UNICEF’s resilient Cold Chain restoration program following Typhoon Haiyan: an innovative approach towards health systems strengthening and “building back better”

Update from the UNICEF Philippines Country Office
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Contents

Executive Summary ............................................................... Page 3
1. Issue .................................................................. Page 4
2. Action and Impact ....................................................... Page 6
   2.1 Disaster – resilient Cold Chain Equipment ............... Page 7
      2.1.1 Surechill© Vaccine Refrigerators: the latest technology allowing vaccine storage
              for ten days despite of power outage .......................................................... Page 9
      2.1.2 Installation of 17 resilient walk – in cold rooms .......... Page 9
      2.2 Cold Chain Training and Immunization Campaigns ....... Page 11
3. Future steps and nation – wide impact ............................. Page 12
Annex 1: Documents and Evidence ........................................ Page 14
Executive Summary

Super Typhoon Haiyan, which hit the Philippines on November 8th 2013, affected over 18 million people and caused 6,000 deaths. Experiencing at least 20 typhoons every year, building resilience has become common place in the Filipino culture and is an attitude that needs to be applied to the re-development of the healthcare systems as well.

As a direct impact of Typhoon Haiyan almost all affected areas lost electricity for several weeks or even months leading to substantial damage of large amounts of vaccines not being cooled. The dramatic loss of vaccines, cold chain equipment, and healthcare personnel resulted in an abrupt halt of immunization services, leaving 2.5 million affected children at risk of disease and death. This was combined with already low vaccination rates, crowded evacuation centers, and sporadic measles outbreaks, further exacerbating the health consequences felt by these displaced communities.

Following the assessment of the devastation, and the acceptance of the likelihood of future disasters, UNICEF highlighted the need to “build-back-better”. This meant for UNICEF resilient health systems strengthening, with the improvement of the cold chain taking top priority. In close collaboration with UNICEF’s Supply Division in Copenhagen, the UNICEF Philippines Country Office undertook a systematic step-by-step approach towards re-establishing the cold chain system across the entire typhoon affected area. In order to maximize resiliency, UNICEF selected specialized equipment: not only does the newly established equipment ensure optimum vaccine temperature for at least 10 days without power, but it is also built to withstand 7.5 Richter earthquakes and 300km/h typhoons (including so called ‘Sure-Chill’ back-up equipment); 50 solar fridges; 715 generators and voltage stabilizers; 10,900 vaccine carriers and transport boxes; 10,000 ice packs; 5130 temperature monitoring devices; and 17 40m² walk-in cold rooms. UNICEF also worked together with the Department of Health (DOH) and the World Health Organization (WHO) to restore immunization services in the region. 500 healthcare workers (Training of Trainers - ToT) were trained in improved vaccine and cold chain management, with training disseminated to several thousand health workers in total. The first 3 weeks of an immunization campaign vaccinated over 83,200 children under 5 years of age against measles, over 82,100 against polio, and over 55,300 received vitamin A and were screened for malnutrition.

With such new resilient cold chain standards set in the typhoon-affected areas, the government of the Philippines has requested UNICEF to support the scale up of this intervention to the entire country in 2016 and 2017.

Our experience shows that rebuilding a disaster-resilient cold chain system in a post disaster setting offers an excellent opportunity to strengthen health systems and ensures that cold chain equipment and facilities are able to withstand future assaults. Furthermore, this case study shows how UNICEF’s engagement at district level in a post emergency setting can be transferred into catalytic engagement in upstream policy dialogue with government, advocacy, brokering, transfer of knowledge, and national scale up for implementation. Close collaboration between development partners and with the Ministry of Health (MoH) are crucial prerequisites for successful planning and implementation. Other countries facing similar challenges might find merit in learning from our experience.
1. ISSUE

In 2014 Philippines has been positioned among those countries with the highest economic growth in South East Asia. However, despite an increasing economy, a significant proportion of the Filipinos remain poor. Being considered the world’s 12th most populous country in 2013, the Philippines has an estimated population of 98.7 million. The annual birth cohort in the Philippines constitutes an estimated 2.6 million children, which is the yearly target for national immunization programs. The proportion of fully immunized children fluctuated over the past 20 years (figure 1). However, in 2013 the proportion was only 61.8%, which is much lower than the coverage in 1998. Despite the conduct of SIAs in the past, the country still suffers from outbreaks of vaccine preventable diseases: In the last five years the DOH (equivalent to MoH) has recorded more than 26,000 cases of measles with 166 deaths. To prevent more outbreaks from happening, supplemental immunization activities (SIA) or mass immunization campaigns are undertaken every 3 years with varying level of success in terms of coverage. In the past years the UNICEF Philippines Country Office has been instrumental in supporting

Figure 1: Proportion of Fully Immunized Children in the Philippines. National Health Survey (NHS) versus Department of Health (DOH) report.

Picture 1: As a direct impact of Typhoon Haiyan health systems became dysfunctional. Electricity cuts over a period of several weeks or even months lead to substantial damage of large amounts of vaccines not being cooled.
the Philippine government in vaccine procurement, facilitating procurement of vaccines worth 50 million USD per year.

Climate change continues to affect weather patterns, increasing the frequency and strength of extreme weather events globally. The devastating impacts of natural disasters are exposing the vulnerability of communities and destroying their livelihoods. Natural disasters have especially deleterious effects on children, increasing their exposure to trauma and disease, disrupting their education and social development, and increasing their overall risk of death. This has become an unfortunate reality for the Philippines. Being affected by more than 20 typhoons each year, the environmental context of the Philippines makes disaster preparedness and resilience particularly critical. The Philippines is the third most disaster-prone country in the world, with high vulnerability not only to typhoons, but also flash flooding, volcanoes, and earthquakes. The most recent example in the Philippines is Super Typhoon Haiyan (Figure 2), which hit the country on November 8th 2013 affecting over 18 million people and causing 6,000 deaths. The most deprived regions in the country were the hardest hit: with a 40% prevalence of child poverty before the disaster, the destruction of their livelihoods and communities had a profound impact on the poorest families and their children.

During Typhoon Haiyan, the surge in acute and emergency cases overwhelmed the local health system, which was also reeling from the damages to infrastructure, costing approximately US$1.5 billion. The national government, with support from the global health community and development partners including UNICEF, responded by sending supplies, equipment, and health workforce teams.

Figure 2: Path of Super Typhoon Haiyan which hit the Philippines in November 2013
A direct impact of Typhoon Haiyan on child health was demonstrated in the destruction of the immunization system; a system which was already proven to be inadequate by the relatively low levels of measles, diphtheria, pertussis and tetanus coverage. The loss of cold chain equipment (for the definition of “cold chain” refer to box 1), vaccines, supplies, facilities, and healthcare staff resulted in widespread disruption in routine vaccination; thousands of vaccines were rendered useless as even the facilities that had generators lacked fuel and capacity to keep them running for an extended period of time.

Box 1: WHAT IS A “COLD CHAIN”? “Not too hot, not too cold - protecting lifesaving vaccine from heat and freezing damage through the Cold Chain”.

Vaccines lose their effectiveness when they are exposed to extreme heat conditions. Making sure that vaccines stay at the right temperatures at every step of a journey, from the manufacturer to children and mothers in need of immunization, requires a network of equipment and services called a “cold chain.” A strong cold chain system is vital for immunization programs. Maintaining the right temperature for vaccines can be extremely challenging, especially in low-resource settings with unreliable electricity, poorly maintained equipment, and long distances between facilities. As a result, health workers are sometimes forced to discard vaccines that they suspect have been exposed to extreme temperatures. Worse still, damaged vaccines might be inadvertently administered, leaving people vulnerable to disease. During natural disasters, vaccine damage is very common due to inadequate refrigerator equipment, power outages and lack of electricity backup systems like generators.

2. ACTION AND IMPACT

Following Typhoon Haiyan, almost all affected areas lost electricity for several weeks or even months leading to substantial damage of large amounts of vaccines. Thus, with most of the cold chain in the typhoon-affected areas being destroyed, more than 2.5 million affected children were at risk of disease and death. The worst affected cities were Leyte and East Samar, which sustained irreparable damage to their refrigeration and cooling systems due to high winds and floods. This discontinuation of immunization services was profoundly felt by the displaced communities, where crowding and measles outbreaks exacerbated the already severe consequences of the disaster, causing deaths among children in the affected population. The assessment of the devastation, and the acceptance of the likelihood of future disasters, highlighted the need to “build-back-better”. This meant for UNICEF resilient health systems strengthening, with the improvement of cold chain logistics taking top priority. In close collaboration with UNICEF’s Supply Division in Copenhagen, the UNICEF Philippines Country Office undertook a systematic step-by-step approach towards re-establishing the cold chain system across the entire typhoon affected area in a resilience-focused manner (figure 3).
2.1 Disaster - resilient Cold Chain Equipment

UNICEF responded to the request of the DOH (Department of Health, equivalent to Mistry of Health) to provide most resilient cold chain equipment currently available to the entire typhoon affected area. 430 state of the art electric fridges (including so called ‘Sure-Chill’ back-up equipment); 50 solar fridges; 715 generators and voltage stabilizers; 10,900 vaccine carriers and transport boxes; 10,000 ice packs; 5130 temperature monitoring devices; and 17 40m² walk-in cold rooms were supplied. This range of equipment was sited differently in different geographic locations based on an initial needs assessment. Together with WHO, UNICEF also provided technical expertise as well as several million doses of measles-rubella and oral polio vaccines (figure 4). By investing 8 million USD, UNICEF ensured that 190 Local Government Units (LGU; equivalent to districts) benefitted from restored and improved cold chain systems reaching 2.5 million children.
UNICEF selected specialized equipment in order to maximize resiliency. Not only does the newly established equipment ensure optimum vaccine temperature for at least 10 days without power, but it is also built to withstand 7.5 Richter earthquakes and 300km/h typhoons. The cold chain includes a unique new ice-cooling technology which does not require a constant power source; it works via a special cooling systems adjacent to the refrigerator compartment, and allows equipment to continue to operate effectively without power until the stored ice has completely melted. This equipment was provided to more than 500 healthcare facilities at various levels, complemented by 17 walk-in cold rooms constructed at the provincial and regional levels, dramatically improving the cold chain facilities. Furthermore, the new disaster-resilient cold chain structure helps to increase the rural vaccine storage capacity from 60 liters to 100 liters, a clear advantage for future routine and mass immunization programs. All immunization equipment was formally turned over to the government March 20th 2014 (see annex 1).

**Table:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2 million</td>
<td>doses of Oral Polio Vaccine</td>
</tr>
<tr>
<td>3 million</td>
<td>doses of Measles Rubella vaccine</td>
</tr>
<tr>
<td>10,900</td>
<td>vaccine carriers and transport boxes</td>
</tr>
<tr>
<td>10,000</td>
<td>ice packs for vaccines</td>
</tr>
<tr>
<td>5,130</td>
<td>temperature monitoring devices</td>
</tr>
<tr>
<td>430</td>
<td>state of the art vaccine refrigerators</td>
</tr>
<tr>
<td>715</td>
<td>generator sets and voltage stabilizers</td>
</tr>
<tr>
<td>17</td>
<td>walk in - cold room and freezers</td>
</tr>
</tbody>
</table>

**Figure 4:** Cold Chain supplies and vaccines provided and installed through UNICEF totaling 8 million USD.
2.1.1 Surechill® Vaccine Refrigerators: the latest technology allowing vaccine storage for ten days despite power outage

Being disaster-resilient means being able to withstand all situations and its consequences, such as power outages. Keeping this in mind, UNICEF procured and installed refrigerators featuring the latest technology on the market: Surechill® vaccine refrigerators are known to be highly resilient due a smart technology adopted in the design. These refrigerators are made of sturdy materials, with an outstanding thick insulation layer using simple water reservoirs for cooling. This thick water insulation (125 gallons), once cooled to the desired temperature, is able to maintain the correct vaccine storage temperature for ten consecutive days without power or electricity. The equipment weighs only 145 kgs, and if water is added, the weight will be almost double which makes it resistant to strong currents of water and earthquake shakes. Furthermore this equipment is flood proof since the main mover (motor and electrical connections) is situated on the top of the equipment, only 2 meter deep water can submerge it. Additionally, a special door mechanism prevents water from entering the vaccine storage space at any time.

2.1.2 Installation of 17 resilient walk - in cold rooms

The cold room installation in 17 strategic key locations for Typhoon Haiyan affected areas is a UNICEF-turn-key project; it adheres to international standards set by the WHO and UNICEF by utilizing Product Quality Standard (PQS) equipment. Pre-fabricated materials which are connected and joined together on site are being used to form a building (40 - 60 m²). While the structure is made of container–like iron, galvanized iron sheets are used for the roof and G.I. insulated panels serve as walls. The building contains various spaces such as storage space with shelves for dry supplies, a room for packing items for distribution or unpacking received shipments, a mini office, and (most importantly) a space which serves as a walk–in cold room. The building can accommodate additional vaccine storage equipment,
refrigerators as back up, freezers for ice packs, and vaccines for immunization outreach activities. Each facility is supported by a back-up voltage stabilizer and power generator.

The Cold Room itself, which is being installed inside the building, is also a pre-fabricated item, measuring 3 meters by 5 meters, equipped with two alternating cooling units to provide a cooling effect between +2°C to +8°C (the required temperature to store vaccines safely to ensure potency). The 17 cold rooms come in two sizes: (1) a plain 30 cubic meters with 9 units and (2) 40 cubic meters: a mix of cold and freezer rooms, 25 cubic meters and 15 cubic meters respectively. Each cold room provides adequate vaccine storage space for a 6 month supply of vaccine, a requirement for each of the facilities.

The decision to construct 17 new buildings for hosting 17 cold rooms stemmed from the unavailability and destruction of existing buildings after the typhoon. Thus, the project became more ambitious as it required a dedicated site for construction. A series of meetings and negotiations with the national/provincial and city government were necessary in order for UNICEF to be able to secure government provision of appropriate land. In addition, pieces of land identified had to be covered by the commitment of mayors at municipality level in the form of special resolutions to protect the facility from being ejected after the national elections in 2016.

UNICEF undertook the procurement of services. Following an international tender, a China-based company was identified for installation of the facilities. A separate tender was issued for constructing the foundation. As a pre-requisite, UNICEF ensured the commitment of local government unit officials to take responsibility of the operating and maintenance costs of the facility and equipment, including the management of local human resources. Currently, a total of 340 municipalities benefit from this equipment.
2.2. Cold Chain Training and Immunization Campaigns

Following Typhoon Haiyan, UNICEF in close collaboration with the DOH and WHO, trained 500 healthcare workers (ToT) in improved vaccine and cold chain management, reaching several thousand health workers in total. UNICEF also focused on supporting the DOH in building capacity for primary healthcare for community health workers; establishing a mechanism for quick surge for local health capacity in future emergencies; and supporting local units of the DOH to strengthen emergency preparedness, response, and recovery capacity. Additionally UNICEF partnered with DOH and WHO to conduct measles and polio immunization campaigns, distribute vitamin A, and screen for malnutrition. Efforts were focused on the most at risk areas, including evacuation centers and communities with confirmed and suspected measles cases. Within its first few weeks, the campaign vaccinated over 83,200 children under 5 years of age against measles, over 82,100 against polio, and over 55,300 received vitamin A and were screened for malnutrition. From December 2013 the strategy shifted to re-establishing the routine Expanded Programmed on Immunization (EPI), however, UNICEF retained a capacity to flexibly respond to outbreaks. This allowed for UNICEF and partners to logistically support mop-up campaigns when a case of measles was reported.

Testimonials

“Do you see that freezer? The cold chain system? It’s from UNICEF. [Pointing to some boxes] Those supplies? Also from UNICEF. UNICEF provided us with so much assistance, we are grateful for the support provided to us.”

Health Official, Typhoon Affected Area

“Pinalangga namon ang UNICEF diri sa amon.” UNICEF is well-loved among our people. We are glad that our vaccine can now be safely stored”.

Health Official, Typhoon Affected Area
3. FUTURE STEPS AND NATION – WIDE IMPACT

Our experience shows that rebuilding a disaster - resilient cold chain system in a post disaster setting offers an excellent opportunity to strengthen health systems and ensures that cold chain equipment and facilities are able to withstand future assaults. The establishment of a disaster resilient cold chain system helps to reduce morbidity and mortality before, during, and after natural disasters through improved resilience, and has a direct lifesaving impact through routine immunization.

With such new resilient cold chain standards set in the typhoon-affected areas, the government of the Philippines is ready to scale this intervention up to the entire country including its expansion already as a major strategy in the “Expanded Program on Immunization (EPI) Strategic Plan for 2015 – 2019”. Thus, the DOH has requested UNICEF to technically support the scale up process. In it, UNICEF would support procurement of over 400 electric and solar refrigerators (with innovative remote temperature monitoring devices) that would benefit more than 300 municipalities and cities over 50 provinces, potentially reaching several million children and mothers with life-saving vaccines. The introduction of new technology would be supplemented with capacity building activities targeting EPI and cold chain managers, supportive supervision, and follow-up training to ensure knowledge retention and practical application. Mothers and caregivers will also be targeted with vaccination education and health promotion materials via a variety of media.

Middle-income countries like the Philippines increasingly require a mix of technical and policy-oriented support from UNICEF. The establishment of a resilient cold chain system is a bottom-up initiative bringing resilience from the local level up to the national level via potentially improving national policies for new cold chain standards in the country, training human resources for immunization within and outside of in emergencies, as well as creating standards for facilities and hospitals among others. This case study shows how UNICEF’s engagement at a district level in a post emergency setting can be
transferred into catalytic engagement in upstream policy dialogue with government, advocacy, brokering, transfer of knowledge, and scale up for implementation.

As disasters and their impacts intensify, there must be a corresponding adaptation by health systems. It is imperative that UNICEF demonstrate its support toward this goal to ensure lifesaving vaccines reach every child. Building capacity, reducing risk, and increasing resilience today is the best way to ensure the health and achievement of children tomorrow. UNICEF and partners also recognized the urgent need to build cold chain and immunization capacity; by training health workers, sustainability and resilience has been promoted. Close collaboration between development partners and the Ministry of Health are crucial prerequisites for successful planning and implementation. Other countries who face the frequent occurrence of natural disasters and their corresponding challenges may find merit in learning from our experience.
PRESS RELEASE

Vaccines and immunization equipment to benefit children affected by Typhoon Yolanda

MANILA, 20 March 2014 — Rebuilding the cold chain infrastructure, which was severely damaged by Typhoon Yolanda last November, has been a shared priority for the Philippine Government, the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO).

When Typhoon Yolanda struck, Leyte and Eastern Samar were among the hardest hit areas, with Tacloban City bearing the brunt of the damage. Health care infrastructure was severely damaged; and cold chain equipment and vaccines were destroyed.

Cold chain is a system used for keeping and distributing vaccines in a condition that retains its ability to give protection against disease. The cold chain consists of a series of storage and transport links, which are all designed to keep the vaccine at the correct temperature until it reaches the user, namely children and mothers in need of immunization. With most of the cold chain in the typhoon-affected areas being destroyed, more than 1.8 million affected children are at risk of disease and death.

UNICEF and WHO are supporting the Philippine government to re-establish its national immunization programme in Yolanda-affected areas, and make it disaster-resilient, providing equipment that will be able to withstand future calamities.

UNICEF will assist 450 DOH health care facilities at different levels by providing them with earthquake and typhoon resistant cold chain equipment; including 5,000 temperature monitoring devices, 4,000 vaccine carriers, 800 cold boxes, 400 back-up generator systems, 150 ice-lined refrigerators, 50 solar-powered refrigerators and 200 Sure Chill freezers running on an innovative cooling technology, allowing them to operate for more than ten days without electricity. Additionally, 16 walk-in cold rooms for vaccine storage will be constructed at the regional and provincial levels, supported by three million doses of measles-rubella and oral polio vaccines. Based on in-depth assessment of short term requirements for routine immunization in affected regions, the equipment donation is budgeted at US$8 million.

WHO together with UNICEF has also trained health workers to improve vaccine and cold chain management.

Within the third week of this crisis, WHO delivered 16 solar powered vaccine refrigerators to key points in Leyte to enable autonomous storage of vaccine stock replenishment from the Department of Health’s warehouses. These refrigerators were supplied by DFID (Department of International Development) U.K., and flown directly from Oxfordshire to Mactan International Airport in Cebu on board a Royal Air Force C17 transport jet. From Mactan, WHO logisticians transported the solar powered refrigerators to Tacloban via a Korean Air Force C130 transport. Even without electric power or generator sets, these self-contained devices restored the cold chain capability of some parts of Leyte, thereby enabling the DOH (Department of Health) to conduct its mass immunization effort in late November.

WHO also provided a million doses of measles/rubella vaccine for the DOH program, along with AD mixing syringes and safety boxes, and two domestic refrigerators for use in Tacloban. As the power outage caused by the storm also affected the cold chain of earthquake-stricken Bohol province, WHO provided key areas with necessary equipment such as icedine refrigerators, icepack freezers, chest type cold boxes, vaccine carriers, icepacks, 6KVA electric generator sets, and other supplies.
Still in the pipeline from WHO are 66 ic pack freezers, 4,500 safety boxes, 88 cold boxes, 300 vaccine carriers, Measles/Rubella test kits and laboratory equipment, temperature monitoring devices. A second delivery of vital hospital equipment requested by the infectious disease referral center, the San Lazaro Hospital in Manila is soon to follow the donation given last January. As the lead agency in the Tacloban health cluster, WHO oversees the disease monitoring activities in the province to ensure prompt response to any brewing disease outbreak.

Together with WHO and partners, UNICEF conducts the symbolic hand-over to the Department of Health (DOH) in Tacloban City today. These agencies plan to establish the cold chain first in Tacloban; and then expand the program across the typhoon-affected area.

“The needs on the ground remain great. The risk of disease outbreaks is ever present, and so far only half of affected communities have seen their health centres reopen,” said Lotta Sylwander, UNICEF Philippines Representative.

UNICEF and WHO will focus on supporting DOH in building capacity for primary health care for community health workers, and establish a mechanism for quick surge in local health capacity in future emergencies and support local units of DOH to strengthen emergency preparedness, response and recovery capacity.

“The objective is to build capacity, reduce risks and increase resilience so all children can thrive today and stay confident for the future.” she added.

WHO Representative in the Philippines Dr Julie Hall stressed the importance of building back better when ensuring that health infrastructure, which includes services, facilities, and equipment for the most vulnerable populations is present, as this is an essential step in guaranteeing healthy and capacitated communities.

“Exploring alternative technologies such as the use of solar energy, is a wonderful way of promoting resilience for these communities, considering that calamitous events such as Typhoon Yolanda can occur at any time. Ascertaining that such capability is in place is a positive way of placing health at the heart of healing for the communities in the Yolanda corridor,” Dr Hall continued.

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About UNICEF
UNICEF promotes the rights and wellbeing of every child, in everything we do. Together with our partners, we work in 190 countries and territories to translate that commitment into practical action, focusing special effort on reaching the most vulnerable and excluded children, to the benefit of all children, everywhere. For more information about UNICEF and its work please visit www.unicef.org.

Please visit UNICEF Philippines website, Facebook and Twitter.

About WHO:
WHO is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

To know more about WHO and its work in the Philippines, please visit http://www.wpro.who.int/philippines/en/
Picture 5: Hand over of cold chain equipment in Tacloban City on 20 March 2014
INSTALLATION OF COLDROOM IN DOH-REGION-VIII
PALO, LEYTE
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