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Resilient against the elements: the preparedness and response to cyclone 'Phailin' by the state of Odisha, India

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More intense cyclones are predicted with the ongoing climatic changes. Therefore, strengthening disaster preparedness to cope with cyclones is recommended. The state of Odisha in India, could be considered to be the cyclone capital of India. On the 12th of October 2013 a very severe cyclonic storm "Phailin" hit the State. The State Government, took into account the learning of 1999 Super Cyclone with 10,000 deaths and was well prepared and aimed for zero casualty. As a result, minimal human suffering was observed. The response has been recognized as a "landmark success" in disaster management and risk reduction by the United Nations. This paper analyses the preparedness and response by the Government with a focus on the water and sanitation sector and distils the learning from the disaster response.

Background

Odisha, with a population of 42 million, is one of India's 28 states, and is located on the eastern coast on the Bay of Bengal. The Bay of Bengal is located in the Inter Tropical Convergence Zone (ITCZ) which generates monsoons, depressions and cyclonic storms (Wallace et al.; 1977). As a result, India's east coast is one of the six most cyclone-prone areas of the world (World Bank; 2013). The state of Odisha has experienced 98 cyclones during the last century, much more than any other Indian state (Government of Odisha; 2013a), and can be referred to as the cyclone capital of India. Cyclones pose a huge threat to human life and morbidity caused by injuries, drowning, hypothermia and diarrhoea outbreaks. Vector control is therefore a key strategy to minimize the risk of a diarrhoea outbreak and thus the loss of human life (Patra et al.; 2013).

The State bears in mind the experience of the Super Cyclone (category 5) which hit Odisha on 29th October 1999. With estimated sustained wind speeds of 260 km/h, it was the most intense cyclonic storm over the north Indian Ocean in recorded history. This cyclone led to a peak surge of sea water of 7.9 meters followed by heavy rains, 400mm to 955mm in 4 days. The raised sea level resulted in tidal waves which moved inland and wiped away six villages completely and 59 villages partly. The wind speed devastated houses, human settlements and caused destruction at a large-scale. The associated heavy rainfall resulted in high floods causing a number of breaches in the flood embankments and these floods caused diarrhoeal outbreaks (Patra et al.; 2013). The cyclone damaged a total of 1.9 million houses, took a death toll of 9,893 human lives and left 7,507 people injured. The scope of damages and loss of human life could be attributed to the ill-preparedness of the state and it was recommended to strengthen the preparedness capacity (Kalsi; 2006). In the current scenario of climate change, models predict a substantial increases in the frequency of most intense cyclones (Thomas R. Knutson et al.; 2010), hence the need to improve cyclone preparedness for the state of Odisha cannot be overstated.

Preparedness

Triggered by the huge devastation caused by the Super Cyclone, the Government of Odisha set up the Orissa State Disaster Mitigation Authority in December 1999 and in 2008 changed it to the Orissa State Disaster Management Authority (OSDMA). The OSDMA is the mandated authority to undertake and coordinate

relief, restoration, reconstruction and other measures between departments, bi- and multi-lateral agencies, United Nations (UN) agencies and Non-Governmental Organisations (NGOs). The OSDMA is governed by Ministers and Secretaries of relevant departments and is chaired by the Chief Minister. The execution at the state level is with the State Executive Committee (SEC) and at district level with the District Disaster Management Authorities (DDMA). These institutions bring relevant departments together and is chaired by the highest authority: the SEC by the Chief Secretary and the DDMAs by the District Collectors. This gives these institutions a high level of authority to coordinate between relevant departments. As part of the work of OSDMA, a State Disaster Management Plan (SDMP) has been developed, where the response plans of various departments are articulated. The Rural Development Department (RDD) is responsible for drinking water and sanitation, while hygiene is shared with Health and Family Welfare Department (Government of Odisha; 2013b).

Water and sanitation preparedness

The implementing agency under RDD for rural water and sanitation sector in Odisha is the Rural Water Supply and Sanitation (RWSS) Organisation. Since 2002, the Odisha State Water and Sanitation Mission (OSWSM) has been established as a support organization to RWSS. In 2004, an Emergency WATSAN Manual was developed by OSWSM with the technical support of the United Nations Children's Fund (UNICEF). The manual allocates responsibilities of the various officials and describes actions to be undertaken during (1.) pre-disaster (2.) during disaster and (3.) post disaster (Government of Odisha; 2004). At the national level, rural water supply and sanitation falls under the responsibility of the Ministry of Drinking Water and Sanitation (MDWS). In 2011, the MDWS released the Standard Operating Procedures (SOPs) for responding to natural disasters, which were developed with the technical assistance of UNICEF. Responsibilities at the various level: national, state, district, block and village level have been laid out during the various phases (Government of India; 2011a). These preparedness plans guided the creation of two specific hardware components in relation to floods and cyclones:

- Construction on 180 cyclone shelters, from 23 in 1999, to 203 in 2013, in the six coastal districts in collaboration with OSDMA, the Indian Red Cross Society and the World Bank. These shelters are located at strategic sites along the coast to accommodate people from the most vulnerable habitations in the event of a cyclone. The shelters are managed by community-based Cyclone Shelter Management and Maintenance Committees (OSDMA; 2013).
- Establishment of 9401 raised platforms for tube wells by RWSS (RWSS; 2013a), which were not available in 1999. Every year RWSS constructs new raised platforms in flood-prone areas as identified by OSDMA, aiming to have at least one functioning safe water source in submerged villages.

Early warning cyclone Phailin

On Tuesday the 8th of October 2013, the Indian Meteorological Department (IMD) alerted the build-up of a depression in the Bay of Bengal. The IMD predicted that the depression would build up to a Very Severe Cyclonic Storm (VSCS), category 4. The IMD predicted the landfall of the cyclone in Ganjam district on the 12th of October. Simultaneously, international predictions from the US Navy's Joint Typhoon Warning Center (JTWC), and the London-based Tropical Storm Risk (TSR) predicted Phailin as a "super cyclone", category 5. These alerts triggered a sequence of early responses by the Government of Odisha, NGOs and the United Nations (UN). This paper deliberately focusses on the response of the Government of Odisha, while acknowledging the contributions of the NGOs and the UN.

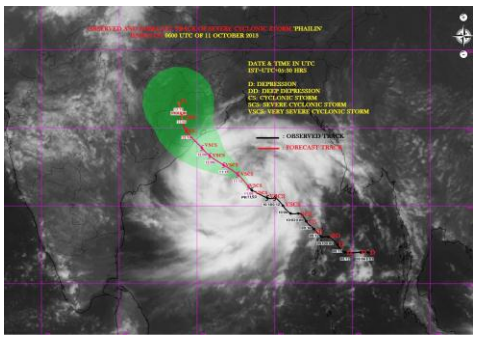

Figure 1. Projected path Cyclone Phailin

Source: IMD 2013

Timeline of events and government response

The timeline of events in Figure 3, illustrates a compressed overview of the major phases and the Government's response towards the incoming cyclone. The figure shows the seriousness with which the state government leadership handled the expected emergency, which was in sharp contrast with their

response in 1999 (Patra et al.; 2013). The priority given at the top government level, allowed the whole government machinery to treat the cyclone as their first priority.

Early warning and preparations — **8- 11th of October**

•8th of October

- Early warning by IMD followed by updates twice a day
- All cyclone prone-districts and line departments informed and instructed to activate preparedness measures

9th of October

- Meeting of SDMA with all relevant departments and conference calls with District Collectors
- Instructions to make cyclone shelters ready, including water supply
- Instructions from RWSS to affected districts to start preparations, filling of tanks and pre-positioning of storage tanks, filling of overhead water tanks, etc.
- Cancelation of upcoming religious festival holiday leave of all government staff

10th of October

- Instructions to achieve zero casualty and mass evacuation initiated
- Establishment of 24x7 control rooms at state and affected districts
- Draining of river reservoirs to accommodate the expected rainfall.
- Establishment of free kitchens including filling of water tanks and back-up generators in cyclone shelters, schools and community buildings

11th October

- All districts specially directed to evacuate population in low-laying areas
- Free kitchens opened catering to the evacuated population

Landfall cyclone Phailin — **12th of October**

•12th Morning

•Evacuation of 984,000 people completed, 4197 free kitchens operational, 338 medical relief centers opened

•12th 8:30 pm

•Landfall of cyclone in Ganjam district causing intensive, sustained winds of 200-210 km/h gusting up to 220 km/h, causing a maximum storm surge of 3.5m. Intensive rainfall, up to 380 mm over a 24 hour period in one pocket.

Relief and reconstruction — **13th of October onwards**

•Reconstruction activities started on the 13th of October and continuous updates from all districts to line departments, twice a day, for three months

Table 1. Timeline of events and Government Responses

Source: Government of Odisha 2013a & RWSS 2013b

Impact on Odisha

The overall impact of the cyclone on Odisha has been assessed by the World Bank. The impact assessment report states a total affected population of 13.2 million people in 18 districts, 171 Blocks, 44 Urban Local Bodies, 2164 Gram Panchayats (GPs) and 18374 village and 44 persons lost their lives (World Bank 2013).

Impact on water and sanitation sector

From the water and sanitation sector perspective, the cyclone and rains impacted water service provision and water infrastructure as given in Table 1. The floods submerged tube wells and piped water supply systems, which made them unfit for human consumption. This required disinfection and emergency water supply distribution to the affected population. It should be noted, that this area had access to the 9,401 raised tube wells, which

Table 2. Impact figures on water supply

Impact area	Numbers
Population	3,712,869
Blocks	127
Districts	20
Piped water supply (PWS) affected	3,089
Tube wells affected	44,955

Source: World Bank 2013 and RWSS 2013a

were not available in 1999. The cyclone did not cause substantial damages to the piped water supply infrastructure itself, however the cyclone caused massive damage to the energy infrastructure (World Bank 2013). This caused 3089 piped water supply (PWS) schemes to go out of order (RWSS; 2013). There is no comprehensive information available on the impact on the sanitation infrastructure by RWSS or the World Bank. In the current scenario, only 14.1% of the rural households in Odisha have access to sanitation facilities (Government of India; 2011b), An assessment implemented, on behalf of UNICEF, in 141 worst affected villages in Ganjam district, indicates that 15.4% of the existing individual household latrines were damaged (UNICEF; 2013a).

Response output

The following highlighted response by the Government were guided by the response plans:

- **Emergency water supply**, by tankers and water pouches. RWSS deployed a total of 318 water tankers, distributing safe water to the affected population. For the population trapped in marooned areas, boats were deployed in collaboration with OSDMA and over 5 million water pouches were distributed (RWSS; 2013).
- **Household water treatment** and Oral Rehydration Salts (ORS), in collaboration with H&FW department more than 9 million halazone tablets and over 12 million ORS packets were distributed across the affected districts (Government of Odisha; 2013a)

Photograph 1. Water trucking
Source: B. Mommen

- **Disinfection of tube wells**: RWSS aimed at the disinfection of all 44,955 tube well with the deployment of 108 mobile teams, having access to more than a metric ton of bleaching powder. The disinfection was done in two rounds and a 'tick mark' on the tube well was painted for visible verification (RWSS; 2013).
- **Restoring power to Public Water System (PWS)** in collaboration by RWSS, the Energy Department and private sector. While power was being restored by the Energy Department, a total of 118 generators were deployed to restore power to PWS in Ganjam (88) and Puri (30) district. With the deployment of these generators, the PWS also became a filling station for water trucks, covering an additional area. An additional 34 generators were deployed for the sole purpose of water truck filling (RWSS 2013).
- **Hygiene promotion**, massive mobilization by volunteers, grassroots functionaries, NGOs and media. UNICEF provided technical support with dissemination of 50,000 hygiene booklets to grassroots functionaries and volunteers. The booklet covered critical messages on source disinfection, water treatment and handling, hand washing and health messages. Additionally, 83 mobile vans were deployed giving hygiene messages in the forms of songs (Mudrakartha et al.; 2013).

Best practises: moving beyond the procedures

On behalf of the RDD, UNICEF documented the response, including human interest stories. The case documentations has identified several best practices and outstanding initiatives which could be replicated.

- **Disinfection of private sources:** The district of Baleshwar with a high ground water table has an estimated 21,641 private hand pumps. The prevalent instruction did not cover disinfection of private sources. The district administration instructed RWSS and H&FW to disinfect these sources as well.
- **Monitoring of disinfection**: The district of Ganjam improved the monitoring component of source disinfection, by requesting signatures of community leaders / school headmasters once disinfection was completed. Report figures could, therefore, be verified with the obtained signatures.
- **Mobile treatment plans**: In the districts of Ganjam and Puri, RWSS in collaboration with the Indian Red Cross, deployed five mobile water treatment plans. This enabled the use of surface water in large quantities while guaranteeing the highest quality standards.

Source: UNICEF; 2014

Response outcomes

Safe water provision was rapidly restored, on 26th of October for all 44,955 affected tube wells had been disinfected, while 2493 out of 3089 affected piped water supply systems was restored on 20th of November.

These reports are from RWSS and across India there is no independent performance monitoring of the emergency response (UNICEF; 2013b). A small-scale WASH assessment conducted in Ganjam district by UNICEF shows that 84% of the 637 functional tube wells in the 141 villages, were indeed disinfected (UNICEF 2013a). The response plans instruct that the water quality of all sources should be tested regularly with the use of H2S strips (Government of Odish; 2013b). These H2S strips are used as a screening tool, if the test turns out positive, further testing are done at a laboratory. However, as there were limited H2S strips available with RWSS (Mudrakartha et al.; 2013), this screening test could not be uniformly rolled out. As the daily reports from RWSS did not include water quality aspects, there is no information available on the total number of sources tested or the results.

There is limited to no data available on sanitation provision by the Government. The normal, wide spread, practise of open defecation poses a great threat to vector control throughout the year. A study commenced by UNICEF shows that the sanitary facilities provided during the emergency was limited, and by large, people continued the practise of open defecation (UNICEF; 2014).

Impact

Overall, vector control was managed well as there was no spike in diarrhoea cases. Despite that no comprehensive analysis was been done on diarrhoea cases across the affected districts. A selected sample analysis by UNICEF in the worse affected area suggests that there was no peak in diarrhoea cases. This analysis was based on surveillance date from health centres in the nine worse affected blocks over the months of October and November compared to the previous two years, see figure 4 (UNICEF 2014). Media reports, initially warning about possible diarrhoea epidemics, but subsequent coverage did not suggest any significant increase of diarrhoea cases. The absence of diarrhoeal outbreaks is an improvement compared to 1999 (Patra et al.; 2013).

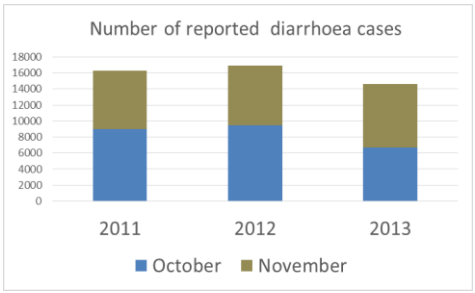

Figure 2. Reported diarrhoea cases in nine worse affected blocks, Ganjam
Source: UNICEF 2014

Lessons learnt

The first and foremost learning from this event is that the disastrous 1999 Super Cyclone experience has effectively paved the way for a holistic disaster risk reduction and response plan. These plans, combined with the priority given by the state leadership, guided the lower levels to successfully respond to the emergency. The evacuation of nearly 1 million people, which has ensured a minimal loss of human life, has been recognized as a "landmark success" in disaster risk reduction and management by the United Nations (Patra et al.; 2013). As there was no increase in diarrhoea cases or any reported outbreaks, vector control was overall well managed. The experience has led to a multitude of learning, a few are highlighted below:

- Learning from experience and a constant process of improvements has enabled this success story. It is, therefore, recommended that the government of Odisha conducts a comprehensive review, to allow further learning from the best practises. These learning can again feed into the response plans. Globally, countries might do the same and learn from their own experiences and from others.
- The cyclone shelters, for the first time put to the test, proved to be a safe refuge for hundreds of thousands of people. Other cyclone prone countries could consider such shelters as it has effectively protected the population against cyclones.
- The dependency on electricity of piped water supply schemes was a weakness in the system. Due to the damages to the electricity infrastructure, the piped water supply systems became defunct. In areas where piped water supply is present, the hand pumps gotten defunct due to irregular use and maintenance. It is, therefore, recommended that piped water supply systems have an alternative power source and/ or that functionality of hand pumps is ensured even when piped water supply are in place.
- Sanitation was found to be the weakest. The normal practise of open defecation weakens vector control, especially during floods. During the emergency sanitation provisions were minimal, while the sanitation infrastructure at household level was affected due to the floods. It is, therefore, recommended to continue

the state's efforts to achieve an open defecation free Odisha, improve sanitary provisions during emergencies and promote flood-resilient sanitary options in flood-prone areas.

- Water quality testing could be strengthened by ensuring availability of H2S strips before the monsoon season and include water quality indicators into the RWSS daily updates from the control rooms.

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