PINPOINTING WHAT IS WRONG WITH CROSS-AGENCY COLLABORATION IN DISASTER HEALTHCARE

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Abstract

A disaster is an event in which a hazard has a destructive environmental or ecological impact on such a scale that the effects cannot be managed within local community resources. In disaster healthcare, the main responders to provide emergency relief are usually emergency management and health personnel. Although these two sectors share the same vision of providing public health services to disaster victims, post-disaster analysis reflects poor communication between them leading to delayed, substandard and even unavailable healthcare. This paper investigates the barriers to smooth and effective communication between health and emergency management personnel in a disaster, with the aim of pinpointing possible points of improvement. The paper presents a comprehensive review of the available literature on the subject and suggests suitable interventions to enhance healthcare delivery through cross-agency collaboration and information exchange based on a projected telehealth system.

Keywords: disasters; cross-agency communication; healthcare; emergency management; disaster medicine; eHealth

Introduction

Over the period from 1994-2013, EM_DAT recorded 6,873 natural disasters, which claimed 1.35 million lives and affected an annual average of 218 million people.[1] Moreover, whilst the frequency of geophysical disasters such as earthquakes, tsunamis, and volcanic eruptions, has changed little over this period, the incidence of climate-related events, such as floods and storms,[2] has increased dramatically, up to 44% over the 1994-2000 average and more than double the level in 1980-1989.[3]

These challenging figures have stimulated international calls to action emphasising the need for taking measures to reduce their impacts. In 2015, the United Nations adopted the Sendai framework for disaster risk reduction with the goal of reducing the risk of man-made and natural hazards and the consequent losses in lives, livelihood, and health.[4]

While disaster management is concerned with the organisation and management of resources and responsibilities for dealing with disasters,[5] disaster medicine defines protocols for dealing with clinical events in a disaster, and the training and competencies required by clinical personnel.[6] Despite many common values and foci, as well as having many similar operational characteristics, health and emergency managers have mostly failed to share their tools and personnel.[7] Moreover, there is limited, effective use of eHealth technologies such as electronic health records, cloud computing, big data analytics, and Internet of Things that are currently revolutionising normal healthcare.[8]

Investigating communication failures in disaster scenarios has the potential to make a dramatic improvement in the appropriateness and quality of disaster healthcare by identifying ways in which information and communication technologies (ICTs) and eHealth technologies can be used to establish meaningful communication channels between emergency managers and disaster healthcare professionals.[9] Integrated information flows and optimal workflows facilitated by ICTs before, during, and after a catastrophic event are crucial to the formation of these channels. The collaboration of emergency management personnel and emergency medicine practitioners, and their use of eHealth technologies for the delivery of disaster-related healthcare has led to the establishment of a new discipline of Disaster eHealth (DEH) defined as "The application of information and eHealth technologies in a disaster situation to restore and maintain the health of individuals to their pre-disaster levels".[10]

The present paper identifies some key issues that hinder effective communication between the agencies

responding to the health demands of disaster victims. Although the paper concerns primarily the response phase of the disaster lifecycle, it highlights points of possible application throughout the disaster lifecycle. The paper aims at reducing the devastating impacts of disaster by showing how ICTs and eHealth can enhance the quality, access, safety, and cost-effectiveness of healthcare delivered to disaster victims and improve situational information that is crucial in such circumstances.

Methods

A literature review was undertaken to understand the obstacles that hinder collaboration and smooth information exchange between agencies responding to the health demands of disasters victims. The review attempted to answer three main research questions; What are the barriers to effective communication between clinical and emergency personnel during disasters? What essential information do these practitioners need to communicate in emergency situations? How can communication between emergency management and emergency medicine practitioners be improved?

The databases used included TRACIE: Healthcare Emergency Preparedness (Information Gateway), Disaster Lit: The Resource Guide for Disaster Medicine and Public Health (National Library), EM_DAT: The International Disaster Database (EM-DAT), Google Scholar, SocIndex, and Scopus. Journals consulted include but are not limited to; The American Journal of Public Health, Information Systems Frontiers, International Journal of Emergency Management, American Journal of Disaster Medicine, Disaster Medicine and Public Health Preparedness, Journal of Public Administration Research and Theory, Policy Studies Review, Prehospital and Disaster Medicine, and Public Management Review. Grey literature used included government reports, policy statements, and issues papers. The search also covered websites of international humanitarian organisations including IFRC, UNOCHA, WHO.

Articles from different disciplines including information and communication technologies, healthcare, humanitarian relief and public policy were searched using keywords such as *cross-agency collaboration*, *information exchange*, *disaster medicine,* and *disaster management*. The search revealed 56 relevant articles from more than 100 publications, analysis of which extracted re-occurring themes reported as having a significant influence on inter-agency communication and representing potential barriers to concerted action. These themes were grouped into five categories; authority, cultural and trust, situational awareness, technical and legislative challenges.

Results

Communication Challenges in Disaster Healthcare

When a disaster event occurs, it is crucial that information is exchanged as early as possible to determine the extent of damage, the number of affected individuals, the dimension of required response, and the expected complications ahead. However, cross-agency collaboration is a complex task that requires considerable effort by the collaborating stakeholders especially when the response process requires several interrelated services provided by multiple agencies. The need to collaborate and coordinate efforts becomes vital as no one agency has sufficient information or resources to address the issues alone,[11,12] leading to poor information/technical/human resource management.[13] This paper categorises and discusses these issues under the key category headings mentioned above.

Authority Challenges

A potential cause of the sub-optimal collaboration between emergency management and health professionals is the different authority structures that ultimately reflect on organisational cultures, operational modalities, and capabilities, and the way each agency responds to disasters.[14] Emergency managers have traditionally been trained according to a military command-and-control model but there is a growing awareness that this model has limitations in emergency situations that require collaborative situation awareness, and rapid, adaptive decision making between the responding groups, e.g. civil defence, fire fighters, and increasingly ordinary citizens. Although local government agencies usually have the most extensive experience and expertise in disaster management among responding agencies, they cannot manage risk and respond to catastrophes without the aid of other sectors that are usually excluded from planning efforts.[15] Establishing cross-sectorial horizontal information exchange between intervening agencies gives a holistic picture of the situation in hand and reduces response cost as agencies share knowledge and expertise. Nevertheless, management in fluid,

transitory, cross-agency arrangements is different from the vertical and horizontal management that goes on within stable organisations, and requires different skills and knowledge.[16-18] In a collaborative cross-sectorial context, the substitute for a command-and-control modus operandi would be a facilitative leadership. The management focus then would be on selecting appropriate agencies and resources, shaping the operating context and developing ways to cope with the strategic and operational complexity.[19]

In contrast with emergency management, disaster medicine, often seen as a poor relation of mainstream and emergency medicine,[7,20] whilst based on multi-disciplinary team work, is extremely hierarchical, very conscious of its academic credentials, focused on strict, set protocols, and is less familiar with the need to collaborate in real time with agencies external to its domain.[21] These distinctions can lead to different priorities and territorial misunderstandings making it difficult for disaster victims in need of treatment to receive seamless 'coordinated' care.[22] Moreover, authority (and cultural) differences can impose a leadership conflict when responding collectively to critical situations. For example, who is responsible for declaring a state of emergency?

Frameworks such as The New Zealand Coordinated Incident Management Systems (CIMS)[22] have been developed to coordinate emergency response but their success depends on the extent to which each agency applies the framework's concepts making the need for cross-agency collaboration indispensable. Cross-sector collaboration often includes elements of multi-functionality where people switch between roles and assignments in the organisations involved.[23] Clear roles, responsibilities and information needs for disaster respondents need to be well-defined but flexible in the context of emergencies in order to achieve the aims of the emergency response as a whole. This requires identifying the skills, resources and information that build the processes and culture needed. Collaboration has the potential to bring huge benefits to intervening agencies as they can exchange research findings and sector-specific tools and expertise to facilitate information exchange essential for decision-making whilst recognising each agencies origins and priorities. An important means to unravelling the complexities of disaster management is to recognise the interdependencies between healthcare and broader social systems and how they intersect to promote health and resilience before, during and after a crisis.[24]

Cultural and Trust Challenges

The way an organisation is structured, how its members communicate with one another, and perform day-to-day activities shape its organisational culture.[25] According to Schein, organisational culture is divided into three different levels; artefacts and symbols, espoused values, and basic underlying assumptions.[26] Artefacts such as logos, architecture, structure, processes and corporate clothing are the visible elements in the organisation. Espoused values refer to the standards, values and rules of conduct. Basic underlying assumptions are the deeply embedded assumptions manifested in unconscious behaviour.[27] Although emergency management and clinicians share the same vision of providing public health services to disaster victims, it is probably naive to expect the two sectors to communicate smoothly without efforts to resolve issues that may stem from their different cultural origins. The way each agency perceives information (situational awareness – see next), for example, is completely dependent on the type of tasks that this information will be used for. These tasks are carried out to achieve the end goals of the responding agency. Medical respondents have their own evidence-based criteria for ranking emergencies. On the other hand, emergency managers cannot dispense with principles from multiple disciplines such as geography, geology, and meteorology in classifying and responding to a certain type of disaster. The two sectors may look at an emergency from different perspectives, as each is unfamiliar with the other's decision-making factors.

This situation poses the critical question of what information needs to be communicated between responding agencies to ensure a mutual understanding and collective decision-making. To answer this question, the two sectors need first to have an understanding of their basic concepts, structures, and processes. The complexity of interaction increases with the increase in the number of collaborating agencies. Standardising definitions and sector-specific terminologies is essential for synthesising the complete picture of the collaborative disaster response. Combined educational courses for emergency management and health practitioners could achieve this objective. In addition, the mix of roles and responsibilities in a collaborative context raises risks of dependence, distrust, managerial complexity, and power imbalances.[28] For instance, health specialists usually conduct a needs assessment and then evaluate the extent of damage, whereas emergency managers

usually evaluate the damage and then respond to the needs of affected populations. Agencies need to "understand" each other's operational modes and cultures in order to communicate smoothly.

A critical factor for successful cross-agency collaboration is trust.[29] Trust has dual and interrelated aspects: trust in integrity and trust in competence of the other party. Trust in integrity means confidence that the other party will not withhold information, will willingly share necessary information, will commit to shared contracts and laws, and will maintain confidence and work together with due diligence. On the other hand, trust in competence refers to a mutual confidence that the other party has the abilities, resources, skills, and willingness to contribute to the collaborative relationship in a complementary way.[30] Agencies that trust each other engage in joint problem-solving, joint action, and increased information sharing.[31] Moreover, trust eases the need for control, which in turn reduces transaction costs and the need for formal contracting.[32] Factors that influence the quality of trust in a cross-agency collaboration include team flexibility and adaptability, and the ability of actors to work together and with project outcomes.[33]

Information sharing, a major component of collaboration, is related to the trust that a person giving the information, has in the person receiving the information, to treat it professionally and use it judiciously.[31] Zaheer, et al.[33] refer to this type of trust as interpersonal trust and distinguish it from inter-organisational trust. Interpersonal trust affects inter-organisational trust, which in turn has a significant influence on information exchanges. Although face-to-face interactions may have the most significant impact on the establishment of trust between collaborators, other forms including email exchanges, blogs, web conferencing, and other shared information and communication spaces and channels are also influential on trust gaining. The emphasis here is on interpersonal skills regardless of the communication medium.

Another important concept that has the ability to foster cross-agency trust is the relatively new approach of colocation.[34] In emergencies and disasters, co-locating main actors, that is locating them in the same physical place, facilitates effective communication and increases efficiency due to better information interpretation, coordination and task allocation resulting in less response time and a shared sense of ownership that ultimately builds trust. The sources of trust and trustworthiness include accountability, reputation,

reciprocity, third-party assurances and common norms. On the other hand, the sources of mistrust include lack or asymmetry of information, uncertainty, anonymity, a limited time window for decision making and lack of persistency.[35] A study conducted in the United Arab Emirates about government cross-agency collaboration found out that key barriers to collaboration among UAE public servants include losing ownership of ideas, losing control over information, undermining managerial hierarchy, and lack of ideas recognition.[30] The study suggests "incentivising" collaboration and sharing of information and knowledge through appraisal systems, as well as legislations enforcing information openness both within and between collaborative stakeholders.

Situational Awareness Challenges

Reliable information is crucial in dangerous times – to calm public anxiety, to mobilise resources from within the community, to tell people to move when they need to, and to warn people to stay away at times.[36] The common exchange of information in such scenarios is usually vertical, where information is exchanged with a top-level central agency that acts as a clearinghouse for subsidiary groups.[14] Although this centralised approach simplifies the process of information verification, establishing real-time horizontal information exchange networks between agencies can be more efficient and timely and lead to improved decisions and action.[7] Therefore, there is a need for a coordinated approach to information exchange, which is essential for situation awareness. The shock and scale of a disaster count against collaboration and level-headed decision making and the importance of coordinated decisions points to the key role of situation awareness.

Situation awareness is about knowing and recognising what is going on around us.[37] Situation awareness (SA), defined as "The perception of the elements in the environment within a volume of time and space, the comprehension and the projection of their status in near future" is required for moment-to-moment decision-making and improved performance in complex systems.[38] This definition points to the three levels of Endsley's situation awareness; perception, comprehension, and projection. Perception refers to understanding the importance of information about a certain situation. Comprehension refers to how the perceived information is combined, interpreted, stored, and retained. Projection refers to the ability to forecast future situations from current and previous ones.[39] In a collaborative context, two concepts are eminent; shared

situation awareness (SSA) and team situation awareness (TSA).

On an individual level, each person 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. Endsley defines TSA as the degree to which every team member possesses the situation awareness required for his or her responsibilities.[40] SSA on the other hand refers to the overlap between the SA requirements of the individual team members.[28] Both individual and cross-agency situational awareness are of immense significance in emergency response since an individual's SA contributes to the information that needs to be interpreted and built upon in the process of decision-making. 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'. The challenge here is to determine what are the minimum data sets that need to be communicated during emergencies? Defining these data sets cannot be done without unravelling the interactions that take place within and between responding agencies to have a clear picture of the information flow in order to be able to "see" where "blockages" exist. A suggested approach to do so is by carrying out workflow analysis for certain collaborative systems. Another pre-requisite is standardising definitions and terminologies of different responding agencies. The end goal of situation awareness is to have the right information sent to the right person at the right time.

Situational awareness is directly impacted by the structure of information flow. Thus, a study of several disasters where information flowed according to a command and control structure revealed a lack of shared protocols and a limited ability to cope with the resulting information surge, leading to poor shared situational awareness and fragmented views of the incidents.[40] On the other hand, situation awareness is positively impacted when responding organisations share timely information across a single platform designed to build a dynamic, holistic picture of a disaster situation. Platforms of this type, known as Common Operating Picture (COP) systems,[41] collect and integrate data from automated sensors, satellite feeds, and geospatial and mobile systems. Even so, COP systems requirements must involve all disaster stakeholders if they are to represent the range of perspectives that often challenge responders.

Situation awareness is not only critical for disaster response, it is also crucial to identify threats that may be on the way. Sharing different information views exposes otherwise unforeseen scenarios for which plans can be devised to minimise impact and determine appropriate responses that avoid under- or over-reactions (e.g. unnecessary mass evacuation) that can exacerbate already critical circumstances.[42]

Whilst the coordinated exchange of information in disasters is essential, informal exchange via, for example, social media has been used to find people in need, map damaged areas, organise relief efforts, disseminate news and guidance, attract donations, and help prepare for future disasters.[36] These, largely uncoordinated, exchanges can provide instant, up-to-date news faster than traditional news outlets or sources. There is, however, a need to verify the accuracy of this information.[43] Social media exchanges are so much part of modern society that they should be central to the development of disaster response strategies.[44]

Technical Challenges

The previous sections rightly offer a spotlight on human and organisational issues that hinder or expedite communication in disasters. Much of this communication, however, is facilitated by technology. The importance of ICTs in disaster response was especially obvious after the disaster of the Haiti earthquake in 2010. Underutilisation of ICTs in disaster response by both emergency management and medicine sectors almost certainly reflects understandable concerns about the costs and complexities associated with their adoption, application, and likely impact on practitioners and victims.[45] Technical interoperability refers to the ability of two or more ICT applications to accept data from each other and perform a given task in an appropriate and satisfactory manner without the need for extra operator intervention.[46] Technical interoperability is a significant concern. For instance, each responding agency usually has its own information storing processes and access controls that are pertinent to its mandate. Access restrictions can be based on considerations around information security, but also on the perceived need to own and control the data.

These factors were pointed out by an empirical study of information sharing in the management of shared social outcomes in New Zealand.[31] The study found out that the barriers to technical interoperability are incompatibility of hardware or software, mismatched data structures, incompatible database designs, incongruous data and information distribution channels,

conflicting data definitions and different terminology. It also revealed that technical solutions to data management across agencies are available but unused because agencies lack the technical capability to explore and use technical solutions available to them, some officials would want to control data sets to ensure validity and accuracy, and due to cost-related restrictions for some non-governmental organisations (NGOs). Overcoming these technical communication barriers through a collaborative approach provides several benefits including enhanced health information management, timely access to health records regardless of time and geography, better communication between both healthcare providers and consumers, and better use of scarce commodities such as healthcare providers.[47] Post-Haiti earthquake, experts agreed on the need for more collaboration around an integrated framework for the use of multiple channels of information during disasters, better ICT preparedness, and public education on the use of alternative communications channels during an emergency.[48] ICTs can significantly impact information exchange, particularly in the first few hours after a disaster event happens; a critical time for making decisions.

Legislative Challenges

As mentioned earlier, information sharing is closely related to trust. However, in the healthcare context, there is a legal dimension to information sharing that stems from the need to protect patients' privacy and confidentiality. Using a Privacy Act as a restricting tool, many health practitioners are unwilling or unable to cooperate with other professional organisations as medical records including private patients' information are not shared even between members of the same agency.[31] Moreover, different agencies have different interpretations of privacy legislation and how it should be applied. In addition, it is not clear how government agencies should deal with other non-governmental organisations (NGOs) and community-based service providers who are not covered in the formal information exchange protocols of government agencies. This is sometimes solved through using consent forms but clearly there is a need to have a policy that governs this type of interactions. Cross-agency, information-sharing protocols provide clarity to officials of different agencies with varying mandates about how to interpret or apply legal provisions and helps build trust between them.

Thus there is a need to emphasise legal interoperability in a collaborative disaster response.

Legal interoperability covers laws, policies, procedures and cooperation agreements needed to allow the seamless exchange of information between different organisations, regions and countries.[46] A trade-off between protecting patients' confidentiality and achieving a flexible level of information sharing that enables cooperation is crucial to the success of cross-agency collaboration. An important factor that complicates the process of legislating cross-agency collaboration is accountability. Accountability flows directly from the vertical structure of bureaucracy.[49] In a horizontal collective response to disaster events, where the leadership is only facilitative, individuals switch between roles and assignments and accountability may become unclear and needs to be legislated.[23] Accountability does not only stand out when addressing legislation; it also impacts cross-agency collaboration funding.[50]

Discussion

This paper pinpoints a number of obstacles that hinder meaningful communication and efficient information exchange between emergency management and health personnel and agencies in disasters. Further research involving health and emergency management personnel is needed to determine the extent of these and other factors. Much of this research will focus on the authority, cultural and trust, situational awareness, and legislative challenges noted in this paper but the ICT aspects of information exchange are critically important for the effective collaboration of responders during a disaster.

The goal is a single, usable, knowledgebase system, which is dynamically updatable, and accessible to every disaster agency providing them with customised and interactive data. The system should have the ability to analyse inbound data items, perhaps generated by sensors, from responders and automatically route the items to identified recipients for decision making and action. The system will also be able to answer requests from agencies and source the required information from wherever it resides (including social media). To ensure that all data transactions are appropriate and efficient, the analytical engine should strip out irrelevant and superfluous items that could be time-consuming, confusing, or distracting in the stressful circumstances of a disaster situation. Minimum dataset specifications[51,52] would be especially apposite for this purpose.

In a disaster healthcare context, the above requirements specify an intelligent telehealth system (ITS) that can utilise the speed, accessibility, and cost-effectiveness benefits of eHealth technologies, for example, the electronic health record and decision support systems such as electronic triage. Disaster response plans aim primarily at avoiding loss of life so that their procedures tend to prioritise the evacuation of people rather than addressing the health status of victims and the interventions they require. Although a medium to long-tem prospect, an ITS would greatly facilitate inter-agency interaction and have the potential to effect a radical improvement in the quality of disaster healthcare.

It is important to appreciate that the emergency management and disaster medicine domains targeted in this paper are not the only contributors to disaster healthcare. Several other agencies provide humanitarian relief in crisis and their existence cannot be ignored when addressing cross-agency collaboration. Underlying the current communication failings is a critical problem – independent disaster response – providing relief without appreciating the full benefits of collaboration or the means to achieve it. This fragmentation of response efforts results in lost resources, increased relief expenses, poor communication, and, most importantly, often poor healthcare quality. There is an urgent need for revising current emergency response strategies that develop collaborative approach to disaster response. The ITS and associated eHealth technologies will have a central role to play in this development.

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