

## Original Research

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# Interdisciplinary Collaboration in International Crisis Medical Relief: A Look at the Nepal Earthquake and Ebola Relief Efforts

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### Abstract

**Objective:** This study explores interprofessional collaboration among medical and non-medical personnel planning and implementing international crisis health and medical relief efforts, and how disciplinary and professional background influences these activities.

**Methods:** This study analyzes semi-structured interviews with individuals involved in organizations medical or health services to the Ebola epidemic in West Africa (2014–2016) or the 2015 Nepal earthquake.

**Results:** Disciplinary background, sometimes coupled with organization role, shaped how relief workers engaged in the process of planning and implementing crisis medical relief. There were 3 thematic areas where these differences emerged: issue focus, problem-solving approaches, and decision-making approaches. Solutions from the field emerged as a fourth theme.

**Conclusions:** The study demonstrates medical relief required collaboration across medical and non-medical professions and highlights the importance of relief workers' disciplinary background in shaping the planning and implementation of crisis medical relief. Successful collaboration requires that people involved in crisis relief communicate the relevance of their own expertise, identify limits of their own and others' disciplinary perspective(s), seek out strengths in others' expertise, and can identify/respond appropriately to others who do not see their own disciplinary limits, as well as learn these skills before engaging in relief.

## Introduction

Provision of medical care relies on the collaboration of multiple individuals with different sets of expertise. Consequently, increasing attention has been paid to Interprofessional Collaboration (IPC). Advocates argue IPC improves health care in multiple ways, including the quality of patient care, decreased fragmentation in medicine,<sup>1,2</sup> and increased patient satisfaction, as well as more efficient (and therefore less costly) staff work, improved job satisfaction, and participation in decision-making.<sup>2</sup>

This work primarily focuses on actors directly involved in provision of healthcare services, including medicine and nursing, physical/ occupational therapy, and social work.<sup>2</sup> However, the successful operation of the healthcare system relies on a broad range of actors with diverse skills that extend beyond those with specific medical or health knowledge. Their importance is especially apparent in extreme events. For instance, 'Research has shown that in many incidents within the United States, it is not a lack of resources that has hampered response efforts, but a lack of a management system to match the appropriate resources to the current needs.'<sup>3</sup> Supply and logistics issues are critical for medical providers that could be exposed to agents harming their patient (i.e., virus, bacteria, and hazardous material). The lack of sufficient provision of personal protective equipment (PPE), for instance, creates difficult choices for providers between working at increased personal risk or denying care to some patients.<sup>4</sup>

The experiences of hospitals during crises show the essential role that non-healthcare actors play in ensuring the delivery of healthcare services. Hirsch and colleagues highlight the role that administrative staff's problem-solving played in supporting the treatment of a rapid influx of patients during the 2015 Paris attack.<sup>5</sup> It was not structural damage, but disruption of systems necessary for providing care (generator fuel transport and water supplies) that led to evacuation of Bellevue Hospital during Hurricane Sandy.<sup>6,7</sup> The COVID-19 response has faced supply chain issues (i.e., difficulty acquiring masks) and has required some hospitals to alter their physical space to provide care. Non-medical hospital personnel have fallen ill with and died from COVID-19.<sup>8</sup>

International crisis health and medical relief represents the most extreme version of healthcare provision under stress, further demonstrating the significance of non-medical actors in healthcare provision. Logistics is an important part of relief operations,<sup>9–11</sup> including medical humanitarian relief. According to Van Wassenhove, 'disaster relief is about 80% logistics.'

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(p. 475)<sup>11</sup> These trends collectively demonstrate the importance of non-medical actors in crisis relief work. While this discussion has focused on the role of logistics support, this is just one example of the myriad non-medical functions and personnel key in providing healthcare services under normal and crisis conditions, within hospitals and in medical relief efforts.

The IPC literature would suggest that IPC with non-medical personnel offers similar benefits for the delivery of crisis healthcare, yet the dearth of IPC literature with such a professionally diverse sample composition points to a need for research directly examining the process, challenges, and benefits of collaboration across these actors. Health and medical relief for crisis events, especially international relief efforts provided for large disasters, present both an important domain for ensuring effective IPC, and an ideal context for understanding IPC amongst this diverse set of actors. Using interviews with people involved in medical relief efforts for the 2015 Nepal earthquake and 2014 - 2016 Ebola epidemic in West Africa, this study explores interprofessional collaboration among medical and non-medical personnel and the ways professional background influenced relief work.

## Methods

### *Data & data collection*

This study examines the processes used in planning and implementing medical relief efforts. Specifically, the study examines if and how professional disciplinary backgrounds of individuals involved in medical relief efforts affected these planning and implementation processes. It focuses on groups providing international relief in the form of medical or health services to at least 1 of 2 events: the Ebola epidemic in West Africa that began in 2014 or the April 25, 2015, Nepal earthquake. The study relies on interviews with individuals within these organizations who occupied positions enabling them to shape the relief effort and be knowledgeable about the various aspects of the process.

Events, organizations, and individual participants for this study were selected through a purposive sampling strategy, intentionally selected based on their relevance to the research question. Purposive techniques were supplemented with snowball sampling as interviewees recommended other individuals who met the inclusion criteria for participation.<sup>12</sup> Events were selected because they occurred at approximately the same time, triggered involvement of the international community in providing health and medical relief, and adhered to the characteristics of crises defined by Boin and 't Hart.<sup>13,14</sup> These criteria ensured that these 2 events would have a sufficient population from which to draw from, and that macro level contexts in the international community would be consistent for both events. See [Table 1](#) more detailed selection criteria. Examining IPC in 2 events reflecting 2 different hazards offers an analytical strength by providing an opportunity to identify the extent to which IPC behaviors, challenges, needs, benefits, etc. are hazard-specific versus relevant across hazards. Planning and implementation encompass a range of activities including (but not limited to) needs assessment, information seeking and sharing, decision-making, transport, supply acquisition and distribution, coordination, and evaluation. While specific healthcare needs and procedures may differ in treating viral illness and earthquake injuries, there are commonalities in the planning process, implementation activities required to make delivery of

that care possible, and challenges faced in these processes.<sup>8,24</sup> This work involves multiple individuals, and it is through this work that relief efforts come into existence, making this ideal activity in which to observe collaboration.

Organizations in the study provided an international medical or public health response to the Ebola epidemic and/ or to the Nepal earthquake. Organizations were selected to represent a range of types of organizations that responded to these events, from smaller volunteer groups (groups of small personnel size, composed of volunteers with limited to no permanent administrative or logistical infrastructure) to international nongovernmental organizations (INGOs), and government responses to reveal planning and implementation processes shared across groups. An initial list of organizations was generated based on media coverage and internet searches for responding organizations. This list was supplemented with groups mentioned in the interviews or recommended by interviewees. Individuals were selected because they occupied positions which allowed them to influence the relief effort or offer insight on the decision-making within the organization. Interviewees worked in a decision-making capacity within the operation or had sufficient perspective within the organization to speak to the decision-making process. In some cases, specific individuals were identified (such as people identified with contact information on the organization website), or the general contact email for the organization was 'cold-emailed' asking for direction to relevant individuals. Other times, key informants outside of organizations facilitated initial contacts with the organization. As interviews were conducted, participants identified additional individuals to approach as well. Participants were contacted via phone and email.

The study used semi-structured interviews exploring topics including needs and resource identification, what people engaged in the organization's processes (including their professional backgrounds), interactions within the group, and interactions between their group and other responding organizations, as well as the kinds of interruptions and challenges they faced, and how they adapted to those challenges. Interviews were conducted by phone and via web-based video calls, and were audio recorded. Interviews took place from September 2016 through February 2017.

The relief work and specific roles interviewees engaged in were public in nature. Interviews were focused on organizational decision-making, not patient care, and did not include any identifiable patient information. Consequently, participants and the organizations they represented were not promised confidentiality, which was disclosed during the informed consent process. Participants were informed organization names would be used during the consent process. This research was reviewed by the institutional review board at the University of Delaware and approved as expedited before the researched commenced.

### *Sample description*

The organizations and individual participants for this study participated in relief efforts to at least 1, but in some cases both, of the following events: the 2015 Nepal earthquake, and the 2014 - 2016 Ebola epidemic in West Africa. A total of 10 organizations were included in the study for the Nepal earthquake response, and 10 for the Ebola epidemic. Because some organizations engaged in both events, there were a total of 15 organizations included in the study. The number of interviews per organization

**Table 1.** Crisis criteria used in event selection

Crisis Characteristic*	Evidenced By	Nepal Earthquake	Ebola Epidemic
<b>Value Threatened</b>	Providing sufficient service to meet the health and medical needs of a given population: in particular, to meet those health and medical needs created by the crisis.	The International Medical Corps and WHO reported 7885 deaths and 17803 injured persons from the first earthquake. <sup>15-17</sup> IMC reported that 269 health facilities were completely damaged and 527 facilities partially damaged from the initial quake. <sup>15</sup> The aftershock caused additional damage, injuries, and deaths. <sup>17</sup>	Based on the March 30, 2016 WHO situation report, there were 28646 cases of Ebola in all countries combined, with 11323 deaths. <sup>18</sup>
<b>Threat</b>	The value is threatened by an inability to meet the health and medical need of the affected population because of a crisis-induced insufficient supply of resources and/ or an increase in demand.	Injuries and increase in demand from the earthquake and aftershocks and tremor-induced damage to buildings.	The increase in people needing intensive medical because of the number of Ebola infections, and the inability of the local health infrastructure to meet those demands in part because of an unfamiliarity with the virus.
<b>Urgency</b>	The need to meet medical demands quickly to prevent a worsening of patient medical conditions and a potential increase in the numbers of people who die or face poor health outcomes.	Failure to address earthquake-induced injuries quickly can lead to death or disability, and depending on sanitary conditions, could lead to illness if infected.	Failure to identify and treat people with Ebola and do so early increases likelihood of death and that they spread the disease to others.
<b>Uncertainty: Nature of the Event</b>	Uncertainty in population needs, the number of injured and dead, the locations of the injured, and other actors involved in the response, as well as where they are, what they are doing, resources available, legal context, etc.	Uncertainty about how the absence of a constitution will affect response, in the number, strength, and location of the aftershocks, the safety/ structural integrity of the buildings, accessibility of roads, the effects of landslides, and the start of monsoon season. In the Nepal earthquake, several local hospitals in Kathmandu determined that they did not need personnel support from Foreign Medical Teams (FMTs) and there were requests from the Ministry of Health for additional outside medical groups to not come, yet FMTs continued to arrive, numbering over 100 registered teams at peak numbers (World Health Organization 2015). <sup>19</sup>	The characteristics of this virus, including how long someone can still pass on the disease, uncertainty regarding the West African context (since Ebola was new to this region), and the protective measures needed.
<b>Uncertainty: Consequences of the Event</b>	How the event and response will affect recovery, the local economy, local use, and perceptions of local medical resources even after the responders leave, as well as how the event affects other health issues for the affected population and the broader community.	Damage to health infrastructure may mean medical service shortage when responders leave, interactions with foreign medical teams may change attitudes and usage of remaining medical resources in Nepal, and sustainability of treatment options.	How experiences during the epidemic will affect people's interactions with the healthcare system in the future for further Ebola outbreaks and for other medical conditions, including long term effects on local medical resources.
<b>Not Temporally Confined</b>	The events are protracted, taking place over extended periods of time	A 7.8 Magnitude earthquake occurred in Nepal on April 25, 2015. <sup>20</sup> A 7.3 magnitude aftershock followed on May 12, <sup>20,21</sup> and other aftershocks continued for months afterward.	The World Health Organization publicly announced the Ebola outbreak in March 2014. <sup>22</sup> The WHO Director-General declared the epidemic ceased to be a Public Health Emergency of International Concern on March 29, 2016, <sup>23</sup> approximately 2 years in duration.
<b>Not Geographically Confined</b>	The events are not restricted by geopolitical boundaries and affected a broad geographical area.	14 districts in Nepal were deemed 'crisis-hit' and nearly 50% of the districts were affected by the earthquake in some way. The mobility of affected people within the country and to other countries also defies geographic boundaries. More than 30 of Nepal's 75 districts were affected by the quake, 14 of which were designated as 'crisis-hit'. <sup>21</sup>	Ebola crossed national boundaries and reached multiple continents, especially concentrated in Guinea (3811 cases, 2543 deaths), Liberia (10675 cases, 4809 deaths), and Sierra Leone (14124 cases, 3956 deaths). <sup>18</sup> Organization worked to prepare countries that never ended up seeing the virus. The mobility of people infected with Ebola presented a continually evolving crisis site.

\*Crisis criteria drawn from Boin and 't Hart (2003; 2007).<sup>13,14</sup>

**Table 2.** Common types of organizational roles and positions interviewees occupied in their relief efforts

Organizational Role/Position	Explanation
Leadership and Administration	Sometimes formal titles of leadership in the organization in the whole, sometimes formal titles of leadership within the field teams deployed to the affected area, sometimes adopted leadership role outside of formal title or designation. Responsible for overarching strategic decisions for the relief efforts, such as if/when to deploy and when to cease operations. Often a key point of contact for people within and external to the organization.
Communication and Coordination	People in this role were responsible for any number of a range of activities related to receiving and sharing information within or between organizations. These activities include but are not limited to acquiring and maintaining communications equipment, maintaining contact with teams and headquarters and individual team members, or development and dissemination of risk communication messaging. Also includes individuals whose work involved information gathering, needs assessments, and epidemiological work.
Logistics	Encompassed responsibilities including arranging transportation of people and supplies to and within the affected area, and identifying, acquiring, storing, and equipping people with necessary supplies.
Healthcare Delivery	Provided health and medical services to injured/sick people affected by the event. Range of medical specializations and services represented here.

varied, but there was at least 1 interviewee from each of these 15 organizations. The sample includes 20 interviews about the Nepal response and 22 interviews about the Ebola response, 36 interviews in total.<sup>a</sup> There are at least 2 interviewees for most (though not all) of the organizations.

The sample represents governmental and diverse types of non-governmental organizations that became involved in providing health and medical relief to at least 1 of the 2 events of focus. Interviewees reflect diverse roles in relief efforts. Some participants were involved directly in patient care, while others reflected diverse administrative and coordination roles and positions in the relief efforts. See Table 2 for a list and description of common roles and positions frequently represented among the participants. Interviewee professional backgrounds and occupational roles varied. Many indicated having some form of medical training (primarily doctors, but included nursing, paramedics, and public health practitioners, as well as general first aid, and psychology). Others had backgrounds in or roles focused on logistics, communications, information technology, and management. A third of participants indicated some previous experience and/or education in disaster relief or emergency response/emergency management. Several participants (a fifth) mentioned having previous military experience. Interviewees ranged in position from senior personnel to lower-level personnel who were directly involved in some aspect of decision-making, or who were lower in organizational hierarchy, but assumed important roles in the relief activity, such as leaders of field teams.<sup>b</sup>

While the organizations included in the study sometimes had a pre-existing presence in the country they responded to and may have collaborated and partnered with local individuals or organizations, the organizations included here were all based outside of the affected countries. Interviewees were not asked their national origin, but interviewees themselves were living outside of the affected countries, with most interviewees coming from the United States (only an exceedingly small number were from or had connections with the affected country). A focus on non-local responses and relief organizations was selected to best reveal the

activities of interest to the larger data collection effort: the processes involved in planning and implementing these relief efforts. Focusing on people and organizations providing relief in unfamiliar contexts would provide more opportunities to bring assumptions, priorities, decisions, and other activities to the fore in the interviews than might be present in interviews with people operating in more familiar contexts.

### Data analysis

Data were coded using Atlas.ti (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) software. Analysis involved first and second cycle coding using both deductive and inductive coding processes. The existing literature indicated the disciplinary and professional background influence decision-making, but use of open coding allowed the specific ways this characteristic influenced the processes captured in this study to emerge from the data itself. Process, *in vivo*, provisional, and values, as well as attribute, open, and sub-coding coding techniques were used; utilizing multiple coding techniques simultaneously as appropriate.<sup>25,26</sup> The data were initially coded for 2 phenomena: the processes underlying the organization and implementation of a medical relief effort, and the justifications, reasons, and influencing factors shaping those processes. Of those justifications, reasons, and influencing factors, the present analysis focuses on instances when characteristics of the decision-maker affected decision-making. In that initial coding, characteristics of the decision-maker (specifically the professional and disciplinary background of relief workers) emerged as a crucial factor shaping the planning and implementation processes. Subsequent coding cycles identified themes in the how this characteristic shaped that activity. These themes reflect areas where the interviewees specifically noted the influence of disciplinary background or where background informed the decisions and activities being discussed in the interview without the participant explicitly stating that connection.

## Results

### Themes

The data revealed that disciplinary background, sometimes coupled with organization role, shaped how different actors involved in the relief efforts engaged in the process of planning, and implementing crisis medical relief. These differences coalesced around 3 themes: differences in issue focus, problem-solving

<sup>a</sup>A small number of interviewees (and therefore, organizations) participated in relief efforts for both events. They are included in the organization and interview counts for both events. Consequently, the total numbers of included organizations and interviews is less than the sum of all the Nepal and Ebola organizations interviewees.

<sup>b</sup>The low hierarchical status, but ability to influence relief effort execution through planning and implementation is akin to the concept of street-level bureaucrats described by Michael Lipsky.<sup>27</sup>

approaches, and decision-making approaches. In addition to differences, solutions to IPC challenges emerged as a fourth theme in the data.

#### *Focused on different issues*

Relief workers' disciplinary backgrounds and positions in their organization could focus their attention, consciously or unconsciously, on some aspects of the relief effort more than others, particularly on components of the activity most clearly aligned with their own expertise (specialized knowledge and skills). A situation from Team Rubicon's experience highlights how people's disciplinary backgrounds and roles (in the absence of experience) lead them to identify some needs rather than others, with potential implications for the response. This interviewee participated in logistics for the organization's relief effort and was present in the crisis-affected area. Doctors from another medical group joined them to support the provision of medical services. This interviewee described a day when the team was preparing to enter some very remote areas, the doctors:

'... showed up in like windbreakers and day packs and you know, for me I am like, 'are you serious?' because if you go out there like that, you are going to become part of the disaster. Hence I would say that often, the medical field in-in responses like this forgets how important logistics is, because (and it's no fault of their own) they just want to get out there and help, but that safety net, that lifeline quickly becomes [taut and] breakable the further they stay out, and if they don't recognize the fact that they need logistical support, they'll end up becoming part of that disaster . . . . . once we got them outfitted, they performed remarkably, but it wasn't on their mind. They were thinking of things like, 'what do I need in my pack to go help those people,' and they would forget, like, what do they need to help themselves to be able to help those people.'

The physicians in this example were focused on medical needs and materials to address them and became aware of their own logistical needs through interactions with an individual himself who was focused on that domain.

An interviewee from CDC involved in the agency's early epidemiological work in Liberia explained the communication situation during his first deployment to Monrovia:

'We underestimated the need for much greater investment in data management. . . . I do not mean epidemiology, I mean basic infrastructure and people to manage data, make sure that all the logistics, the computers, the reporting, . . . reports are coming into the ministry on scraps of paper, by cell phone, sometimes by email, but you know very disorganized. . . .'

The organization was extremely focused on epidemiological investigation, information needs, and communicating information about the epidemic, but less focused on the logistical needs required to support that activity.

#### *Differences in problem-solving perspectives*

Likewise, discipline appeared to affect how relief workers viewed resources and the types of solutions they identified. Some interviewees highlighted the value of interdisciplinary teams in opening new perspectives or addressing the issues more broadly. For example, a participant who provided relief to the Nepal Earthquake with a group from Massachusetts General Hospital said about the importance of differing perspectives and diverse backgrounds in teams:

'To me, that's 1 of the best things about bringing a multidisciplinary team. This is because I might not be able to problem solve it with the way I look at it, but if I have somebody who has a completely unique perspective, and I

listen to them . . . often they're proposing solutions or ideas that improve the function of the team or how we provide care.'

This interviewee reflected on a time during the Nepal response when listening to a colleague with expertise in a different area of medicine improved their operations an example of these benefits. The team was setting up tents to serve as a clinic spaces. They explained:

'At 1 point the OB [obstetrician] said, 'How about we keep 1 of the tents up and use it as a private room for OB exams?' . . . At first, I was like, 'Well those are our private tents.' You know you kind of keep this mental separation, and then after, I paused and said 'no that's a fabulous idea, and I can't believe we didn't think of it until now! Yes, we should do that, and we should do that from now forward for when we're not working in a structure.'

The colleague's perspective allowed for the identification of a need and a resource unnoticed by the other team members. Similarly, 1 participant from the American Nepal Medical Foundation, a group composed of medical personnel, explained that he has a background in both medicine and information technology (IT). He occupied this IT role at the time and believed that these dual perspectives helped prevent cross-disciplinary focus issues.

#### *Differences in approaching decision-making*

How people approached the decision-making process itself was linked to the disciplinary norms and expectations around decision-making in each field. A participant from CDC from an emergency management background highlighted apparent disciplinary differences in the amount of information required to decide:

'... I am not a doctor by trade, ok? And I am about as non-medical as you can get. I was trained that if I only had 50% of the information and I had to decide, I could decide. Some of the people, well, most of the people are medical professionals, and docs like to have 100% of the information before they decide, and that was sometimes challenging.'

The consequences of these differences extended beyond that decision. Waiting for more information could delay this decision, and potentially affect other ones. The individuals responsible for information gathering were heavily burdened with information requests. Requesting more information when there was no more to be found could affect information gathering group priorities and add to their workload, either in attempts to find more information or in conversations to convince others that they would be unable to further fill the information gaps.

#### *Solutions from the field*

As interviewees revealed challenges to IPC, their words also suggested strategies from the field to overcome them. Interviewees revealed the importance of communication in navigating disciplinary differences. The emergency manager with CDC who discussed different information thresholds for decision-making explained:

'It took some time to get across to them that there was no way you are going to get of the information. You know, and to be honest, sometimes you would get so many requests for information, that you would have to ask people 'here's what I got, now, which ones of these are priority information requirements?' That would help. That would help us out a great deal. You know, because if everything is a priority, then nothing is a priority. So it was, to get people to understand that.'

Some interviewees noted language differences in how different agencies or organizations discussed aspects of the response and the importance of learning how to overcome those professional

language differences to work together. Another CDC interviewee involved in the Ebola response focused on communication discussed ‘learning the culture of how to speak DoD [Department of Defense] language, and then learning how to speak public health language’ as the agency learned what information DoD needed and how that needed to be communicated.

2 elements of communication emerged as important in the data: (1) listening to other’s perspectives and recognizing their insights and (2) speaking up when necessary. The idea to use a private tent as an exam space only emerged because a member of the team was able to vocalize that idea. The physicians who were inappropriately dressed to go into the field were prevented from doing so and ‘performed admirably’ with the intervention of a teammate.

Interviews conveyed that this was learned behavior, often learned *while providing relief*. While learning in the field was implicit in participants’ discussions, some noted it explicitly, such as the physician leading a hospital-based organization’s Nepal earthquake relief effort who explained, ‘... and certainly I will tell you this is something I learned. I did not come to this—I had to learn it the hard way.’

### Limitations

There are limitations to the current study. Cultural differences across national contexts may influence these findings in ways not captured in this study due to the sample composition. Reliance on purposive and snowball sampling approaches can result in sampling bias. While the focus on non-local organizations providing relief was intentional, and the predominance of interviewees from the United States in the sample is known, it is also possible the organizations and individuals included in this study differ from the broader population of people and organizations responding to these events in ways not captured by the study, but important in shaping the findings presented here. Sample compositions are not identical for both cases. There was a limited presence of government personnel amongst Nepal interviewees, while most of the Ebola interviewees came from the government. This is the result of the nature of the responses themselves, with Ebola response being less conducive to short deployments which could be staffed with volunteers, and more reliant on long deployments with personnel working full time, typically from governments and larger, more established NGOs. Nevertheless, the overall diversity of positions and organizations in the study, combined with the similarities across the interviewees, suggest that this sample was adequate to identify general trends. Most groups had more than 1 interviewee, offering multiple perspectives within organizations. The examination of these patterns across various kinds of extreme events, organizations, and individuals with varying professional backgrounds and roles within their organizations helps to illuminate patterns which are consistent across hazards, actors, and relief efforts rather than identifying patterns that are unique to one effort or unique circumstances of 1 event.

### Discussion

Crisis health and medical relief benefits from professionally diverse team composition, consistent with claims of the benefits on healthcare highlighted by IPC work focused exclusively on healthcare workers.<sup>1,2</sup> However, the interviews indicate that there are multiple dimensions to expertise. There is discipline specific expertise, but there is also expertise related to the context. Changes in the context in which that medical care is being delivered may require

additional expertise (and by extension, collaboration with different actors). Shifting roles may require new knowledge and expertise. In non-crisis circumstances, one’s profession or discipline may be clearly aligned with roles. In the crisis context, individuals may adopt new roles which require knowledge and skills not exercised their day-to day activities. Likewise, crisis circumstances may elevate the importance of other types of knowledge and skills, requiring collaboration with unfamiliar partners from different professional domains.

The skills revealed in the interviews which facilitated collaboration across disciplines, including with non-medical personnel, are consistent with findings from existing IPC research. Communication in general,<sup>28</sup> sharing knowledge and skills,<sup>29</sup> and recognizing/ acknowledging, and respecting others’ expertise are important in enabling collaboration across professional lines.<sup>28</sup> This echoes the practices of high reliability organizations, which recognize knowledge by deferring to people with the appropriate expertise in decision-making rather than deferring to senior personnel in the organizational hierarchy.<sup>30</sup> Interviewees conveyed these sentiments as they praised the contributions of other professionals on their teams and highlighted shortcomings which emerged from too narrow a focus. Interviewees similarly highlighted the importance of role awareness for IPC,<sup>1,2,29</sup> in their discussions of recognizing skills and knowledge. Participants in the collaboration must understand their own and others’ roles to successfully collaborate in healthcare.<sup>1</sup> This study indicates that it is important for people on these teams to be able to identify the limits of their own disciplinary knowledge, when others have more appropriate knowledge, and to defer to that more appropriate expertise. Further, it demonstrates the importance of people being able to identify when others are acting outside of their boundaries of their disciplinary expertise and to intervene in those circumstances. Teams work better when the individual team members are capable of both, and the organizations foster an environment that facilitates that communication.

Finally, beyond the importance of these IPC findings themselves, it is also important that these patterns emerged in *both events*. Rather than witnessing differences in the presence, merits, and challenges of IPC in the Ebola versus Nepal responses, the interviews point to a remarkable consistency in the value of and challenges to IPC across medical and non-medical personnel. This study examined only 2 hazards: infectious disease and earthquake. Consequently, there is a need to further examine IPC in medical relief efforts for other types of hazards such as meteorological and hydrological hazards. However, this study offers early evidence of the value of IPC across diverse actors in crisis medical care in multiple hazard contexts. Relief organizers can use these findings to anticipate and proactively address these issues in future events.

Despite its importance, as evidenced in both the data and the literature, professionals are not inherently good at IPC and its requisite skills. This ability is learned.<sup>28</sup> Healthcare professionals have a different vocabulary, problem-solving approaches, and different understandings of issues, and values,<sup>1</sup> as well as professional boundaries created in the education and professionalization process.<sup>1,31</sup> The professionalization process creates cultural differences in approaches to healthcare, problem-solving and philosophical approaches, values, and cultures, which can present obstacles to IPE.<sup>1,28</sup>

Given these findings, IPC training should extend beyond healthcare actors in the normal healthcare setting. Healthcare workers should be trained to understand how to collaborate with

non-medical actors, particularly logisticians and emergency managers, and how crisis/disaster context may influence what counts as relevant expertise. Given the interdisciplinary nature of emergency management, students in emergency management programs should similarly undergo IPC training, since the field will continue to require interdisciplinary and multidisciplinary collaborative efforts across professional lines. The involvement of emergency management alongside public health and medicine in the COVID-19 pandemic underscores this need.<sup>8</sup> Future work should build on the existing IPE literature<sup>31,32</sup> in healthcare to further examine how to build this important skill most effectively, including appropriate implementation in emergency management education.

While this study focused on disaster relief, these issues are relevant to provision of medical care within healthcare facilities experiencing crisis. Tornadoes in Joplin, Missouri (2011),<sup>33</sup> Hurricanes Katrina (2005)<sup>34</sup> and Sandy,<sup>6,7</sup> the 2011/12 Christchurch earthquakes,<sup>36</sup> and most recently the inundation of hospitals with COVID-19 patients<sup>8,37–39</sup> show that hospitals and health care centers can be the locations of crises themselves. As the context in which care is being delivered comes under stress, the kinds of collaboration discussed in this study may occur, presenting similar IPC demands, requiring further examination in future work.

## Conclusions

This study highlights the importance of relief workers' disciplinary background in shaping the planning and implementation of crisis medical relief. Their backgrounds shaped what they focused on, and how they approached the decision-making process. Crisis medical relief inherently requires drawing personnel from multiple disciplinary backgrounds. This study offers evidence that those relief efforts benefit from these diverse perspectives. Healthcare workers can become involved in situations which require them to engage with personnel who are responsible for activities important for the provision of health and medical services, but who never interact directly with patients. The abilities of these diverse actors to work together is important for the success of these efforts. Members of each discipline often have different perspectives that emerge in their thinking and actions in crisis medical relief, which can bring to the fore problems to be addressed and solutions that might otherwise have gone overlooked by some team members. Likewise, this work highlights the potential for medical personnel to be in roles and making decisions about things for which they have not been explicitly trained, further reemphasizing the importance of these IPC skills. In these cases, there is a clear benefit to the diversity of perspectives.

However, despite its importance, the differences between fields can present collaboration challenges, and has the potential to present obstacles to provision of crisis relief services. This potential is particularly relevant when there is an inability for people to engage across disciplinary lines. Successfully doing so requires that people involved in crisis relief: communicate the relevance of their own expertise, identify limits of their own and others' disciplinary perspective(s), seek out strengths in others' expertise, can identify and respond appropriately to others who do not see their own disciplinary limits, and learn these skills *before* engaging in relief.

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