Disaster Healthcare: An Attempt to Model Cross-Agency Communication In Disasters

Reem Abbas
Auckland University of Technology
r.abbas@aut.ac.nz

Tony Norris
Auckland University of Technology
tonorris@aut.ac.nz

Dave Parry
Auckland University of Technology
d.parry@aut.ac.nz

ABSTRACT

In disasters, several national, international, and non-governmental organisations such as police, health, ambulance, fire and civil defence services are usually involved in the response process. Therefore, it is crucial that responding agencies communicate effectively to avoid fragmentation and duplication in services, to harmonise separate activities, and to clarify roles and responsibilities. Central to communication is information exchange. Effective information exchange enhances not only the appropriateness and success of disaster response, it also ensures timeliness. However, cross-agency communication is extremely challenging especially at times when there are high stress levels, incomplete data, and minimum time to make critical decisions. This paper attempts to specify a 'best-practice' model for cross-agency communication with the aim of identifying the specific information requirements of disaster management and disaster medicine agencies. The end goal is to design a system that improves the overall quality of healthcare services provided to disaster victims.

Keywords

Disaster healthcare, communication, connection, collaboration, coordination, minimum datasets

INTRODUCTION

A disaster is an event with an impact that exceeds the ability of a community or society to deal with the incident from within its own resources (IFRC, nd). Accordingly, no single agency can respond solely to the complexity associated with disaster preparedness and response Given the mix of roles, responsibilities and priorities, effective coordination within and among these different responding agencies is crucial to eliminate gaps and duplication in services, determine an appropriate division of responsibility, and establish a framework for information sharing, policy agreements, program collaboration and joint planning (IFRC, 2000). Poor coordination and information exchange on the other hand, can result in failures including inappropriate allocations of resources, delivery of relief processes, and delayed evacuations leading to escalations and higher numbers of casualties (Bharosa, Lee and Janssen, 2010). Therefore, it is vital to prepare for effective cross-agency communication and smooth information exchange that enables agencies to acquire the knowledge and tools necessary for a well-coordinated response.

This paper attempts to model cross-agency communication in disaster healthcare by identifying the most important communication activities, their attributes, order of occurrence, relationship with each other, and the information required to fulfil them. The end goal of the model is to achieve a significant improvement in the appropriateness and quality of disaster healthcare by using information and communication technologies to establish meaningful communication channels between the main agencies that provide public health services to

disaster victims.

A comprehensive literature review has been conducted to investigate the obstacles to effective cross-agency communication and information exchange in emergencies and disasters. An earlier study (Abbas, Norris and Parry, 2018) categorised these challenges into five themes; authority and leadership, culture and trust, situation awareness, technology, and legislation. Based on the issues arising from these themes, an initial communication model has been drafted and discussed with participants from emergency management and health to gather insights and opinions that can lead to refinement of the model.

METHODOLOGY

The literature study focused on the information exchange between disaster management and disaster medicine agencies and their information requirements. The search covered a number of Databases including TRACIE: Healthcare Emergency Preparedness (Information Gateway), Disaster Lit: The Resource Guide for Disaster Medicine and Public Health (US National Library of Medicine, 2018), The International Disaster Database (EM-DAT, 2018), Google Scholar, Scopus etc. Journals consulted included The American Journal of Public Health, International Journal of Emergency Management, American Journal of Disaster Medicine, Disaster Medicine and Public Health Preparedness, Prehospital and Disaster Medicine etc. Government reports, policy statements, etc were also accessed. The search also covered websites of international humanitarian organisations such as IFRC, UNOCHA, and WHO. More than fifty articles were retrieved and the outcome of the search was used to draft the communication model. Fifteen semi-structured interviews, about an hour each, were then conducted with eight disaster managers and six senior disaster-healthcare experts to gather their insights and views about the model and the information required for each of its activities. Participants were chosen from the emergency management departments of the main governmental response agencies in New Zealand and from international and non-governmental humanitarian response agencies including the United Nations, New Zealand Red Cross, and The Salvation Army. Governmental agencies included Police, Ambulance, Fire and Emergency Services, Ministry of Civil Defence, Ministry of Health, and a District Health Board. Participants are experienced in diverse types of disasters including earthquakes, armed conflicts, and epidemics.

MODELLING DISASTER HEALTHCARE COMMUNICATION

While disaster management and preparedness has always existed, disaster medicine in the western world is attributed to the development of triage in the 1790s, the works of Heinrich Zangger on civilian mine explosions in the early 20th century, and to the rapid evacuation and field surgical care which started in WWII (Suner, 2015). Both disciplines are concerned with healthcare provision in disasters. The mere definition of 'health' as a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity (WHO, 2006), highlights the importance of the distinct roles of various response agencies resulting in different mandates, organisational structures, and operational modalities that can cause substandard and sometimes unavailable healthcare (Abbas, Norris and Parry, 2016). In spite of the existence of emergency response frameworks designed to coordinate disaster response, the literature reveals poor communication between responding agencies that highlights a knowledge gap between 'what we know and what we need to know' to improve the overall quality of response in disasters.

For example, in New Zealand, disaster response is guided by the Coordinated Incident Management Structure (CIMS). CIMS is a framework that describes how agencies coordinate, command, and control incident response of any scale, how the response is structured, and how the relationships function between the respective CIMS roles, and between the levels of response (MCDEM, 2014). However, according to one senior health emergency manager interviewed, *"It gives guidance about good practice for planning but doesn't own the content of what agencies do, it won't tell you what to put inside it or how to think outside the box of who to talk to".* She continues, *"Sometimes you have to have direct contacts with agencies working outside the route of information flow described in CIMS"*.

Although, in most cases**,** formalised vertical information exchange guarantees credibility and relevance, informal information exchange is still vital for situation awareness. A mechanism that ensures timely horizontal information exchange to manage situations that are not catered for by incident management frameworks such as CIMS is needed. In a multi-agency network through which information flows both vertically and horizontally, facilitative leadership is more appropriate than one that is based on command and control. The management focus is on selecting appropriate agencies and resources, shaping the operating context, and developing ways to cope with the strategic and operational complexity (Agranoff and McGuire, 1999). The following sub-sections discuss current communication scenarios, interviewees' perspectives, and

the suggested cross-agency communication model.

CONNECTION, COLLABORATION, AND COORDINATION

To avoid confusion we use the definitions of the terms 'collaboration' and 'coordination' provided by the World Health Organisation and International Federation of Red Cross and Red Crescent Societies.

Connection

Connection refers to the establishment of relationships between different agencies through educating them about each other's missions and structures, and their anticipated interactions or cooperation in preparedness and/or response activities. Relationship building involves knowledge of each other's roles, responsibilities, equipment and tasks, information requirements, and trust building (Granåsen, Olsén and Oskarsson, 2018). Trust facilitates the task of knowing who to talk to in critical times; an issue that has been emphasised frequently by the interviewees in our study. "*Those who work together well on a daily basis tend to work together well in disasters*" (Auf der Heide, 1989). Connectedness, although rarely established in practice, is paramount to the effectiveness of the other components of communication; collaboration and coordination.

Collaboration

Collaboration is more than simply sharing and exchanging information. Collaboration means that agencies assess the situation together, share ideas on how to overcome problems and initiate joint practical responses. According to IFRC (IFRC, 2000), collaboration covers the following four activities:

a) Identifying affected population groups and jointly assessing their potential capacities and needs so as to determine high priority groups
b) Coordination of assistance standards of health services, water supply and sanitation, nutrition, food aid, shelter and site planning based on the minimum humanitarian standards in disaster response as developed by the Sphere project (The Sphere Project, ND).
c) Mobilisation of relief resources taking into consideration medical supplies, food, communication systems, transport and organisation of deliveries, availability of people to render urgent assistance (relief), equipment and sanitation
d) Joint training. Training highlights areas for improved inter-organisational cooperation in preparedness, response, and mitigation, and provides recommendations for ensuring unchecked assumptions do not become threats (Graham and Stephens, 2018).

According to several interviewees, disaster responders often lack training in emergency management leading to the repetition of old mistakes without making use of the lessons learnt from previous disaster events. Joint training reduces the costs of independent agencies, enhances the quality of training, and improves trust and relations between disaster response agencies. Relationship building is often established during joint training thus facilitating cross-agency communication.

Coordination

Disasters are characterised by overwhelming needs, competing priorities, destroyed or damaged communication and infrastructure, a rapid influx of humanitarian assistance organisations and an outburst of mutual aid from local citizens and highly stressed local governmental and non-governmental institutions (IFRC, 2000). In such a situation, utilising existing resources and capabilities is crucial for the effectiveness of any response. Coordination is about this effectiveness.

According to WHO, coordination is defined as the systematic utilisation of policy instruments to deliver humanitarian assistance in a cohesive and effective manner. Such instruments include: strategic planning; gathering data and managing information; mobilising resources and assuring accountability; orchestrating a functional division of labour in the field; negotiating and maintaining a serviceable framework with host political authorities; and providing leadership (WHO, 2018). Coordination aims at eliminating fragmentation and duplication in services, harmonizing separate disaster actions or activities and clarifying roles and responsibilities (IFRC, 2000). In a coordinated effort, people and units know "*what they are to do"* and "*when they are to do it"* and they see the relationship between what they do and what the coordinated whole achieves (Denise, 1999). The greatest challenge to coordination is the inherent difficulty of identifying a common purpose and approach among agencies whose mandates, methods, resources and systems are diverse (IFRC,

2000). This challenge evidently falls into the Authority and leadership category of cross-agency disaster communication.

In a practical context, it is debatable whether collaboration precedes coordination or vice versa. We believe that normally collaboration precedes coordination. Our rationale is that coordination is about knowing what to do, when to do it, and how it fits within the whole picture of response, a prelude to action that clearly depends on the outcome of the joint assessment of the situation that takes place at the collaboration stage.

MINIMUM DATASETS FOR MODELLING COMMUNICATION IN DISASTER HEALTHCARE

Effective information sharing is critical for responding agencies to make well-informed and timely decisions with regard to what needs to be done, and when and how, following the occurrence of a disaster event. Hence, the quality of the information exchanged between responding agencies in disasters is crucial to the quality of response provided to disaster victims. Poor information sharing and coordination during inter-agency disaster response has a negative influence on collective decision-making and actions (Junglas and Ives 2007). Information sharing builds situation awareness, which is a key requirement for good decision making in a disaster situation. Situation Awareness is defined as "*The perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future*" (Endsley, 1988). In a collaborative context, each individual within a team needs to have some level of situation awareness in order to perform their tasks as they contribute to the overall objective of the team. Both individual and cross-agency situational awareness are of immense significance in emergency response since an individual's situation awareness contributes to the information that needs to be interpreted and built upon in the process of decision-making. A common escalation of the lack of individual situation awareness is depicted in Figure 1.

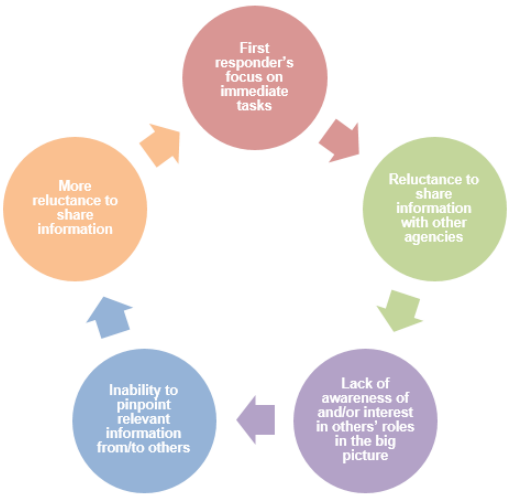

Figure 1: Cross-agency Communication: First Respondents' Attitude Towards Information Sharing

Information that is not relevant to the situation awareness of team members, other than the sender, results in wasted time and is best filtered to avoid unwanted 'noise' (Abbas, Norris and Parry, 2018). The challenge here is to define the exact needs required for fulfilling individual tasks upon which a holistic picture of what is happening is built. Accordingly, we believe the notion of a Minimum Data Set (MDS) could be a viable approach to model cross-agency communication.

An MDS is a set of data elements with uniform definitions that is minimally sufficient to define the information (i.e. useable data) requirements for a specific task (The Free Dictionary, 2018). The 'minimal' aspect is critical for the exchange of healthcare information in disasters where situations change quickly and extraneous data could hamper rapid and accurate decision making under highly stressful conditions. The notion of Minimum Data Sets has been used previously, sometimes referred to as common operational datasets. The Inter-Agency Standing Committee (IASC), a unique forum involving the key UN and non-UN humanitarian partners, has developed Common Operational Datasets in disaster preparedness and response

related to the information requirements of national authorities and humanitarian organisations. The World Health Organisation MDS determine the items that should be included in reporting by emergency medical teams (Benin-Goren, Kubo and Norton, 2017). Turoff et al. (2003) discussed the importance of preventing information overload, and searching processes for obtaining relevant information as an important aspect of designing a dynamic emergency response management information system. They argue that emergency responders work an average of 14-18 hours daily and have no tolerance or time for things unrelated to dealing with the crisis.

Our model envisages an MDS as an assembly of database records defined for an individual agency and, as importantly, inter-agency, needs. The records are stored in a structured information system and constructed from environmental, demographic, clinical, and other pertinent sources, updated in real time, and maintained by the individual agencies. An agency responder can edit and customise the content of an MDS with the permission of their manager. The combined data from all agencies are stored in a database and an MDS is defined by an agency as the minimum set of those items in the database collection that it needs to discharge its role in a disaster. Some of these items will be provided by the agency itself but others will be provided by other collaborating agencies and each agency is responsible for updating data items that it owns. When an agency is in need of a data item that is not part of its usual MDS, it can automatically issue a request for that item to an existing source or route it to a team charged with locating uncommon items.

This model has the flexibility to define MDS for different circumstances, for example, different types of disaster, different resource or infrastructure constraints etc. It could even be used to define an MDS instantly if an unusual agency, e.g. Poisons, Information Centre has to be called upon. The model presents a systematic but flexible approach to information sharing that has the potential to re-engineer critical communication processes in disaster healthcare. The detailed design of such a system is part of our on-going research.

In emergencies, common health interventions cover a broad range of activities (Figure 2) from setting up health facilities to distributing health-related kits. These interventions cannot be achieved by the health sector solely and have to be enacted in conjunction with other response agencies that require different datasets to fulfil their missions. Thus, datasets need to be categorised to make them manageable.

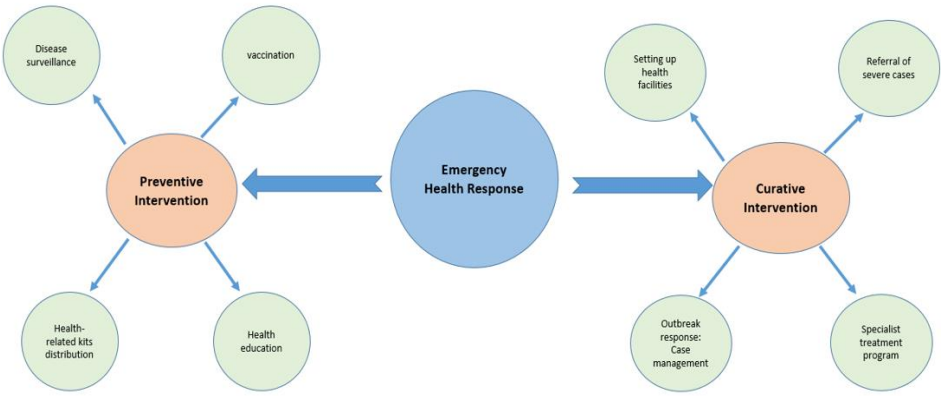

Figure 2: Common Health Interventions in Disasters

By examining typical information needs in a diverse range of disasters we currently perceive the need for four distinct, but interconnected, MDS as follows:

Primary MDS

Data in this MDS describe fundamental needs and services such as shelter, food, water, evacuation priorities etc., that although clearly related to health needs also apply when healthcare is not the major consideration.

Contains *a priori* data about the geography, infrastructure, and demographics of the region affected by the disaster as well as relevant health and epidemiological data. These data may be comparatively static in non-

disaster situations but can be changeable and dynamic when a disaster strikes. The baseline MDS are key elements of resilience planning.

Situation Awareness MDS

This MDS comprises dynamic data on the general, current status of the disaster, its severity, impact (casualties, damage etc.), prognosis, risks, and general priorities.

Healthcare MDS

Healthcare MDS focus specifically on the health situation. A healthcare MDS embraces numbers of casualties, types of injury, triage statistics, resource availability and requirements, etc.

INTERVIEWEES PERSPECTIVES ON CROSS-AGENCY COMMUNICATION AND INFORMATION NEEDS

The model below (Figure 3) has been presented to the participants to elicit their expert opinions on its usability, its strengths and weaknesses, and the concept and composition of the suggested MDS. Participant responses were then used to refine the model and realise its potential benefits (Abbas, Norris and Parry, 2018). The refined model will be subjected to a Delphi study to gain a higher degree of granularity.

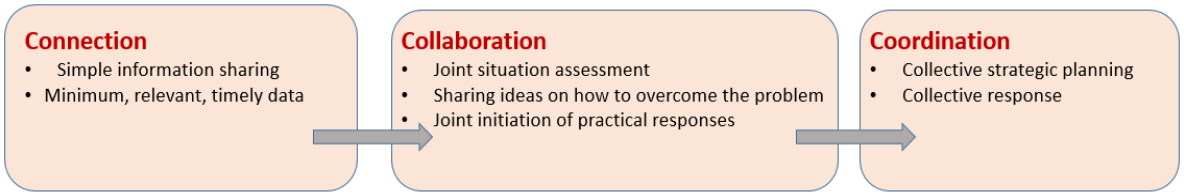

Figure 3: The Draft Communication Model

The draft model presented to the participants is a linear one. However, there is consensus that disaster communication is never linear in practice and that the order in which these activities are carried out depends to a great extent on the context, which can change rapidly. Participants agreed that the components are interchangeable and interconnected. One interviewee even went further saying that *"… there's even a potential for an additional 4th C, 'Cooperation,' which refers to ensuring that all agencies are seeing the same picture"*. They agreed that information exchange is constantly happening across all three components, connection, collaboration, and coordination, and that the need to visit MDS is not going to be restricted to one phase or activity. Figure 4 shows possible scenarios of communication flow.

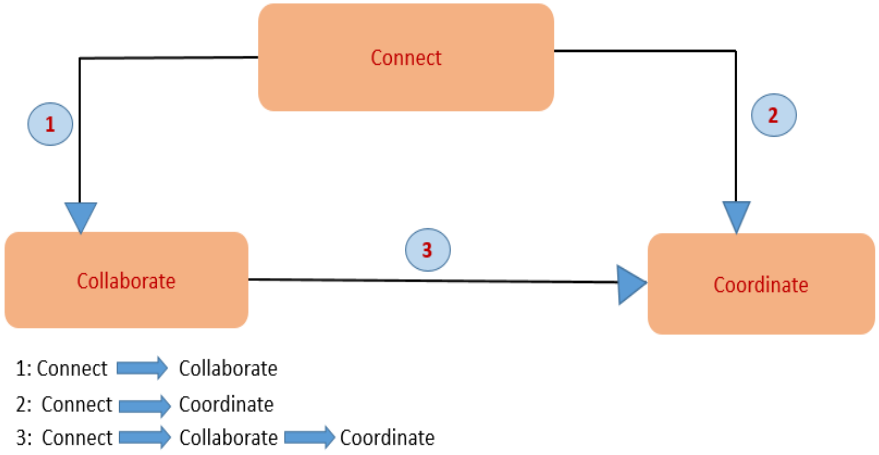

Figure 4: Current Communication Scenarios

A major issue is 'unknown unknowns' That is, groups may well not be aware of what information or knowledge they hold which may be of use to other groups, either because they are not aware that this information could be useful to the other groups, or is already known to them, or that they do not understand that such information exists. An MDS has the potential to solve this problem by giving agencies the ability to 'pull' what they need from the available MDS on demand.

Another issue describes the extent to which groups are prepared to change their own behaviour or share information in order to cooperate. Trust eases the need for control, which in turn reduces transaction costs and the need for formal contracting (Dyer and Chu, 2003). Interpersonal trust affects inter-organisational trust, which in turn has a significant influence on information exchanges (Abbas, Norris and Parry, 2018). However, Bernstein argues that more-transparent environments are not always better and that privacy is just as essential for performance (Bernstein, 2014). This is consistent with views of some survey participants who mentioned that total transparency results in an abundance of information, which can either reduce an individual's ability to determine what should be shared or lead to misinterpretation by the recipient.

Interviewees were curious about the implementation of MDS. When the concept of specifying a structured information system that implements MDS was discussed with them, participants had valuable feedback on both functional and non-functional requirements for such a system. They suggested that the information system that implements MDS should be integrated into existing information sharing systems, rather than be used separately as current systems are very useful but not comprehensive. Information systems usability features including search capabilities and documents display that need to be simplified, as they are essential to decision-making. "*Currently, decision-makers as well as responders need to navigate through massive documents and situation reports to get simple information that would help make a decision*", said one interviewee (Abbas and Norris, 2018). Another important point concerned the needs of disabled emergency responders, *"When building an information system for emergency management, the needs of people with disabilities with regards to text colours and functionality need to be taken into consideration… Visual strategies should be developed where possible to minimise the need for text commentary".*

Many participants agreed with the categorisation of MDS into baseline, healthcare, and humanitarian but disagreed that Situation Awareness (SA) should be a separate MDS. The argument was that baseline, healthcare, and humanitarian MDS all feed into situation awareness. They argued that SA should be the parent of the other MDS because 99% of what is needed to gain that SA actually comes from the other three categories. A suggested approach to implementing SA is through identifying elements in the other three MDS categories that could be flagged as essential items for the purpose of emphasising situation awareness.

Data items of each MDS were discussed. Aside from healthcare, participants were mostly happy with the items presented. Further granularity of these items will be sought at a later stage. As for healthcare MDS, a WHO-trained emergency management team member confirmed that the clinical information requirement in the first few hours of response is minimal and does not extend beyond identifying a victim by some serial number, knowing what drugs they have been given, what they presented with, their discharge disposition, and where they will be going to from their current location. One senior emergency manager mentioned that this information is saved but is not used except *"if something goes wrong"* whereas the emergency medicine expert confirmed that it would be very useful to be able to marry the clinical data gathered in disasters to their respective health records at some point.

One health person who has been deployed as part of an international medical team highlighted the need to have a patient tracking system that informs healthcare providers of where victims have been picked up. He argues that knowing this critical piece of information has significant implications from a public health perspective. Patient tracking and triage systems do not only improve healthcare provision for victims, they can also be conducive to prevent health personnel from experiencing stress-related diseases like post-traumatic stress disorder (PTSD) (Donner, Greiner-Mai and Adler, 2012). Interestingly, even healthcare providers agreed that situation awareness items do not form a separate category but are in fact updated healthcare data items.

Further findings (to be published) touch on the importance of simplified emergency response plans, community engagement in needs assessment, responders training and the role of personal relations on the efficiency of disaster response, and addressing the needs of vulnerable people. There is strong emphasis on relationship building and prior liaison between disaster responders. A study (Bateman and Gralla, 2018), that evaluated strategies for information management in humanitarian response, found that among several strategies, holding regular meetings makes the largest difference in the time it takes to collect sufficient information for decision-making. Ongoing analysis will reveal more information about the insights of experts about modelling communication and the datasets essential for building it.

DISCUSSION

This paper describes an on-going attempt to model cross-agency communication in disaster healthcare by identifying the main communication activities and the information required to fulfil them. The paper uses preliminary findings gained through semi-structured interviews with disaster mangers and health personnel. We believe the model has the potential to make substantial improvements to the quality of communication and the effectiveness of the exchanged disaster healthcare information.

Participants were highly supportive of the concept of MDS as a means of eliminating excessive data and restricting information exchange to relevant and timely data. The fact that an MDS is developed and maintained by an agency for its own purposes automatically puts an obligation of accountability on the agencies supplementing the data. The ability of agencies to 'pull' their unplanned information needs by accessing relevant data from MDS 'owned' by other agencies was also viewed favourably. This is a fruitful approach because, instead of receiving irrelevant information, agencies will take the responsibility of defining what is crucial to them. Certain data perceived as not-so-important to one agency may prove to be crucial to others.

Based on interview feedback, the initial model has been refined in preparation for a more rigorous Delphi study. Table 1 below defines the current state of the model, the three activities their attributes, and their expected outcomes.

A visual representation of the model is shown in Figure 5. The model depicts how agencies supplement different MDS categories with data, the connections between the model's components, and how the final outcome, which is well-coordinated action, feeds back into the agencies' operations that in turn updates the MDS with data for future use.

Table 1. Components, Definitions, Attributes, and Outcomes

Activity	Definition	Attributes	Outcome
Connection	The establishment of relationships between different agencies through educating them about each other's missions and structures and potential areas of cooperation.	1. Simple information exchange 2. Relationship building (Who to contact) 3. Identification of clear lines of communication 4. Standardised assessment forms	1. What agencies do 2. How they do it 3. Who to contact
Collaboration	The 'joint' assessment of the situation together, sharing of ideas on how to overcome the problem and initiating practical responses together	1. Situation awareness 2. Identifying affected population groups 3. Jointly assessing their potential capacities and needs to determine high priority groups 4. Specifying standards of health services, water supply and sanitation, nutrition, food aid, shelter and site planning (The Sphere) 5. Joint risk assessment 6. Mobilisation of relief resources: Medical supplies, food, communication systems, transport and organisation of deliveries, availability of people to render urgent assistance, equipment and sanitation 7. Joint training (Connection)	1. What is the situation? 2. High priority groups 3. Standards of care 4. Available resources 5. Risks
Coordination	Elimination of fragmentation and duplication in services, harmonizing separate disaster actions or activities, and clarifying roles and responsibilities	1. Situation Awareness (Challenges) 2. High priority groups 3. Available resources 4. Risks	1. What to do 2. When to do it 3. How it fits within the bigger response picture (Who else is doing it)

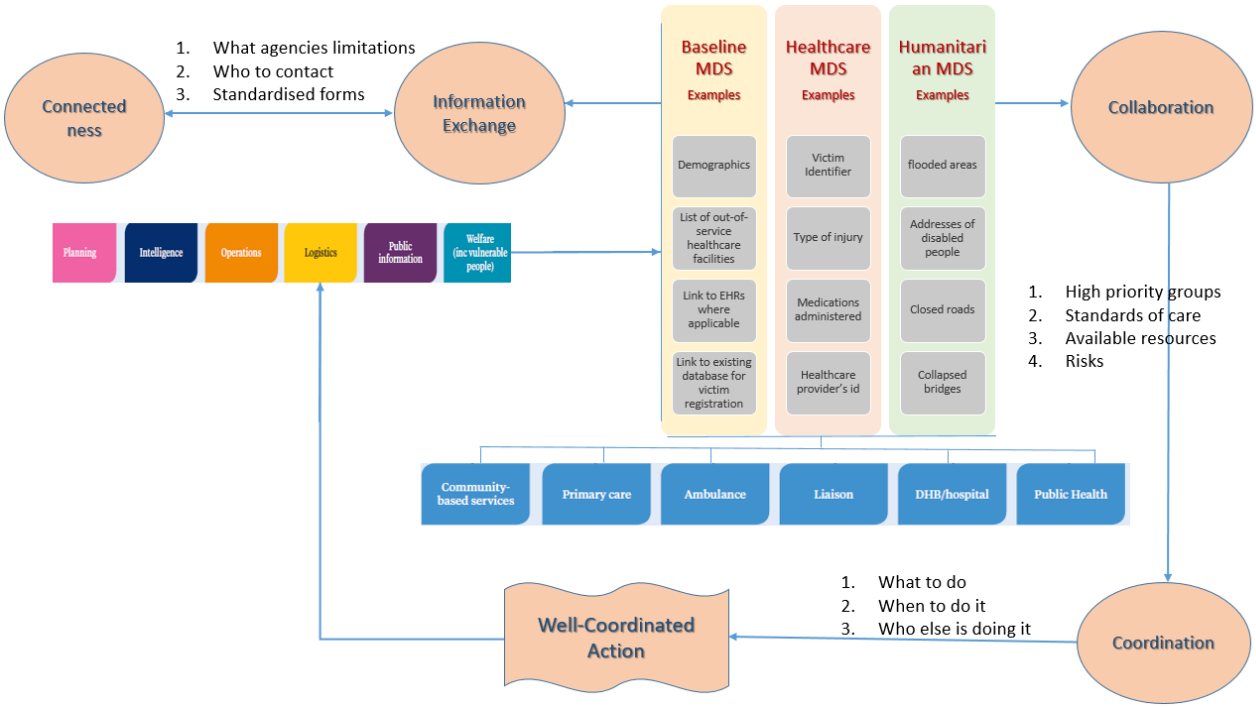

Figure 5: Best-practice Model for Cross-agency Communication

CONCLUSIONS AND FUTURE WORK

The literature survey reported here has identified and categorised key themes that impact inter-agency communication in disaster healthcare. These themes have been used to construct a communication model based on minimum datasets and practitioner feedback has refined the model to the point that it demonstrates potential for improving communication and the delivery of disaster healthcare.

Further refinement of the model is projected by assigning weights from practical experience and perceived value to the level of importance (low, medium, or high criticality) of MDS items in specific situations (Dombois, Bittner and Rüppel, 2018). The weighted items can then be aggregated in way to be determined to designate the levels of inter-agency connection, collaboration, and coordination and so used to identify and improve upon weaknesses in the communication chain.

In considering the practical implementation of the model it should be noted that telecommunications and geo-spatial technologies can automatically generate data based on agency data/information sharing requirements and shift the focus from a technology-based approach to a needs-based one. If such a model is realised by a structured information system, the system will have the capability to incorporate, display, and share information continuously. The target is a single, usable, knowledgebase system that is dynamically updatable, and accessible to every disaster agency providing them with customised and interactive data. In a fully-fledged form, the system could collect multimedia data from sensors and GIS components, and use adaptive artificial intelligence algorithms to route extracted information between appropriate contacts and agencies.

An approach with such potential inevitably faces challenges. Privacy and confidentiality restrictions related to what needs to be shared, system interoperability issues, and the incompatibility of standard operating procedures are paramount amongst such challenges. On the other hand, a strength of the model lies in the continuous update of MDS data items by their respective agencies as part of their usual operations. This inherent continuity places 'connection' on a semi-permanent basis and increases community resilience by lessening the criticism often leveed against disaster preparedness plans that they are out of date when a disaster occurs.

The 'attempt' mentioned in this paper's title represents a work-in-progress towards a prototype that has received practitioner approval and encouragement for further development.

REFERENCES

Abbas, R., Norris, A.C., Madanian, S. and Parry, D. T. (2016) Disaster E-Health and Inter-agency Communication: A Suggested Road Map. *Proceedings of the Health Informatics New Zealand Conference*, Auckland.

Abbas, R., Norris, T. and Parry, D. (2018) Pinpointing What is Wrong with Cross-agency Collaboration in Disaster Healthcare, *Journal of the International Society for Telemedicine and eHealth*, 6e3, 1-10.

Abbas, R. A. and Norris, A. C. (2018) Inter-Agency Communication and Information Exchange in Disaster Healthcare, *Proceedings of the 15th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2018),* Rochester NY, pp. 886-892.

Agranoff, R. and McGuire, M. (1999) Managing in Network Settings, *Policy Studies Review*, 16, 1, 18–41.

Auf der Heide, E. (1989) *Disaster Response: Principles of Preparation and Coordination, Chapter 5: Inter-Agency Communications*, St Louis, Mosby.

Bateman L. and Gralla E. Evaluating Strategies for Intra-Organizational Information Management in Humanitarian Response, *Proceedings of the 15th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2018)*, Rochester NY, pp. 145-157.

Benin-Goren, O., Kubo, T. and Norton, I. (2017) Emergency Medical Team Working Group for Minimum Data Set, *Prehospital and Disaster Medicine*, *32* (S1), S96-S96.

Bernstein, E. (2014) The Transparency Trap, *Harv Bus Rev*, 92, 10, 48-66, 121.

Bharosa, N., Lee, J. and Janssen, M. (2010). Challenges and Obstacles in Sharing and Coordinating Information During Multi-agency Disaster Response: Propositions from Field Exercises. *Information Systems Frontiers*, 12, 1, 49-65.

Denise L (1999) Collaboration vs. C-three (Cooperation, Coordination, and Communication), *Innovating*, 7, 3, 1-6.

Dombois, M., Bittner, T. and Rüppel, U. (2018) Approaching the Criticality of Information for Emergency Response and Control Center Operations, *Proceedings of the 15th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2018)*, Rochester NY, pp. 388-397.

Donner, A., Greiner-Mai, T. and Adler, C. (2012). Challenge Patient Dispatching in Mass Casualty Incidents, *Proceedings of the 9th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2012)*, Vancouver, pp. 1-5.

Dyer, J. and Chu, W. (2003) The Role of Trustworthiness in Reducing Transaction Costs and Improving Performance: Empirical Evidence from the United States, Japan and Korea. *Organ Sci*, 14, 1, 57-68.

EM-DAT (2018) *The International Disasters Database*, https://www.emdat.be/, Retrieved 12 June 2018.

Endsley, M. R. (1988) Design and Evaluation for the Situation Awareness Enhancement. In *Proceedings* of the *Human Factors Society, 32nd Annual Meeting Volume-1*, pp. 97-101.

Graham, J. L. and Stephens, M. B. (2018) Analytic Decision Gaming – A Tool to Develop Crisis Response and Clinical Reasoning, *Proceedings of the 15th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2018),* Rochester NY, pp. 60-68.

Granåsen, M., Olsén, M. and Oskarsson, P-A. (2018) Assessing Inter-organizational Crisis Management Capability - Initial Results of a Systematic Literature Review, *Proceedings of the 15th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2018)*, Rochester NY, pp. 190-202.

Suner, S. (2015). History of disaster medicine. *Turkish journal of emergency medicine*, *15*, 1-4.

Junglas, I. and Ives, B. (2007) Recovering IT in a Disaster: Lessons from Hurricane Katrina, *MIS Quarterly Executive*, 6, 1, 39-51.

Ministry of Civil Defence and Emergency Management (MCDEM) (2014) *New Zealand Coordinated Incident Management System (CIMS)*, Second Edition, Wellington, New Zealand Government.

The Free Dictionary (2018) *Minimum Data Set*, https://medical-dictionary.thefreedictionary.com/minimum+data+set, Retrieved 12 June 2018.

The International Federation of Red Cross and Red Crescent Societies (IFRC) (nd) *What is a Disaster?*, http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/, Retrieved 12 June 2018.

The International Federation of Red Cross and Red Crescent Societies (IFRC) (2000) *Improving Coordination, Disaster Preparedness Training Programme*, http://www.ifrc.org/Global/Impcoor.pdf Retrieved 12 June 2018.

The Sphere Project (2013) *Humanitarian Charter and Minimum Standards in Humanitarian Response*, https://data2.unhcr.org/en/documents/download/59742, Retrieved 12 June 2018.

Turoff, M., Chumer, M., de Walle, B. V. and Yao, X. (2003). The Design of a Dynamic Emergency Response Management Information System (DERMIS). *Journal of Information Technology Theory and Application (JITTA)*, *5* (4), 3.

U.S. National Library of Medicine (2018) *Disaster Lit. Database for Disaster Medicine and Public Health*, https://disasterinfo.nlm.nih.gov/disaster-lit, Retrieved 12 June 2018.

World Health Organization (WHO) (2006). *Constitution of the World Health Organization*, http://www.who.int/governance/eb/who_constitution_en.pdf, Retrieved 12 June 2018.

World Health Organization (WHO) (2018) *Definitions: Emergencies*, http://www.who.int/hac/about/definitions/en/, Retrieved 12 June 2018.