. The disasters also
impacted a large geographic area: the tsunami wiped out hundreds of square kilometers of coastal communities, and the nuclear crisis threatened the health of individuals and environmental conditions within a large radius from the nuclear plants. A unique feature of the Tohoku disaster that the damage was both widespread and localized. It was widespread because it impacted large continuous urban areas, e.g., Ishinomaki, and it was localized as it destroyed numerous isolated communities leaving untouched communities nearby that were not on the path of the tsunami. The time-persistence of the nuclear crisis—which lasted months—and its impacts on the response may ultimately be the defining factor as it profoundly altered the flows of goods and the very essence of the PD-HL process.

Important to the purposes of this paper is that the Tohoku disaster is a catastrophic event, as it meets all the criteria identified by disaster researchers (10, 11):

- **Impacts on the built environment:** “…most or all of the community built structure is heavily impacted… [and] facilities and operational bases of most emergency organizations are themselves usually hit…” (10, 11). For instance, in the town of Yuriage at the Miyagi Prefecture all four of the evacuation sites were flooded by the tsunami (5).

- **Impacts on local leadership:** “…local officials are unable to undertake their usual work role…” (10, 11), which has been amply established was the case. In the Minami-Soma city, for instance: “…local officials are now fighting the threat of radiation…some of them lost their families in the earthquake disaster and some lost their houses…” (12).

- **Impossibility of help from nearby communities:** “…help from nearby communities cannot be provided…” (10, 11). The extent of the event was such that most communities were impacted, while the lack of communication made it almost impossible to assess the needs of nearby communities.

- **Concurrent interruption of community life and activities:** “…most, if not all, of the everyday community functions are sharply and concurrently interrupted…” (10, 11). This was obviously the case as entire cities and towns were destroyed (12).

- **Massive media interest:** “…the mass media system especially in recent times socially constructs catastrophes even more than they do disasters…” (10, 11).

- **Political attention:** “…because of the previous five processes, the political arena becomes even more important…” (10, 11).

These features have a profound and dramatic impact on PD-HL because of a number of interrelated effects. First, large portions (and, in some cases, all) of the inventories of supplies held by households and businesses in the impacted area are destroyed, which deprived the local communities of what otherwise
would be readily available critical supplies. Second, the private sector supply chains that—in normal conditions bring all the supplies needed by the community—are severely disrupted and in some cases totally destroyed. The extent of the disruption is so serious that it could take the private sector weeks to fully restore the supply chains, while some are gone forever. Third, the demand for supplies at the disaster area increases tremendously due to the combined needs of survivors (who may have lost all their possessions) and the response process itself, as well as the local stores that perceiving a business opportunity increase the size of their orders above and beyond what is actually needed. The combination of impacts on supply (local inventories, private sector supply chains) and demand lead to a situation in which the only practical alternative is to bring the supplies from the outside of the area. This stands in contrast with the case of small disasters where local inventories and the existing supply chains could satisfy a significant portion of the needs. The failure to recognize this fundamental difference between catastrophic events and other smaller disasters had a major impact on the PD-HL response in Tohoku.

2. METHODOLOGY

The data collection strategy encompassed a multi-prong approach based on: in depth interviews with participants in the relief efforts, the assembly of a comprehensive database of news articles and reports, and the creation of a timeline of relevant events. The interviews, conducted during a field trip to the Tohoku area during May 16th to 20th, 2011, were with the Tohoku Regional Bureau of the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT); the prefectures of Miyagi, Iwate, and Fukushima; the cities of Ishinomaki and Kesennuma, and three large private companies (two trucking companies and one retailer), that were directly involved in the response. In most cases, the authors met with numerous staff members. To ensure the anonymity of the responses, the names of the individuals that provided the information are not used. In the case of the public sector, the paper only mentions the agency where the interviewee works; in the case of the private sector the paper uses generic descriptors that do not identify individual companies. The data gathered was analyzed to provide a comprehensive picture of the response. Triangulation of the data provided was routinely conducted to mitigate some of the limitations inherent in relying on perishable data.

3. PRELIMINARY FINDINGS

This section discusses the initial observations made by the authors as part of the research. The discussion centers around two major topics: disaster preparation and post-disaster response. Section 4 identifies the chief findings and policy implications.
3.1 Disaster preparation

The public sector interviewees reported to have conducted numerous actions aimed at enhancing disaster response. In all cases, the prefectures and cities had disaster response plans that outlined in some detail the actions they were expected to take. However, all the interviewees said that these plans were not followed, for the simple reason that they only considered a small disaster and not a catastrophe as the one of March 11th. Moreover, the respondents indicated that—with perfect hindsight—PD-HL was not adequately discussed in the response plans: in some cases it was not mentioned at all; in another “…it was just one line in the plan…”; and in a couple of cases was limited to identifying a handful of distribution centers (DCs) (13-17). Quite tellingly, none of the plans considered the crucial aspect of local distribution, and how the manpower and assets required for the operation of the DCs and warehouses and local distribution would be secured. As a manager of the trucking companies interviewed put it “…they were assuming that ‘somebody else’ would take care of the distribution of relief supplies…” (18).

Not surprisingly, PD-HL did not figure prominently in the training exercises annually conducted by the local governments. The respondents could only recall three exercises with a PD-HL component—albeit small ones—typically transporting supplies from the outside to a DC inside the impacted area. In only one instance, there was an effort involving local distribution, i.e., transporting cargo from a shopping mall to a single Refuge Center (RC), which was deemed “…simplistic…” Reflecting on the experience that they went through, a staff member at one of the prefectures indicated that “…a quality exercise would have been very helpful…” (17). The lack of complex and realistic exercises involving local distribution prevented the agencies from appreciating the complexity associated with the local distribution challenge that they would face in the days following March 11th, 2011.

In their favor, most of the agencies had agreements for cooperation agreements with potential private sector partners. In the case of the MLIT, the agreements were with construction companies for debris removal, engineering work, and construction (19). These agreements played a key role in expediting the recovery and reconstruction efforts. In the case of prefectures and cities, the typical agreement was with the Japanese Trucking Association (JTA) for transportation of supplies from the outside to the DCs operated by these governments. Unanimously, these agreements were deemed “…too general…” by interviewees (13, 15, 17, 18). The lack of established relationships between the government authorities and transport and logistics companies hindered an efficient response. Only one city had an agreement with a local trucking organization (17), which seems to have worked well as the local truckers understood from the start that they would take care of the local distribution. Equally important, this agreement with local truckers provided the Prefecture with speedy access to local assets and knowhow where it was needed the most.
In terms of the structure of the PD-HL networks, the disaster response plans typically defined a three echelon network with the DCs managed by the prefectures at the top, a middle layer with DCs operated by the cities, and Refuge Centers (RCs) at the bottom. In real life, however, the process was not as neatly organized—typical of the chaos of PD-HL—as some goods went directly to the city DCs, and even others to the RCs. Over time, some Prefectures and cities evolved towards a structure in which some of the DCs operated as warehouses of low/non-priority supplies; while others operated as true DCs. In this way, depending on the type of cargo the vehicles were sent to one or the other. In other cases, non and low priority cargo was allowed to unload at the busiest DCs complicating their operations tremendously as these locations were already congested; and had limited human resources to unload, sort, store, and manage the cargo.

All the prefectures and one city, indicated that they prepositioned critical supplies (e.g., blankets, meals ready to eat, or MREs and water) (13, 16). Unfortunately, they all indicated that the prepositioned amount “…was not enough…” This would come to haunt them as there were major delays in starting the local distribution. The companies interviewed did have inventories of food, water, and other supplies which they were planning to use as part of their normal business operations (18).

3.2 Disaster response

The analyses of the response after the GEJE needs to take into account the catastrophic nature of the events, and the impacts it had on the responders themselves. In addition, the nuclear crisis brought a new element to the problem: countless survivors that, in other conditions would have left the area, decided to follow the government advice and stay indoors to minimize their exposure to radiation (12). With the sustained nuclear crisis, these individuals were trapped in the disaster area, and became completely dependent on outside help increasing the importance of the local distribution efforts.

Not surprisingly, all public sector officials reported that their operations were severely impacted by the earthquake, the tsunami, or the nuclear crisis (13-17, 19). In all cases, they did not have proper communication systems, and were hindered by lack of power and fuel. In some cases, staff were killed, injured or missing, and key components of the response system, e.g., the hospital at Minami-Sanriku, was hit by the tsunami leading to numerous deaths as only the individuals that made it to the roof (of a four story building) survived the waves.

The private sector companies interviewed did not fare much better. In the case of the trucking companies 6 out of 69 DCs, and 3 out of 43 DCs in the Tohoku region were damaged or destroyed by either the earthquake or the tsunami (18). Two DCs and a shopping mall operated by the retailer were also damaged, and its main DC in Tohoku was without power for a week, which produced major
complications in their operations (20). In essence, these companies had to both recover from disaster and help the surrounding local communities. A surge in demand from other major cities in Japan for food and water also compounded supply and distribution systems.

As soon as they organized themselves, the public sector agencies tried to assess the impacts on their jurisdictions. The MLIT and one of the Prefectures indicated that they used helicopters and planes to get a sense of the conditions of roads and critical infrastructure (13, 19). The MLIT reported making good use of the 1,800 Closed Circuit Television Cameras (CCTV) part of their state of the art Disaster Control Room in Sendai. The CCTV system has a disaster mode feature—automatically engaged when a warning is received from the national government—that focuses the cameras on pre-defined critical infrastructure (e.g., bridges and tunnels). This enabled MLIT staff to get a sense of the overall conditions at key strategic locations where the cameras are located. One of the cities, which had access to a local Self Defense Force (SDF) airport, could not use the helicopters and planes located there because they were destroyed when tsunami waves arrived (the pilots did not take off once the tsunami warnings were issued) (16). However, the rest of the agencies did not have an idea about the extent of the physical damage in their regions, and the impacts on the local populations. Complicating the matter, the subsidence of the ground—in some cases 0.7 m—led to flooding in high tide that reduced the effectiveness of air inspections, which eventually had to be repeated (14).

None of the interviewees were involved in access control to the impacted areas, which they deemed to be the responsibility of SDF. They did report that in the first phase, only emergency vehicles were allowed into the disaster area; in the second phase, delivery trucks were added to the permitted list of entry; and finally, the restrictions were removed in the third phase. Some of the respondents indicated that unscrupulous individuals falsely reported transporting supplies to gain entrance to the disaster area and/or to avoid paying the tolls at the Tohoku Motorway, which had granted full toll exemptions for vehicles involved in relief efforts.

The PD-HL operations had an inauspicious start. To begin with, the Prefectures and cities—which had not identified PD-HL as a critical function in their disaster response plans—made no provisions for it. Most likely influenced by their experience with only small disasters in which PD-HL is of secondary importance, they failed to recognize that catastrophic events require that most of the relief supplies be transported from the outside. Furthermore, taking into account that there were hundreds of thousands of individuals needing critical supplies, PD-HL became a monumental challenge for which, regrettably, they were not ready, as they may not have been aware that they had to deal with this huge responsibility. As a result, for at least the first six days of the crisis hundreds of thousands of survivors had not receive relief supplies (12, 21). This prompted heavy criticism of the government response, which was accused of
ignoring the plight of the survivors: a member of the Democratic Party of Japan said, “…The prime minister and Mr. Edano [Chief Cabinet Secretary] are focusing too much on the accidents at the nuclear reactors, and not caring enough about the evacuees…” (21). In response, the SDF announced a plan to distribute relief supplies (21). At this point, SDF started to transport critical supplies of water and food to the pockets of individuals that assembled together at high points and safe places after the disaster. The crisis would have been worse, if not by the admirable community spirit of the Japanese that led survivors to share the supplies they had with their neighbors, as corroborated by the first author in Higashi-Matsushima (22). In spite of that, the human suffering due to the lack of critical supplies was significant, though it did not lead to widespread riots. However, looting of warehouses in the Watanoha area and the robbery of a bank were reported to the authors (18). At this juncture, everything seemed to indicate that—with the SDF strained to the limit—and the normal private sector supply chains severed, that a huge humanitarian crisis was unavoidable.

Fortunately, fate intervened in the form of a handful of trucking/distribution companies, that—because of their experience in delivering food and retail products—were in a position to know that the private sector supply chains had been severely disrupted, and that the public sector was not ready to fill the gap. They recognized that a huge humanitarian crisis was looming and that without their intervention things would get much worse. Independent of each other, they approached local officials during the period March 15th-March 19th and took the unprecedented step of volunteering to do the local deliveries (18). In the two cases interviewed for this paper, the companies paid for the full costs of the local distribution (and the supplies donated in the first week) for almost a month of PD-HL operations in entire cities (18). Without their timely intervention, the situation in Tohoku would have taken the path of Haiti, where the lack of help from the local business class contributed to a crisis of huge proportions (23). Ironically, it seems that many other trucking associations and companies reacted in the same way and volunteered their services, though the idea was dropped because the government could not guarantee the fuel for the return trips (21). Although it is not the objective of this paper to second guess decisions made in the midst of chaotic field conditions, it is important to highlight that using SDF’s assets to transport fuel to the disaster area would have enabled help from the private sector for PD-HL, thus expediting the relief effort.

The volunteer companies—in spite of their high level of professionalism and experience—did not have an easy time as they faced numerous challenges, in spite of the fact that one company reported that it “…learned from the experience after the 1995 Kobe earthquake...”. In most cases it took the companies more than a week to start distributing supplies to the RCs, which started during the period March 22nd-25th, 2011, i.e., more than 10 days after the start of the crisis. The staff members interviewed reported being shocked by the complexity and magnitude of the challenge. Unanimously, they complained about:
not having a good idea about the actual needs at the RCs, not knowing the conditions of roads and bridges, the lack of a single person in command of the PD-HL effort, and above all, of the challenge of doing local deliveries in a disaster zone. In their own words: “…transporting to DCs was easy…”, while “…transporting to RCs was very difficult…” (18). The experience of these world class companies clearly show that the local distribution of critical supplies cannot be taken for granted; and that the response plans for catastrophic events must seriously take into account, and prepare for, such effort.

The interviews with the staff at Fukushima Prefecture indicated that the nuclear crisis had a major impact on the response process. First, it deterred the flow of volunteers and damped the arrival of supplies to areas within a large radius around the Fukushima Daiichi Nuclear Plants. This led to a situation in which many locals were left to their own devices in the midst of a catastrophic event. Although the authors could not find hard data to assess the extent of the problem, there is substantial evidence that illustrates the impacts of the nuclear crisis. For instance, in the days after the nuclear crisis started international airlines canceled numerous flights (24), major international shipping companies rerouted their ship schedules to avoid nuclear contamination (25-27), and even the U.S. Navy ships decided to pull out of the Fukushima area due to the radiation risks (28).

At the same time, the Fukushima Prefecture was experiencing a very difficult time coordinating the relief effort because—in addition to the impacts of the tsunami and earthquake—they had to contend with the impacts of the nuclear crisis on the local response (17). The most obvious of these impacts is that many truckers decided to stay away from the area which dampened the flow of supplies, as it happened after Hurricane Katrina when truckers left the area upon hearing that a second hurricane (Rita) was coming (1). Although there are no data, the prefecture staff indicated that “…a large number…” of truckers simply unloaded their cargo at the border of Fukushima Prefecture, or parked the trucks and left. Of particular importance was the case of 36 fuel tankers that—at the height of the crisis—were left about 50 km from their destination. This required sending local drivers to retrieve the trucks and their critical cargo (17).

The impacts of the nuclear crisis on the local residents is dramatically illustrated in the video uploaded to the Internet by the Mayor of Minami-Soma (12). In the video, he discusses in agonizing details how the nuclear crisis both forced the survivors indoor, and prevented the arrival of the volunteers and supplies they needed. Pleading for volunteers willing to “…act at their own risk…” that “…could bring in petrol (so that they could leave)…”, he outlined the challenges they were facing. The video implies that there were substantial numbers of residents that had to stay indoors to reduce the risk of nuclear contamination; residents could not leave the area because of lack of fuel and vehicles, and impassable roads; and they were not receiving the supplies needed.
The Tohoku experience yet again demonstrated the problems caused by excessive donations of non-priority (supplies that are either not needed at all, expired products, or products that could do harm), and low-priority goods (those that could be used at some point and that should be stored for future use) vs. high-priority supplies, which are the goods needed at the site (29). This phenomenon, i.e., material convergence (30), has been identified in all large disasters and has been labeled by many a “…second tier disaster…” (31, 32). The problem with the convergence of low and non-priority goods is that they arrive in such large volumes, and at a time at which the responders are busy with other more important things, that they severely disrupt response operations. The trucking companies interviewed—which were responsible for the operations of the DCs and had to deal with the problem—indicated that between 50% and 70% of the cargo they handled was not needed at all, and should not have been sent there. This is consistent with the literature on the subject that suggest 60% (30), and with the observations of the first author on Katrina and Haiti (1, 23). The amount of resources required to manage this humongous and uncoordinated flow of goods is significant. For instance, when the authors visited a large DC in Iwate Prefecture, one third of the staff of this large facility were sorting clothing that had been donated (20 out of 60 staff members), and that occupied between 40%-50% of the floor space. There was consensus among interviewees that blankets, clothing (used and new), and water were the top three non/low priority supplies. The case of blankets (and water) is illustrative because during the first week after the tsunami disaster they were high-priority supplies. However, as the weather warmed up, blankets ceased to be high-priority and became a nuisance as hundreds of thousands of blankets from dozens of prefectures in Japan, and countries like Canada (that sent 25,000 blankets) descended on Tohoku (33).

Although for reasons of space, it is not possible to fully elaborate, it is important to highlight that these findings are consistent with the realities observed in previous catastrophic events, e.g., Katrina and Haiti (1, 23). This may indicate the existence of common underlying factors, which may be integrated into a set of general principles for disaster response that—though requiring adaptations to local conditions—could help improve the resilience and effectiveness of PD-HL.

4. POLICY IMPLICATIONS

The experience of the participants in the Tohoku disaster response provides important lessons for the disaster research community. These lessons could be summarized as follows:

(i) The disaster response plans, particularly at the prefecture and city levels, failed to consider and prepare for worst case scenarios as they only focused on small disasters, that they could handle on their own. This proved to be inadequate. In this context, it is important to ensure that guidelines for development of disaster response plans consider a wide range of disaster scenarios, and particularly
large catastrophic events spanning over multiple jurisdictions. This is particularly important for midsize/large cities because in these cases the magnitude of the disaster could lead to radically different PD-HL operations.

(ii) Not having disaster response plans that, in detail, considered PD-HL hampered public sector response as local officials had to confront the crisis without any guidance about how to proceed. Thus, it is important to develop specific and detailed disaster response plans for mid/large cities for the reasons discussed above.

(iii) The lack of training and realistic exercises on PD-HL significantly diminished the effectiveness of the public sector response to the disaster. This suggests the need for a training program in PD-HL that provides responders with the knowhow to a good job, if the need arises; and the convenience of either real-life or simulated (table-top) exercises on PD-HL.

(iv) The lack of technologies and systems to quickly assess the conditions of the transportation network and other critical infrastructure hampered the response process. This highlights the need for integrated systems that combine satellite imagery, remote sensing, and geographic information systems thus providing local responders with an assessment of conditions on the ground. These systems must be complemented with proper communication, computer, and backup systems so that the locals could benefit from them; as well as the assets needed to do local inspections.

(v) The lack of efficient communications with the field was a negative factor in the response that made the assessment of local needs a difficult task. For that reason, ensuring good communication with the field should be a key priority to ensure a timely assessment of the needs on the ground. The only way to achieve this is to preposition either satellite phones, or priority phones with preferential access to bandwidth, at strategic locations so that they could be quickly deployed.

(vi) The private sector in the construction, transportation, and retail sectors played a key role in the response as they brought to bear expertise and assets that benefited the response, though in most cases their participation was improvised and unanticipated. This experience suggests that integrating the private sector into disaster preparations could open the door to new paradigms of disaster response and a better integration with public sector efforts. In this way, they would be able to contribute ideas to disaster plans, and know what is expected from them in the case of a disaster.

(vii) In catastrophic events, the bulk of the relief supplies has to be transported from the outside of the impacted area. This is because private sector supply chains are severely disrupted, significant portions of the local inventories at household and businesses are destroyed, there are significant increases in demand for supplies, and transportation networks are impacted. As a result, the first
wave of critical supplies could take more than a week to arrive. For that reason, it is important to preposition supplies so that they become the first wave of resources to reach the impacted area.

(viii) The most challenging part of the entire PD-HL process was the local distribution. For that reason, disaster planning must pay special attention to it so that all potential participants are prepared to deal with the challenge. As the experience of Haiti shows, the integration of the local communities to the effort could play a fundamentally important role as they are the only ones that could provide the manpower and local knowledge needed to man the points of distribution (23).

(ix) Lack of fuel (for the return trips) prevented the volunteer participation of numerous trucking companies on the PD-HL effort during the initial days of the crisis. The importance of fuel is impossible to overstate, as without it the PD-HL effort collapses. For that reason, disaster response plans must make specific provisions to ensure that an adequate and robust supply of fuel is available at the disaster site that should be shared with private sector companies that are participating in the PD-HL process.

(x) Non/low priority donations created a lot of problems as they consumed significant amounts of resources, were not needed, and arrived at a time at which there were more important activities to undertake. For that reason, it is important to implement proactive donation management plans that: provide potential donors with guidelines about what and when to donate; controls access to the disaster site to prevent entry of non/low priority supplies; engages the media so that they help inform the public about how to help; and uses information systems to try to match needs on the ground to potential donations.

5. CONCLUSIONS

The research reported in this paper provides a number of important conclusions that should be taken into account by disaster response agencies. The fact that these findings are consistent with what was observed after other catastrophic events, e.g., Katrina and Haiti, clearly suggest their robustness. Among the similarities it is important to highlight: the need to bring large amounts of outside resources to the impacted area to satisfy the needs of survivors and the response process; the importance of prepositioning critical supplies; the magnitude and complexity of the PD-HL challenge and particularly of the local distribution, undoubtedly the most difficult part; the necessity to integrate all segments of Society—the military, public sector, the various strata of the private sector—to ensure the most efficient response permitted by the circumstances; and the need to proactively manage and control the flows of non/low/high priority supplies that accompany large disasters (1, 23).
An important conclusion is that the failure to prepare for the worst case scenario hampered the ability of all layers of government to respond to the challenge. This suggests the necessity of strengthening the guidelines for preparation of disaster plans and operations so that they specifically consider a range of disaster scenarios of various degrees of severity and magnitude. This is the only way to ensure that local governments are ready when the need arises.

Worthy of specific mention is that catastrophic events require PD-HL that are orders of magnitude larger and more complex than the ones required in, the more frequent, smaller disasters. This is a problem because disaster responders tend to assume that response plans apply to both cases, which is not correct. In large urban catastrophes the bulk of the relief supplies must be transported from the outside of the impacted area. This is because: (1) large portions of the supply inventories held by both households and businesses are destroyed by the event; (2) private sector supply chains, that in normal conditions bring to the area all the goods and services needed are severed, taking weeks to be fully restored; (3) the local leadership may be killed or injured, making the coordination with the outside world either difficult or impossible; and, (4) demands for supplies from both survivors and the response itself significantly increase. In this context, since the outside world plays a key role, the issue of coordination with the locals for the delivery of a massive amount of aid is a major challenge as made evident in Haiti (23).

The research also highlighted the importance of proper and effective donation management. At the heart of the issue is the fact that, if left unchecked, the flow of non-priority (not needed) and low priority (items that may be needed later on and must be stored) supplies slowdown the flow of the high-priority supplies. Preventing this from happening consumes large amounts of resources as non/low priority supplies must be processed to prevent the collapse of DCs and entry points to the disaster area. For that reason, effective donation management would require a combination of: access control to the disaster area so that non/low priority goods are prevented to enter, or redirected to suitable processing points; public awareness campaigns aimed at educating the general public, private and public sector executives about how and what to donate; proactive engagement of the news media; and, information systems to match supply to needs in the ground.

Taken together, these conclusions shed light into the lessons that should be incorporated in disaster response plans and operations. In spite of the contributions made in this paper, however, the reality is that PD-HL is still poorly understood. This unfortunate situation highlights the need for additional field research that helps characterize such complex problems. The knowledge derived from these studies will enable disaster responders to develop adequate procedures for responding to catastrophic events.
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7. REFERENCES


