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Understanding the Health Disaster: Research Design for the Response to the 2014 West African Ebola Outbreak

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Abstract

The 2014 Ebola outbreak in West Africa is the largest ever in history, affecting multiple countries and to this date, the World Health Organization has registered more than 6,500 deaths attributed to Ebola. The challenges arising from this outbreak to responders worldwide do not follow the standard characterisation or response patterns of natural sudden onset vs. conflict disasters. Rather, it is a medical emergency, which is intertwined with multiple challenges in the sectors decision-making, coordination, logistics and information management. In this paper, we present our research framework, which is based on desk research and initial interviews with responders. This framework guides on-going field research in Ghana (December 2014), and Liberia (Spring 2015).

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1. Introduction

The Ebola crisis continues to threaten the safety and well-being of thousands. The current outbreak in Western Africa, (first cases notified in March 2014), is the largest and most complex Ebola outbreak since the Ebola virus

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was first discovered in 1976. Current statistics by WHO (World Health Organization), as of December 7th, 2014[†] count almost 6,400 deaths across several West African countries, most notably Liberia, Sierra Leone and Guinea.

Although Ebola has been described as “the health disaster” by most of our interviewees, responders continue to struggle with getting reliable and timely information. Only on the basis of data, responders can get a realistic picture of the epidemic in the various districts on the ground, and enable effective prioritisation of the still scarce resources. Once more, we observe that massive amounts of information are created by the aid agencies, authorities, NGOs; 3,429 entries for epidemiological information are listed on reliefweb.int alone (by December 15th, 2015). This information is shared and further processed and enriched remotely, for instance by and volunteers and technical communities such as the Standby Task Force leading to large volumes of volatile and highly diverse – in other words: Big Data. At the same time, remote efforts do not address the problems of missing data or unreliable reporting structures, hiding the present information gaps in a fog of information.

Current approaches to humanitarian needs assessment, planning, or response operations have currently no mechanisms in place to support responders working with large amounts of volatile and diverse data sets over a longer period in time. Typically, in sudden onset disasters the assumption is made that uncertainties decrease after an initial “chaotic phase” [1]. The ongoing and still increasing the spread of Ebola in Sierra Leone, and the high uncertainty about case numbers or contacts, however, highlights the impact of lacking, distorted or even fraudulent reporting and surveillance structures are immature. Thus, the aim to provide a coherent picture of the requirements at local, regional or strategic level is hard to achieve.

Moreover, infographics and maps seem often to be generic, informing media or the public rather than being tailored to address decision makers needs at operational level, especially not in the initial phase of the emergency. When referring to the “initial phase” in sudden onset disasters, typically responders refer to the first 72 hours, which are characterised by high levels of uncertainty and the chaotic conditions of initiating the response [1], [2]. Despite early reports and cases and spread that were reported by Médecins Sans Frontières and WHO[‡], the epidemics reached the urban areas of Conakry, Freetown and Monrovia, requiring a rapid upscaling of the response, essentially following the spread of the disease with installation of Ebola Treatment Units or Community Care Centres, where this was not possible. The uncertainty about the potential paths of the disease is not reflected in the current numbers, neither are the remaining high levels of uncertainty particularly in the rural areas – stretching the initial phases of the Ebola response over months;

In spite of the importance of assessment and addressing different decision-makers’ needs in the Ebola disaster, no commonly accepted methodology exists so far to understand the different actors and organizations, and their respective needs to fight Ebola for information; information sharing; and coordination. Numerous methodologies have been developed by individual agencies and within sectors for sudden onset disasters and relatively small data sets, on which this project will build. Humanitarian logistics will be our central field of application and testing for our findings around decision-makers needs, providing a qualitative *and* quantitative framework to address decision-makers’ needs.

In this paper, we first provide the background for our work. Subsequently, we outline our research approach starting from data collection and initial interviews that were used to build concepts that guide our field research.

2. Background

The Disaster Resilience Lab (DRL) was established in the response to Haiyan in 2013 as a joint initiative of researchers working in different fields of humanitarian information management, decision support and logistics. To conduct research that is relevant to practitioners’ while applying scientifically sound and rigorous methodologies, we have developed an approach that is based on cooperation between research teams deployed to the field during the response while providing continuous remote expert support during the team's operations [3]. For the specific

[†] WHO Ebola Situation Reports available on <http://www.who.int/csr/disease/ebola/situation-reports/en/>

[‡] For case numbers in early April reported by WHO, see instance <http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4089-dashboard-ebola-virus-disease-in-west-africa-07-april-2014.html>

purpose of the Ebola response, we have brought together a team with in humanitarian logistics [4], [5], collaborative decision support [6] and humanitarian information management [7], [8]. In the response to Ebola, we aim to conduct field research to better understand:

- *Decision Makers Needs*

The number of problems that need to be addressed in the response to a disaster is overwhelming - so is the number of decision-makers. To find out more about which information is relevant for strategic decisions in logistics, coordination and planning, we investigate decision-makers' needs and compare different roles and how decisions are made in different organizations and at different hierarchical levels.

- *Information Sharing and Coordination*

Starting from decision-makers' needs, we investigate which information is available, and which information is used by decision-makers. We collect information to analyse the flows of information between different actors and organizations including the mechanisms and tools that are used to communicate, process and share information. Aligning decisions across the different actors and organizations is key to efficient response. Coordination remains a challenge between professional and volunteer actors; military and civil organizations; local and global actors across hierarchical levels or contexts, in which decision makers are acting.

- *Logistics and Supply Chain Management*

The process of supplying disaster relief goods, such as food, water, or medical aid, to the right people and at the right time is a key challenge in disaster management. Supply chain management (SCM) serves as bridge between procurement and distribution, headquarters and field operations, and the problems of decision-making, information sharing and coordination can be studied with this special logistics focus. We specifically investigate how the flows of goods and information are matched, and what the specific difficulties of sourcing and distributing aid in the case of Ebola are.

In the following, we further describe our research approach and detail how we refined research methods based on initial findings from interviews and data analysis. In our presentation, we will provide insights and first results from this work.

3. Remote Data Collection

To further define and detail the research questions as outlined above, we engaged in an initial data collection process that was carried out by students of the University of Agder. Additionally, we conducted Skype interviews with responders who have worked as responders to the Ebola response in various roles – such as Information Management Officer, Logistician, or UNDAC member – both in the countries or at head quarter level.

The remote data collection was inspired by discussions with ACAPS and MapAction regarding the Secondary Data Review[§], for Ebola that has started in December 2014. Students curated data across 15 websites and data portals see Table 1 below. The websites provide different types of information, ranging with respect of the field of application (medical vs. non-medical) and geographical scope (national vs. international). Most of these platforms are structured as a humanitarian data warehouse, providing specific types of information products and updates thereof. Analyses and meta-reviews of trends, information gaps, or data quality are rare. Information gaps range from nutrition to healthcare information, and are consistently reported for weeks^{**}.

[§] A guidelines on how to conduct the Data Review is available on <http://www.acaps.org/img/documents/secondary-data-review---summary-secondary-data-review---summary.pdf>

^{**} See for instance ACAPS Ebola Needs assessments available on <http://www.acaps.org/en/pages/ebola>

Table 1: Ebola Information - Remote Data Collection

What?	Organization	Link
Situation Reports	WHO	http://www.who.int/csr/disease/ebola/situation-reports/en/
Data Sets	HDX	https://data.hdx.rwllabs.org/ebola
FactSheets	Echo	http://ec.europa.eu/echo/en/ebola-in-west-africa
Financial Tracking	FTS	http://fts.unocha.org/pageloader.aspx?page=emerg-emergencyDetails&emergID=16506
Global Ebola Response	UNMEER	http://www.un.org/ebolareponse/resources.shtml
Outbreak Reports	CDC	http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/index.html
Information Repository	Ebola Toolbox	http://www.medbox.org/ebola-situation-reports/listing
Outbreak Reports	Healthmap	http://healthmap.org/ebola/
Information Repository	Reliefweb	http://reliefweb.int/disaster/ep-2014-000041-gin
Logistics	Logs Cluster	http://www.logcluster.org/ops/ebola14
Food security	FAO	http://www.fao.org/emergencies/crisis/ebola/en/
Government	Ministerium of Health Liberia	http://www.mohsw.gov.lr/
Government	Ministerium of Health Sierra Leone	http://health.gov.sl/?page_id=554
Maps	ArcGIS	http://disasterresponse.maps.arcgis.com/home/group.html?id=5364ffdec63645c392e8b55cfc728bfl
Information Repository	Nethope	http://ohdr.nethope.opendata.arcgis.com/
Humanitarian Response	West Africa	http://www.humanitarianresponse.info/operations/west-and-central-africa
Ebola Communication Network	Community based	http://ebolacommunicationnetwork.org/latest-materials/
Ebola Digest	Blog	http://eboladigest.blogspot.ch/
Ebola Needs Analyses	ACAPS	http://www.acaps.org/en/pages/ebola
Maps	MapAction Liberia	http://www.mapaction.org/deployments/depldetail/231.html
Maps	MapAction Sierra Leone	http://www.mapaction.org/deployments/depldetail/232.html

The data collected was both qualitative and quantitative, targeted at answering key information needs, and tracing the available information over time. While WHO measures performance by isolation of patients, and safe burial of victims, and sticks to the proclaimed targets to isolate 70 % of Ebola patients and bury 70 % of victims safely in Guinea, Liberia and Sierra Leone^{††}, our data collection covers the scope and context of the situation as is, but were also meant to enable the identification of early warning indicators and potential risk drivers of the longer term development, particularly with a focus on healthcare and food security. Early results confirm the dependence between goals related to this very response, and longer-term development goals, related to the availability of surveillance systems, healthcare facilities, or transportation and storage capacity. Table 2 below gives an overview of initial data collection scheme.

^{††} WHO Ebola Response Roadmap, 28th August 2014. Available on <http://www.who.int/csr/resources/publications/ebola/response-roadmap/en/>

Table 2: Ebola Data Collection Framework

Context and Scope:	
Affected population	Fatalities (owing to Ebola)
	How many people have been affected? (directly and indirectly)
	How many people are displaced?
Reporting and Information Management	Information available from a district?
	How regular are updates made?
	Which level of detail?
	Reporting channels
Information Availability	What are the existing sources of information? e.g. from various actors, local knowledge, previous experience, official stats, data collection
	Information about the quality / uncertainty of information
	Information gaps described
Humanitarian Needs	How many people are there in need per region?
	Is there telecommunication coverage in a region?
	Food
	Healthcare
	WASH / sanitation
Response	
Activities	Ebola treatment units and community care centres
	Medical teams onsite
	Supporting teams onsite (logistics, IM)
Access	Transportation capacity available
	Transportation time (land, air)
	Location of hubs
	Relief items received (food, water, other?)
Forecasting and predictions	Looting and reports of violence
	Longer term predications of evolution of the situation
	Governance structures and responsibilities

Interestingly, epidemiological data is prominently available by WHO reports; however, further information about different sectors is harder to find in the data collection. This may be owing to the fact that Ebola is widely considered as a health disaster, although it certainly is related to water, sanitation and hygiene as well as security, education, nutrition, gender etc. Additionally, the cluster system has not been activated fully. The logistics cluster, for instance, is not activated in all countries, although it provides logistics support at regional level, under the umbrella of UNMEER^{##}.

In addition to these ongoing data collection processes, which will later on lead to an overview of information that has been published remotely – enabling mapping and tracing of information, we conducted an initial series of interviews with people who were involved in the early operations both at headquarter level in Geneva and on site. Common themes of these interviews were

^{##} Ebola Logistics Cluster Update as of 03 October, 2014:

http://reliefweb.int/sites/reliefweb.int/files/resources/logistics_cluster_ebola_outbreak_situation_update_1401002.pdf

- Unclear coordination and decision-making structures
- Difficulties of access, including problems of last mile distribution and access to information from the field
- Volatile situation developments, requiring quick adaptations at operational level
- Reported problems with lacking material, kitting / pooling, and long waiting times for material to reach the sites where it was needed
- Lack of information sharing and protocols to coordinate the response between the three affected countries

4. Field Research Approach

On the basis of this initial information, our research team has developed an approach that combines onsite information collection with remote analysis. This remote expert team has to bring in ‘real time’ inputs to the field research team in order to tailor the different interviews and to maximise their significance. This team is also designed to support the logistics and communications of the field team on the basis of contact lists, which are expected to evolve during the field trip. Last but not least, this team has to support the field research team during their interviews by remotely and regularly analysing the gathered information in order to ensure the completeness and the relevance of them regarding the future exploitation.

The aim of our joint work both onsite and remote is:

- Eliciting information requirements in terms of relevance, credibility, interoperability, accuracy and actionability for different decisions and perspectives.
- Developing a business and flow modelling approach that helps in understanding and evaluating logistics. Practically, we collect information to draw flows and business processes cartographies following standard notations. The resulting models can be used to improve the coordination capabilities and business transactions within and between relief organizations.
- Understanding performance measurements and the role of monitoring and KPIs to steer the response, particularly in terms of supply chain processes and case tracking.
- Understanding information collection and information flows; information sharing protocols; and enablers and barriers of information sharing.
- Analyzing decision-making processes and investigating the alignment of information flows and decision structures.

From these generic aims we derived the following research questions that are guiding an initial visit of a field team to Accra / Ghana working at UNMEER headquarters and the UNHRD.

1. What are the most relevant flows of goods and information, from sourcing to disposal of waste
 - a. For an individual organization, in its specific role as provider of goods or supporting / enabling organization (e.g., responsible for distribution)
 - b. For the specific product category of Personal Protective Equipment (PPE), how are the goods sourced, standardised, kitted and distributed?
2. How well are logistics and IM processes aligned meet decision making needs in terms of the information quality dimensions in the Figure below, and notably with respect to:
 - a. Lead time and relevance;
 - b. Reliability and verifiability;
 - c. Information sharing and access to information;
3. How are the different needs, gaps and logistics flows planned, managed and monitored so that they enable the efficient provision of aid?
 - a. Data collection; information processing (workflows and systems)
 - b. Strategic decision-making and logistics planning processes (push vs. pull)
 - c. Monitoring, scheduling, routing and operational logistics decisions?

DRL FIELD RESEARCH: SUPPLY CHAIN ORIENTED INTERVIEW GUIDELINE															
Operation	<input type="radio"/>	Considered Flow :	Filed by:	General Comments:											
Transfer	<input type="checkbox"/>		Organisation:												
Stock/Wait	<input type="checkbox"/>		Location:								Date:				
Outstanding	<input type="checkbox"/>		Respondent:												
Control	<input type="checkbox"/>	Position:													
Description of the Value Stream					Description of the Business Processes										
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS IS description	Main Evolutions	km	Qz	Time	Inputs	Outputs	Resources	Controls	Events	Comments
					Order preparation		1000	0,5			Order by email	Confirmation and Order shipment			
					Custom		1000	0,5							
					Waiting for shipment to the airport		1000	1					Select flight		
					Transfer to the airport (truck)	20	1000	0,3							

Figure 1 Example of the workflow grid designed to support the field interview protocol

These questions are reflected in an interview protocol that has guided the questions of the field team. For the logistics part, this protocol has been structured following a Process Flow Chart step [10] (Figure 1). Following approaches from lean management, in this protocol, we are looking for identifying the value stream map of the main processes of humanitarian supply chains in order to underline the main weaknesses and potential wastes. Our objective consists in understanding, analysing, evaluating and then developing a formal expression of this value stream map. Such a model, therefore, will have an added value for practitioners and scientists and should allow reliable decision support systems to be produced.

Practically, the exploitation should have two different and complementary dimensions. Firstly, some geographical maps will be produced in order to explain both the global (source, make and distribution at a worldwide scale) and local (source, make and distribution at a country level) Ebola Outbreak Supply Chain (EOSC). Figure 2 represents an illustration of potential results regarding this point.

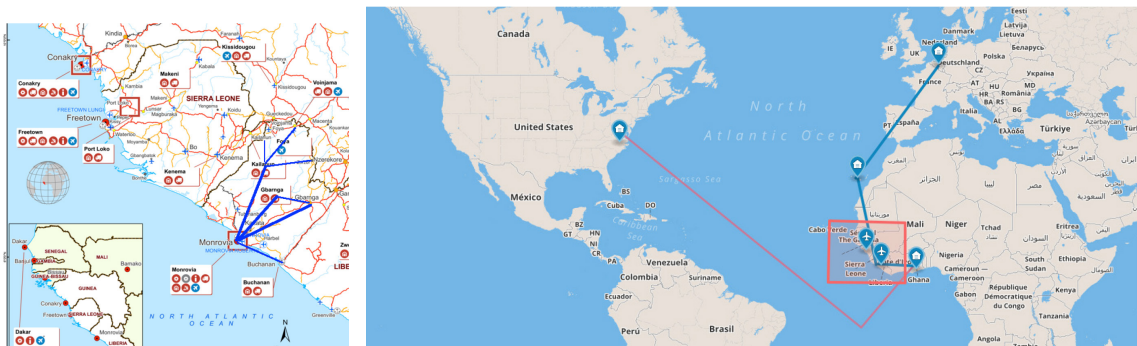


Figure 2 Example of the expected geographical mapping results of the supply chain physical flows; left Figure based on the Logistics Cluster Map for the Ebola response (<http://www.logcluster.org/ops/ebola14>).

Secondly, the functional view should be formally explained by modelling the current business processes. The objective will consist in precisely and accurately analysing the coordination issues that exist between the different stakeholders. As shown by [9], this approach corresponds to a Business Process Management step. In this research the authors have proposed to use the *Enterprise Modelling* standard (ISO 19439) for humanitarian operations. They show that a mapping of the functional view through Business Process Modelling Notation (BPMN) can be used to analyse and understand the coordination behaviours. An illustrative example of what we aim to extract is presented in Figure 3 in a BPMN diagram that was developed by Charles & Lauras in a research project with the International Federation of the Red Cross (IFRC) [11].

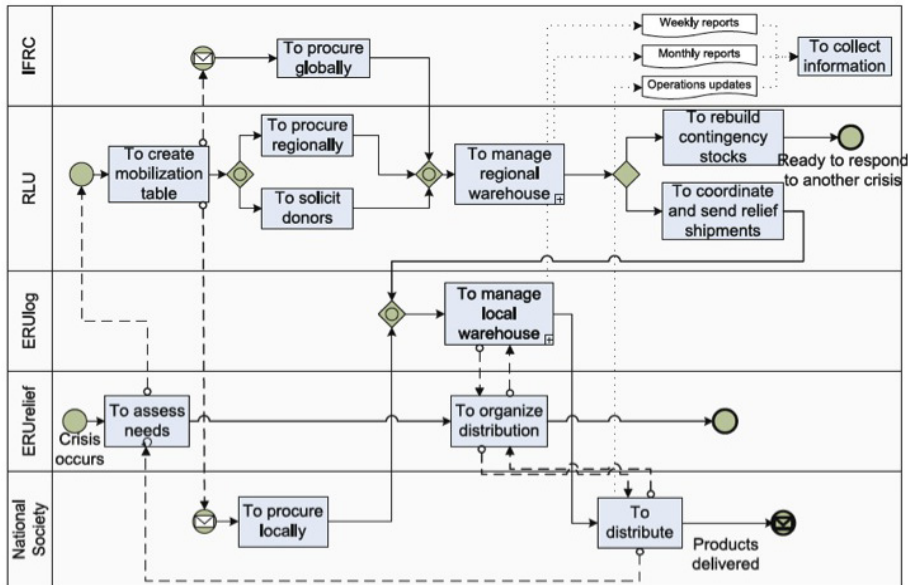


Figure 3 Example of the expected BPM results of the functional view; from [11].

4. Conclusions

In this paper we outlined the research design for an on-going field research project aiming at understanding decision-making and coordination of logistics processes and planning. We described the complexity of the Ebola disaster, which is neither a conflict, nor a sudden onset disaster; needs are hardly predictable and have continued to rise for months now. In this situation, a thorough understanding of the data and processes that drive – or should drive – planning, coordination and decision making is vital.

To gain a deep understanding of the emergent structures we propose an interdisciplinary research approach that is combining onsite field research with remote expert support. In this manner, data collection processes can be aligned. Feedback mechanisms between the team shall assure high synchronicity, despite our differences in context and background.

As we are writing this work, the field team just conducted a first research trip to Accra / Ghana, and is preparing for follow up research in the three most affected countries: Guinea, Liberia, and Sierra Leone. At the conference, we will present initial findings and insights resulting from this work.

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