

A Field Evaluation of Tools to Assess the Availability of Essential Health Services in
Disrupted Health Systems: Evidence from Haiti and Sudan

Jason W. Nickerson

Supervisor: Dr. Peter Tugwell
Co-Supervisor: Dr. Amir Attaran

**Thesis submitted to the Faculty of Graduate and Postdoctoral Studies
In partial fulfillment of the requirements for the PhD degree in Population Health**

Population Health
Faculty of Graduate and Postdoctoral Studies
University of Ottawa

Table of Contents

Table of Contents.....	ii
Acknowledgements.....	iv
Abstract.....	v
Tables Included in Thesis.....	vii
Figures Included in Thesis.....	viii
Chapter 1 – Introduction.....	1
Abstract.....	1
Rationale.....	11
Objectives.....	12
Literature Review.....	13
Methodological Overview.....	23
Conceptual Frameworks.....	29
Organization of the dissertation.....	34
Chapter 2 – Monitoring the Ability to Deliver Care in Low- and Middle-Income Countries: A Systematic Review of Health Facility Assessment Tools.....	46
Abstract.....	47
Methods.....	51
Health Systems Framework.....	53
Results.....	54
Discussion.....	63
Conclusion.....	69
References.....	70
Table 2.1 – Summary of Included Assessment Tools.....	77
Table 2 – Framework of Health Facility Assessment Domains, With Corresponding Health Systems Building Blocks.....	78
Table 2.3 – Summary of Included Assessment Tools.....	80
Figure 2.1 – PRISMA Flowchart.....	83
Figure 2.2 – CSIH Health Systems Framework.....	84
Chapter 3 – Health Facilities Assessments in Humanitarian Emergencies: A Field-Based Evaluation from Haiti and Sudan.....	85
Abstract.....	86
Methods.....	91
Results.....	93
Discussion.....	97
Limitations.....	104
Conclusion.....	105
References.....	106
Table 3.1 – Included Assessments or Databases of Health Facilities and Health Services Availability.....	112
Table 3.2 – Analysis of Included Assessments and Databases Using Health Systems Indicators and Global Health Cluster Core Indicators.....	113

Table 3.3 – Analysis of Included Assessments and Databases Using Sphere Indicators	114
Chapter 4 – What Kinds of Health Systems Information Do Humanitarian Aid Workers Need? Interviews with Practitioners in Haiti and Sudan	115
Abstract.....	116
Methods.....	120
Results.....	122
Using Data for Decision Making	123
Collecting Health Systems Data	126
Data Analysis	128
Information management	130
Managing Uncertainty	131
Ideal Health Information System for Monitoring the Availability of Health Services	133
Open and Crowdsourced Data	134
Discussion	135
Conclusions	140
References.....	142
Chapter 5 – Conclusion	146
Abstract:.....	146
Introduction	147
Objective One – What methods, indicators and benchmarks are currently used by Health Cluster lead agencies during acute and protracted humanitarian crises to assess health services and resources availability?.....	147
Objective two – What overlap exists among health resource and service availability assessment tools currently in use at the Cluster level and how do these align with the suggested Global Health Cluster core indicators and essential services/packages in the HeRAMS framework?	150
Objective three – What data and indicators should be included in a minimum dataset for health services assessment and reporting? Can this be implemented at a global and country level?	153
Objective four – What are the opportunities for, and barriers to, integrating data from existing health services assessment tools into the Health Cluster Information Management Framework at the country and global levels?.....	157
Relevance to Humanitarian Reform	161
Humanitarian Assistance and Health Systems Strengthening	162
Strengths and Limitations.....	164
Recommendations for future research and practice.....	168
Conclusion.....	171
Appendix 1 – MEDLINE/Embase Literature Search Strategy	176
Appendix 2 – University of Ottawa Health Sciences and Science Research Ethics Board Approval Certificate	177
Appendix 3 – Letter of Permission from the Canadian Society for International Health	178

Acknowledgements

There is no shortage of family, friends, colleagues, supervisors, and participants who deserve to be acknowledged for helping make this project a success. Without all of you, none of this would have happened. In the interest of naming names who deserve to be named, here are but a few: My supervisors, Drs. Peter Tugwell and Amir Attaran; my committee members, Janet Hatcher-Roberts and Orvill Adams; at the World Health Organization, Drs. Andre Griekspoor and Xavier de Radigues; at the World Health Organization Sudan office, Drs. Anshu Banerjee and Yakub Vaid; at the Canadian Red Cross, Dr. Salim Sohani; and with the International Federation of the Red Cross, John Fleming.

To my family and friends, I am eternally grateful for the love, patience, and support that you have provided me throughout the past four years while I embarked on this work. My wife, Rachael, has been a constant source of support and balance, without whom this work could never have been completed. My family has consistently supported my adventures, escapades, and questionable decisions, and for that I shall be forever thankful.

A great deal of gratitude is owed to everyone who participated in a direct or indirect way in the studies described herein. I was invited for tea, for dinner, and for coffee, in metropolitan cities, in tents in the desert, and in some of the most challenging, beautiful, and surreal places I have been in my life, by countless people who made this project a success. I owe so much to the generosity of everyone who opened their lives to me, if only for a few moments, to not only allow me to conduct some research, but to show me their world through many different lenses. The research contained within this thesis represents only a small fraction of what I have learned, and only a snapshot of the experiences I have had in the past four years in some of the most profoundly fascinating places in the world. Most importantly, the analysis of the data, the listening to interviews, and the writing of this thesis brought me as close as I can get to keeping a hold of the things – friends, family, cities, struggles, conversations, nights at basecamp, drives through the desert – that truly matter. This is only the beginning.

“Go for broke. Always try and do too much. Dispense with safety nets. Take a deep breath before you begin talking. Aim for the stars. Keep grinning. Be bloody-minded. Argue with the world.”

- Salman Rushdie

Abstract

Background: This thesis presents three research papers that evaluate the current tools and methods used to assess the availability of health resources and services during humanitarian emergencies.

Methods: A systematic review of peer-reviewed and grey literature was conducted to locate all known health facilities assessment tools currently in use in low- and middle-income countries. The results of this review were used to generate a framework of essential health facilities assessment domains, representative of seven health systems building blocks.

Using this framework, a field-based evaluation of tools used to assess the availability of health resources and services in emergencies in Haiti and the Darfur states of Sudan was conducted. The collected assessment tools from these countries were compared against the framework from the systematic review, as well as the Minimum Standards for Health Action in the Sphere Humanitarian Charter and Minimum Standards in Humanitarian Response, and the Global Health Cluster's Set of Core Indicators and Benchmarks by Category. A coding system was developed using all of these frameworks that enabled the comparison of the assessments collected in both countries.

Field-based interviews were conducted with key informants using a convergent interviewing methodology, to gain perspectives on data collection and the use of evidence in formulating health systems interventions in emergencies.

Results: 10 health facility assessments were located in the systematic review of the literature, generating an assessment framework comprised of 41 assessment domains. Of the included assessments, none contained assessment criteria corresponding to all

41 domains, suggesting a need to standardize these assessments based on a structured health systems framework.

In Haiti and Sudan, a total of 9 (Haiti, n=8; Sudan, n=1) different assessment tools were located that corresponded to assessments of the availability of health resources and services. Of these, few collected data that could reasonably have corresponded to the different assessment domains of the health facilities assessment framework or the Sphere Standards, nor could many have provided the necessary inputs for calculating the Global Health Cluster's indicators or benchmarks. The exception to this was the one tool located in Sudan, which fared reasonably well against these criteria.

The interviews with participants revealed that while evidence was viewed as important, systematically-collected data were not routinely being integrated into program planning in emergency settings. This was, in part, due to the absence of reliable information or the perceived weaknesses of the data available, but also due to uncertainty as to how to best integrate large amounts of health system data into programs.

Conclusions: Greater emphasis is needed to ensure that data on the availability and functionality of health services during major emergencies is collected using methodologically-sound approaches, by field staff with expertise in health systems.

There is a need to ensure that baseline data on the health system is available at the outside of emergency response, and that humanitarian health interventions are based on reliable evidence of needs and capacities from within the health system.

Tables Included in Thesis

Table 2.1 – Included Assessment Tools, Developer, and Version	77
Table 2.2 – Mapping of Health Systems Building Blocks and Assessment Domains	78
Table 2.3 – Summary of Included Assessment Tools.....	80
Table 3.1 – included Assessments or Databases of Health Facilities and Health Services Availability.....	112
Table 3.2 – Analysis of Included Assessments and Databases Using Health Systems Indicators and Global Health Cluster Core Indicators	113
Table 3.3 – Analysis of Included Assessments and Databases Using Sphere Indicators	114

Figures Included in Thesis

Figure 2.1 – PRISMA Flowchart.....	83
Figure 2.2 – CSIH Health Systems Framework.....	84

Chapter 1 – Introduction

Abstract

Humanitarian emergencies present major challenges for the global health community, creating a large, sudden increase in the burden of disease and reversing years of hard-earned progress in improving the health of populations. Ensuring that humanitarian assistance is targeted, efficient, and equitable is essential for optimizing the impact of these interventions.

This chapter provides an introduction to the thesis, the challenges faced in evaluating and assessing the availability of health services in disrupted health systems, the rationale for the methods chosen, and an overview of the included chapters.

Humanitarian emergencies present formidable challenges to global health. Emergencies manifest as both sudden and protracted onset disasters, that may be caused by natural or human factors, the effects of which are often exacerbated by existing risks to the affected population such as poor population health and coverage of health services, the under-development of basic social and governmental infrastructure and capacities, and the marginalization or exclusion of populations from social services.

Emergencies consist, broadly, of natural phenomena (including weather events, such as hurricanes, as well as other natural phenomena such as earthquakes) and human events such as wars and complex emergencies. The complexity of these situations is often lost in the application of broad terms such as these, where a climatic event such as a hurricane or earthquake may result in minor damage for resilient, prepared communities, and substantial losses in areas with weak social and physical infrastructures. Complex emergencies have been described as “situations in which mortality among the civilian population substantially increases above the population baseline, either as a result of the direct effects of war or indirectly through increased prevalence of malnutrition and/or transmission of communicable diseases, particularly if the latter result from deliberate political and military policies and strategies (national, subnational, or international).” (1)

The population health implications of emergencies are vast and complex. Entire health systems can be disrupted, destroyed, or overwhelmed, the health needs and risks often abruptly increase, and power becomes decentralized. (2) The operational environment in which these scenarios manifest themselves are chaotic, dynamic, and

often fraught with security concerns, all of which increase stress and limit the operational space in which health services can be delivered. (3,4)

The combination of these factors can lead to uncertainty and imprecision in determining the population's health needs and designing the most appropriate interventions to address major health concerns. As a result, action often precedes understanding, out of both necessity and pragmatism, and shapes decision-making and resource allocation in emergencies. (2) While there is arguably an impetus and an imperative to do something, there are growing calls for the humanitarian system to become more professional and, therefore, accountable to the actions taken by aid workers in the field. (5)

The effective coordination of a health sector response to both acute and protracted emergencies requires striking a balance between immediate and future concerns and priorities. Health systems in crises are remarkably adaptable – a function that must not be conflated with being adequate – and may even yield useful innovations or new and more effective models for delivering health services. (2,6) However, there are considerable reasons to be skeptical that the humanitarian system is consistently capable of producing meaningful reforms to health systems, particularly following sudden onset emergencies. (7)

Critical flaws within the humanitarian system have been well-documented for some time, with calls for greater coordination emerging after virtually every major emergency. (8,9) Several major emergencies in the 1990s, including the 1994 Rwandan genocide and the war in Kosovo, provided considerable reason to be concerned of the fate of the humanitarian response system and international aid organizations' abilities

to effectively coordinate humanitarian relief and rebuild health systems following disasters and conflicts. (10,11) While certainly not new, these concerns began to concretely take hold following the response to the 2004 Indian Ocean tsunami, when it became evident that the humanitarian response provided by international actors varied considerably among crises, coordination was often weak and fragmented, and concerns were raised of the quality of services provided by humanitarian agencies. These concerns resulted in the commissioning of the Humanitarian Response Review in 2005 and, subsequently, the creation and implementation of the Humanitarian Cluster System. (12) This system relies on the clustering of agencies to address major priorities in humanitarian operations, regardless of the setting, with each Cluster being led by an agency with the technical expertise to provide guidance and leadership administratively and operationally. The Clusters reflect common operational issues that must be consistently addressed in emergencies, which are grouped into the following 11 Clusters: Logistics, Nutrition, Emergency Shelter, Camp Management & Coordination, Health, Protection, Food Security, Emergency Telecommunications, Early Recovery, Education, and Sanitation, Water & Hygiene. (13)

The Cluster system relies on both sectoral and inter-sectoral approaches to humanitarian action; For obvious reasons, there is considerable overlap among many of the Clusters in different circumstances. For example, during a cholera outbreak, there is a need for consistent collaboration between the Health and the Sanitation, Water & Hygiene Clusters. The availability of timely, accurate, and reliable information and information management practices to guide the implementation of effective and appropriate interventions is fundamental to the operations of all of the Clusters, and

the humanitarian system, in general. While each Cluster is responsible for information collection and management related to their sector, this is overseen by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), which compiles country-level humanitarian data and priorities.

Effective information systems have long been the cornerstone of basic public health: the ability to reliably detect, map, and respond to emerging health threats are the basis upon which modern paradigms of public health have been established, beginning with the allegorical accounts of John Snow and the Broad Street pump. (14) In emergencies, relevant health information is comprised of components that must be established with both logical and temporal purposes to generate useful information on the health status of the population, but implemented in ways that facilitate evidence-based decision making and coordination. (15) Although conceptualized as comprising three main components in an operational context (the health status of the population, the resources available to address health needs, and the performance of the health system), this greatly oversimplifies the complexity of information required to effectively coordinate humanitarian interventions in complex environments and to adequately summarize information for each of these components. (16,17)

Despite the growing recognition of the important role of information management in the coordination of humanitarian responses in the health sector, this continues to be a major weakness within the humanitarian system. (18) While several critical concerns of health information systems have been previously described in the literature, the absence of a guiding organizational framework to guide the implementation of information systems in acute emergencies that also evolve into

useful information systems during the health system's recovery from the emergency remains a critical weakness.

The absence of reliable information systems and evidence to guide humanitarian interventions can have grave consequences, wasting valuable time, money, and resources, while contributing little to the overall recovery of the health system (and potentially detracting from it). Following the 2004 Indian Ocean Tsunami, Indonesia received 4,000 tonnes of unsolicited, unnecessary and often-expired drug donations for a population of two million people(19); similarly, in Haiti, by some estimates over 600 health agencies responded following the earthquake, many without the relevant experience or capacity to provide effective care or infrastructure in such an austere setting, and creating as many problems as they solved in their wake. (20) In the absence of an effective, valid and standardized system for monitoring the availability of health resources and services that can be compared against assessed population needs to determine gaps in coverage, the provision of unnecessary services or the duplication of health services in some areas while others have none is inevitable. Furthermore, as crises transition from emergency relief to recovery and rebuilding, ensuring the availability of accurate assessments of health resources necessarily provides the foundation from which future interventions ought to be based.

This information must rationally be aligned with the broader interests of health system strengthening and frameworks. (21) In the aftermath of the 2010 Haiti earthquake, the mantra became "building back better" – something that has yet to be realized in any sector, but in Haiti's public health system, progress has not only been slow, but may have actually regressed. (7,22)

Despite the obvious need for health system reconstruction and the potential opportunities for building back better, there is little evidence that experience gained in the reconstruction of health systems in many recent humanitarian emergencies has been integrated into the foreign assistance policies of major international donors. (23) Additionally, the comparison of successes and failures between settings is notably difficult, given the diversity of settings in which health system reconstruction efforts have been targeted as countries emerge from conflict, or recover from sudden-onset disasters, and thus limiting the development of a large body of knowledge or evidence. Drawing on specific examples of successes has its challenges, given the complexity of health, governmental, or donor policies, however there are several broad frameworks and recommendations that can frame these reconstruction efforts.

A prevailing assumption in the reconstruction of health systems is that the perpetuation of an emergency-oriented model of health service delivery is unsustainable and can ultimately weaken the ability of the government to restore or rebuild the health system. The acute needs of the population must, of course, be balanced against the need to establish effective mechanisms for transitioning from the emergency and into sustained recovery of the health sector. Traditional models of humanitarian assistance have, regrettably, viewed these as separate functions (humanitarian relief and long-term development), though it is clear that these activities and funding should overlap, given the long time frame required to develop local capacities, establish political support, and other essential elements of implementation planning. (23,24)

Failing to achieve this coordination has major implications in both the acute response to major emergencies and for the long-term recovery of the health system. Interventions established at the outset of the emergency by international agencies often establish a trajectory for future assistance through dedicated funding and program models; thus, programs that are duplicative, redundant, or inappropriate at the outset of the emergency are unlikely to deviate from this course. Establishing where needs exist, where health services are functional, and where gaps remain is, therefore, essential early on in the emergency response in order to establish programs that are effective in addressing the needs of the population throughout the transition and recovery.

Several anecdotes of health providers organizing duplicative health services abound in the literature, however there is limited understanding of the impact of this overlap at the level of the health system. One salient example of this lack of coordination emerged in the response to the 2010 Haiti earthquake, where coordination among surgical teams and rehabilitation specialists was weak at the outset of the emergency when amputations and reconstructive surgeries were performed, and were subsequently poorly developed to address these patients' needs in the long-term. In this context, referral from surgical care providers to rehabilitation specialists was poor, in part due to a lack of available information on where rehabilitation care was available, and what capacities or expertise was available in functional health facilities. (25) The resultant effect was that providers often operated in an information vacuum and provided surgical care that may have been inappropriate for the Haitian context (such as amputations that could not easily be fitted for

prosthetics, or the surgical management of patients with spinal cord injuries) or care that was outside of their scope of practice (such as amputations performed by providers with no orthopedic surgical training or experience), in part due to an absence of information on the resources available within the health system in the immediate aftermath of the earthquake. (18)

A number of rehabilitation providers have since emerged in Haiti, however the organization of rehabilitation care for patients who required it occurred in a fragmented manner, rather than as part of a transition from emergency response to recovery and rebuilding. The consequences of this are undoubtedly that patients failed to receive the care that they needed or received care that was inappropriate. The population's need for comprehensive rehabilitation care was evident in the early days of the earthquake response and should have begun at the same time as when amputations were being performed to ensure that patients received care that was competent and suitable for their needs. (26) Assessing the gaps in the health system to provide this care would have potentially assisted in strengthening the recovery for this particular need.

Examples of success in achieving this transition are frequently poorly documented. However, a recent report from the World Health Organization on the strengthening of mental health services following conflict provides a guiding framework that could drive policy and practice linking humanitarian assistance to health systems strengthening. (27) The report identified overlapping practices from 10 case studies in which mental health care was provided as part of an emergency intervention that was then leveraged to strengthen the delivery of mental health care as

the health system recovered. These practices provide pragmatic examples of ways in which a health systems perspective was adopted early on in the humanitarian response and used as a mechanism for building back a better health system.

These recommendations, though directed at mental health in this context, have repercussions for other areas of health system reconstruction following disasters and conflicts. First, they recognize the central role of local governments and health professionals who were integrated into the planning and delivery of health services. Second, they adopted broad recommendations for mental health reform, focusing not only on one vertical program but on the comprehensive mental health needs in the affected communities. Third, coordination across agencies, a review of education needs for providers, and a review of existing policies and processes were driven by comprehensive needs assessments to ensure that gaps were addressed. If these recommendations are extrapolated to broader health system recovery efforts, there are many valuable lessons that can be learned.

The humanitarian health response to future emergencies necessarily requires reliable tools and knowledge to not only respond to the immediate needs of the population, but also to establish effective interventions that lay the foundation for longer-term health system strengthening as the country transitions into recovery. To respond to these needs, this thesis addresses a component of health information systems deployed in emergencies to assess the availability of essential health resources and services availability.

Rationale

The rationale for this study is based on the need to establish trusted, effective, and scientifically valid assessments of health services availability to guide humanitarian interventions during crisis response and recovery. Major emergencies can result in the rapid disruption of health services delivery while simultaneously increasing the burden of disease. Estimating the gap created between the health needs of the population and the resources available to respond to them – referred to as the health sector gap (27) – is essential for coordinating a coherent response to strengthen the health system and providing appropriate health services, both during the emergency and with a purview for ensuring that appropriate services are available during the recovery phase.

There are major concerns that humanitarian response is not living up to the expectations of aid beneficiaries and that accountability mechanisms need to be strengthened. The focus adopted could be characterized as rather myopic, focusing only on the immediate burden of disease, and lacking a coherent strategy to harmonize interventions to ensure that they corresponded to gaps in the health system both immediately and in the future.

The major concerns related to the appropriateness and effectiveness of humanitarian interventions following the Haiti earthquake provided an opportunity for completing thesis research that would contribute to humanitarian coordination in the health sector. At the time of beginning this work, there were several discussions taking place within the humanitarian health system concerning how to improve the professionalization and predictability of future responses. A component of these discussions included establishing better information management of health resources present in emergency settings, including both existing health facilities and foreign

medical teams. Owing to the paucity of empirical, field-based research conducted in this area, this thesis was designed with a purview of furthering the capacity and accountability of the humanitarian system to more reliably assess gaps in health service availability and provide more targeted, equitable interventions to crisis-affected populations.

Objectives

The research projects included in this dissertation were based on four guiding research questions, which are addressed throughout the three included manuscripts:

1. What methods, indicators and benchmarks are currently used by Health Cluster lead agencies during acute and protracted humanitarian crises to assess health services and resource availability?
2. What overlap exists among health resource and service availability assessment tools currently in use at the Cluster level and how do these align with the suggested Global Health Cluster core indicators and essential services/packages in the HeRAMS framework?
3. What data and indicators should be included in a minimum dataset for health services assessment and reporting? Can this be implemented at a global and country level?
4. What are the opportunities for, and barriers to, integrating data from existing health services assessment tools into the Health Cluster Information Management Framework at the country and global levels?

Literature Review

There has been growing recognition of a need to establish effective and accountable processes for coordinating and delivering humanitarian assistance following major humanitarian emergencies. Within the humanitarian health sector, there has been a growing appreciation of the need to adopt an approach that encompasses a broad array of health systems functions, which has in large part been catalyzed by the response to the 2004 Asian tsunami and the 2010 Haiti earthquake.

Both of these emergencies have presented formidable challenges for providing competent and effective humanitarian assistance during crises that have been described as “unprecedented” in scope and scale. (28–30) Additionally, the response from the international community to these emergencies occurred through the proliferation of international aid agencies and individuals, some with considerable experience in global health and humanitarian assistance, many with none. (31) The resultant effect has been mixed, with a large amount of aid delivered, the quality and effectiveness of which has been questioned, leading the editors of the medical journal *The Lancet* to declare in 2010, immediately following the Haiti earthquake that, despite the growth of aid and claims by various agencies to be spearheading the relief effort, “the situation in Haiti is chaotic, devastating, and anything but coordinated.” (32)

More empirically, these claims appear to have been substantiated by those working in the field in the immediate aftermath of the earthquake. In the months following the 2010 earthquake, several leading medical journals published accounts of various medical teams who had responded to the emergency who were unprepared and inexperienced for the conditions and patient populations that they would encounter on the ground. (33) Recent retrospective reviews of the health services

provided during the earthquake response reveal that while there were many examples of excellent health services delivered by Haitian health workers and foreign medical teams, there is also evidence of concern for the quality of care provided by many. (25)

Following the 2004 Asian tsunami, similar concerns of the quality of humanitarian assistance were raised. Like Haiti, large numbers of non-governmental organizations, United Nations agencies, governmental relief agencies, and individuals rushed to the scene to provide assistance. However, also like Haiti, many questioned the quality and effectiveness of this relief to both do no further harm, and to strengthen, rather than weaken, local health systems. (34–36)

Central to these concerns has been a lack of effective coordination of humanitarian health assistance, and, moreover, a lack of authority by international actors to provide coordination and accountability functions. (8,18,37) The Health Cluster, the entity responsible for coordinating humanitarian assistance in the health sector, has within its mandate a responsibility for coordinating joint needs assessments in order to identify and respond to pertinent health concerns. (17) The Health Cluster has developed systems and processes to strengthen coordination and information management in emergencies, however these appear to have been inconsistently applied during recent emergencies. (38)

Experience from Haiti suggests that information management in the health sector was weak during the initial days, weeks, and months following the earthquake, which undoubtedly led to poor coordination of humanitarian actors. (18) Various reports highlight the fact that it was unclear which hospitals were operational and what capacity they had, which resulted in unclear assessments of the coverage of essential

health services and patients being sent to health facilities that were unable to provide the appropriate care that they required. (39) The implications of this were that patients in parts of Port-au-Prince had access to several providers who may have provided duplicative and redundant health services, while other parts of the city had none. (20) Similar patterns of duplicative health service delivery were noted following the 2004 tsunami, which also resulted in the delivery of redundant health services. (35)

One potential source of this weakness in coordination resides in a lack of effective systems to collect, analyze, and manage data on the functioning of a disrupted health system or the availability of health services provided by foreign medical teams during emergencies. Following an emergency, health systems become disrupted, resulting in the displacement of health workers, damage to health infrastructure, and the disruption or distortion of the supply chain, among others. This disruption has major implications for establishing situational awareness of the state of the health system: existing facilities may no longer be operational, a once stable burden of disease may shift, health needs rise, health resources become scarce, and a large influx of foreign resources may occur in a short period of time. In absence of a reliable means of determining the status of the health system, valuable resources may be wasted or used inappropriately, unnecessary or wasteful resources may enter the system, and the population may not benefit from the assistance provided.

Logically, action should follow information, with the exception of the most urgent of circumstances where the need to intervene outweighs the benefits of conducting structured assessments. Even within this operational paradigm, however, there remains a need to establish reliable situational awareness of which local and

international actors are providing health services and to determine with a reasonable degree of certainty whether the population's basic health needs are being met.

Regrettably, this model appears to be infrequently followed, with action regularly occurring outside of the influence of needs assessments. In the 2005 field evaluation of needs assessments following the Indian Ocean tsunami, the reviewers noted that "the UN and Red Cross should either invest massively in rapid humanitarian needs assessment or stop pretending that assessment influences decision making." (40)

In 2010, Merlin (a non-governmental organization based in the United Kingdom) released a report questioning the lasting impact of the influx of humanitarian assistance on Haiti's health system. (7) The report was scathing, documenting instances where local health workers were displaced by foreign medical teams who took over local clinics, used international volunteers instead of existing Haitian health workers, and actively recruited Haitian health professionals from the public sector to more lucrative positions within non-governmental organizations. These concerns were not unique to the report, with other authors documenting the decimation of Haiti's private health facilities, which suffered considerable losses owing to the widespread availability of free health services in the months following the earthquake, resulting in many health workers having to close their clinics. (22) The dynamics of Haiti's health system are notably complex, particularly following the influx of humanitarian assistance; While access to health services has likely increased, this appears to have had consequences for local providers, both positively and negatively.

Evaluations of the 2004 Indian Ocean tsunami highlight how the absence of structured needs assessments in emergencies can play a strong role in hindering the

effective response to major crises. The 2006 Tsunami Evaluation Coalition's review of needs assessments highlights several major concerns related to the quality of needs assessments conducted by national and international agencies that formed part of the humanitarian response across several countries. (40) In their evaluation, the reviewers note several concerns related to the coordination, quality, comprehensiveness, and use of the assessments, including the absence of standardized assessment templates or frameworks, which the authors highlight as having been a major factor in the poor information management aspects of the humanitarian response. Ultimately, the reviewers conclude that "few formal humanitarian needs assessments were coordinated to serve the broader humanitarian effort," and noted that there was only limited evidence of needs assessments guiding operational decisions in the field, in part due to poor information management practices by operational agencies, but also in part due to the perceived poor optics of delaying targeted interventions in favor of conducting needs assessments, first. (40)

In considering the influence of needs assessments in guiding international humanitarian assistance to support local health service delivery, it is critical to consider whether needs assessments led to appropriate interventions to support disrupted health systems, or whether they were merely duplicative, ineffective, or wasteful. In reviewing the response to the 2004 tsunami, the Tsunami Evaluation Coalition reviewers found that, first, "the quality of the assessment of needs for urgent medical care was below expectations," highlighting the fact that evidence was readily available to suggest that the medical response in Indonesia, Sri Lanka, and other countries was often excessive and inappropriate. (40) In Sri Lanka, for example, health services were

only minimally disrupted, and 700 national medical volunteers were available to be deployed to affected areas. Regrettably, information management practices (including needs assessments) failed to effectively capture unmet needs or monitor the “second tsunami” of Western medical assistance, which then failed to discourage inappropriate and excessive forms of international assistance. The one positive finding of the health needs assessments noted by the evaluators is that assessments conducted by the Ministries of Health in the affected countries of the functionality of existing capacities in health facilities were of a good standard, were timely, and were coordinated. This highlights the need to resist adopting a myopic focus on international responders and the services they can provide, in favor of ensuring that local capacities are reflected in needs assessments.

In protracted emergencies that result from armed conflicts, similar challenges to public health and health systems are encountered, albeit within a very different political, social, and economic context. In post-conflict situations, large numbers of aid agencies are often present, and the environment is frequently characterized by a weak health system, overseen by a weakened government structure with limited capacity to appropriately address all of tasks necessary for rebuilding. (41)

Recent conflicts with considerable Western involvement and investment (notably, in Afghanistan and Iraq) have, however, provided important new evidence for adopting a health system strengthening approach to the delivery of humanitarian assistance, and different models for financing and delivering health services in post-conflict settings. These approaches are both complex and controversial, given the relationship between states and non-state providers of health, who may have technical

and managerial expertise that supersedes that of the government, in addition to financial accountability mechanisms, all of which may be more favorable to donors than a new, potentially unstable government. (42)

Such an approach was adopted in Afghanistan after the fall of the Taliban in 2001, at a time when the country's health statistics were among the worst in the world. (43) In order to rapidly improve the country's health status, a Basic Package of Health Services (BPHS) was developed by the Ministry of Public Health (MOPH), corresponding to the country's most pressing health concerns. (44,45) These services were funded by international donors, and contracted out to international and national NGOs operating in the country that then delivered the BPHS under contract to the MOPH, resulting in the rapid expansion of health services in the regions of the country covered by this contracting scheme. The contracting model (which was deployed in other countries before Afghanistan) has since been proposed as a viable mechanism for expanding coverage of health services in other low- and middle-income countries. (46)

Within this model was a mechanism for evaluating the scaling-up of health services throughout the country with the capacity to monitor both the availability of essential health services defined in the BPHS, as well as their quality. The approach used relied on a balanced scorecard approach, a methodology developed for managing the performance of large, complex organizations. (47) This assessment system, first deployed in Afghanistan in 2004, has yielded important findings and contributed to the benchmarking of performance in order to improve the delivery of basic health services. (48,49)

While the Afghanistan situation has provided considerable evidence with regard to post-conflict health systems strengthening, these approaches are not universally applicable in part owing to the nature of complex humanitarian emergencies. (1) Whereas the Afghanistan conflict is an internationalized civil conflict between the Afghan government/NATO forces and the Taliban, most conflicts are now intra-state, fuelled by warring factions within the same country or territory. In the Darfur states of Sudan, where data collection for this thesis took place, a precarious humanitarian emergency continues to unfold as a result of persistent conflict.

In Darfur, ongoing conflict between Arabic and non-Arabic speaking tribes has resulted in the population being in crisis since the Government of Sudan first began a military response in 2004 to suppress armed groups that opposed it. (50) Estimates suggest that nearly one-third of the population of the Darfur states have been actively displaced by the conflict, which has targeted civilians as well as rebel groups, leading to an indictment of Sudanese President Omar Hassan Ahmad Al Bashir by the International Criminal Court for crimes against humanity and genocide. (51)

Under these circumstances, estimates of population health needs regularly exceed emergency thresholds and health services are routinely disrupted by measures such as the arbitrary expulsion of NGOs by the Sudanese government in 2010 following the issuing of the ICC arrest warrants, or restrictions on travel of essential medical supplies or staff. (52–55) The deplorable health situation is further exacerbated by routine outbreaks of communicable diseases, and difficulties in delivering even basic health services to a population that is routinely displaced by conflict. (56,57)

In this setting, comprehensively delivering health services within a disrupted health system is nearly impossible. A basic package of health services exists for the country, however the comprehensive delivery of these services is exceptionally difficult given the ongoing nature of the conflict. This is complicated by the active displacement of populations who may be forced to move to camps where health services are inadequate and under-resourced, as well as the changing nature of the humanitarian response contributed to by shrinking support from international donors.

Similar to the Afghanistan situation, there have been attempts to monitor the availability and functionality of essential health services provided by NGOs, governmental health facilities, and UN agencies. The HeRAMS system, developed specifically for the Darfur crisis, addresses this need and utilizes a basic conceptual framework to develop key assessment domains. A more critical analysis is provided within the various manuscripts of this thesis, and includes the only known structured evaluation of this system.

A critical component in the response to both natural disasters and complex humanitarian emergencies is the ability to reliably estimate both needs and capacity within the health system. In the absence of the necessary tools to determine the capacity of the health system, it becomes impossible to navigate a suitable course forward for strengthening and rebuilding the health system. Yet, the methods and information systems available for doing so have been notably weak during many recent emergencies.

Particular attention has been paid to the methods used for assessing health needs in crisis-affected populations. The bulk of this work has focused predominantly

on the core indicators used to gauge the scope of an emergency, notably the crude mortality rate (CMR), under-5 mortality rate (U5M), and global acute malnutrition (GAM). These population health indicators have been the subject of considerable scrutiny among public health experts, (58–60) with remaining uncertainty as to the quality of studies being conducted and appropriate methods for compiling and analyzing these data in non-traditional settings. (61–64) Despite these concerns, all three of these public health indicators have been integrated into existing frameworks for health action in humanitarian emergencies, notably the Sphere Standards for Humanitarian Action. (65)

While there has been growing appreciation of the use of common assessment tools and methodologies to assess health needs, (66) there has been less emphasis within the public health community on the assessment of health capacities to respond to these needs. The resultant effect has been inconsistency in the application of capacity assessments and a lack of predictable and consistent field-level information management with regard to existing health services and resources during sudden-onset emergencies. As a result of this, considerable confusion has emerged during recent emergencies, where it was unclear which health facilities were functional, what services they provided, and other pertinent information of value to responders and patients. (67)

This thesis directly addresses these methodological concerns, specifically with regard to the assessment of the capacities of disrupted health systems in the context of both natural disasters and protracted complex humanitarian emergencies. Drawing on field-based operational research in Haiti and North Darfur State in Sudan, I provide an

examination of the current methodologies deployed during current, ongoing humanitarian emergencies to assess the functionality of disrupted health systems.

Methodological Overview

The specific research methods employed for each of the studies contained in this dissertation are described individually within each manuscript. This section provides a general justification for the methods used to formulate a coherent research approach to the complete thesis.

Conducting research in humanitarian emergencies is fraught with ethical, logistical, and methodological constraints that must be overcome to ensure that the outputs of the work are ethically justifiable, scientifically valid and operationally relevant. (68) While every effort to mitigate these constraints has been made in the conduct of the research contained in this dissertation, this work is similarly affected by a variety of outside factors that were beyond the control of those involved in implementing the project.

Similarly, the success of this project was in large part due to the technical, logistical, and intellectual support provided by national and international staff in various aid agencies. This project relied heavily on partnerships that were established in order to facilitate the safe and pragmatic conduct of the necessary field research, notably with the Canadian Red Cross, the International Federation of the Red Cross, and the World Health Organization in Geneva and their country office in Khartoum, Sudan. These organizations provided critical input into the conduct of the research to ensure that it addressed salient questions of operational relevance to the broader humanitarian community. The two countries selected for this project (Haiti and Sudan)

were selected based on pragmatic considerations of locations where the work could be conducted safely, with the support of national, international, and local staff, and where resources existed to house a researcher. The limitations of utilizing these countries as comparators are discussed in subsequent sections of the thesis.

Research ethics approval was obtained through one submission to the University of Ottawa Health Sciences and Sciences Research Ethics Board that encompassed the key informant interviews and the review of documents obtained in both Haiti and Sudan. Field work in Haiti was secured through collaborations with the Canadian Red Cross and the International Federation of the Red Cross, who provided logistical support (living quarters, transportation, and security) in the country and access to a network of humanitarian aid agencies operating in the field. The World Health Organization provided similar support in Sudan, including the arranging of the necessary travel permits and logistical support and security while in the country.

Operationally, this project required conducting research under very difficult circumstances, in insecure environments, with changing dynamics. In Haiti, for example, fieldwork was conducted during the end of hurricane season, at a time when cholera was beginning to spike due to contaminated water sources and the reduction of donor funding. This resulted in a substantial burden of illness, and necessitated many interviews being conducted in difficult conditions, such as airport hangars or logistics bases.

In Sudan, the fieldwork was conducted in May of 2012, immediately following the passing of the United Nations Security Council Resolution 2046 of May 02, 2012 which would have imposed sanctions on the Sudanese and South Sudanese

governments unless the parties would “formally convey their commitments to end hostilities, including aerial bombardments, not later than 48 hours from the adoption of the resolution to the African Union and the Security Council.” (69) The political situation at the time severely limited humanitarian access to border areas of Sudan and South Sudan, and also resulted in a more restrictive process for obtaining permissions for international staff to travel to the Darfur states. As a result of these, and other security-related concerns, the time available for conducting fieldwork in Sudan was limited.

Pragmatically, conducting fieldwork under difficult circumstances required substantial additional work to ensure that risks could be mitigated, within reason. For instance, travel to certain parts of Port-au-Prince was restricted during my time in Haiti, due to concerns for staff safety. Similarly, rebel groups control large parts of the Darfur states, and access is, again, severely limited. Additional barriers to the free movement of personnel through the Darfur region – such as a large number of checkpoints requiring verification of paperwork, passports, and visas, and travel through insecure areas – also placed considerable restrictions on the ability to conduct visits to different regions of the country.

The ethical oversight of this project was relatively non-contentious, in that the project relied heavily on document reviews that were generally accessible in the public domain, and key informant interviews with field workers in each country. No data were collected from vulnerable populations or patients in health facilities, and all participants provided written informed consent prior to participating in the study. Attempts were made to locate competent and functional research ethics boards in both

Haiti and Sudan, through internet searches and consultation with other researchers and agencies who were operational in both countries. Because of the importance of ethical review in the conduct of field studies in difficult settings with vulnerable populations, (70) extensive efforts were made to locate local research ethics boards. This included specific requests to local academics and the embassies of both countries in Canada, as well as general appeals for information on research ethics boards made through social media, via Twitter. Despite these extensive attempts, no research ethics board could be located for either country.

The overarching goal of this research project was to determine how the availability, functionality, and capacity of health services were being assessed during major humanitarian emergencies. In answering this question, it was clear that it was necessary to determine not only the methods and indicators that were used to generate these data, but also to provide an analysis of the quality and comprehensive of these assessment tools. Furthermore, recommendations on strengthening the assessments of health services availability necessarily required input from field-level humanitarian staff who would likely be both contributors and users of this information. Thus, a mixed-methods approach was developed to provide a broad perspective to guide my analysis of this important issue.

The paucity of scientific research in this area presented a major challenge for rigorously assessing the quality of the assessment tools collected in the field. There were no known minimum standards for collecting these data, and no evaluations of how these data were being used to guide program delivery or humanitarian coordination. To address the first of these concerns, a broad systematic review was

conducted to understand how health facilities assessments were conducted in low- and middle-income countries in a non-emergency context, presuming that these models would be a likely successor to any assessments introduced during an emergency. The results of this review, which form the basis of the first manuscript in my dissertation, provided a necessary framework for evaluating the assessment tools collected in the field in Haiti and Sudan, and this review provided an essential conceptual framework for evaluating the data collected in the field. The second manuscript draws on the framework developed through the systematic review, as well as other standards for health service delivery in humanitarian assistance, specifically the Sphere Minimum Standards for Humanitarian Action and the Global Health Cluster Suggested Set of Core Indicators and Benchmarks by Category. (65,71)

For this review, health facilities were chosen as the unit of analysis that was most suitable for providing an assessment of the health system. This was done for several pragmatic reasons: first, this thesis was a review of the methodologies used in the field to assess the availability and functionality of health services in emergency settings. The unit of analysis used in the known assessment tools and benchmark indicators is that of the health facility, and thus, this provided a convenient entrée to health system analyses in crisis settings. Second, there are varying levels of granularity with which health systems data can be collected, grouped, stratified, and analyzed, all of which have major implications for the reliability of the data. Adopting a focus that was at an administrative level higher than the individual facility would potentially mask the inequitable distribution of health resources by grouping incomparable health facilities into one assessment. Similarly, a more granular analysis of health resources contained

within small units of analysis such as hospital wards would produce voluminous data that would ultimately be difficult to analyze and interpret. By focusing on health facilities as the point of data collection, yet grounding the analysis in the context of the overall health system and its administrative and governance functions, it was felt that this provides a suitable balance between recognizing variations in the data and being able to reliably contextualize individual findings in the broader health system.

Due to the limited access to key informants in both countries, and the high likelihood of these individuals being lost to follow-up given the high turnover rate within NGOs, a methodological approach was needed that allowed for the evolution of the interview data collection process in the field, based on the input of key informants. For this reason, a convergent interviewing approach was selected, which allows the interviewer to begin with a set of pre-determined interview questions, and adapt and expand upon them throughout the course of project. This proved to be very useful as participants provided different perspectives or introduced new concepts into interviews, which resulted in subsequent interview questions being developed and used in future interviews.

The operational and methodological challenges faced in conducting this research are characteristic of the constraints encountered by others conducting research on complex humanitarian emergencies. (68,72) Given the necessity of rigorously-conducted field investigations and evaluations of health needs, capacities, and interventions, there is a substantial need for investment into the development of appropriate methods and capacities for conducting this work. (64) It is my intention for this dissertation to contribute to this growing body of knowledge and to demonstrate

that with the proper provisions and collaborations, graduate student researchers can contribute to this field.

Conceptual Frameworks

The initial proposal for this project proposed the use of two conceptual frameworks to structure the analysis of the assessment tools evaluated in this research: the Health Cluster Information Management Framework and the Health Resources Availability Mapping System (HeRAMS) framework. (17,73)

The Health Cluster Information Management Framework allows for an understanding of how the collected data are used, grounded in the context of crisis decision-making at the cluster level. As a framework, it focuses on the inclusion of data concerning the health status of the population, the availability of health resources and services, and the performance of the health system, in order to collectively identify priorities and gaps in the humanitarian health response. This provides a broad conceptualization of decision-making and information management, however lacks the specificity necessary to formulate recommendations on the quality of the information needed to make evidence-based decisions.

This thesis research should be viewed as contributing to the overall Health Cluster Information Management Framework, by focusing on the components that correspond to health system performance and health resources and services availability. Rather than use this Framework as an analytic tool, the Framework has provided the parameters for formulating a coherent research question and approach. This framework also provided the impetus for pursuing the third study included in this

thesis, using key informant interviews to ascertain the utility of health systems information in formulating evidence-based decisions.

During the preliminary stages of the research for this project, it became clear that the HeRAMS framework lacked a strong evidentiary basis to support its development and could therefore not be considered a reliable analytic model against which other assessment tools could be evaluated. As a result, an evaluation of HeRAMS (which was developed and deployed for the Darfur states of Sudan) was included in this study to provide a preliminary evaluation of its comprehensiveness in responding to other broad health systems frameworks and benchmarks.

Analytically, two frameworks were used in the evaluation of the assessment tools collected in Haiti and in Sudan in the second manuscript of this thesis: the framework developed in the first manuscript of this thesis, from a systematic review of health facilities assessments, and the Sphere Minimum Standards for Humanitarian Action section on Health Services Delivery.

In order to utilise previous work that had been conducted on the assessment of health facilities and the status of health systems in low- and middle-income countries, a systematic review of all retrievable assessment tools was conducted to create a pragmatic framework for analysing data in this thesis, as well as for guiding future developments in the assessment of health facilities.

The use of the Sphere standards aligns with current best practices in humanitarian action, and links the analysis of the data included in my thesis to broader standards in humanitarian assistance. There have been considerable questions raised concerning the use of Sphere standards, in particular, questions as to whether they can

be measured in practice. (74) These concerns are also applicable to the analysis used in this project, as the Sphere standards concerning health service delivery are broad categories of priorities within the health sector, few of which contain any measurable outputs.

In this thesis, the Sphere standards were used to guide the development of a coding scheme that was useful in highlighting weaknesses in the included assessments. While particular metrics of evaluation were not possible from these standards, Sphere was an effective means of conceptualizing essential components of assessment tools used in emergencies.

The other analysis used in this project consisted of the Global Health Cluster Suggested Set of Core Indicators and Benchmarks by Category, specifically the nine indicators corresponding to health resources availability. These indicators and benchmarks are essentially taken from standard measures of health systems performance and the coverage of health services. (75) These standards are broadly accepted, though with the exception of the coverage of basic and comprehensive emergency obstetric care, few are supported by substantial empiric evidence. (76–79)

Closely aligned with the conceptual frameworks are the common definitions employed throughout this dissertation to capture the different types of health interventions. In the literature, there exists a plurality of health systems frameworks, nomenclature, and taxonomies, many of which are used interchangeably and without due consideration of the interoperability of these terms. (80,81) In this thesis, there are several key terms that emerge to describe particular, and unique, aspects of the organization and delivery of health services, all of which imply different aspects of

coordination, geographical distribution, and engagement with health workers and patients.

The World Health Organization defines a health system as consisting of “all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct health-improving activities.”(82) In the context of this thesis, the term *health system* is used to refer to health activities, organizations, people, and actions that form part of an organized and coherent system to improve the health of the population. In general, this term refers to existing health systems that are owned and operated by local authorities, whether public or private, recognizing that the boundaries can be blurred by, for instance, a private international NGO providing services within a public hospital. Conceptually and operationally, this is different from the *humanitarian system*, a term that is used throughout this thesis to describe the architecture, coordinating mechanisms, international legal obligations and protections, and interventions that are provided by international aid agencies, United Nations agencies, military institutions, donor countries, and local governments, and whose primary goal is to reduce short-term mortality associated with major emergencies. This distinction is important, because while the local health system will become a critical component of the humanitarian response, and therefore the humanitarian system, not all humanitarian actors will readily integrate into the local health system, out of fears of compromising their neutrality or impartiality, or the perception thereof.

Health facilities are frequently referred to throughout the thesis, primarily as a point of data collection for understanding the distribution and availability of essential

health services within disrupted health systems and as provided by humanitarian actors within the humanitarian system. No standard taxonomy of health facilities exists that can be applied across different countries or health systems, however for the purposes of this thesis, they can be presumed to be any facility within which patients interact with the health system for the purposes of receiving health services. This broad definition, therefore, encompasses a range of facilities, including (but not limited to), hospitals, primary care clinics, and health posts. In emergency settings, additional temporary health facilities may also be established, such as mobile health clinics or field hospitals; where these are discussed, they are referred to explicitly as such.

The term *health sector* is used frequently throughout the thesis, particularly in areas where it is unclear whether the providers or health services being referred to can reasonably be presumed to fall neatly into one of the other definitions being applied. For example, humanitarian interventions may traverse time periods beginning with the emergency phase and concluding several years into the recovery. Thus, the goal of the intervention is no longer solely on the reduction of short-term mortality, but also on the reconstruction of the health system and the integration of humanitarian programming into this system. Given this overlap, the term *health sector* is used to describe the range of actors who may have responsibilities for coordinating humanitarian health assistance, developing or delivering interventions, or a number of other supportive functions within both or either the humanitarian and health systems. This term also has particular relevance for describing actors who potentially fit into neither of the aforementioned definitions, for example informal medicine providers and shops that may flourish in the absence of an organized health system. (83)

Organization of the dissertation

This dissertation is presented as three chapters with an accompanying introduction and conclusion, corresponding to the requirements of the Faculty of Graduate and Postdoctoral Studies at the University of Ottawa. Each chapter is written as a stand-alone manuscript to allow for its submission as an article for publication in a peer-reviewed academic journal. The articles are complimentary and provide a collective analysis of the assessment of disrupted health systems in humanitarian emergencies.

Chapter one is a systematic review of various quantitative assessment tools used to conduct assessments of health facilities in low- and middle-income countries. The results of this study revealed a large number of different assessment tools, which assessed different domains of health systems organization. In this chapter, I discuss the need for an organizational framework to guide the further development of these tools to ensure that they address the full range of health system building blocks and not exclusively the priorities of donors who are often the developers of these tools. The development of a conceptual framework for health facilities assessments is the major output of this study and this framework is used as an evaluative tool in assessing the quality of health facility assessments used in humanitarian emergencies in chapter two.

Chapter three builds on the research conducted in the first study to provide a critical appraisal of the various health facility assessment tools deployed during two humanitarian emergencies in Haiti and Sudan. These assessment tools provide quantitative assessments of the location, functionality, and capacity for health service delivery within health facilities in Haiti and the Darfur region of Sudan. This study provides what I believe to be the first structured evaluation of these assessment tools

and provides evidence of the technical feasibility of conducting these assessments in future emergencies. The results of this study indicate that the quality of assessments conducted during these emergencies is mottled, with some including a comprehensive assessment of essential health system domains and others lacking even basic information.

Chapter four utilizes a convergent interviewing methodology to provide critical perspectives on the collection, analysis, and use of health systems information in emergencies, derived from key informant interviews in the field. This chapter addresses critical issues regarding the challenges faced in collecting data from health facilities, concerns of the quality of data that are available, and the use of this information in an operational context to formulate health interventions.

Finally, the conclusion summarizes the primary findings of this dissertation. A discussion of how these findings contribute to current initiatives to ensure a more predictable humanitarian response and to the current knowledge base of health in emergencies is also included. In the conclusion I also outline the strengths and limitations of this dissertation and provide recommendations for future research in this area.

References

1. Salama P, Spiegel P, Talley L, Waldman R. Lessons learned from complex emergencies over past decade. *The Lancet*. 2004;364:1801–13.
2. Pavignani E, Colombo S. *Analysing disrupted health sectors: a modular manual*. Geneva, Switzerland: World Health Organization; 2009.
3. Bornstein L, Lizarralde G, Gould KA, Davidson C. Framing responses to post-earthquake Haiti: How representations of disasters, reconstruction and human settlements shape resilience. *Int. J. Disaster Resil. Built Environ*. 2013 Feb 22;4(1):43–57.
4. Zanotti L. Cacophonies of Aid, Failed State Building and NGOs in Haiti: setting the stage for disaster, envisioning the future. *Third World Q*. 2010;31(5):755–71.
5. Walker P, Hein K, Russ C, Bertleff G, Caspersz D. A blueprint for professionalizing humanitarian assistance. *Health Aff*. 2010 Dec 1;29(12):2223–30.
6. Bradol JH, Vidal C. *Medical innovations in humanitarian situations*. United States of America: MSF-USA; 2011.
7. Merlin USA. *Is Haiti's health system any better? A report calling for a more coordinated, collaborative approach to disaster response*; 2011.
8. Burkle FM, Redmond AD, McArdle DF. An authority for crisis coordination and accountability. *Lancet*. 2011 Jun 16;379(9833):2223-5.
9. Demul E. Coordination of humanitarian aid -- a UN perspective. *Lancet*. 2002 Jul 27;360(9329):335–6.
10. Percival V, Sondorp E. A case study of health sector reform in Kosovo. *Confl Health*. 2010 Apr 16;4(1):7.

11. Borton J. An Account of Co-ordination Mechanisms for Humanitarian Assistance During the International Response to the 1994 Crisis in Rwanda. *Disasters*. 1996;20(4):305–23.
12. United Nations Office for the Coordination of Humanitarian Affairs. Humanitarian Response Review. United Nations Emergency Relief Coordinator and Under-Secretary-General for Humanitarian Affairs; 2005.
13. What is the Cluster Approach? [Internet]. [cited 2013 Jun 14]. Available from: <http://clusters.humanitarianresponse.info/about-clusters/what-is-the-cluster-approach>
14. Brody H, Rip MR, Vinten-Johansen P, Paneth N, Rachman S. Map-making and myth-making in Broad Street: the London cholera epidemic, 1854. *Lancet*. 2000 Jul;356(9223):64–8.
15. Maxwell D, Watkins B. Humanitarian information systems and emergencies in the Greater Horn of Africa: Logical components and logical linkages. *Disasters*. 2003;27(1):72–90.
16. Thieren M. Health information systems in humanitarian emergencies. *Bull World Health Organ*. 2005;83:584–9.
17. World Health Organization. Health Cluster guide. Geneva, Switzerland: Inter-Agency Standing Committee; 2009.
18. Pan American Health Organization. Health response to the earthquake in Haiti January 2010: Lessons to be learned for the next massive sudden-onset disaster. Washington, DC: Pan American Health Organization; 2011.
19. Donation after disaster strikes. *Nat Med*. 2008 Jun;14(6):596–596.

20. Chu K, Stokes C, Trelles M, Ford N. Improving effective surgical delivery in humanitarian disasters: Lessons from Haiti. *Plos Med.* 2011;8:e1001025.
21. Lind K, Gerdin M, Wladis A, Westman L, von Schreeb J. Time for order in chaos! A health system framework for foreign medical teams in earthquakes. *Prehosp Disaster Med.* 2012;27(1):90-3.
22. Adams P. Health-care dynamics in Haiti. *Lancet.* 2010 Sep;376(9744):859–60.
23. Rubenstein LS. Post-conflict health reconstruction: search for a policy. *Disasters.* 2011;35(4):680–700.
24. Pavignani E. Health service delivery in post-conflict states. High Level Forum on the Health Millennium Development Goals: Selected Papers 2003-2005. Geneva, Switzerland, and Washington, DC: World Health Organization and World Bank; 2006.
25. Redmond AD, Mardel S, Taithe B, Calvot T, Gosney J, Duttine A, et al. A qualitative and quantitative study of the surgical and rehabilitation response to the earthquake in Haiti, January 2010. *Prehosp Disaster Med.* 2011;26(6):449–56.
26. Knowlton LM, Gosney JE, Chackungal S, Altschuler E, Black L, Burkle FM, et al. consensus statements regarding the multidisciplinary care of limb amputation patients in disasters or humanitarian emergencies: Report of the 2011 Humanitarian Action Summit Surgical Working Group on Amputations Following Disasters or Conflict. *Prehosp Disaster Med.* 2011;26(06):438–48.
27. World Health Organization. Building back better: Sustainable mental health care after emergencies. Geneva, Switzerland: World Health Organization, 2013.
28. Griekspoor A, Spiegel P, Aldis W, Harvey P. The health sector gap in the southern Africa crisis in 2002/2003. *Disasters.* 2004;28(4):388–404.

29. Dowell SF, Tappero JW, Frieden TR. Public health in Haiti: Challenges and progress. *N Engl J Med.* 2011;364:300–1.
30. Landry MD, McGlynn M, Ng E, Andreoli A, Devji T, Bower C, et al. Humanitarian response following the earthquake in Haiti: reflections on unprecedented need for rehabilitation. *World Heal. Popul.* 2010;12:18–22.
31. Thieren M. Asian tsunami: death-toll addiction and its downside. *Bull World Health Organ.* 83(2):82.
32. Burkle FM, Nickerson JW, von Schreeb J, Redmond AD, McQueen KA, Norton I, et al. Emergency surgery data and documentation reporting forms for sudden-onset humanitarian crises, natural disasters and the existing burden of surgical disease. *Prehosp Disaster Med.* 2012 Dec;27(6):577–82.
33. The Lancet. Growth of aid and the decline of humanitarianism. *Lancet.* 2010 Jan;375(9711):253.
34. McCunn M, Ashburn MA, Floyd TF, Schwab CW, Harrington P, Hanson CW, et al. An organized, comprehensive, and security-enabled strategic response to the Haiti earthquake: A description of pre-deployment readiness preparation and preliminary experience from an academic anesthesiology department with no preexisting international disaster response program. *Anesth Analg.* 2010;111:1438–44.
35. Lee ACK. The tsunami and the dangers of goodwill. *BMJ.* 2005;330:261–2.
36. Sondorp E, Bornemisza O. Public health, emergencies and the humanitarian impulse. *Bull World Health Organ.* 2005 Mar;83(3):163.
37. Carballo M, Daita S, Hernandez M. Impact of the Tsunami on healthcare systems. *J R Soc Med.* 2005 Sep;98(9):390–5.

38. Zoraster R. Disaster coordination needs more than the “Health Cluster”. *Prehosp Disaster Med.* 2010 Jul-Aug;25:372–3.
39. Dar OA, Khan MS, Murray V. Conducting rapid health needs assessments in the Cluster era: Experience from the Pakistan flood. *Prehosp Disaster Med.* 2011 Jun;26(03):212–6.
40. Sullivan SR, Taylor HOB, Pauyo T, Steer ML. Surgeons’ dispatch from Cange, Haiti. *N. Engl. J. Med.* 2010 Feb;362:e19.1–e19.2.
41. De Ville de Goyet C, Morinière L. The Role of Needs Assessment in the Tsunami Response. Stockholm, Sweden: Tsunami Evaluation Coalition; 2006.
42. Fujita N, Zwi AB, Nagai M, Akashi H. A comprehensive framework for human resources for health system development in fragile and post-conflict states. *PLoS Med.* 2011;8(12):e1001146.
43. Commins S. Non-state providers, the state, and health in post-conflict fragile states. *Dev. Pr.* 2011;20(4-5):594–602.
44. Newbrander W, Ickx P, Leitch GH. Addressing the immediate and long-term health needs in Afghanistan. *Harv. Heal. Policy Rev.* 2003;4:24–31.
45. Sabri B, Siddiqi S, Ahmed AM, Kakar FK, Perrot J. Towards sustainable delivery of health services in Afghanistan: options for the future. *Bull. World Health Organ.* 2007 Sep;85(9):712–8.
46. Roberts B, Guy S, Sondorp E, Lee-Jones L. A basic package of health services for post-conflict countries: implications for sexual and reproductive health services. *Reprod. Health Matters.* 2008;16:57–64.

47. Loevinsohn B, Harding A. Buying results? Contracting for health service delivery in developing countries. *Lancet* Aug. 2005;366(9486):676–81.
48. Peters D, Noor AA, Singh LP, Kakar FK, Hansen PM, Burnham G. A balanced scorecard for health services in Afghanistan. *Bull. World Health Organ.* 2007 Feb;85:146–51.
49. Edward A, Kumar B, Kakar F, Salehi AS, Burnham G, Peters DH. Configuring balanced scorecards for measuring health system performance: Evidence from 5 years' evaluation in Afghanistan. *PLoS Med.* 2011 Jul 26;8(7):e1001066.
50. Hansen PM, Peters DH, Niayesh H, Singh LP, Dwivedi V, Burnham G. Measuring and managing progress in the establishment of basic health services: the Afghanistan health sector balanced scorecard. *Int. J. Health Plann. Manage.* 2008 Jun;23(2):107–17.
51. Cockett R. Sudan: Darfur and the failure of an African state. Yale University Press; 2010.
52. Tsai AC, Eisa MA, Crosby SS, Sirkin S, Heisler M, Leaning J, et al. Medical evidence of human rights violations against non-Arabic-speaking civilians in Darfur: A cross-sectional study. *PLoS Med.* 2012 Apr 3;9(4):e1001198.
53. Depoortere E, Checchi F, Broillet F, Gerstl S, Minetti A, Gayraud O, et al. Violence and mortality in West Darfur, Sudan (2003-04): epidemiological evidence from four surveys. *Lancet.* 2004 Oct;364(9442):1315–20.
54. Gately R. Sudan: A humanitarian response to a silent genocide: An American nurse's perspective. *J. Emerg. Nurs.* 2005;31:325–32.

55. Degomme O, Guha-Sapir D. Patterns of mortality rates in Darfur conflict. *Lancet*. 2010 Jan;375(9711):294–300.
56. Wakabi W. Aid expulsions leave huge gap in Darfur's health services. *Lancet*. 2009 Mar;373(9669):1068–9.
57. Markoff L. Yellow fever outbreak in Sudan. *N. Engl. J. Med.* 2013;368(8):689–91.
58. Grais RF, Strebel P, Mala P, Watson J, Nandy R, Gayer M. Measles vaccination in humanitarian emergencies: a review of recent practice. *Confl. Health*. 2011 Sep 26;5(1):21.
59. Bostoen K, Bilukha O, Fenn B, Morgan O, Tam C, ter Veen A, et al. Methods for health surveys in difficult settings: charting progress, moving forward. *Emerg Themes Epidemiol*. 2007;4:13.
60. Checchi F, Gayer M, Freeman Grais R, Mills E. Public health in crisis-affected populations: A practical guide for decision-makers. Humanitarian Practice Network; 2007; Report No. 61.
61. Mills E, Checchi F, Orbinski J, Schull M, Burkle F, Beyrer C, et al. Users' guides to the medical literature: how to use an article about mortality in a humanitarian emergency. *Confl. Health*. 2008 Sep;2:9.
62. Tapp C, Burkle FM, Wilson K, Takaro T, Guyatt GH, Amad H, et al. Iraq War mortality estimates: A systematic review. *Confl. Health*. 2008 Mar 7;2(1):1.
63. Spiegel PB, Salama P, Maloney S, van der Veen A. Quality of malnutrition assessment surveys conducted during famine in Ethiopia. *JAMA* 2004;292:613–8.
64. Spiegel PB, Robinson C. Large-scale "expert" mortality surveys in conflicts-- concerns and recommendations. *JAMA*. 2010;304:567–8.

65. Spiegel P. Who should be undertaking population-based surveys in humanitarian emergencies? *Emerg Themes Epidemiol.* 2007;4:12.
66. The Sphere Project. Humanitarian charter and minimum standards in humanitarian response. United Kingdom: Practical Action Publishing; 2011.
67. Garfield R, Blake C, Chatainger P, Walton-Ellery S. Common needs assessments and humanitarian action. London, UK: Humanitarian Practice Network; 2011.
68. Pape JW, Johnson WD, Fitzgerald DW. The earthquake in Haiti — dispatch from Port-au-Prince. *N. Engl. J. Med.* 2010;362(7):575–7.
69. Morton M, Levy JL. Challenges in disaster data collection during recent disasters. *Prehosp Disaster Med.* 2011 Jun;26:196–201.
70. United Nations Security Council. Resolution 2046 (2012). S/RES/2046. May 2, 2012.
71. Schopper D, Upshur R, Matthys F, Singh JA, Bandewar SS, Ahmad A, et al. Research ethics review in humanitarian contexts: The experience of the independent ethics review board of Médecins Sans Frontières. *PLoS Med.* 2009 Jul 28;6(7):e1000115.
72. World Health Organization. Global Health Cluster Tools [Internet]. 2010 [cited 2013 Jun 17]. Available from: http://www.who.int/hac/global_health_cluster/guide/tools/en/
73. Brown V, Guerin PJ, Legros D, Paquet C, Pécoul B, Moren A. Research in complex humanitarian emergencies: The Médecins Sans Frontières/Epicentre experience. *PLoS Med.* 2008;5:e89.

74. Global Health Cluster. Health Resources Availability Mapping System Checklist [Internet]. 2009 [Accessed July 11 2013]. Available from: http://www.who.int/entity/hac/network/global_health_cluster/herams_services_checklist_eng.pdf
75. Griekspoor A, Collins S. Raising standards in emergency relief: How useful are Sphere minimum standards for humanitarian assistance? *BMJ*. 2001 Sep 29;323(7315):740–2.
76. World Health Organization. Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies. Geneva: World Health Organization; 2010.
77. Echoka E, Kombe Y, Dubourg D, Makokha A, Evjen-Olsen B, Mwangi M, et al. Existence and functionality of emergency obstetric care services at district level in Kenya: theoretical coverage versus reality. *BMC Health Serv. Res.* 2013 Mar 25;13(1):113.
78. Lobis S, Fry D, Paxton A. Program note: Applying the UN process indicators for emergency obstetric care to the United States. *Int. J. Gynecol. Obstet.* 2005;88:203–7.
79. Gabrysch S, Simushi V, Campbell OMR. Availability and distribution of, and geographic access to emergency obstetric care in Zambia. *Int. J. Gynaecol. Obstet.* 2011;114:174–9.
80. Gabrysch S, Civitelli G, Edmond KM, Mathai M, Ali M, Bhutta ZA, et al. New signal functions to measure the ability of health facilities to provide routine and emergency newborn care. *PLoS Med.* 2012 Nov 13;9(11):e1001340.

81. Olmen J van, Marchal B, Damme WV, Kegels G, Hill PS. Health systems frameworks in their political context: framing divergent agendas. *BMC Public Health*. 2012 Sep 12;12(1):774.
82. Pallas SW, Curry L, Bashyal C, Berman P, Bradley EH. Improving health service delivery organisational performance in health systems: a taxonomy of strategy areas and conceptual framework for strategy selection. *Int. Health*. 2012 Mar;4(1):20–9.
83. World Health Organization. Everybody's business: Strengthening health systems to improve health outcomes. Geneva, Switzerland: World Health Organization; 2009.
84. Kohler JC, Pavignani E, Michael M, Ovtcharenko N, Murru M, Hill PS. An examination of pharmaceutical systems in severely disrupted countries. *BMC Int. Health Hum. Rights*. 2012;12(1):34.

Chapter 2 – Monitoring the Ability to Deliver Care in Low- and Middle-Income Countries: A Systematic Review of Health Facility Assessment Tools

Nickerson JW, Adams O, Attaran A, Hatcher-Roberts J, Tugwell P.

Abstract

Health facilities assessments are an essential instrument for health system strengthening in low- and middle-income countries. These assessments are used to conduct health facility censuses to assess the capacity of the health system to deliver health care, and to identify gaps in the coverage of health services. Despite the valuable role of these assessments, there are currently no minimum standards or frameworks for these tools.

Methods: We used a structured keyword search of the Medline, Embase, and HealthStar databases and searched the websites of the World Health Organization, the World Bank, and the International Health Facilities Assessment Network to locate all available health facilities assessment tools intended for use in low- and middle-income countries. We extracted the indicators from the assessments and organized them into common assessment domains. These were used to develop an assessment framework inclusive of the assessment domains covered by the included tools, mapped to eight health systems building blocks.

Results: We identified 11 health facility assessment tools through our search strategy and were able to obtain 10 of them, all of which were included in our analysis. We found substantial variation in the comprehensiveness of the included tools, with the assessments containing indicators in 13 to 33 (median: 25.5) of the 41 assessment domains included in our framework. None of the tools collected data on all 41 of the assessment domains we identified.

Conclusions: A large number of different health facility assessment tools are currently in use. Substantial variation exists in the kinds of data they collect and the methods

used to collect it, likely limiting the comparability of the data among countries and omitting critical information of value for strengthening health systems. Agreement is needed on the essential elements of health facility assessments in order to guide the development of specific indicators and for refining existing instruments.

Introduction

The need for systems-wide strengthening of health systems has become a critical component of global public health and international development. (1–3) Bolstered in part by substantial, yet still insufficient, investment in achieving the Millennium Development Goals, improving population health through a focus on health systems strengthening rather than through vertical, disease oriented programming is increasingly recognized as critical for tackling complex health problems in low- and middle-income countries (LMIC). (4–7)

To improve population health, health services must be available, accessible, functional, and used by the population. To achieve this, comprehensive interventions are needed that strengthen not only service delivery, but also the laws and policies that influence the functionality of a health system and the health of the population. This necessitates a pragmatic assessment of where gaps or weaknesses exist within the system, using rigorous and valid methodologies to determine both the availability and functionality of essential health resources and services, and the factors that influence them.

Yet, the evaluation of health system interventions has suffered from several important methodological limitations. While some consensus has emerged surrounding suitable approaches to evaluation within health systems, significant controversy as to whether research findings obtained in one country can be applied in another remain. (6) To address these differences, broad frameworks for health systems strengthening(8) and research and evaluation(9,10) have been established that provide guidance and some standardization, while retaining the flexibility needed to adapt to

different countries and contexts. Despite this, evidence suggests that even when evaluations of health systems interventions are conducted, they often do not adhere to basic frameworks or standards, such as the World Health Organization's (WHO) health systems building blocks. (11)

Structured health systems evaluations are complicated by the frequent absence of basic data, such as assessments of the availability of essential health resources and services, which is integral for understanding the implications of population health statistics, such as mortality. (12) Conducting a detailed health facilities assessment and compiling a master list of health facilities is a cornerstone for monitoring the supply and quality of health services within a country. Despite the centrality of such data, (13,14) little guidance exists on the essential characteristics or minimum standards for conducting assessments of health facilities, and a diversity of assessment tools appear to currently be in use.

The presence of a plurality of potentially incomplete health facility assessments is problematic for achieving important health gains in LMIC. Major investments in initiatives to scale up health services necessarily rely on reliable, accurate, and comprehensive information on both capacities and gaps in health services availability in order to prioritize interventions and ensure equitable access to care. The absence of guidance on the essential data elements of these assessments potentially results in the over-emphasis of certain kinds of health priorities to the neglect of others, or a focus on clinical services to the neglect of administrative functions. The plurality of the number of assessments runs the potential risk of incomparable data among countries and regions where different tools and indicators have been applied. This has important

implications for monitoring progress of global initiatives, such as the Millennium Development Goals, and for estimating the impact of interventions to scale up access to health services in LMIC. Ensuring that data are both comprehensive and comparable is one step in estimating progress in improving the health of people living in LMIC, but as of yet few standards exist for achieving this.

We sought to address this absence of guidance on health facilities assessments in LMIC and to establish a clear framework to guide the development of future tools and the refinement of existing ones. We provide a comparative analysis of the different tools currently used to monitor the availability of health services and the capacity of health facilities in LMIC, and an assessment of how these reflect broader goals of health systems strengthening across different domains.

Methods

The Medline, Embase, and HealthStar databases were searched for articles published in English using the keywords and search strategy described in Appendix 1, developed with the assistance of a medical librarian. To locate non-peer reviewed reports, a keyword search was conducted in the following databases: (i) the International Health Facilities Assessment Network (IHFAN)(15); (ii) the World Bank(16); and (iii) the World Health Organization. (17) Abstracts from all manuscripts retrieved in the Medline/Embase search were screened and inclusion criteria applied. Non-peer reviewed reports were initially obtained in full text when an abstract was unavailable, and the same inclusion criteria applied. All manuscripts and reports meeting the inclusion criteria were included in the analysis.

The inclusion criteria were the presence of an assessment tool, checklist, or questionnaire that evaluated the availability of health resources or services at the health facility level. All questionnaires, regardless of the level of care evaluated (health posts, health centres, hospitals, etc.), were included, consistent with WHO's definition of health systems as being inclusive of "all organisations, people, and actions whose primary intent is to promote, restore or maintain health." (8). We excluded commentaries, reports without a standardized assessment, assessments that evaluated only a specific type of health service (e.g. sexual and reproductive health, surgery, etc.), and any reports that lacked explicit methodologies for data collection, such as anecdotal accounts of health service availability. Authors whose studies made reference to systematic data collection tools or approaches but did not include them in the manuscript were contacted for copies of these assessments and clarification of the methods used.

Data were extracted into an Excel (Microsoft Corporation, USA) database from all included reports using a thematic analysis of the health services included in the assessment tools. All of the tools were analyzed twice: the first time, to compile a list of the assessment indicators present in each of the tools, and the second time to evaluate which of these indicators were measured by each of the assessment tools. Each extracted indicator was categorized into a broader domain reflecting a group of health services. For instance, an indicator measuring the availability of surgical instruments was included under the domain "surgery". Each of these domains was then mapped to the health systems building blocks contained in the health systems framework. Using

the defined list of assessment domains and their indicators, a second reviewer screened 30% of the assessments to ensure consistency in the data extracted.

Health Systems Framework

The analysis of these domains and indicators was conducted using a health systems framework to contextualize these assessments in the essential capacities of health systems in LMIC. We used the Canadian Society for International Health (CSIH) health systems framework, (18) which closely aligns with the World Health Organization's (WHO) health systems building blocks. (8) Included in our framework is a total of eight building blocks, which form the basis of our analytic approach: (i) Stewardship and leadership; (ii) Health human resources; (iii) Health financing and resource allocation; (iv) research for development & evidence-based planning and policy-making; (v) Health information systems & data for decision-making (vi) Evidence-based Decision-making; (vii) Service delivery; and (viii) Community interventions and health promotion. This framework was chosen to facilitate a comprehensive analysis of a complex array of health services, health human resources, and other administrative and clinical elements at the level of the health facility. While a number of different health systems frameworks exist and have been applied, they are not all uniformly fit for purpose for all analyses. (19) The CSIH framework applied in this study was familiar to the authors, and has been used in different settings to facilitate a broader analysis of health service delivery and health policy development.

The integration of community interventions and health promotion recognizes the salient role of health facilities as a focal point for community health interventions and promotions, ranging from community-based treatment of illnesses to

communicable disease control initiatives such as the distribution of malaria bed nets. (20,21) This additional focus also addresses the need for the integration of community health workers, who may be the first point of contact within a larger referral network outside of health facilities, (22) and for community-based health interventions to be integrated into the overall health system. (23,24)

Evidence-based decision-making is an essential component of virtually all of the six WHO building blocks, though it is most closely conceptually linked to service delivery and health workforce as a component of provider education that is essential for high-quality clinical care within the context of the local environment. (25,26)

Results

Study Selection

The search strategy was run on May 05, 2011 and again on April 19, 2012. A total of 1962 abstracts obtained in the first search of the Medline, Embase, and HealthStar databases were located, and an additional 179 abstracts were retrieved following the second search. Of the abstracts screened, 121 full text manuscripts were obtained and screened for eligibility. 11 references from the other databases were located: six from IHFAN, two from WHO, and three from the World Bank. Only four studies located in the medical literature databases reported using a standardized assessment tool meeting the inclusion criteria. Of these, three reported using the Service Provision Assessment (27–29) and one reported using the Health Facility Census, (30) both of which were also located in the IHFAN database. None of the studies included copies of the tools. (Figure 1)

This search also located two other reviews of health facility assessment tools, one published by MEASURE Evaluation (31) and one by The World Bank, (32) neither of which utilized a systematic literature search, and both included fewer assessments than were located for this review. All of the assessment tools included in these previous reviews had already been located through our search strategy.

Characteristics of the Included Assessment Tools

11 health facility assessment tools were identified through the search strategy. Of the 11 assessments, 10 of the 11 assessment tools were accessible (Table 1). All of the assessment tools collected are intended for use in LMIC, with one (Health Resources Availability Mapping System – HeRAMS) intended for use during humanitarian emergencies. (33) All of the other included assessment tools were readily available online, with the exception of the Health Facility Census developed by the Japan International Cooperation Agency (JICA) and the Afghanistan Balanced Scorecard, (34) which were obtained by contacting the authors and requesting a copy of the assessment tools. The only tool not available was the Rapid Health Facility Assessment (R-HFA) developed by Child Survival Technical Support Plus (CSTS+). We attempted to obtain this assessment tool by contacting CSTS+ as well as MEASURE Evaluation, but were not able to locate it.

All of the tools utilized a checklist-like approach, and the Afghanistan Balanced Scorecard supplemented quantitative data with qualitative interviews. The assessments varied considerably in the format and length, with some clearly being designed for rapid assessments, containing only a small number of indicators, while others contained several hundred questions and indicators. This large variation

highlights the inherent challenges in comparing data derived from different settings, collected using different tools, in that the specificity of data collected is likely to vary considerably.

Thematic Analysis of Assessment Domains

Our thematic analysis of the tools revealed 41 different assessment domains, and several sub-domains. We mapped these to the health systems building blocks contained in the health systems framework (Table 2), and provide a discussion of the included building blocks, below.

None of the tools included in our review collected data on all of the assessment domains we identified, and the specificity of the tools varied significantly, ranging from indicators in 13 to 33 (median: 25.5) of the 41 assessment domains. The majority of the differences fell within the areas of health services delivery, with considerable variation in the types of health services assessed, and with a trend toward assessments of services at the primary care or community level rather than secondary-level services such as surgery or intensive care. A summary of the assessment domains and tools is included in Table 3.

A recently published review of health facility assessment tools examined four of the assessments included in our study for the purpose of developing indicators of newborn care. (35) We compared our extracted results with the relevant indicators examined in that study and found that our data extraction matched theirs, with the exception of the safe administration of oxygen, which may be due to differences in the survey instrument used.

Health Systems Building Blocks

Stewardship and Leadership

Eight of the included assessments contained some form of basic information concerning the organization, ownership, and leadership of health facilities. These data consisted of basic descriptive data of the ownership of the facility, department heads, and basic questions of how the facility was organized and run. These basic data provide an important assessment of the context through which the provision of services can be assessed. Facilities owned and operated by international agencies or in the private sector may have access to different pharmaceutical supply networks or pools of human resources, for example, compared with publicly run facilities. Combined with relevant geographic and population demographic information, this information allows for important analyses of equity in the distribution of health services and resources, and the identification of underserved populations when health facilities and population data are compared. (36–38)

Health Human Resources

All of the assessments collected data on health human resources, in some capacity, disaggregated by specific cadres of health professionals, though these cadres varied significantly among the assessments. Only five of the assessments contained indicators for assessing the hours of operation of the facility (when staff would be present), and only three collected data on the availability of emergency staff available in-house 24 hours a day.

Assessments of health human resources must necessarily focus broadly on “all people engaged in actions whose primary intent is to enhance health” including clinical staff such as physicians, nurses, and midwives, as well as management and support staff

who do not provide direct clinical services, but who are essential to supporting the delivery of health services and the functioning of the health system. (39) In many LMIC, however, levels of health professionals have reached crisis levels, as a result of a complex set of circumstances, ranging from supply-demand imbalances to internal, regional, and international migration and labour market factors. (40) In short, monitoring the availability of a country's health workforce is integral for understanding the human resources available to deliver essential health services, and is a central component of health facilities assessments.

Health Financing and Resource Allocation

Only two assessments collected information on how the health facility was financed, and only five on whether user fees were charged. Countries where the health system is financed through national schemes may account for the absence of these questions in some assessments (such as in Afghanistan (41)), however, assessments of donor or organizational funding for individual facilities provides a nuanced assessment of the sustainability of the health system.

Assessments of the financial sustainability, including donors' contributions, of individual health facilities are integral for understanding weaknesses and vulnerabilities throughout the health system. This holds particularly true at the level of service delivery, where staff salaries are paid, infrastructure is upgraded or maintained, and essential medicines and equipment are purchased, among other costs. (42) Furthermore, that many of the included tools are developed by donors highlights the necessity of compiling data on the financial sustainability and make-up of the health system.

Research for Development & Evidence-Based Planning and Policy Making

There were no particular indicators that individually corresponded to this health systems building block in and of themselves. However, we consider the outputs of health facility assessments to be an essential component of this health system building block. Functioning health facilities and infrastructure are integral to the safe and effective delivery of health services; assessing the availability and capacity of health resources and services at the facility level is, therefore, integral to evidence-based planning and research across the health system. Collecting these data at the level of health facilities allows for a detailed assessment of the various components that function (or do not) at the level of service delivery, which is a useful level of analysis for identifying the weaknesses within a national health system. (43)

The outputs of these assessments provide important data to guide further health systems planning, such as the resources available within geographic areas and the proximity of essential health services to higher levels of care. (30) Thus, research for development and evidence-based planning and policy making are integral for understanding the distribution of health services, but also for estimating and ensuring the effective coverage of various health services. (44)

Health Information Systems & Data for Decision-Making

Eight of the included assessments in our review contained assessments of a health information system, with eight collecting data on service utilization, and six with assessments of communicable disease surveillance. Other data collected were less consistent across the assessments, such as vital statistics, patient charts, and vaccination activity.

Health information systems (HIS) are an integral component of a functioning health system, providing accurate and timely data on health needs, service utilization, vital statistics, and surveillance of relevant communicable diseases. The foundations of public health presuppose the ability to quantify and monitor relevant health indicators of the population, making a functioning HIS essential for a functioning health system.

(45)

Evidence-Based Decision-Making

Seven of the included assessments contained indicators for assessing the availability of clinical practice guidelines for relevant health conditions. These guidelines were often integrated into assessments of service availability, assessing services for the availability of essential resources and equipment as well as relevant clinical practice guidelines. Five of the included tools assessed whether clinicians had received continuing education or training in priority areas, generally over the past two years.

The use of evidence to guide treatment decisions is essential for providing high-quality health care, though it is fundamentally constrained by the availability of evidence to support decision-making. In LMIC, an important constraint is the absence of available evidence to support locally-relevant medical conditions, as much of the body of medical knowledge has focused on priority illnesses in high-income countries. (26) Paradoxically, clinicians in LMIC where resources are more limited have a greater need for evidence to ensure that the care provided does not waste scarce resources on incorrect diagnoses and ineffective treatments. (46)

Service Delivery

The delivery of health services is the point of contact between patients and the healthcare system, where diagnosis and treatment occurs. Not surprisingly, service delivery accounts for the bulk of the data collected by the assessments included in our review, collected across a large number of different clinical domains. The range of clinical services evaluated are, in some ways, misleading as some tools included only single indicators of complex, yet poorly-defined, packages of services rather than specific measures (for example, “family planning” as one indicator, rather than a series of individual service or process indicators).

In addition to health services, significant variation was uncovered in the assessment of diagnostic services, essential medicines, and laboratory services. All of these domains have the potential for expansive lists of assessment criteria (consider every medication on a country’s essential medicines list, or every diagnostic test available), though most used a selective sampling rather than an exhaustive list. For example, most assessments included indicators for basic equipment such as a stethoscope, blood pressure cuff, and adult scale. This is similar to a tracer medicines approach advocated for by WHO, which lists 14 tracer medicines in use worldwide and 16 regionally-specific medicines. Countries are further encouraged to collect data on 20 additional medicines of national importance, for a total of approximately 50 medicines to provide data on the drug supply system. (47) Such an approach allows for an estimation of capacity, without extensive and laborious measurement.

Assessments of diagnostic services (including laboratory and diagnostic imaging) were frequently included, though again the specificity of these assessments varied. All ten of the assessment tools evaluated the availability of some form of

laboratory services, while only seven assessed the availability of diagnostic imaging. These assessments ranged from indicators for specific analytical tests and equipment, to general questions of capacity (“are malaria diagnostic services available at this health facility?”).

All of the assessment tools also included some form of basic structural assessments, such as the condition of walls, floors, and heating/cooling systems. As a basic structure constitutes an integral component of a health facility, this is included as an element of the health services delivery building block. Another key infrastructure assessment, the hospital bed census, was included in six of the included assessment tools, representing a significant absence of basic structural information in these tools. Bed availability data are critical during emergency situations, provide a measure of a facility’s capacity and size, and when data on bed usage are also collected, provide a means of monitoring service utilization. (48)

Community Interventions and Health Promotion

We identified two assessment domains related to community interventions and health promotion from the included assessments: environmental health and nutrition.

Nutrition services were included in five assessments, including indicators for malnutrition screening and therapeutic feeding. Environmental health was less frequently included in assessment tools, with only 30% of the included assessments containing indicators related to environmental health. One assessment – the JICA Health Facility Census – included indicators for the availability of water and food inspection services, though this was not included in any others, nor does it seem a

particularly relevant focus for health facilities. The other two assessments that included environmental health services were both related to malaria bed net distribution.

Discussion

Health system strengthening requires reliable, accurate, and comparable data sources across the health system to identify gaps in coverage and to identify priority health needs. The monitoring and evaluation of the health system necessitates a focus on how inputs and processes (e.g. health human resources and health services delivery) contribute to outputs (coverage of health services) and their impact on relevant health indicators (morbidity and mortality). The absence of any of these data sources results in incomplete information and unreliable assessments of priority areas. (12) Ensuring that these data are comparable across countries requires methodological consistency, which this review reveals is currently lacking in the assessment of health facilities.

This review located ten different assessment tools that have been developed and used by donor countries, NGOs, ministries of health, and multilateral organizations to assess the availability and functionality of health facilities in LMIC. While the assessments, generally, address similar domains, the specificity and homogeneity of the indicators used in these tools vary significantly. This undoubtedly limits the ability to compare data across surveys, countries, and time, despite being conceptually similar.

The intended use of the assessment tools collected likely provides some insight into their development, as the majority of them were donor-developed and likely reflects donor priorities rather than a health systems approach. This is most evident in such tools as the Service Provision Assessment, developed by the United States Agency for International Development (USAID) or the Afghanistan Balanced Scorecard,

developed by researchers at Johns Hopkins University. Both are designed to reflect specific programmatic goals or packages of health services, rather than to develop a framework for health services delivery within a health system approach. The Balanced Scorecard utilizes a comprehensive methodology to examine different aspects of the health system; however, it is tailored specifically for use in Afghanistan, based on their packages of health services. Interestingly, a donor also developed the most comprehensive tool: the Health Facility Census, developed by JICA, which included indicators corresponding to 33 of the 41 assessment domains. Some of this variation is likely attributable to the level of health care for which the assessment was designed (for example, assessments focused on primary health care are unlikely to inquire about the presence of a trained surgeon), which may also reflect donor or organizational priorities oriented toward specific kinds of programs. This is an important finding, as these tools appear designed to assess the programs that donors fund, rather than initiatives that are led and monitored by the countries, themselves.

Only one of the tools included in our review (HeRAMS) made use of an explicit framework to guide the assessment of available health resources and services. While the HeRAMS framework is explicit, it also does not clearly link to a broader health systems framework. This is, in part, due to the nature of the tool's initial deployment in the Darfur region of Sudan, an area of ongoing conflict, rather than stable development.

There are several key data that can be collected from health facilities that provide greater clarity into accessibility and coverage of health services. For instance, data concerning the financing of health services are integral for understanding the sustainability and structure of the health system. A standard dichotomy of public and

private health services is pervasive, though the mix can be far more nuanced, including the contracting of health services by governments to other entities. (49) Regardless, the availability of information at the level of health service delivery, such as user fees and the costs for services, may provide an important analytic tool for understanding barriers to health services and the potential economic impact of out-of-pocket health expenses on population health. That only half of the included assessment tools collected information on user fees (the most pragmatic health expenditure for patients) represents a significant weakness.

We noted a trend toward the evaluation of primary care services, with secondary and tertiary care being absent from many assessments, despite a need for these services in LMIC. (50) Furthermore, little data is available in the literature concerning the absence of or need for secondary and tertiary care infrastructure or services, potentially owing to the absence of these services in infrastructure assessments such as those included in our review.

This review provides a broad framework for the assessment of health facilities by identifying core assessment domains that should provide a foundation for more detailed assessment indicators. However, we also identify significant weaknesses within the health facilities monitoring and evaluation systems, as several integral health services remained absent from most tools and many data are likely incomparable among the various tools. For example, non-communicable diseases, physical rehabilitation, mental health, and palliative care were only assessed in a small number of the included assessments. Given that many of these conditions are underfunded and poorly accessible in LMIC, in general, it is not entirely surprising that

they were largely neglected. Yet, even obviously necessary services were neglected by many assessments: the availability of a mortuary, for example, was included in only one assessment.

Achieving a balance in the specificity and logistical practicality of health services assessments is difficult, given the potential for an increasingly long list of health services with exceptionally detailed indicators. Many health services have developed specific assessments that apply a more detailed approach using specific indicators that correspond to assessments of the quality of processes, as well as the availability of essential infrastructure. For example, WHO has developed the Tool for Situational Analysis to Assess Emergency and Essential Surgical Care, which contains an extensive set of indicators and which has been successfully used in several countries. (51) Other approaches have used a select set of signal functions as a proxy for more in-depth assessments, such as for Basic and Comprehensive Emergency Obstetric Care (BEmOC and CEmOC)(52), routine and emergency newborn care, (35) and for identifying essential components of health information systems. (45) In evaluating health human resources, international classifications exist and ought to form the basis of assessment criteria so as to allow for international comparisons to be drawn. (53) Ideally, assessments of the health workforce should be mapped to these international classifications. (47) This modular approach to health service-specific evaluations may present an option for integrating more nuanced information into broader health facilities datasets. The integration of different kinds of modular data warrants further investigation.

This study evaluated only those tools applied in low- and middle-income countries, and excluded search strategies that would have captured similar tools developed for use in high-income countries. The basis of this decision was that the health priorities of high-income countries are different from LMIC, and that these priorities would be reflected differently in any assessment tool for high income countries. For example, communicable diseases play a prominent role in many of the included assessments; while these diseases are of obvious concern in all countries, the particular emphasis on HIV, malaria, and tuberculosis that is of particular relevance in LMICs would not likely be as prominent in an assessment of health services availability in most high-income countries.

The decision to limit the search strategy to only those assessments that included a comprehensive assessment of all health services may have excluded some service-specific assessments that collected data pertinent to other health sectors. For example, an assessment that specifically targeted HIV treatment facilities may have collected data on general clinical services, sexual and reproductive health care, and palliative care, among others. However, the goal of this study was not to catalogue the number of assessments that collected data on given assessment domains (though that was an outcome of the study), but rather to generate a framework of essential assessment domains, linked to health systems building blocks, that could be applied in the development of future assessments. To that end, we feel justified in excluding these service-specific assessments, in favour of this more comprehensive approach.

Further studies that expand on this work could also consider including additional databases for their search, which may result in additional references being

located in peer-reviewed journals and in the grey literature. This project's findings are representative of the search strategy employed, and expanding on this may result in additional resources, such as those in languages other than English. Additional databases could be searched, including expanding on the grey literature search.

Our approach utilized a broad health systems framework (Figure 2), as the foundation for aligning health facilities assessment domains with a broader objective of health systems strengthening. In doing so, we have identified common domains that ought to be included as part of a health facilities census, which should guide the development of more specific assessment indicators to correspond to each of these domains similar to those service-specific tools mentioned above. Our review and recommendations fall short of prescribing particular indicators or assessment strategies; rather, we propose this as the next step in the evolution of these assessments: defining the indicators that best align with countries' packages of health services, and the information needs of specialists working in these areas of health service delivery to ensure that detailed assessments of specialized health services are comparable among countries.

Our results should be interpreted to recognize that different agencies (including national ministries of health) have a desire to exert ownership of their own data collection tools and processes, structured in a way that makes sense for the delivery or support of their own programs. Rather than proposing the development of one tool that should be universally applied, our results propose a broad framework that can be used to guide the development of these tools, thereby ensuring a more comprehensive approach.

Conclusion

This review highlights a fundamental problem in the collection of health facilities and health services availability data: the absence of common assessment tools yields incomparable data making it difficult, if not impossible, to track progress toward increasing access to health services, globally. Our review found ten different health facility assessment tools currently in use. Our comparative analysis of these tools revealed that there are significant gaps in the areas evaluated by many of them, often orienting their focus toward primary care, rather than the broader health system.

This review provides a framework in the form of 41 assessment domains linked to health systems building blocks that should guide the development of new health facilities assessment tools and the refinement of existing ones. Furthermore, these assessment domains provide a useful starting point for defining more detailed assessments that correspond to specialized health services. Future developments in this area should integrate existing specialized indicators into assessment tools to enhance the comparability of the data collected and to align these data with existing standards.

References

1. Frenk J. The Global Health System: Strengthening national health systems as the next step for global progress. *PLoS Med.* 2010 Jan 12;7(1):e1000089.
2. Samb B, Desai N, Nishtar S, Mendis S, Bekedam H, Wright A, et al. Prevention and management of chronic disease: a litmus test for health-systems strengthening in low-income and middle-income countries. *Lancet.* 2010 Nov;376(9754):1785–97.
3. Atun R. Health systems, systems thinking and innovation. *Health Policy and Planning.* 2012 Sep 26;27(suppl 4):iv4–iv8.
4. Adam T, de Savigny D. Systems thinking for strengthening health systems in LMICs: need for a paradigm shift. *Health Policy and Planning.* 2012 Sep 26;27(suppl 4):iv1–iv3.
5. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, et al. Overcoming health-systems constraints to achieve the Millennium Development Goals. *Lancet.* 2004 Sep;364(9437):900–6.
6. Task Force on Health Systems Research. Informed choices for attaining the Millennium Development Goals: towards an international cooperative agenda for health-systems research. *Lancet.* 2004 Sep;364(9438):997–1003.

7. Swanson RC, Cattaneo A, Bradley E, Chunharas S, Atun R, Abbas KM, et al. Rethinking health systems strengthening: key systems thinking tools and strategies for transformational change. *Health Policy and Planning*. 2012 Sep 26;27(suppl 4):iv54–iv61.
8. World Health Organization. Everybody's business: Strengthening health systems to improve health outcomes. 2007. Geneva, Switzerland: World Health Organization.
9. Murray CJL, Frenk J. A framework for assessing the performance of health systems. *Bull. World Health Organ*. 2000;78:717–31.
10. International Health Partnership+ Related Initiatives, World Health Organization. Monitoring, evaluation and review of national health strategies: A country-led platform for information and accountability [Internet]. 2011 [Accessed July 11, 2013]. Available from: http://www.internationalhealthpartnership.net//CMS_files/documents/monitoring_evaluation_and_review_of_national_health_strategies_EN.pdf
11. Adam T, Hsu J, de Savigny D, Lavis JN, Rottingen J-A, Bennett S. Evaluating health systems strengthening interventions in low-income and middle-income countries: are we asking the right questions? *Health Policy and Planning*. 2012 Sep 26;27(suppl 4):iv9–iv19.
12. Echoka E, Kombe Y, Dubourg D, Makokha A, Evjen-Olsen B, Mwangi M, et al. Existence and functionality of emergency obstetric care services at district level in Kenya: theoretical coverage versus reality. *BMC Health Serv. Res*. 2013 Mar 25;13(1):113.

13. Casey S, Mitchell K, Mulamba Amisi I, Migombano Haliza M, Aveledi B, Kalenga P, et al. Use of facility assessment data to improve reproductive health service delivery in the Democratic Republic of the Congo. *Confl. Health*. 2009;3:12.
14. Falade CO, Oladoyinbo SO, Elemile TT, Ajayi IO, Fawole OI, Oladepo O, et al. How well equipped are healthcare facilities to manage childhood malaria? The situation in selected local government areas in South Western Nigeria. *African Journal of Medicine & Medical Sciences*. 2006;35:329–35.
15. International Health Facility Assessment Network (IHFAN) [Internet]. [cited 2012 Jun 19]. Available from: http://www.ihfan.org/home/index.php?editable=yes&page_type=catalogsurveys#
16. The World Bank. Central Microdata Catalog [Internet]. 2012 [cited 2012 Jun 19]. Available from: <http://microdata.worldbank.org/index.php/catalog/central>
17. World Health Organization. WHO World Health Organization [Internet]. 2012 [cited 2012 Jun 19]. Available from: <http://www.who.int/en/>
18. Canadian Society for International Health. CSIH Approach to Health Systems Strengthening. 2004.
19. Olmen J van, Marchal B, Damme WV, Kegels G, Hill PS. Health systems frameworks in their political context: framing divergent agendas. *BMC Public Health*. 2012 Sep 12;12(1):774.
20. Soofi S, Ahmed S, Fox MP, MacLeod WB, Thea DM, Qazi SA, et al. Effectiveness of community case management of severe pneumonia with oral amoxicillin in children aged 2-59 months in Matiari district, rural Pakistan: a cluster-randomised controlled trial. *Lancet*. 2012 Feb 25;379(9817):729–37.

21. Yukich JO, Zerom M, Ghebremeskel T, Tediosi F, Lengeler C. Costs and cost-effectiveness of vector control in Eritrea using insecticide-treated bed nets. *Malar J*. 2009 Mar 30;8:51.
22. Lewin S, Munabi-Babigumira S, Glenton C, Daniels K, Bosch-Capblanch X, van Wyk BE, et al. Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database of Systematic Reviews* 2010;Issue 3: Art no.: CD004015.
23. Hanson K, Nathan R, Marchant T, Mponda H, Jones C, Bruce J, et al. Vouchers for scaling up insecticide-treated nets in Tanzania: Methods for monitoring and evaluation of a national health system intervention. *BMC Public Health*. 2008;8:205.
24. Bhutta ZA, Soofi S. Community-based newborn care: are we there yet? *Lancet*. 2008;372:1124-6.
25. Ehrhardt S, Meyer CG. Transfer of evidence-based medical guidelines to low- and middle-income countries. *Trop. Med. Int. Health*. 2012 Feb;17:144-46.
26. Chinnock P, Siegfried N, Clarke M. Is evidence-based medicine relevant to the developing world? *PLoS Med*. 2005 May;2(5):e107.
27. Agha S, Do M. The quality of family planning services and client satisfaction in the public and private sectors in Kenya. *Int J Qual Health Care*. 2009 Apr;21(2):87-96.
28. Cherlin EJ, Allam AA, Linnander EL, Wong R, El-Toukhy E, Sipsma H, et al. Inputs to quality: supervision, management, and community involvement in health facilities in Egypt in 2004. *BMC Health Serv. Res*. 2011 Oct 20;11:282.
29. Hong R, Montana L, Mishra V. Family planning services quality as a determinant of use of IUD in Egypt. *BMC Health Serv. Res*. 2006 Jun 22;6(1):79.

30. Gabrysch S, Cousens S, Cox J, Campbell OMR. The influence of distance and level of care on delivery place in rural Zambia: A study of linked national data in a geographic information system. *PLoS Med.* 2011;8:e1000394.
31. Edward A, Matsubiyashi T, Fapohunda B, Becker S. A comparative analysis of select health facility survey methods applied in low and middle income countries [working paper WP-09-11]. Chapel Hill, NC: MEASURE Evaluation; 2009.
32. Lindelow M, Wagstaff A. Health facility surveys: An introduction. World Bank Policy Research Working Paper 2953; 2003.
33. Global Health Cluster. Health Resources Availability Mapping System Checklist [Internet]. 2009 [Accessed July 11, 2013]. Available from: http://www.who.int/entity/hac/network/global_health_cluster/herams_services_checklist_eng.pdf
34. Edward A, Kumar B, Kakar F, Salehi AS, Burnham G, Peters DH. Configuring balanced scorecards for measuring health system performance: Evidence from 5 years' evaluation in Afghanistan. *PLoS Med.* 2011 Jul 26;8(7):e1001066.
35. Gabrysch S, Civitelli G, Edmond KM, Mathai M, Ali M, Bhutta ZA, et al. New signal functions to measure the ability of health facilities to provide routine and emergency newborn care. *PLoS Med.* 2012 Nov 13;9(11):e1001340.
36. Moisi JC, Gatakaa H, Noor AM, Williams TN, Bauni E, Tsofa B, et al. Geographic access to care is not a determinant of child mortality in a rural Kenyan setting with high health facility density. *BMC Public Health.* 2010 Mar 17;10:142.

37. Noor AM, Gikandi PW, Hay SI, Muga RO, Snow RW. Creating spatially defined databases for equitable health service planning in low-income countries: the example of Kenya. *Acta Tropica*. 2004;91:239–51.
38. Noor A, Alegana V, Gething P, Snow R. A spatial national health facility database for public health sector planning in Kenya in 2008. *Int J Health Geogr*. 2009;8:13.
39. World Health Organization. *Working Together for Health*. World Health Report 2006. Geneva, Switzerland; 2006.
40. Narasimhan V, Brown H, Pablos-Mendez A, Adams O, Dussault G, Elzinga G, et al. Responding to the global human resources crisis. *Lancet*. 2004 May 1;363(9419):1469–72.
41. Sabri B, Siddiqi S, Ahmed AM, Kakar FK, Perrot J. Towards sustainable delivery of health services in Afghanistan: options for the future. *Bull World Health Organ*. 2007 Sep;85(9):712–8.
42. Shakarishvili G, Lansang MA, Mitta V, Bornemisza O, Blakley M, Kley N, et al. Health systems strengthening: a common classification and framework for investment analysis. *Health Policy and Planning*. 2010 July;26:316–26.
43. Paxton A, Bailey P, Lobis S, Fry D. Global patterns in availability of emergency obstetric care. *Int J of Gynaecol Obstet*. 2006 Jun;93:300–7.
44. Shengelia B, Tandon A, Adams OB, Murray CJL. Access, utilization, quality, and effective coverage: An integrated conceptual framework and measurement strategy. *Soc Sci Med*. 2005 Jul;61:97–109.
45. AbouZahr C, Boerma T. Health information systems: the foundations of public health. *Bull World Health Organ*. 2005 Aug;83:578–83.

46. Volmink J, Swingler G, Siegfried N. Where to practise evidence-based medicine? *Lancet*. 2001 Mar 3;357(9257):724.
47. World Health Organization. *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies*. Geneva: World Health Organization; 2010.
48. Kanter RK, Moran JR. Hospital emergency surge capacity: An empiric New York statewide study. *Ann Emerg Med*. 2007 Sep;50:314–9.
49. Loevinsohn B, Harding A. Buying results? Contracting for health service delivery in developing countries. *Lancet* Aug. 2005;366:676–81.
50. Fowler R, Adhikari N, Bhagwanjee S. Clinical review: Critical care in the global context - disparities in burden of illness, access, and economics. *Critical Care*. 2008;12:225.
51. Choo S, Perry H, Hesse AAJ, Abantanga F, Sory E, Osen H, et al. Assessment of capacity for surgery, obstetrics and anaesthesia in 17 Ghanaian hospitals using a WHO assessment tool. *Trop Med Int Health*. 2010 Sep;15:1109–15.
52. WHO, UNFPA, UNICEF, AMDD. *Monitoring Emergency Obstetric Care: A Handbook*. Geneva: WHO; 2009.
53. International Labour Organization. *ISCO-08 Structure and preliminary correspondence with ISCO-88* [Internet]. 2012 [Accessed July 16, 2012]. Available from: <http://www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm>

Table 2.1 – Summary of Included Assessment Tools

Assessment Tool	Developed by	Version
1. Facility Audit for Core Indicators	MEASURE Evaluation/United States Agency for International Development (USAID)	2007
2. Service Provision Assessment (SPA)	MEASURE Evaluation/USAID	Uganda, 2007
3. Service Availability Mapping (SAM)	World Health Organization (WHO)	2009 (Date when SAM was discontinued)
4. Balanced Score Card (BSC), F and H Forms	Johns Hopkins University/Ministry of Public Health of the Islamic Republic of Afghanistan	July 2011
5. Health Facility Census	Japan International Cooperation Agency (JICA)	Zambia Health Facility Census, September 2007
6. Health Resources Availability Mapping System	WHO	Sudan, 2012
7. Service Availability Readiness Assessment (SARA)	WHO	October 2011
8. Living Standards Measurement Study	Vietnam General Statistical Office	Vietnam, 1997-1998
9. Nigeria Public Delivery of Primary Health Care Services	National Primary Health Care Development Agency and World Bank	2002
10. Indonesian Family Life Survey (IFLS)	RAND Corporation	IFLS4, 2007

Table 2 – Framework of Health Facility Assessment Domains, With Corresponding Health Systems Building Blocks

Health Systems Framework Building Blocks	Assessment Domains Identified
1.Stewardship and Leadership	Ownership/Management of facility
2.Health Human Resources	National health professions/cadres of workers
3.Health Financing and Resource Allocation	Financing of facility User fees charged/cost of service
4.Research for Development & Evidence-based planning and policy-making	Outputs of the mapping exercise
5.Health Information Systems & Data for Decision-Making	Service Utilization Disease registers Caseload data Mortality data Vital statistics
6.Evidence-based Decision-Making	Evidence-based guidelines Continuing Medical Education
7.Service Delivery – Treatments and Programs	<ul style="list-style-type: none"> • Basic structural components <ul style="list-style-type: none"> ○ Identification as a health facility ○ Bed census • General Clinical Services <ul style="list-style-type: none"> ○ Non-communicable Diseases ○ Child Health • OPD/Emergency Room • Dental/Oral Health • Communicable Diseases <ul style="list-style-type: none"> ○ HIV/AIDS ○ Vaccines • Infection control <ul style="list-style-type: none"> ○ Cleaning/Sterilization • Sexual and Reproductive Health <ul style="list-style-type: none"> ○ Obstetric Care ○ Sexually Transmitted Infections • Surgery • Intensive Care Unit • Disabilities and injury rehabilitation • Mental health care • Urology • Palliative care • Mortuary • Basic Equipment • Diagnostic Services • Laboratory Services • Pharmacy

	<ul style="list-style-type: none">• Essential Medicines
8. Community Interventions and Health Promotion	Environmental Health Nutrition

Table 2.3 – Summary of Included Assessment Tools

Domain	MEASURE Core Indicators	Service Provision Assessment	Service Availability Mapping	Balanced Score Card	Health Facility Census	Health Resources Availability Mapping System	Service Availability Readiness Assessment	Living Standards Measurement Study	Nigeria Public delivery of Primary Health Care Services	Indonesian Family Life Survey
Stewardship and Leadership										
Ownership/management of facility		✓	✓	✓	✓	✓	✓		✓	✓
Health Human Resources										
Health human resources (cadres of health workers)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health Financing and Resource Allocation										
Financing of facility		✓				✓				
User fees charged		✓				✓		✓	✓	✓
Health Information Systems & Data for Decision-Making										
Collection of vital statistics	✓	✓		✓		✓				
Caseload data	✓	✓		✓	✓	✓	✓			✓
Priority disease caseload register	✓	✓	✓	✓	✓					
Evidence-Based Decision-Making										
Evidence-based guidelines	✓	✓	✓	✓	✓		✓			✓
Continuing medical education		✓	✓	✓			✓			✓

Service Delivery - Treatments and Programs										
Basic structural components	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bed census		✓	✓	✓	✓	✓	✓		✓	
Identification as a health facility					✓	✓				
General clinical services	✓	✓	✓	✓	✓	✓	✓		✓	✓
Non-communicable diseases					✓	✓	✓			✓
Child health	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Outpatient Department/Emergency Room	✓	✓		✓	✓	✓				
Dental/oral health		✓			✓			✓	✓	✓
Communicable diseases	✓	✓	✓	✓	✓	✓	✓		✓	✓
HIV/AIDS	✓	✓	✓	✓	✓	✓	✓			
Vaccines		✓	✓	✓	✓	✓	✓		✓	✓
Infection control	✓	✓	✓	✓	✓	✓	✓			✓
Cleaning/Sterilization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sexual and reproductive health	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obstetric Care	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sexually transmitted infections	✓	✓	✓		✓	✓	✓		✓	✓
Surgery	✓		✓	✓	✓	✓	✓	✓		✓
Intensive Care Unit				✓	✓					
Disabilities and injury rehabilitation					✓	✓				
Mental health care					✓	✓				
Internal Medicine					✓					

Palliative care	✓	✓			✓		✓			
Mortuary					✓					
Basic equipment	✓	✓	✓	✓	✓		✓	✓	✓	✓
Diagnostics		✓	✓	✓	✓	✓	✓			✓
Laboratory services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pharmacy		✓		✓	✓					✓
Essential medicines	✓	✓	✓	✓	✓		✓		✓	✓
Community Interventions and Health Promotion										
Environmental Health					✓	✓	✓			
Nutrition		✓			✓	✓	✓	✓		

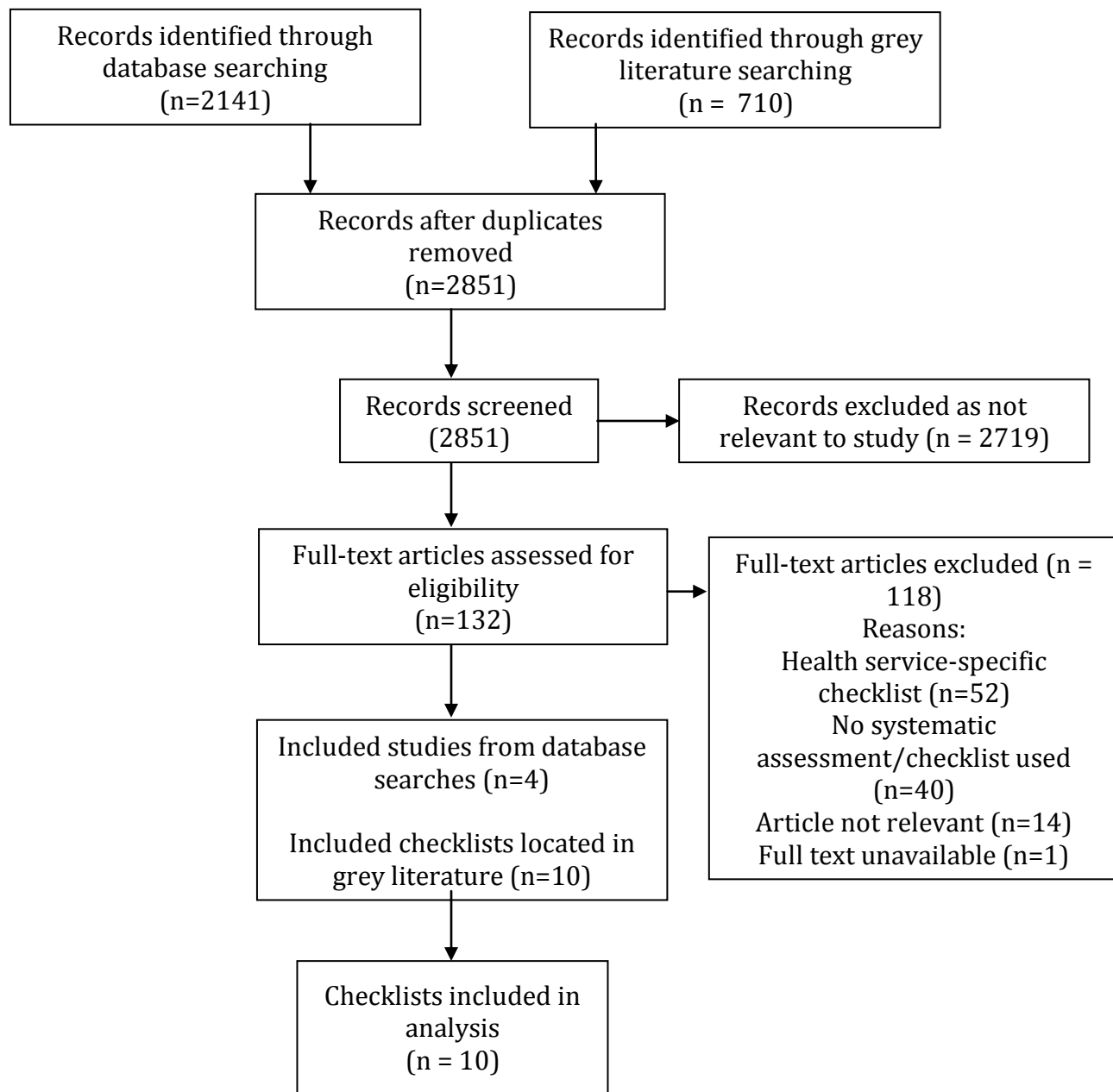
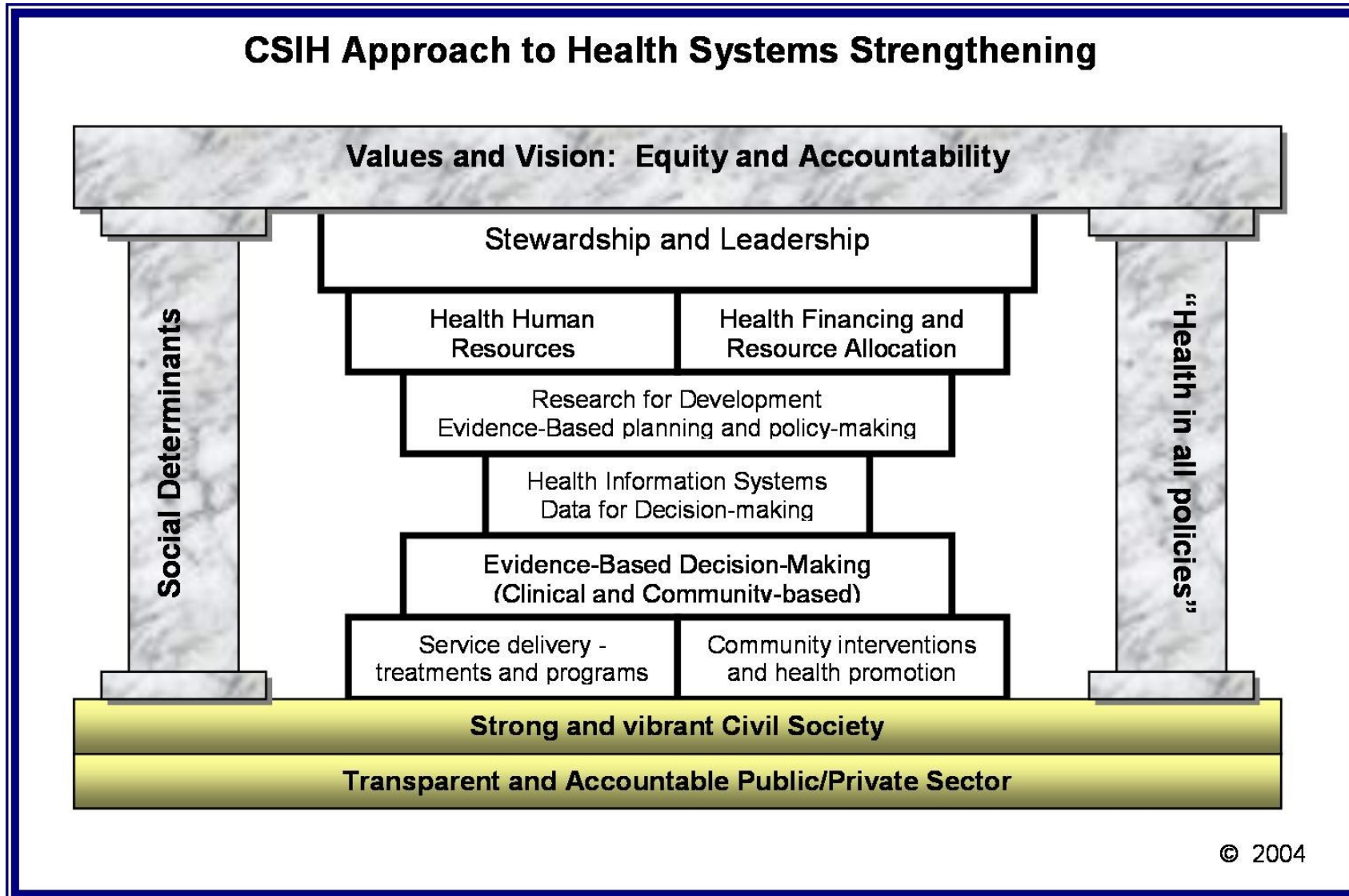
Figure 2.1 - PRISMA Flowchart

Figure 2.2 – CSIH Health Systems Framework



Chapter 3 – Health Facilities Assessments in Humanitarian Emergencies: A Field-Based Evaluation from Haiti and Sudan

Nickerson JW, Adams O, Attaran A, Hatcher-Roberts J, Tugwell P.

Abstract

Background: The assessment of the availability of health services during natural disasters or armed conflicts is essential for understanding the capacities and weaknesses of disrupted health systems. Yet, experience in recent emergencies suggests that these assessments and data have been lacking, potentially compromising the coordination of humanitarian actors. This study investigated how health services availability data were collected during recent emergencies in Haiti and the Darfur region of Sudan, and evaluated their quality and comprehensiveness.

Methods and Findings: A field-based evaluation of health facilities assessments was conducted in Haiti and Sudan by one of the investigators, using a snowball sampling technique to locate all existing assessments that collected data on the location, capacity, functionality, and health services provided by health facilities in each country. A total of 9 assessments (8 in Haiti; 1 in Sudan) were located that met the inclusion criteria, and were assessed for quality and comprehensiveness using a coding scheme based on existing health facilities assessment criteria, the Global Health Cluster Suggested Set of Core Indicators and Benchmarks by Category, and the Sphere Humanitarian Charter and Minimum Standards in Humanitarian Response.

The overall quality of the health facilities assessments from Haiti was poor, with few providing comprehensive data corresponding to the evaluation criteria. Many of the assessments used aggregate indicators of broad, complex health services, limiting the ability to determine the specific elements of these services. This may be appropriate given the constraints faced during emergency response, however, many essential data

elements were lacking, limiting the detail of analysis possible for calculating benchmarks and evaluating the coverage of health services.

In Sudan, the Health Resources Availability Mapping System (HeRAMS) was the only assessment located for evaluating health facilities in the Darfur states. HeRAMS corresponded reasonably well with the quality criteria applied, collecting data in most of the assessment domains identified by the frameworks, and with the ability to calculate benchmarks and coverage indicators.

Conclusions: The large number of health facilities assessment tools currently in use suggests a need to identify the essential data necessary to make reasonably informed decisions concerning gaps and capacities of disrupted health systems during humanitarian emergencies. Although the quality of the assessments in Haiti was generally poor, the large number of platforms and assessment tools deployed suggests that health services availability data can be collected even during acute emergencies. Further consensus is needed to establish essential criteria for data collection and to establish a core group of health systems assessment experts to be deployed during future emergencies.

Introduction

Acute and protracted crises have grave immediate and long-term effects on population health and health systems, particularly in low-income countries. Both direct and indirect morbidity and mortality are exacerbated by major emergencies such as sudden-onset disasters or war: Health workers may leave, be killed, or have disappeared, health facilities may be attacked, looted, or destroyed, normal supply chains may become inaccessible, and the overall functionality of the health system is disrupted. (1–3) This disruption widens the gap between a population’s health needs and the availability of health services to address them, and further reduces access to essential health services. (4) Implementing health interventions that address salient health needs in emergencies requires accurate assessments of the health status of the affected population and the functionality of the health system in order to respond to gaps in health services either created or exacerbated by the crisis. (5)

The collection of scientifically valid public health data during major emergencies has been the subject of considerable scrutiny, most notably in the conduct of mortality surveys, which have garnered significant political and public interest. (6–9) Despite the centrality of public health data as part of a coordinated humanitarian response, significant gaps exist in the methodologies used to collect most kinds of health data in crisis settings, where a lack of appropriately trained field staff who can implement complex study designs in these environments has led to serious concerns of methodological validity, and has likely impacted the uptake and application of existing assessment methodologies. (10–13) This is further complicated by logistical

constraints, which may make the collection of data impossible due to security or other restrictions. (14)

Data on the health status of the population, the availability of health resources and services, and the performance of the health system play a central role in the coordination of humanitarian assistance during major emergencies. (15) These data provide a means of quantifying the excess needs that can be attributed to the crisis, gaps in the coverage of health services, and the proportionality of a response needed to address them. (16,17) Despite an increasingly refined understanding of the characteristics of public health threats following large-scale emergencies, it remains unclear to what extent operational decisions utilize the systematic collection of field-based evidence. (18–20) The likely reasons for this are potentially pragmatic: augmenting the processes for conducting detailed needs assessments often requires slowing down another process, and the coordination of the medical response to emergencies has become increasingly complex as the number of aid agencies responding has proliferated. Following the 2010 earthquake in Haiti, for example, 44 foreign medical teams and field hospitals were deployed in the first 15 days, and within the first month there were 246 organizations registered with the Health Cluster as providing health services in the country, which is almost certainly an underestimate of the true number of aid agencies on the ground. (21,22)

The absence of accurate health systems data to guide the coordination of health services delivery under these conditions can have grave consequences resulting in duplicative or ineffective interventions. Following the 2004 Indian Ocean tsunami, reports suggest that some children may have received up to four measles vaccinations,

while others received none, in part due to a lack of knowing which actors were providing services in different areas. (23) Similarly, in Haiti following the 2010 earthquake, the absence of effective coordination mechanisms for humanitarian surgical providers resulted in too many agencies operating in some parts of Port-au-Prince while other parts of the city had little to no access to surgical care. (24)

The collection of data to answer seemingly straightforward health systems questions such as “who is where, doing what?” has proven elusive during recent crises, resulting in a limited understanding of which health facilities were functional, what their capacities were, who was providing care, and what coverage of essential health services existed. Coordinated information management was found to be particularly weak in the health response to the 2010 earthquake in Haiti, where even basic data on the location of functioning health facilities was questionable and data on the capacity and capabilities of foreign medical teams was largely unknown. (25) Currently, little guidance exists to support the development of health facilities assessment tools appropriate for use in emergency response and recovery, and it is unclear what kinds of information are of value to operational agencies and whether the collection of these data should be formulaic or process-driven. To address this gap in knowledge, a field-based assessment was conducted to locate and evaluate existing health facilities assessment tools that have been used in current emergencies in Haiti and Sudan in order to better understand how this aspect of health systems data are collected in emergencies, and the strengths and weaknesses of different approaches.

Methods

This study was approved by the University of Ottawa Health Sciences and Sciences Research Ethics Board.

All accessible databases and assessment tools that contained useful assessments of health facilities and the availability of health services intended for use in the coordination of the humanitarian response or the rebuilding of the health system in Haiti and the Darfur Region of Sudan were collected. Assessments whose purpose was limited to the collection of basic identification information that did not contribute to the monitoring of the coverage of health services, such as lists of only phone numbers or contact information, were excluded from the analysis.

Data were collected during field visits by one of the authors (JWN) to Haiti (November/December 2011) and Sudan (May 2012). These two locations were selected based on logistical considerations of operating in difficult environments, and the resources available to support operational field research. Because no systematically-populated databases of correspondence or documents are known to exist following the Haiti earthquake (25) or in Sudan, a snowball sampling approach was used, enlisting guidance from 21 key informants in the field and by contacting agencies who contributed to the coordination of humanitarian assistance to identify all of the known documents of interest to this study. Key informants included current and past humanitarian coordinators from various United Nations agencies, field staff from governmental and non-governmental organizations, and local ministry of health staff. Any relevant documentation was obtained and reviewed, and was often located with

the assistance of key informants, rather than through known databases. Similar methods have been reported by other authors working in complex environments. (26)

To identify any other potential sources of information, Health Cluster Bulletins, PAHO Situation Reports, and the Consolidated Appeals Process documents produced in Haiti from January 2010-December 2011, available through ReliefWeb were reviewed.

(27) In Sudan, the Consolidated Appeals Process, Humanitarian Workplans, and HeRAMS Reports for Darfur for 2010-2011 were reviewed. Any examples of health facilities assessment data, as well as any reporting of health services coverage or indicators, were extracted for analysis.

The included assessments were entered into data analysis software (NVivo 9, QSR International) and were evaluated for their comprehensiveness and quality, based on two frameworks of minimum standards and indicators for humanitarian health assistance: the Global Health Cluster Suggested Set of Core Indicators and Benchmarks by Category; (15) and the Sphere Humanitarian Charter and Minimum Standards in Humanitarian Response. (28)

To evaluate the comprehensiveness of the included assessments for evaluating a comprehensive package of health services and organizational processes at the facility level, a framework of health facilities assessment criteria was applied to the analysis.

(29) This framework was developed for a previous study, and includes criteria representing 41 different assessment domains that correspond to seven health systems building blocks, (stewardship and leadership, health human resources, health financing and resource allocation, research for development & evidence-based planning and policy-making, health information systems & data for decision-making, community

interventions and health promotion, and evidence-based decision-making). (30) Each of the assessments was coded according to the domains included in the framework. Because few of the assessments included sufficient detail on the kinds of health services provided, the analysis was reduced from the 41 domains to the seven health systems building blocks, using the assessment domains as guiding criteria.

A similar approach was applied for both the Global Health Cluster (GHC) Set of Core Indicators and Benchmarks by Category and the Sphere standards. The assessments were evaluated using the nine GHC indicators that correspond to health resources availability assessments (out of a total of 26 indicators), based on whether they were capable of collecting the necessary data for calculating each of the indicators. The calculation of the GHC indicators requires population estimates, which were assumed to be best measured through other methodologies, rather than through health facilities assessments. (31,32)

A coding system was developed based on each of the Sphere Minimum Standards for Health Action, which correspond to 14 different areas of health priorities and standards. Because many of the Sphere standards exist as broad guides rather than specifically quantifiable measures, (33) the included assessments were evaluated based on whether they contained information that could reasonably correspond to each Sphere standard, using the same approach to coding described above.

Results

A total of 11 assessment tools or databases of health facilities were located in Haiti and 1 in Sudan, of which 9 met the inclusion criteria (Haiti, n=8; Sudan, n=1) (Table 3). In Haiti, 1 assessment tool was excluded (the MSPP NGO Registration Tool –

Version 2011) and 1 database (the Health Cluster list of Cholera Treatment Centres and Cholera Treatment Units), as they did not meet the inclusion criteria. The Ministry of Health in Sudan has conducted health facilities assessments in various parts of the country, however neither the data nor assessment instruments for the Darfur region were retrievable during the course of this study. Given this, and that no key informants were able to provide copies of it, the assessment was determined to be non-existent for the purposes of coordinating a humanitarian response. The results of the analysis of included assessments are summarized in Tables 1, 2 and 3.

Haiti

Following the 2010 earthquake, data on the location, functionality, and services provided by health facilities were largely collected by NGOs or PAHO/WHO. Within these databases, the scope and quality of the data collected varied significantly, with some assessments collecting only data on the physical location and functionality (operational or non-operational) of the health facility, while others collected detailed data on the numbers of beds and health workers present, as well as the health services provided.

The median number of the seven health systems building blocks evaluated by each of the included Haiti assessment tools and databases was 3 (range: 1-6). The evaluation of the health facilities assessment domains revealed that while all eight (100%) of the included assessments contained data corresponding to Stewardship and Leadership, criteria corresponding the rest of the building blocks were less consistently evaluated. The types of health services delivered were included in six (75%) of the assessment tools and databases, however the content of these assessments varied

significantly, ranging from the collection of only the presence or absence of health services delivery without further explanation, to fairly comprehensive assessments including the number of medical devices available such as mechanical ventilators. Many of the included assessments utilized aggregate indicators of health services, which limited the ability to clearly identify their individual components. For example, assessments that included broad groupings of health services into one indicator such as “obstetric care” did not allow for detailed analysis of the comprehensiveness of these services, such as whether these services met the criteria for Basic Emergency Obstetric Care (BEmOC) or Comprehensive Emergency Obstetric Care (CEmOC), or neither. (34,35)

Few of the included assessments collected data that corresponded with the remainder of the health systems building blocks. Health human resources data (such as the number of health professionals present in a health facility) were collected in only four (50%) of the included assessments, while the presence of a health information system (such as an early warning system for communicable diseases) was included in only three (37.5%). Community health interventions (such as malaria bed net distribution of public health education) were included in only two (25%) of the assessments, while data on the presence of evidence-based guidelines or the financing (including user fees) of the health facility were each only included in one (12.5%) assessment.

The median number of the nine Global Health Cluster Core Indicators evaluated by each of the included Haiti assessment tools and databases was 2 (range: 0-5). None of the databases or tools was capable of providing the necessary inputs for calculating

all of the core indicators. Of the individual indicators, the most frequently included was the number of health workers (included in 4, or 50%, of the assessments), followed by the number of hospital beds (included in 3, or 37.5% of the assessments). The remainder of the indicators were evaluated by only 1 or 2 of the included assessments.

The review of Health Cluster Bulletins and the Consolidated Appeals Process documents in Haiti did not locate any additional databases or assessments of health services. Furthermore, the review of these documents did not locate any data or results of any assessments of the effective coverage of health services in the country. One Health Cluster Bulletin from March 15, 2010 noted a study was to be conducted by the International Rescue Committee and Management Sciences for Health to identify gaps in primary health care coverage. Attempts to locate this study by contacting both agencies were unsuccessful, and no key informants made reference to it.

Sudan

In Sudan, the collection of health facilities data in the Darfur region was coordinated by the WHO-led Health Cluster, in collaboration with the Ministry of Health. Data were collected by local WHO staff in the Darfur states, with the support of NGOs delivering health services in the region using the Health Resources Availability Mapping System (HeRAMS), which is a data collection platform developed specifically for use in the Darfur states, and managed by the WHO Sudan country office.

The HeRAMS platform collected data corresponding to 6/7 (85.7%) of the health systems building blocks contained in the framework, neglecting only the collection of data on the application of evidence-based decision-making. HeRAMS was also capable of providing data for calculating 7/9 (77.7%) of the GHC indicators, and these

indicators were reported in various HeRAMS reports that were reviewed and which are publicly available.

Of the nine included assessments from both Haiti and Sudan, none collected sufficient data so as to address all 14 of the Sphere standards. The eight Haiti assessments covered a median number of 4.5 (range 2-12) of the 14 Sphere standards for health service delivery, while the HeRAMS assessment in Sudan collected data corresponding to 13/14 (93%) of the Sphere standards.

Discussion

Major emergencies present a paradoxical opportunity: on the one hand, disasters and conflicts result in the loss of lives and critical infrastructure, and disrupt the lives of large numbers of people, often in countries where basic social services are already fragile. On the other, emergencies have the potential to rapidly mobilize large amounts of technical, material, human, and financial assistance that may not otherwise have been committed. In order to optimally capitalize on this mobilization of resources, humanitarian agencies must rapidly assess what is needed, what is already in the process of being provided, and what is duplicative or ineffective, using methods that are appropriate and through an approach that is trusted by all partners involved.

This study consists of the first field-based evaluation of health services and health facilities assessments conducted during major humanitarian emergencies. Examined collectively and comparatively, the results from Haiti and Sudan present several important findings with regard to health systems data collection in humanitarian emergencies.

First, the results from Haiti found that even during the initial stages of the emergency response, there were several agencies collecting data on the location, functionality, and capacity of existing health facilities and incoming foreign medical teams. Rather than being collected by experts in disrupted health systems or humanitarian health service delivery, however, it appears that much of the data were collected largely by specialist agencies and volunteers, many of whom could reasonably be presumed to have been part of the crisis mapping community that emerged following the earthquake. (36) Groups such as OpenStreetMaps and Ushahidi provided necessary assistance in the mapping of vital infrastructure, including health facilities, while other organizations such as the Sahana Foundation and Travax were actively collecting and disseminating their own data on health facilities. Several platforms – such as Google’s Resource Finder and HealthMap – also utilized many of these databases to create maps of the location of health facilities. It is not known to what extent these platforms were used by responding agencies, however the data were regularly updated and the platforms were easily accessible, which presents a significant advance over many of the other assessments that existed only in online repositories or spreadsheet formats and were far less easily retrievable.

That several individuals and agencies collected, analyzed, and mapped large amounts of health facilities data following the Haiti earthquake suggests that the rapid deployment of information gathering platforms is technically feasible in crisis settings. Furthermore, it suggests that large volumes of data can be collected, even under difficult settings. This is further exemplified by the HeRAMS system in Sudan, where data on health facilities in remote locations as well as in semi-urban camp settings are

collected under precarious security constraints. The obvious corollary to this, however, is that following the Haiti earthquake this did not occur in a coordinated fashion and health systems and health service delivery information, in particular, were not being collected by a central agency such as the Health Cluster or MSPP until well after the initial emergency response. Thus, while several platforms existed and were simultaneously operational in Haiti, they lacked a central coordinating mechanism for ensuring their dissemination, uptake, and validation among the humanitarian community.

Second, this work highlights the need for coordinated health systems information management as part of humanitarian coordination structures, which is also a finding of the review commissioned by PAHO of the Haiti earthquake response. (25) Despite the emergence of eight different attempts at assessing and mapping health systems data following the Haiti earthquake, the results of this study suggest that none provided a comprehensive assessment of emergency health services or the overall functionality of Haiti's health system following the earthquake. Perhaps more concerning is that adherence to agreed upon Sphere standards for humanitarian health action did not appear to play a role in defining essential datasets or assessment criteria. What data were collected do not appear to have been used to generate analyses of the adequacy of the humanitarian response through the calculation of the nine Global Health Cluster core indicators for health resource availability, nor could any of them have comprehensively done so with the data they collected.

In part, this discordance can be explained by the nature of the agencies who conducted much of the health facilities mapping during the initial emergency response,

in that they were infrequently conducted by established experts in humanitarian health systems assessments, nor were they coordinating bodies such as the Health Cluster. Had the technical prowess and reach of the volunteer mapping communities been matched with the health systems expertise of the more established humanitarian health agencies, the resultant product may have been a more coordinated, flexible, centralized information management system. However, this synergy did not occur and the good and the bad were neither scaled-up, nor culled. There were calls for such standardization of data collection (one online wiki created to coordinate volunteer mapping efforts calls for the creation of a central call center for reporting health facilities data, using undefined “PAHO standards” (37)), though this consolidation of information appears to have not occurred within centralized coordination structures.

Conversely, in Sudan, where health services availability data collection is embedded within the WHO-led Health Cluster, a reasonably organized system for collecting, analyzing, and disseminating this information exists. The success of this system lies in the enabling role of the Health Cluster in ensuring that physical and human resources exist to centralize and coordinate data collection and dissemination: WHO field staff and Ministry of Health officials in each state attempt to ensure data are collected from NGO and government-run health facilities and is sent to data management coordinators in Khartoum who process, analyze, and disseminate findings on a quarterly basis. While there is reason to be cautiously optimistic of this system (data are collected under precarious security circumstances within a disrupted health system, leading to legitimate concerns of data quality and accuracy) it provides a reasonable model for the centralization of health systems data collection and analysis

in crisis settings. Further discussion of these challenges is provided in a subsequent manuscript.

Third, the lack of definition of essential health services requires urgent attention in order to establish minimum standards for humanitarian health services delivery and the development of indicators to monitor them. Standardized definitions exist for some groups of health services (such as emergency obstetric care (34) and the Minimum Initial Services Package for reproductive health (38)) and monitoring criteria have been proposed for others, such as surgical care, (39) though others must be developed to address the range of essential health services. The analysis of various assessments for this project was directly hampered by an inability to properly discern the specificity, adequacy, and quality of broad groups of vaguely-defined health services – it would logically follow that decision-making in the field would similarly face such uncertainty when given the same data. (3)

This lack of precision is likely a reasonable trade-off in the early stages of disaster response information management. Rather than creating an expansive, complex assessment, the grouping of services into aggregate indicators is likely the most pragmatic approach given the circumstances. Conducting expansive, comprehensive surveys with large datasets and multiple indicators is likely to consume valuable time and resources, yielding results that are quickly outdated: it is better to be approximately right than precisely wrong. These more complex evaluations likely have a place outside of the emergency, in the recovery stage, when the situation stabilizes and some equilibrium is reached within the health sector, however. The determination of this threshold requires careful scrutiny, and the development of a small number of

useful aggregate indicators during the acute emergency response should be based on a presumed trajectory and evolution toward more detailed health facilities assessments and datasets.

A lack of common definitions of essential health services has been previously noted to be a limiting factor in the ability to analyze the functions of medical services provided during major humanitarian emergencies. Attempts to standardize the definitions of essential health services should be viewed as part of the professionalization of foreign medical teams, where the composition and essential services that these teams provide are currently being determined. (40,41)

Finally, this review provides further evidence to suggest that greater structure for health systems data reporting is needed in information sharing platforms such as the Health Cluster Bulletins. While several examples of reporting of numbers of functioning health facilities in Health Cluster Bulletins and Situation Reports from Haiti were located, none provided an analysis of the adequacy or coverage of health services, leading to significant challenges in interpreting these data. Similar findings have been identified concerning the reporting of epidemiologic data in Haiti, (42) and other reviewers have noted that health systems indicators were seldom analyzed before the earthquake, and “least of all under the chaotic conditions and extreme pressure for immediate action.” (25)

Recognizing that under emergency situations, information exists in a tenuous balance between having too little to make informed decisions, and being overwhelmed by superfluous data, it seems evident that consensus is needed on which kinds of information are most useful for coordinating the health response to an emergency.

From a health services and resources management perspective, what is needed is a specific and timely assessment of which resources are already available and functional, which ones are in the process of being made available, and what services and resources are lacking and could be addressed through the mobilization of national or international resources. Within this determination of essential information resides the recognition that while there is a need for common needs assessments in humanitarian emergencies, this may not necessarily imply that all assessments need to be conducted together, but rather that a platform needs to exist for bringing common data together, even if it has been collected by different actors. To that end, clarity on what these essential data must consist of is vital for ensuring the development of timely and ongoing assessments in future emergencies.

While there may be a place for specific assessment tools, such as HeRAMS, in situations where no health information system exists or where these systems are non-functional, this need not apply to all environments, particularly when reasonable information systems already exist. A potentially more useful focus should include updating and extracting core data and analyses (such as the Global Health Cluster core indicators) from existing information systems, rather than aiming to duplicate or replace them. Conducting such analyses requires the development and mobilization of professionals and NGOs with expertise in the area of health systems in emergencies, similar to what has been advocated for the conduct of field mortality surveys. (13) Such an approach would allow for the collection of relevant data, the conduct of appropriate analyses to obtain useful outputs, and the collaborative development of a strategy for

strengthening the country's health information system (rather than duplicating or replacing it) as part of the recovery.

Limitations

This study has several important limitations that are common to the conduct of field-based research in crisis settings. (43) Owing to the nature of humanitarian responses, characterized by fragmented information management and high staff turnovers, limited institutional memory exists, thus creating the possibility that some data may have been missed. This limitation was likely reasonably mitigated by interviewing 21 key informants in the field, as well as by contacting former humanitarian staff that were able to provide additional insight and access to documents. The results of key informant interviews will be published in a separate manuscript.

This study relies on evidence collected in two different countries and types of humanitarian emergencies: Haiti, whose fragmented health system has been disrupted by an earthquake, an influx of foreign assistance, and a cholera epidemic; and a complex humanitarian emergency in the Darfur region of Sudan, where populations are displaced and health care providers are routinely challenged by insecurity, a lack of resources, and a precarious public health environment. While there is a considerable need to conduct and share research on humanitarian interventions, comparisons from one context to another require careful consideration. (44) The two emergencies studied here are not controlled, comparable environments; however, few settings for humanitarian intervention are, and this is a considerable challenge for public health researchers in this field. (45) Results (including those of this study) are not always

easily transferrable from one context to another, (46) further supporting calls for the development of specialist health systems experts in emergencies who can guide the implementation of complex study designs and analyses in austere settings.

Conclusion

The results of this study suggest that the assessment of the availability and functionality of health services and facilities is technically feasible in emergencies, even under difficult circumstances. Furthermore, this research identifies several examples where groups and organizations collected these data during a sudden onset disaster, and established parallel health information systems *de novo*. While these assessments did exist in Haiti, serious concerns were uncovered related to the quality, analysis, and sharing of their data, with little indication that essential health systems indicators were calculated.

Further work is needed to develop consensus on assessment criteria for health resources and services availability assessments in crisis settings. This should closely mimic packages of essential health services and the ongoing efforts to standardize and professionalize foreign medical teams. Beyond the selection of indicators at the facilities level, guidance is needed for utilizing and analyzing health systems benchmark data collected prior to the emergency, and for calculating the effective coverage of essential health services and core health systems indicators.

References

1. Barmania S. Undercover medicine: treating Syria's wounded. *Lancet*. 2012 May 26;379(9830):1936–7.
2. International Committee of the Red Cross. *Health Care in Danger: A Sixteen-Country Study*. Geneva, Switzerland; 2011.
3. Pavignani E, Colombo S. *Analysing Disrupted Health Sectors: A Modular Manual*. Geneva, Switzerland: World Health Organization; 2009.
4. Carballo M, Daita S, Hernandez M. Impact of the Tsunami on healthcare systems. *J R Soc Med*. 2005 Sep;98(9):390–5.
5. Banatvala N, Zwi AB. Conflict and health: Public health and humanitarian interventions: developing the evidence base. *BMJ*. 2000;321:101–5.
6. Degomme O, Guha-Sapir D. Patterns of mortality rates in Darfur conflict. *Lancet*. 2010 Jan;375(9711):294–300.
7. Burnham G, Lafta R, Doocy S, Roberts L. Mortality after the 2003 invasion of Iraq: a cross-sectional cluster sample survey. *Lancet*. 2006 Oct;368(9545):1421–8.
8. Iraq Family Health Survey. Violence-related mortality in Iraq from 2002 to 2006. *N Engl J Med*. 2008 Jan;358(5):484–93.

9. Ratnayake R, Degomme O, Guha-Sapir D. Coming together to document mortality in conflict situations: proceedings of a symposium. *Conflict and Health*. 2009 Feb 25;3(1):2.
10. Spiegel PB, Robinson C. Large-scale “expert” mortality surveys in conflicts-- concerns and recommendations. *JAMA*. 2010;304:567–8.
11. Spiegel PB, Salama P, Maloney S, van der Veen A. Quality of malnutrition assessment surveys conducted during famine in Ethiopia. *JAMA*. 2004;292:613–8.
12. Checchi F, Roberts L. Documenting mortality in crises: What keeps us from doing better? *PLoS Med*. 2008;5:e146.
13. Spiegel P. Who should be undertaking population-based surveys in humanitarian emergencies? *Emerging Themes in Epidemiology*. 2007;4:12.
14. Wakabi W. Aid expulsions leave huge gap in Darfur’s health services. *Lancet*. 2009 Mar;373(9669):1068–9.
15. World Health Organization. *Health Cluster Guide*. Geneva, Switzerland: Inter-Agency Standing Committee; 2009.
16. Thieren M. Health information systems in humanitarian emergencies. *Bull. World Health Organ*. 2005;83:584–9.
17. Griekspoor A, Spiegel P, Aldis W, Harvey P. The health sector gap in the southern Africa crisis in 2002/2003. *Disasters*. 2004 Dec;28(4):388–404.

18. Burkle FM, Redmond AD, McArdle DF. An authority for crisis coordination and accountability. *Lancet*. 2011 Jun 16;379(9833):2223-5.
19. VanRooyen M, Leaning J. After the tsunami — facing the public health challenges. *N Engl J Med*. 2005;352(5):435–8.
20. Lind K, Gerdin M, Wladis A, Westman L, von Schreeb J. Time for order in chaos! A health system framework for foreign medical teams in earthquakes. *Prehosp Disaster Med*. 2012;27(1):90-3.
21. Pan-American Health Organization. Health Cluster in Haiti Bulletin No. 11. 2010.
22. Gerdin M, Wladis A, Schreeb J von. Foreign field hospitals after the 2010 Haiti earthquake: how good were we? *Emerg Med J*. 2013 Jan;30:e8.
23. Sondorp E, Bornemisza O. Public health, emergencies and the humanitarian impulse. *Bull. World Health Organ*. 2005 Mar;83(3):163.
24. Chu K, Stokes C, Trelles M, Ford N. Improving effective surgical delivery in humanitarian disasters: Lessons from Haiti. *PLoS Med*. 2011;8:e1001025.
25. Pan American Health Organization. Health response to the earthquake in Haiti January 2010: Lessons to be learned for the next massive sudden-onset disaster. Washington, DC: Pan American Health Organization; 2011.
26. Kohler JC, Pavignani E, Michael M, Ovtcharenko N, Murru M, Hill PS. An examination of pharmaceutical systems in severely disrupted countries. *BMC Int Health Hum Rights*. 2012 Dec;12:34.

27. ReliefWeb [Internet]. [Accessed Feb 5, 2012]. Available from:
<http://www.reliefweb.int>
28. The Sphere Project. Humanitarian charter and minimum standards in humanitarian response. United Kingdom: Practical Action Publishing; 2011.
29. Nickerson JW, Adams O, Attaran A, Hatcher-Roberts J, Tugwell P. Monitoring the ability to deliver care in low- and middle-income countries: A systematic review of health facility assessment tools. Unpublished manuscript.
30. Canadian Society for International Health. CSIH Approach to Health Systems Strengthening. 2004.
31. Bengtsson L, Lu X, Thorson A, Garfield R, von Schreeb J. Improved response to disasters and outbreaks by tracking population movements with mobile phone network data: A post-earthquake geospatial study in Haiti. *PLoS Med*. 2011;8:e1001083.
32. Bostoen K, Chalabi Z, Grais R. Optimisation of the T-square sampling method to estimate population sizes. *Emerg Themes in Epidemiol*. 2007;4:7.
33. Griekspoor A, Collins S. Raising standards in emergency relief: how useful are Sphere minimum standards for humanitarian assistance? *BMJ*. 2001 Sep 29;323(7315):740–2.

34. Bailey P, Paxton A, Lobis S, Fry D. The availability of life-saving obstetric services in developing countries: An in-depth look at the signal functions for emergency obstetric care. . *Int. J. Gynaecol. Obstet.* 2006;93:285–91.
35. Echoka E, Kombe Y, Dubourg D, Makokha A, Evjen-Olsen B, Mwangi M, et al. Existence and functionality of emergency obstetric care services at district level in Kenya: theoretical coverage versus reality. *BMC Health Services Research.* 2013 Mar 25;13(1):113.
36. Harvard Humanitarian Initiative. *Disaster Relief 2.0: The Future of Information Sharing in Humanitarian Emergencies.* Washington, D.C. and Berkshire, U.K.: UN Foundation & Vodafone Foundation Technology Partnership; 2011.
37. CrisisCommons Wiki. Haiti Hospital Capacity Finder [Internet]. 2010 [Accessed Feb 5 2012]. Available from:
http://wiki.crisiscommons.org/wiki/Haiti_Hospital_Capacity_Finder
38. Austin J, Guy S, Lee-Jones L, McGinn T, Schlecht J. Reproductive Health: A Right for Refugees and Internally Displaced Persons. *Reprod Health Matters.* 2008 May;16(31):10–21.
39. Burkle FM, Nickerson JW, von Schreeb J, Redmond AD, McQueen KA, Norton I, et al. Emergency surgery data and documentation reporting forms for sudden-onset humanitarian crises, natural disasters and the existing burden of surgical disease. *Prehosp Disaster Med.* 2012 Dec;27(6):577–82.

40. Nickerson JW, Chackungal S, Knowlton L, McQueen K, Burkle FM. Surgical Care during Humanitarian Crises: A Systematic Review of Published Surgical Caseload Data from Foreign Medical Teams. *Prehosp Disaster Med.* 2012 Apr;27(02):184–9.
41. Walker P, Hein K, Russ C, Bertleff G, Caspersz D. A blueprint for professionalizing humanitarian assistance. *Health Aff.* 2010 Dec 1;29(12):2223–30.
42. Dhillon P, Annunziata G. The Haitian Health Cluster experience: A comparative evaluation of the professional communication response to the 2010 earthquake and the subsequent cholera outbreak. *PLoS Currents.* 2012 Sep 5;4:e5014b1b407653
43. Morton M, Levy JL. Challenges in disaster data collection during recent disasters. *Prehosp Disaster Med.* 2011;26:196–201.
44. Mills EJ. Sharing evidence on humanitarian relief. *BMJ.* 2005;331:1485–6.
45. Robertson DW, Bedell R, Lavery JV, Upshur R. What kind of evidence do we need to justify humanitarian medical aid? *Lancet.* 2002 Jul 27;360(9329):330–3.
46. Chinnock P, Siegfried N, Clarke M. Is evidence-based medicine relevant to the developing world? *PLoS Med.* 2005 May;2(5):e107.

Table 3.1 – Included Assessments or Databases of Health Facilities and Health Services Availability

Haiti (n=7)	Sudan (n=1)
Travax Database	Health Resources Availability Mapping System (HeRAMS)
Sahana Foundation Database	
International Organization for Migration (IOM) Displacement Tracking Matrix (DTM)	
Ministère de la Santé Publique et de la Population (MSPP) Elaboration de la Carte Sanitaire, Niveau SSPE & Niveau HCR	
Pan-American Health Organization (PAHO) Haiti Health Facilities Master List	
Health Cluster 4W List	
Clinton Foundation List of Health Facilities	
Health Cluster List of Mobile Clinics	

Table 3.2 – Analysis of Included Assessments and Databases Using Health Systems Indicators and Global Health Cluster Core Indicators

	Haiti Health Facilities Lists (n=8)	Sudan Health Facilities Lists (n=1)
Assessment Characteristics, No. (%)		
NGO	2 (25%)	0 (0%)
PAHO/WHO	3 (37.5%)	1 (100%)
Ministry of Health	1 (12.5%)	0 (0%)
Other	2 (25%)	0 (0%)
Health System Building Blocks, No. (%)		
Stewardship & Leadership	8 (100%)	1 (100%)
Health Human Resources	4 (50%)	1 (100%)
Health Financing & Resource Allocation	1 (12.5%)	1 (100%)
Health Information Systems	3 (37.5%)	1 (100%)
Evidence-based decision making	1 (12.5%)	0 (0%)
Service Delivery	6 (75%)	1 (100%)
Community Interventions & Health Promotion	2 (25%)	1 (100%)
Inputs for Health Cluster Core Indicators, No. (%)		
Average population per functioning health facility	2 (25%)	1 (100%)
Number of HF with BEmOC/500,000 pop.	1 (12.5%)	1 (100%)
Number of HF with CEmOC/500,000 pop.	1 (12.5%)	1 (100%)
Percent of HF without stockout of a selected essential drug in 4 groups of drugs	1 (12.5%)	0 (0%)
Number of hospital beds per 10,000 pop.	3 (37.5%)	1 (100%)
Percentage of HF with clinical management of rape survivors + emergency contraception + PEP available	1 (12.5%)	1 (100%)
Number of health workers (medical doctor + nurse + midwife) per 10,000 pop.	4 (50%)	1 (100%)
Number of CHWs per 10,000 pop.	1 (12.5%)	0 (0%)
Number of consultations per clinician, per day	2 (25%)	1 (100%)

Table 3.3 – Analysis of Included Assessments and Databases Using Sphere Indicators

Sphere Indicator	Haiti Health Facilities Lists (n=8) n, (%)	Sudan Health Facilities Lists (n=1) n, (%)
Reproductive Health	3 (37.5%)	1 (100%)
Prioritising Health Services	4 (50%)	1 (100%)
Prevention of Vaccine-Preventable Diseases	1 (12.5%)	1 (100%)
Non-Communicable Diseases	2 (25%)	1 (100%)
Mental Health	1 (12.5%)	1 (100%)
Leadership and Coordination	8 (100%)	1 (100%)
Injury Care	1 (12.5%)	1 (100%)
Human Resources	4 (50%)	1 (100%)
Health Service Delivery	6 (75%)	1 (100%)
Health Information Management	3 (37.5%)	1 (100%)
Health Finances	1 (12.5%)	1 (100%)
Drugs and Medical Supplies	3 (37.5%)	0 (0%)
Communicable Disease Prevention	2 (25%)	1 (100%)
Communicable Disease Diagnosis and Case Management	3 (37.5%)	1 (100%)

Chapter 4 – What Kinds of Health Systems Information Do Humanitarian Aid Workers Need? Interviews with Practitioners in Haiti and Sudan

Nickerson JW, Adams O, Attaran A, Hatcher-Roberts J, Tugwell P.

Abstract

Background: Timely information on the location, functionality, and capacity of health services is essential for prioritizing needs during major emergencies. Health services are the point of contact for patients and the health system, and are vulnerable to disruption during emergencies. During recent disasters, large numbers of foreign medical teams – including field hospitals – have been deployed, adding additional uncertainty to the coverage and capacity of the health system. In the absence of reliable systems to effectively monitor who is where, doing what, and what capacity they have to do it, it is impossible to determine whether the needs of the population are being met or whether efforts are being duplicated.

To determine what kinds of information are most useful for prioritizing humanitarian health assistance in emergencies, we conducted semi-structured interviews with key informants in Haiti and Sudan who had responsibilities for implementing health programs. The interviews focused on their information needs, perceptions of available data and information, and perspectives on how data collection strategies could be refined to more adequately address their needs.

Methods: Key informant interviews using a convergent interviewing methodology in Haiti and Sudan. Interviews were audio recorded, when possible, and transcripts were developed and entered into qualitative data analysis software. Transcripts and interview notes were analyzed using a general inductive approach and common themes were extracted and analyzed.

Results: 21 participants representing a variety of different international organizations participated in this study. The interviewees provided diverse perspectives on their own

information needs, as well as the design of health information systems in humanitarian emergencies. In general, participants felt that information on the location, functionality, and services provided at health facilities was useful for their programs, though for different reasons ranging from patient referrals to gap analyses in the coverage of health services. Participants identified a range of concerns and challenges with current efforts to collect these data and proposed ways of dealing with uncertainties in the data. Although participants identified many similar themes, there was little consensus on the specific aspects of each of these themes, such as descriptions of specific data collection systems or indicators, or the complexity required from different assessment tools for formulating health programs and interventions.

Conclusion: Information and data on disrupted health systems is of value to humanitarian health responders, and this should be made a priority at the outset of future humanitarian responses. The information and data should be widely shared and validated by experts with expertise in disrupted health systems.

Introduction

Timely public health information is vital for responding to major humanitarian emergencies. Yet, after every major emergency, there are calls for better coordination and information management, and more coordinated and targeted needs assessments in future emergencies. (1–3) This is not due to a total absence of information systems nor data; Health information systems (HIS) are often developed and deployed within the emergency phase of disaster response, providing timely and useful surveillance of salient health needs. However, these systems frequently lack the capacity to collect data on the availability and functionality of health services and translate this data into evidence for decision-making.

Outside of a handful of epidemiologic measures (rates of malnutrition and mortality being the most widely recognized), there is often significant variation in the methods used in the collection of other types of public health data in emergencies. (4–6) Concerns regarding health information systems in humanitarian emergencies have been voiced for some time, with authors noting that “the catalogue of complaints against HIS is long: a plethora of approaches and methods exist, with few tools for integrating them; terminology may be ill defined and confusing; many of the existing tools and methods are used ineffectively or inefficiently because they were designed for one particular application but are used in many others; existing information is difficult to access.” (7)

Within these information systems, the collection, analysis, and use of pertinent health service availability evidence provide an essential foundation for directing effective health interventions during emergencies. Knowing who is where, doing what,

and what capacity they have to do it is essential for estimating gaps and prioritizing emergency relief to supplement disrupted or poorly-equipped health services that may be overwhelmed or non-functional. The failure of these coordination mechanisms is well-documented following previous emergencies, where health services were duplicated for some populations while wholly absent for others, or have neglected the health needs of large sub-populations, such as the elderly. (8–10)

Two previous studies conducted as part of this project demonstrated that there are a large number of health facilities assessment tools currently in use in low- and middle-income countries. These assessments utilize different indicators and approaches, and thus limited the comparability of data between countries where different assessments may be deployed. Furthermore, a review of the health service availability assessment tools that were used during emergencies in Haiti and Sudan in order to capture details of the location, functionality, and capacity of health facilities revealed many similar challenges. Regrettably, however, there was little indication that many of the tools used in emergencies had any grounding in health systems frameworks, and most had little capacity to generate essential analyses of health system indicators or benchmarks.

This study presents the results of interviews conducted with key informants in Haiti and Sudan, focused on the use of health service availability information for coordinating humanitarian operations. The interviews focused on participants' perspectives on the best means of collecting, analyzing, and sharing evidence on the functionality of health systems during major emergencies in low- and middle-income countries (LMIC).

The purpose of this study was two-fold: first, the interviews focused on identifying how participants used health services availability evidence in an operational context in Haiti and Sudan. Second, the interviews provided insight to determine what kinds of health service availability tools and indicators were most useful in the field for developing health programs in a coordinated humanitarian response. The interviews explored interviewees' information needs and their perceptions of how to improve the existing assessment tools and indicators and how best to share evidence on the availability, functionality, and capacity of health services and health facilities in emergencies.

Methods

This study was approved by the University of Ottawa Health Sciences and Sciences Research Ethics Board.

Interviews were conducted with key informants representing a diverse group of stakeholders with responsibilities for coordinating or delivering health services during major humanitarian emergencies in Haiti or Sudan. The key informants were identified through consultation with implementing partner agencies in the field or publicly available lists of contacts with subsequent snowball sampling for locating additional contacts. (11) All participants were provided with information concerning the nature of the study, and written informed consent was obtained from all participants.

One interviewer (JWN) conducted semi-structured interviews with participants during field visits to Port-au-Prince, Haiti (November/December 2011) and Khartoum and North Darfur, Sudan (May 2012). Because of presumed differences among interviewees due to different locations and experiences, a convergent interview

research methodology was used, allowing for the analysis to converge on important issues common throughout the interviews. Convergent interviewing is a structured process for conducting and analyzing in-depth interviews with key informants using an initial set of interview questions, followed by interim data analysis following each interview which then allows for the development of new probing questions for subsequent interviews based on previous results, themes and concerns. (12)

Where possible, interviews were audio recorded and transcribed; otherwise, detailed notes were taken and written up after the interview. All data, including audio files, transcripts, and relevant notes, were entered into NVivo9 software (QSR International, Australia). Data were analyzed using a general inductive approach to data coding and analysis, with codes developed from multiple readings of the transcripts or notes. (13)

The audio files were transcribed, and the transcripts and notes were read three times by one author (JWN): first to identify a list of codes, next to code the documents, and a third time to ensure consistency in coding. The results are presented based on the thematic analyses. All transcripts had identifying information removed.

Because of time, financial, logistical, and security constraints, it was not possible to expand the interviews in Sudan to other regions of Darfur. In Haiti, the density of aid agencies in Port-au-Prince was high, allowing the interviews to take place in one city, without the need to travel. All of the interviewees in Haiti had experience outside of the capital, providing insight into programs in different locations. In both countries, interviews were frequently conducted under difficult circumstances, which placed restrictions on the interviewer, including conducting interviews in noisy environments

such as airport hangars or in high-traffic areas, thus limiting the ability to effectively record audio. In some instances, participants agreed to an interview but not to audio recordings. For these reasons, field notes were of great value for ensuring the capture of important data that helped develop the concepts and themes for the analysis.

Results

Interviews with 21 participants (14 Haiti; 7 Sudan) were conducted with participants from a wide range of organizations, including international non-governmental agencies (n=8), the World Health Organization/Pan-American Health Organization (n=7), consultants or technical experts (n=3), international intergovernmental organizations (n=2), and governmental agencies (n=1).

The interview participants in this study were all actively engaged in humanitarian operations at the time of the interview, with responsibilities for the management of health service delivery, health system strengthening, or various aspects of monitoring and evaluation of health programs or health systems. Several of the participants had overlapping roles, such as providing clinical services, but also managing health service delivery for an organization. All of the interviewees were in leadership positions and had insight into their organizations' decision-making processes, including the establishment of new programs or the coordination of other humanitarian aid agencies.

The interviewees provided diverse perspectives on their own information needs, as well as the design of health information systems in humanitarian emergencies. Participants' perspectives converged on several broad themes, which are described below, however there was little consensus on the specific aspects of each of

these themes, such as descriptions of specific data collection systems or indicators, or the complexity required from different assessment tools for formulating health programs and interventions.

A crosscutting theme in three of the interviews conducted in Haiti addressed the use of open source/open access data collection and analysis platforms for mapping the location of and resources available in health facilities. Because these were deployed only in Haiti and not in Sudan, and address various aspects of the above themes, the analysis of these issues is contained separately.

Differences emerged among individuals concerning the role and usefulness of health service availability indicators and data; there was not a clear difference between interviewees in Haiti and Sudan. Participants' perspectives reflected the broad themes that are described, below, and while there were differences, these were often subtle or nuanced, and not paradigmatically different.

Because of the often very basic data that existed on the health system and the availability of health services, broad definitions are often applied that reflect the availability, rather than capacity or quality of health services. For example, the functionality of a health facility is reduced to either "functional" or "non-functional" meaning that it is either open (functional) or closed (non-functional), with very limited assessments of quality.

Using Data for Decision Making

Interviewees expressed considerable support for efforts to collect information on the availability of health services. Yet, their rationale for this support varied considerably depending on their roles. Those who worked most closely to service

delivery or patient care (n=4) expressed a desire for information that reflected the location and capacity of health facilities, largely to enable them to refer patients who required care that they were incapable of providing, and identified this information as a priority.

“Start with big hospitals that I can send somebody [to] who is going to do die.”

“We got many patients a day, they were on the floor, but also the number of patients was higher than the number of beds in total in the capital. But we had the information because they [the Health Cluster] were getting information from everywhere, how many beds were free, so it was not bad.”

Interviewees with responsibility for the management of health programs (n=7) envisioned a theoretical use for gap analyses of the coverage of health services in order to identify weaknesses, which could then be used as evidence of a need for expanding their programs. However, few participants could identify such opportunities outside of acute emergencies. They identified the use of these data largely for the purpose of completing donor reports or requesting further funding for existing programs, because most programs were already operational and the agencies were frequently operating at their maximum capacity, with few plans to expand.

“Before...collecting information to put in a proposal, we use this data, but not daily, not like weekly, no.”

“But for [the database], again, I would say we are using [it] really for proposals.”

Participants whose responsibilities included health system-level (n=10) coordination within countries or regions provided a broader perspective on data collection and usage with a linkage to coordination of other agencies and the rebuilding

of disrupted health systems. At this level, participants identified a need for detailed analysis, provided by readily available and comparable indicators.

"We have the map that shows who's doing what where, then there's the other information that shows these are [internally displaced persons] camps because these are the most vulnerable - this is two or three camps in Darfur. So these would be the areas that we would focus on based on the density of the population and based on the number of partners in that area. Then for example there are areas that we know would be cutoff during the rainy season so again these are there on the map and we know that these are the partners that we need to fund so they can get their supplies in before the rainy season or they'll be cut off for 4, 5, 6 months."

Ultimately, interviewees did not frequently identify a strong evidence base (such as using an evidence based framework or systematically-collected data for gap analyses) upon which their programs were established. This was in part related to weaknesses in the evidence available concerning the availability of health services and the health system, but also to entrenched ways of doing things by international organizations that may rely on local knowledge or organization-specific data and information. Participants with responsibilities for the management of health programs identified a strong role for needs assessments in their programs; however, these were often conducted by the organization themselves, rather than relying on existing, or drawing from multiple, assessments.

"I think this system lacks any sort of effective measure that would help any NGO kind of direct its activities, and in fact a lot of those decisions are made even before showing up in the country, so they're almost not even correlated with data."

"We start with "are we working in that area? or is this a completely new area? Is this something that just popped out of nowhere?" When I say "we" I should say health actors. If there's a health actor working in that area, or not. If they are, what are they doing? What's their capacity? Are they exhausted? Are they not able to continue? Are they not able to do anything?"

Collecting Health Systems Data

Participants were clear that they favored data collection by on-site visits to health facilities conducted by knowledgeable assessors. They expressed skepticism of other methods that used more indirect methods, such as relying on secondary data sources or collecting data by phone or other means. It was also felt that particularly in a very fluid environment (such as the early stages of an emergency) that these data would require updating at regular intervals. Interviewees were supportive of a need to share basic information on their activities and programs as a part of data sharing for humanitarian coordination, though they also felt that by asking agencies to submit data about their own programs, this may introduce biases into the data.

The participants expressed a need for the data collection and updating process to be conducted by content experts. This largely related to concerns of accuracy in the reporting of indicators, as well as the perceived burden to front-line staff (such as clinical or administrative staff) who are already often required to participate in multiple reporting systems. What was clear was that if reporting of activities was to be required from implementing partners or agencies in the field, useful information, data, and analysis had to be provided back to them.

Many participants viewed the responsibility for establishing and maintaining information systems as a shared responsibility between the WHO-led Health Cluster and the Ministry of Health. Many participants lamented the fact that many information systems established *de novo* during emergencies were owned by international staff or organizations who may have duplicated systems already in place and who may lack longer-term mandates to ensure the continuity of the information systems they develop.

“Big turnover here... I would say that is already a problem in here, just speaking about institutional memory, or just knowing people, getting the contacts, getting the context, those kinds of things was already very difficult... If something like really particular has been missed out, I don't know. I can't tell.”

“I would say that the systems that are in place at the moment are very insufficient. And there have been many systems that we could say were parallel... But these systems are, at the same time, very limited.”

Participants were less clear as to the amount of data that could or should reasonably be collected at various stages of the emergency. While there was a desire for more information, there was uncertainty as to what would be a reasonable expectation to ask of responding agencies or of field assessment teams in terms of reporting on their activities, the services provided, and their outcomes. This ambivalence was reflected in conversations concerning both acute (Haiti) and protracted (Sudan) emergencies, with perspectives spanning a broad spectrum, from a desire for complex datasets to very basic ones. Many of the explanations for not wanting more data were

related to a perceived burden on staff who would be required to participate in data collection and reporting systems.

“In the acute phase, you can't ask too much... Later on, you can do that. But, in the beginning, absolutely not. But then really only the information that you can get is what you really need now, that everybody needs. After that maybe there is more room.”

“You would tend to think that the logical rational thing to do post-earthquake would be to collect those basic information that you need, right? That's not precisely what was done, it's kind of what was done, but a bit more because there was also a drive to like ‘well, while we're at it there's so many other things that we need to collect’ and that's how you end up with this ridiculous, long survey, you know, when really that information is at best, you know, kind of useful, at worst irrelevant.”

At the same time, several participants wanted more specific data than what was available in current databases to guide programs.

“...for example, [the database] shows yes there is [emergency obstetric care] services or there is a lab, but when you go there lab has nothing to do, they have no reagents, nothing. [The database] shows theoretically, sometimes, what we have in the areas, but sometimes [it is] not showing the real situation.”

Data Analysis

There were differing perspectives on what kinds of analyses were most useful and how they should be presented. Assessments of access to and coverage of health services was of particular importance, though this information was rarely available and interviewees provided inconsistent assessments of these measures within both countries, ranging from views that access to health services was very good to very poor

within the same regions. It became obvious that while there were many opinions on the accessibility and coverage of health services, these were largely anecdotal and unsupported by empirical evidence, which in turn resulted in inconsistent conclusions. *“There the ministry of health was very much good in saying OK there are problems, maybe health NGOs are absorbing some of the staff from hospitals, but at the end of the day what's happening now soon after the earthquake is an historical change because in the history of the country, the people of Haiti they never had such access to healthcare before... I really don't believe we destroyed the system. We helped a recognition of the weakness of the system to emerge, then we were substituting. But if you tell me that we should go back to what was the system before the earthquake, so I prefer to destroy it and do something new.”*

“...if you imagine, today we are only a few NGOs providing free care. Yes, people had more access during the emergency than before and then now. That's also a big problem, people here they don't have access to health [services] at all.”

These quotes highlight the fact that the density of providers delivering healthcare and access to these services fluctuated significantly during and after the earthquake. Given these changes, in absence of analyses of health service availability data, it is nearly impossible to accurately gauge whether access and coverage are sufficient, or not, as shown by the uncertainty in responses from participants.

Measuring gaps in coverage and access to health services was viewed as being a potentially significant form of analysis by most interviewees that should be linked to coordination or response functions. However, concerns were raised that while considerable amounts of input data were frequently collected (such as the location of

health facilities and the services provided), there were rarely any measures of quality or sufficiency to determine whether these inputs were adequate or effective.

Furthermore, the quality of the data available were often viewed as being limiting factors in the ability to establish estimates of coverage or access.

“They have to provide us with a narrative. Because usually in our reports, for example, we write [that] 60% of the population are covered with primary health care, irrespective of the quality. Because we don't know these facilities are really providing the best care, or providing it with the right quality that we are calling for.”

“To measure access or coverage you would have to have much better data than is currently available on like the most fundamental basic thing which is the location of health facilities... So, months ago, back when I believed in the quality of data that was produced, I did an access... analysis and I was getting all fancy and doing like network analyses and it was beautiful, but the data were so bad that I mean it's really worthless.”

Information management

A recurring concern expressed by interviewees was that data and information were not always easily retrievable, and when they were, the data were rarely available in a format that allowed them to be analyzed or compared for accuracy or validity. The absence of the availability of databases and poor access to raw datasets were significant frustrations for many interviewees and also added to skepticism of the quality of the aggregated data provided. This often limited participants' ability to conduct analyses of relevance to their programs, and also resulted in a lack of clarity surrounding data ownership and sharing. The resultant effect of the absence of reliable data and consistent analysis was the perception that large volumes of information were being

collected, with significant financial and time expenditures that yielded little practical insight into field operations.

“With that, we cannot look at the database, it's the information that was given. It cannot tell us how many NGOs there are, how many doctors there are, where they are working, etcetera... The [database], for me, is an urban legend.”

“Very little of it is freely available, very little of it is useful, next to nothing of it is cross-queriable, next to nothing of it has a geographic component that makes it usable with other sources of information. But so much information has been collected here.”

In Haiti, where a large amount of data were produced, the use of databases was sometimes clandestine, rather than openly available, which limited the ability of analysts to share and query them.

“And to be honest, this - I don't actually have the database, they gave me a copy of the report and I retyped it line by line because I needed it. And that's an absurd way to go about data sharing. Like, it's... That's the general state of how people feel about sharing data here. And I've gotten to the point where... Fabulous! I will be more than happy to retype that report because otherwise you just never will get data”

Managing Uncertainty

There was considerable skepticism among interviewees as to the accuracy and reliability of the health systems data that were frequently available. While participants were cautious of the data, many were aware of the limitations of data collection, in general, in crisis settings and cautiously selected what they felt best represented the situation on the ground, and supplemented it with their own assessment data or knowledge. There was a strong desire to institute validity checks to compensate for

uncertainty and known or perceived errors in the health systems data that was being distributed, but also to update data that had been collected previously and was known to be inaccurate or outdated, yet still used.

"...there was a database - I think it was, you could access it through the internet, it was in Washington - from a survey made 2003 or 2004 and it contained thousands of health facilities throughout the country, but at that time it was outdated and most of these health facilities had no capacities. So it was completely inaccurate for organizations working on the ground."

Participants in both countries were not only skeptical of the available data, but could cite specific examples of errors in data or information that were available. To manage this uncertainty, participants expressed a strong need for active validation and confirmation of data that were available. A recurrent theme was that data should be collected from primary sources through on-site visits, rather than through secondary sources, whenever feasible. This had particular salience in settings where temporary field hospitals may have been established, which by their nature are temporary substitutes for a disrupted health system, and not permanent structures. Without an active surveillance system, it became difficult to determine which temporary facilities were still active, and which were closed.

"I think that even teams who are supposed to be hitting the pavement... they have trouble deleting closed sites out of it because they try to get someone on the phone to verify whether the site is still functioning, and if the site is not still functioning, you will never get someone on the phone. So, that's one where they're supposed to have an active data gathering force, but like, this doesn't do it, either. Like, you literally have to go look at that

site, so you have to know where it was to begin with and that can be tricky, you have to go look at that site and ask around.”

Ideal Health Information System for Monitoring the Availability of Health Services

Interviewees expressed a range of perspectives on how data collection systems could be refined to be more suitable for guiding decision-making in the field, which overlapped broadly with issues of regulation and the coordination of humanitarian agencies during emergencies.

“What I probably would do in any case is I would focus immediately on information. Information gathering and dissemination. I think that that's really - I would get two or three people just to do that. Register people that are coming in, make it known that there is somebody coordinating this, get it all together, [send] it out.”

What most participants desired was consistency in the ways that data were collected, so as to allow datasets to be queryable, linked, and comparable with other types of data (such as population figures). Interviewees were also clear that they wished to have one source for all population health and health systems information, and for the data collection process to be as consistent as possible. While service availability data were of importance, so too were basic administrative functions, such as financing and ownership of the health facilities and the details of available health human resources.

“The system needs to be capable of telling me how many doctors there are, how many of them are specialists, how much of the services are contracted, etc. To know this, you need

to have a system that continues to register. All of the administrative processes must be obliged to make reference to this system, and that does not exist.”

When data were synthesized and analyzed, there was a desire to have this information presented in ways that were immediately usable and recognizable, such as in figures and maps, with datasets to accompany them. Participants recognized that the kind of data collected was complex, but desired this information to be synthesized into formats that were easily usable. The desire for complex forms of data collection and data analysis was tempered by the realities of the context in which data were being collected and the limitations imposed by logistics, insecurity, and other constraints. *“you run into a very simple problem which is that at the end of the day you can have a nice website, you can have all resources you want at the central level, if the person at the very bottom of the chain doesn't have the incentive or quite frankly the capacity, the physical capacity to make that data updated, I mean, it's as far as you'll get.”*

Open and Crowdsourced Data

In Haiti, many interviewees were familiar with efforts to collect information on the location of health facilities using open platforms and crowdsourced approaches such as OpenStreetMaps (OSM). The interviewees expressed both support and skepticism of this approach for collecting different kinds of data. The benefits and risks of using an open or crowdsourced approach to data collection were identified by different interviewees, and included an appreciation of the fact that open data could be collected quickly, did not require specialized technical expertise for basic data collection (such as the location of a hospital), and could be shared easily.

“People want a system that's online and everyone's going to be able to be able to contribute to, and so I mean, I don't advocate anyone building their government strategy based on you know whatever someone's written on Wikipedia or added to OpenStreetMap, but I mean if you can download data, check it, and say yeah that seems about right, and then compare it to your old data you'll probably find new information.”

It was, however, unclear how participants envisioned utilizing these data as part of a rigorous assessment strategy to collect complex data concerning health facilities, their capacities, and gaps within the system. Rather, open, crowdsourced platforms were regarded more as a potential starting point for data collection as opposed to a final product or catch-all solution to information management.

Discussion

While structured, common needs assessments are becoming the accepted standard of practice within the humanitarian assistance community, (3) we believe that this is the first study to critically evaluate how health systems data are used and viewed by those with responsibilities for coordinating and delivering health programs in the field during major emergencies.

Despite a growing desire for humanitarian assistance to be evidence-based and guided by rigorously collected field data, this may not always be feasible. The urgency and necessity of service delivery takes precedence over the establishment of information systems, (14) resulting in field epidemiologic surveys that are of poor quality, (15) information being released in the initial stages of an emergency of questionable quality, (16,17) and services being delivered in absence of an overall coordinating mechanism. (18)

The participants in this study placed a clear value on the existence of health systems data to guide program delivery and development, though the rationale for wanting this information varied based on the interviewee's role in delivering or coordinating health services. The most basic use of health systems data concerned the delivery of clinical services, where interviewees needed to know where to refer patients requiring more complex care than they could offer. This represents a basic use of information that could also reasonably be assumed to be of value to patients themselves who need to know where to seek appropriate care.

More complex patterns of health systems data utilization emerged among interviewees with responsibilities for coordinating the delivery of health services in more senior leadership roles. At this level, interviewees noted the need for both the same basic geographical information as those on the frontline of service delivery, but also for more nuanced needs assessment data to estimate gaps in the coverage of health services.

The interviews in this study revealed that although participants placed value in data and information on the functionality of health systems, the systematic use of this information within program delivery appears optimistic, but not currently grounded in reality for most participants. At a coordination level, several participants were able to cite specific examples of how health systems data linked to geographic information informed more enhanced situational analysis based on population movements or climatologic information. However, within aid agencies, the most frequently cited use of this information was in writing reports or requests to donors. This was most likely due to the timing of the interviews, which took place outside of the acute phase of an

emergency, and when most programs were several years into their operation. As such, these programs were often more static than dynamic in their growth, had set mandates and programmatic goals for the coming years, and were not seeking to expand their services.

Even when gaps in health services are identified, this has not, in the past, been a positive predictor of the scaling up of humanitarian assistance. During the Horn of Africa famine in 2011, for example, famine early warning systems identified a looming disaster in the months leading up to the declaration of famine, yet this resulted in only a modest response. (19) Thus, while there is a clear desire for humanitarian assistance to be predicated on identified needs, our finding that this process is less than linear is not surprising.

The participants from interviews in Haiti, in particular, noted that data were frequently being collected, but expressed serious concerns regarding access to this data. Data availability has been a longstanding challenge within the humanitarian assistance community, where reports of assessments or the raw data, are frequently held by agencies rather than widely shared. (20) We found that participants felt that agencies may be willing to share reports and assessments if directly asked, but that a recurrent concern was the lack of a central repository for managing this information in-country, and a lack of access to original datasets rather than analyzed reports. In absence of this, interviewees were often vaguely aware of reports or assessments, yet were unsure where or how to obtain them. Given that an information sharing platform with country-specific capabilities (ReliefWeb) does exist, it is unclear why this was not being utilized for precisely this purpose.

A clear example of discordant perceptions of important health systems metrics lies in interviewees' perceptions of access to health services in Haiti, where considerable debate has emerged regarding whether the impact of humanitarian assistance following the 2010 earthquake strengthened or weakened the health system. (21,22) Participants provided assessments of access to health services that ranged from very positive to very poor, with little evidence to suggest either was accurate. While the answer to the question of access is undoubtedly complex, it suggests that structured, timely, and rigorously collected assessments of important health systems metrics are important for a coordinated response among different agencies.

Our interviews show that under these circumstances, it is clear that to establish effective health systems information management practices, comprehensiveness must give way to brevity, in favor of data collection that is useful, accurate, and operationally relevant for those coordinating and delivering health services. (23) Basic information such as who is where, doing what, becomes the foundation from which more precise, granular data ought to evolve to generate useful analysis such as assessing the coverage of different health services. Ensuring that these basic data are collected and available for aid agencies on the ground is essential, something which participants in this study highlighted as often lacking. Managing this uncertainty was a recurrent theme in the interviews, as was considerable skepticism concerning the validity and accuracy of information collected.

Participants in this study identified several important characteristics of health systems information collection, dissemination, and use that are of importance to the future deployment of assessment tools and information platforms for data sharing in

crisis settings. Three essential components of an effective system for monitoring the availability and functionality of disrupted health systems in emergencies emerged from the interviews conducted for this study: (1) Reliable and pragmatic indicators that assess core functions and services within health systems; (2) Appropriate data collection methods to ensure that data include as many points of service delivery as possible; and (3) Platforms for data sharing to enable the use and validation of collected data within the humanitarian community.

We found that participants had significant concerns with regard to the quality, comparability, use, and relevance of health systems data in both Haiti and Sudan. Some of these concerns arise as a result of working within complex humanitarian emergencies, where data collection efforts may be hampered and end-users of information are in a position of “making (rough) sense of (shaky) data”. (24) While data validation is an important aspect of any surveillance system, so too is an understanding of the limitations of data collection, which can be impacted by insecurity and rapidly changing situations, which are also important factors in restricting the implementation of public health interventions. (25)

When raw datasets were available to participants, there were concerns of their utility, owing to inconsistencies in reporting or categorizations of data, and the collection of data that were not viewed as useful. Interviewees highlighted issues such as inconsistent reporting of address hierarchies or GPS coordinates, the collection of highly specific data (such as the number of stethoscopes) rather than more general service provision data, and indicators that could easily be misinterpreted (such as one indicator for “Basic Emergency Obstetric Care” in absence of the separate

corresponding signal functions). Standardizing the reporting format, the indicators used, and explicitly denoting the criteria that must be met to satisfy their inclusion can address many of these concerns.

Participants offered unclear perspectives on the success and challenges of using crowdsourced and open data platforms for collecting health facilities data in Haiti. While there are clearly advantages to this approach, it appears unreasonable to assume that crowdsourcing health facilities data collection would produce reliable results at the level of service provision or capacity assessments. A potential suitable use for this information may be in the collection of geographic information on the location of existing health facilities and new field hospitals, which should serve as a guide for more in-depth assessments by technical experts. Such an approach would still align with current calls to build capacity for specialized field assessment teams to ensure methodological rigor in public health data collection, while capitalizing on the successes of mapping initiatives that are underway. (26,27)

Conclusions

This study identified a clear need for a structured, predictable approach to the collection of health systems data during major humanitarian emergencies. Interviewees highlighted the role of this information in coordinating humanitarian assistance, delivering clinical care to crisis-affected populations, and rebuilding health systems.

The participants in this study highlighted the strengths and weaknesses of various approaches for collecting relevant information on the availability and capacity of health services under difficult circumstances. There was a clear desire for information to be collected using on-site assessments by competent assessors as a

means of increasing the validity of the data, however this was tempered by an understanding of the potential logistical limitations to this approach in crisis settings.

Future development of validated tools and methods for assessing the availability, functionality, and capacity of health resources and services must focus on ensuring comprehensive and predictable systems that begin to collect data at the outset of crisis response and to share the results, including datasets. Rather than utilizing separate methodologies or assessments throughout the emergency, early recovery, and rebuilding phases, a preferable approach would include a common dataset whose complexity evolves throughout these phases. To meet this need, practitioners and researchers will require consensus on useful health systems frameworks that have application in sudden onset disasters and complex humanitarian emergencies.

References

1. Burkle FM, Redmond AD, McArdle DF. An authority for crisis coordination and accountability. *Lancet*. 2011 Jun 16;379(9833):2223-5.
2. Lind K, Gerdin M, Wladis A, Westman L, von Schreeb J. Time for order in chaos! A health system framework for foreign medical teams in earthquakes. *Prehosp Disaster Med*. 2012;27(1):90-3.
3. Garfield R, Blake C, Chatainger P, Walton-Ellery S. Common needs assessments and humanitarian action. London, UK: Humanitarian Practice Network; 2011.
4. Bostoan K, Bilukha O, Fenn B, Morgan O, Tam C, ter Veen A, et al. Methods for health surveys in difficult settings: charting progress, moving forward. *Emerg Themes Epidemiol*. 2007;4:13.
5. Checchi F, Gayer M, Freeman Grais R, Mills E. Public health in crisis-affected populations: A practical guide for decision-makers. Humanitarian Practice Networ. 2007;Report No.: 61.
6. Mills E, Checchi F, Orbinski J, Schull M, Burkle F, Beyrer C, et al. Users' guides to the medical literature: how to use an article about mortality in a humanitarian emergency. *Confl Health*. 2008;2:9.
7. Maxwell D, Watkins B. Humanitarian information systems and emergencies in the greater Horn of Africa: Logical components and logical linkages. *Disasters*. 2003;27(1):72-90.

8. Chu K, Stokes C, Trelles M, Ford N. Improving effective surgical delivery in humanitarian disasters: Lessons from Haiti. *PLoS Med.* 2011;8:e1001025.
9. Sondorp E, Bornemisza O. Public health, emergencies and the humanitarian impulse. *Bull World Health Organ.* 2005 Mar;83(3):163.
10. Karunakara U, Stevenson F. Ending neglect of older people in the response to humanitarian emergencies. *PLoS Med.* 2012 Dec 18;9(12):e1001357.
11. Cohen N, Arieli T. Field research in conflict environments: Methodological challenges and snowball sampling. *Journal of Peace Research.* 2011 Jul 1;48(4):423–35.
12. Bohle P, Quinlan M, Kennedy D, Williamson A. Working hours, work-life conflict and health in precarious and “permanent” employment. *Rev Salude Publica.* 2004;38:19–25.
13. Thomas DR. A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation.* 2006;27:237–46.
14. McDonnell SM, Perry HN, McLaughlin B, McCurdy B, Parrish RG. Information for disasters, information disasters, and disastrous information. *Prehosp Disaster Med.* 2007 Oct;22(5):406–13.
15. Spiegel PB, Salama P, Maloney S, van der Veen A. Quality of malnutrition assessment surveys conducted during famine in Ethiopia. *JAMA.* 2004;292:613–8.

16. Von Schreeb J, Legha JK, Karlsson N, Garfield R. Information for action?: Analysis of 2005 South Asian earthquake reports posted on Reliefweb. *Disaster Med Public Health Prep.* 2010 Oct 11; [Epub ahead of print].
17. Wefer A, Von Schreeb J. Timing and type of disaster severity data available on Internet following the 2010 Haiti Earthquake. *PLoS Curr.* 2012;4:e4fb3fd97a2d3c.
18. Pan American Health Organization. Health response to the earthquake in Haiti January 2010: Lessons to be learned for the next massive sudden-onset disaster. Washington, DC: Pan American Health Organization; 2011.
19. Nickerson JW. Global health on the edge – The humanitarian tipping point. *Can J Public Health.* 2013 Mar 6;104(3):e267–e269.
20. Mills EJ. Sharing evidence on humanitarian relief. *BMJ.* 2005;331:1485–6.
21. Merlin USA. Is Haiti’s health system any better? A report calling for a more coordinated, collaborative approach to disaster response; 2011.
22. Adams P. Health-care dynamics in Haiti. *Lancet.* 2010 Sep;376(9744):859–60.
23. Burkle FM, Nickerson JW, von Schreeb J, Redmond AD, McQueen KA, Norton I, et al. Emergency surgery data and documentation reporting forms for sudden-onset humanitarian crises, natural disasters and the existing burden of surgical disease. *Prehosp Disaster Med.* 2012 Dec;27(6):577–82.

24. Pavignani E, Colombo S. *Analysing Disrupted Health Sectors: A Modular Manual*. Geneva, Switzerland: World Health Organization; 2009.
25. Guha-Sapir D, Ratnayake R. Consequences of ongoing civil conflict in Somalia: Evidence for public health responses. *PLoS Med*. 2009 Aug 11;6(8):e1000108.
26. Ratnayake R. Training in epidemiology and disease control for humanitarian emergencies. *J Epidemiol Community Health*. 2011 Feb 1;65(2):98–9.
27. Spiegel P. Who should be undertaking population-based surveys in humanitarian emergencies? *Emerg Themes Epidemiol*. 2007;4:12.

Chapter 5 – Conclusion

Abstract:

This chapter summarizes the results of the thesis, and discusses them in relation to each of the research questions established in Chapter 1. This chapter provides an overview of the results, and makes recommendations for future areas of research and practice with regard to the application of the results of this study.

Introduction

This conclusion summarizes the primary findings of the research conducted for this dissertation. The findings are organized around the primary research questions contained in the introduction, coupled with a discussion of how they contribute to current initiatives to reform the humanitarian health assistance infrastructure, and to population health, more broadly. This chapter concludes with a discussion of the strengths and limitations of this dissertation and recommendations for research and practice that extend from the findings.

Objective One – What methods, indicators and benchmarks are currently used by Health Cluster lead agencies during acute and protracted humanitarian crises to assess health services and resources availability?

This dissertation provides empirical evidence of the need to establish global standards and practices for the collection of health systems data during humanitarian emergencies. In conducting field-based research in Haiti and Sudan, a large number of different assessment tools and databases were uncovered. Each of these assessments were developed with similar objectives of mapping the location, functionality, and capacity of health facilities within disrupted health systems, yet utilized different and often incomplete methods and indicators to achieve this.

The results of the analysis of the included assessment tools revealed considerable variation in the kinds of data that were collected, ranging from very basic assessments that included only some indication of whether the facility was functional or not, to very specific assessments including detailed indicators such as the number of adult and pediatric ventilators present. This variation was only present in Haiti, where groups outside of the Health Cluster's coordinating purview created most of the tools

included in this study, many of whom were information technology experts, rather than health system experts. The influence of this expertise had varying impacts: on the one hand, a number of innovative information management platforms were developed which may have benefits for future emergencies; at the same time, however, the data they collected did not address many of the priority areas for health systems in emergencies and likely had a minimal impact on humanitarian coordination or response.

Early on in the Haiti earthquake response, external health organizations with expertise in disaster and refugee health, such as the United States' Centers for Disease Control and Prevention (CDC), implemented communicable disease surveillance systems, including a sentinel surveillance system to provide early warning and response capacities throughout the country. (1,2) While there were databases of health facilities that were released by the United States Department of Health and Human Services (DHHS) and the Pan-American Health Organization (PAHO), much of the data that were available came from the United States Agency for International Development-funded Service Provision Assessments conducted in the decade prior to the earthquake, with only some post-earthquake updates being included. When data were being updated, these lists were compiled by members of a health facility mapping taskforce that was led by geographic information specialists from the United States Forestry Service, and not by health system experts, limiting the data almost exclusively to geographic, rather than service provision, data and with no clear distinctions in the dataset as to what were new, or old, data.

A detailed review of pertinent documents from Haiti, including Health Cluster Bulletins, Consolidated Appeals Process (CAP) reports, and other situation updates released by PAHO, revealed no indication that any detailed analysis of health facilities data from any of the assessments had taken place. There were no indications of attempts to calculate standard measures of coverage of health services, nor use of the recommended Health Cluster indicators of health resources availability. None of the interviews conducted for this study revealed any new information to suggest that these analyses had taken place.

Conversely, in Sudan, a relatively organized system of information management was located. The Health Resources Availability Mapping System (HeRAMS) developed and used in the Darfur states provides a structured evaluation of the health services available in health facilities run by non-governmental organizations (NGOs), United Nations agencies, and by the Sudanese Ministry of Health (SMoH). The system is guided by a conceptual framework, and deployed by a central team in Khartoum and the World Health Organization field offices in collaboration with the SMoH in the Darfur states.

The approach adopted in both countries provides some potential explanation for the organization seen in Sudan and the diversity of approaches seen in Haiti. In Haiti, the systems for collecting these data were disorganized, often lacked a guiding structure or framework to contextualize the data collection, and were conducted by several different groups, often with little input from the Ministère de la Santé et de la Population (MSPP) – the Haitian ministry of health. In Sudan, data collection was much more streamlined and coordinated by the WHO country office and the SMoH, with buy-in from the NGOs operating in the country. However, independent comparisons of these

two countries and approaches neglects the broader contexts of the environments in which these systems are being deployed: the earthquake in Haiti resulted in a sudden, massive disruption to the health system including large losses sustained by the MSPP; in Sudan, the crisis has been protracted over the course of nearly a decade, allowing for a considerably longer amount of time with which to develop and refine assessment tools.

Collectively, both country examples provide reason to be optimistic of the potential to collect and use health systems data in emergencies. While the Haiti example was - as one key informant and other authors have described it - “cacophonous”, the plurality of attempts at collecting health facilities data demonstrate that conducting facility-based assessments is technically feasible even in acute crises. What is critically needed is leadership within humanitarian coordination functions to ensure that these data are collected in such a way so as to correspond with the information needs of those coordinating the response and those on the ground providing services. The work from this thesis provides a basic framework for doing this, however agreement is needed to correspond to a minimum dataset for health facility assessments in emergencies. (3)

Objective two – What overlap exists among health resource and service availability assessment tools currently in use at the Cluster level and how do these align with the suggested Global Health Cluster core indicators and essential services/packages in the HeRAMS framework?

The results of this study reveal several important features of health systems assessments that must be viewed in the context of a plurality of tools developed during recent emergencies, only one of which (HeRAMS) contained any explicit adherence to a

conceptual framework. Most of the included assessments from Haiti contained reference to basic descriptors and identifying features of health facilities such as their location, ownership, and some assessment of the services provided, however with the exception of the HeRAMS system used in Sudan, few of the tools provided comprehensive information on the relevant health system building blocks or information corresponding to the Sphere standards, nor would they have been capable of providing the data necessary to calculate the Global Health Cluster core indicators.

The original framing of this question in the development of the thesis research proposal was problematic in that it assumed that the HeRAMS framework could be used to assess the comprehensiveness of different health facility assessments in emergencies. In practice, although HeRAMS is the recommended assessment tool for collecting information on the availability of health resources and services in emergencies by the World Health Organization, (4) there have been no evaluations of this tool or its comprehensiveness prior to this thesis, which proved problematic for using it as a model given the need for frameworks to be evidence-, rather than opinion, based.

To address this lack of available frameworks, a systematic review of health facility assessment tools was conducted, forming the first manuscript of this thesis. In conducting this systematic review, a comprehensive framework was developed, matching common assessment domains from the included assessment tools to relevant health system building blocks. This framework was then used as an analytic tool for comparing the quality and comprehensiveness of the assessments collected in Haiti and

Sudan, along with the Global Health Cluster benchmarks and indicators and a coding scheme developed to correspond to the Sphere standards.

In the evaluation of the assessment tools from Haiti and Sudan, it became clear that a comparison of individual indicators would be impossible given the discrepancies in how different health services and other functions were evaluated. Rather than conduct an individual indicator comparison, the indicators were coded using the health facilities assessment framework created in the first manuscript, and then reduced into the appropriate health system building blocks. This framework was included, along with the Health Cluster core indicators and the Sphere standards, into an evaluation matrix to assess the quality and comprehensiveness of the included assessment tools.

The results revealed an inconsistent picture of the comprehensiveness of health facility assessments in Haiti, and a favourable assessment of the HeRAMS system in Sudan. In Haiti, several of the assessments contained only minimal data, which upon evaluation did not represent the breadth or complexity of each of the health systems building blocks or processes, nor the priority areas identified in the Sphere standards. Furthermore, with the data that were available, the median number of Global Health Cluster indicators that could be calculated was only two, representing significant weaknesses in the data.

Given the failures in information management during the response to the 2010 earthquake, these results are not particularly surprising. The earthquake response was characterized by a lack of reliable information management within the Health Cluster, which has been the subject of considerable scrutiny. (5) Moreover, the inability to effectively monitor the presence and functions of many humanitarian health agencies

has major implications for ensuring the quality and accountability of these agencies operating in the field.

In Sudan, this evaluation of the HeRAMS system provides the first evidence to support its use in the field. The results of this analysis revealed that the system collects data on most of the health systems building blocks, provides the necessary data for calculating all but two of the Health Cluster core indicators, and collects data for monitoring all but one of the Sphere health standards. These results support the use of this tool as a potentially viable alternative or supplement to health information systems in emergencies settings, particularly in areas where similar data collection tools do not exist. For those areas where gaps in the indicators do exist, these are relatively easily-solvable problems: the addition of a handful of indicators and some additional forms of analysis.

Objective three – What data and indicators should be included in a minimum dataset for health services assessment and reporting? Can this be implemented at a global and country level?

The development of minimum operational datasets has been proposed for ensuring that important public health information is collected during emergencies. (3) While minimum standards for certain kinds of public health data have been established, this is not true for virtually all health systems data collection in humanitarian emergencies.

This thesis provides a framework for organizing health facilities assessment data, which could be applicable in the development of information systems in emergencies. The evaluation of HeRAMS in Sudan reveals that the HeRAMS assessment framework(6) corresponds with the domains included in the system, which was viewed

favorably by the key informants included in this study. This suggests that information needs correspond to more than just the location and operational status of a health facility, but rather more nuanced information concerning the services provided, the human resources available, and the capacity of the facility to provide care, among others.

The comprehensiveness of the indicators that should be included in these assessments was unclear, based on the results of interviews conducted with key informants and the review of the assessment tools. The results of the interviews conducted in both Haiti and Sudan revealed that key informants desired information on the organization of the health system, including the location, capacities, and services available in health facilities in emergencies. However, particularly in Sudan, the degree of specificity that key informants desired in these indicators was unclear, with some interviewees requesting more detailed information and others being satisfied with more general service provision data.

Existing evidence suggests that there is a need to clearly define the components of health services when conducting assessments, to ensure that the data capture the realities of the processes and capacities available within health systems. For example, a recent study evaluating the availability of emergency obstetric care in Kenya found that a significant gap existed between the theoretical coverage (reported using grouped indicators or broad assessment questions) of these services and the reality on the ground. (7) This suggests that assessment questions may be misinterpreted (both deliberately, or unintentionally), a challenge that the authors determine should be corrected by requiring direct inspection, rather than self-reporting to reduce

uncertainty and variability “...this provides a distinction between how a facility is supposed to function and the reality.” Similar challenges were revealed in interviews with key informants for this project, who could often identify erroneous data at the level of facilities classified as providing broad kinds of services (surgery, comprehensive emergency obstetric care, etc.), which may benefit from direct inspection by trained evaluators in order to provide greater clarity in the classification. While key informants themselves failed to see value in obtaining more granular data, the sum of this granularity may result in more precise aggregate classifications, which interviewees identified as requiring greater accuracy. In essence, interviewees wanted more precise information with less data – which is potentially unattainable.

Additionally, determining the kinds of data and indicators that should be included in minimum datasets for monitoring the availability of health services is highly dependent on the stage of the emergency, which dictates both how much and what kinds of data can be collected in different contexts, as well as what kinds of information are of operational value to those on the ground. This project identified several different kinds of datasets from different operational periods of disaster response, including basic datasets from the initial days of the Haiti earthquake response, and comprehensive databases of health facilities compiled over years in the Darfur region of Sudan. The analysis of these databases is conducted assuming that each dataset is discrete in its scope and timeframe, and indeed they are; However, as a model, what is needed is an evolving dataset that begins by identifying fundamental information needs of responders at the outset of an emergency, which is subsequently refined to become more complex as the emergency stabilizes and recovery begins.

In practice, this model does not exist, however the tools for building it do. For example, the initial stages of emergency response are highly fluid: the scope of the emergency is often unknown, the functionality of the health system decreases abruptly due to disruptions in any or all of its fundamental building blocks, and the burden of disease increases sharply. Assessing the needs and capacities within this disruption is complex, and both are likely to change frequently due to the fluidity of the situation. For this reason, recent developments in conducting initial rapid assessments recommend against conducting purely quantitative assessments, in favour of more qualitative approaches during the initial stages of an emergency, as identified by the Multi-Cluster Initial Rapid Assessment (MiRA), which recommends the initial use of baseline quantitative data over primary data collection for the same reason. (8)

The MiRA is guided by an organizing framework that gradually evolves the complexity of the primary data collected throughout the course of the emergency response. The framework emphasizes the need for data to exist in a continuum, rather than as discrete approaches, inclusive of both common operational information (such as assessments of the scope of the emergency, previous disaster information, etc.), as well as sectoral assessments from each of the Clusters.

This model provides a potential framework for guiding assessments of disrupted health systems, including health facilities assessments. For example, theoretically the inclusion of preliminary data, such as the location and operational status of health facilities (perhaps the only information available in the first few days) should establish the foundation upon which more complex data can be built in the following days, weeks, and months. Following the identification and location of functioning facilities,

basic assessments of packages of services could be integrated to provide initial assessments of coverage. As the situation stabilizes, more granular data on these packages of health services could then be added, providing more precise data on the capacities and weaknesses within the health system. Conceivably, the tools to achieve this evolution already exist, including using the MiRA during the initial stages of the emergency, followed by the application of HeRAMS to provide initial assessments of health services availability in an emergent but stable environment, followed by the use of one of the more comprehensive tools identified in the first manuscript during the recovery stages. Conceptually, these assessment tools have linear linkages at different stages of emergency response, however in practice their integration requires some innovation to ensure technical interoperability.

Objective four – What are the opportunities for, and barriers to, integrating data from existing health services assessment tools into the Health Cluster Information Management Framework at the country and global levels?

A fundamental problem with health information systems created for emergencies is that they are often duplicative of information systems that may already be present in the affected countries. (9) Virtually all countries have some form of health information system in place to collect vital statistics, and the presence of communicable disease. Such systems are, in fact, a requirement under the International Health Regulations (IHRs). (10) However, the quality of these information systems in developing countries is often poor, which limits the usefulness of the included data and presents a major challenge for decision-making as well as for adequately detecting and responding to major public health threats. (11)

As this thesis has shown, there are a large number of tools in use to collect data on the functionality and capacity of the health system through health facility assessments. These assessment tools often do not directly measure the same aspects of health service delivery, nor do they use common indicators when they do; thus, the interoperability of these assessments and the comparability of the data they generate is questionable. Integrating the raw data generated from all of these assessments into one platform or framework would, therefore, undoubtedly be a challenge.

In countries where an existing system for monitoring the availability of health services and health facilities already exists, these data are generally collected infrequently as a static dataset, often only every five or more years. (12) Thus, the data may be obsolete anyhow, but are certainly of questionable relevance in the face of a major emergency that severely disrupts the functioning of the health system. As an intermediary between existing information systems or detailed databases of facilities assessments and the conduct of similarly detailed assessments during the recovery, a temporary substitute is often necessary, capable of capturing data on the health system that can be routinely updated in accordance with a changing landscape of healthcare providers. This thesis has shown that one such option may be available for this purpose – HeRAMS – however, it remains unclear how effectively this could be integrated into an existing information management system as a temporary substitute during a sudden-onset emergency. To rapidly implement a system such as this would require the rapid mobilization of a team of experts with familiarity in the system, the ability to rapidly deploy technical resources such as data collection tools, computers, and

mapping capabilities, and the availability of data collectors on the ground to populate the database.

In addition to the multiplicity of tools in use, several other important barriers exist that may limit the integration of relevant health systems data into information management processes. Health data have important implications beyond the management of an emergency response, including gauging the scope of a humanitarian catastrophe, and providing important scientific testimony of past events. (13) When public health data may document systematic deprivation or human rights abuses perpetrated by both state and non-state actors, either may have an interest in limiting the collection of these data in order to protect their own interests. (14) Many aid agencies collect data that is of value for programmatic use without disclosing it for fear of reprisals, the erosion of their neutrality, or the safety of those who contribute to the data collection as key informants or researchers. (15) Thus, while the imposition of restrictive measures by state and non-state actors has important implications for collecting data on the ground, it often does not outright stop it.

The collection of data can also be affected by generalized insecurity (e.g. active fighting), which may limit the ability to conduct surveys and assessments. This is a known limitation of field epidemiologic surveys in emergencies, and is a reality that must be contended with.

The resultant effect of these limitations is that the integration of important public health data into information management processes is rarely straightforward. As highlighted by key informants in this study, data are often incomplete, potentially

inaccurate or unclear, and difficult to locate. The World Health Organization describes this process as “making (rough) sense of (shaky) data”. (16)

This study found no absolute barriers to integrating data from health services availability assessments into information management or humanitarian coordination functions. Rather, the results of this study indicate that conducting these assessments is technically feasible, albeit with several important limitations. Most importantly, the transfer of existing data and information to coordinating bodies at the onset of a major emergency response is an invaluable process. Duplicating and recollecting data that may already exist is time consuming, wasteful, and often requires the mobilization of financial and logistical resources that may detract from other operational priorities. Given that the various assessment tools located in non-emergency settings collect data that are very different and often offer an incomplete assessment of an overall health system, there is a clear need for health systems assessment experts with insight into the nuances of these tools to be integrated into humanitarian coordination structures. Utilizing existing baseline data is a key component of all needs assessment processes, and needs to be encouraged as a starting point in disrupted health systems. (17)

The multiplicity of assessments located in Haiti reveals precisely the failure of this system and information management process to function effectively by not clearly establishing which data existed, which were missing, and prioritizing which assessments were to be conducted. In this case, the barriers to integrating data into decision-making were not due to a lack of technical abilities, but rather an absence of an effective information management structure within the coordinating bodies. Despite the large amounts of data produced, this study found no evidence that the large amount

of data collected on the location and functionality of health facilities was ever used to form empirical estimates of the coverage or adequacy of health services, suggesting a major weakness not only with the tools, but also with the coordinating systems.

In summary, there are more opportunities than barriers to using health systems data to coordinate the humanitarian health response to major emergencies. These data are being collected before, during, and after major emergencies and can play a strong role in establishing a coordinated rebuilding of disrupted health systems. While a lack of clarity on the precise methods used to collect these data is a major concern, this can potentially be mitigated through the deployment of competent and knowledgeable field staff with experience in health systems in humanitarian emergencies.

Relevance to Humanitarian Reform

This thesis work has implications for current initiatives underway to enhance the coordination and registration of foreign medical teams (FMTs) during sudden onset disasters. Following the 2010 Haiti earthquake and other recent emergencies, the World Health Organization identified several major concerns with regard to the clinical competencies and practices of some of the FMTs that responded and provided medical care. In December of 2010, the World Health Organization and the Pan-American Health Organization convened a stakeholders meeting in Havana, Cuba to establish a working group to develop minimum standards for medical teams and health facilities during humanitarian emergencies. (18) Several mechanisms were included in reports outlining the approach to be adopted as a result of this meeting, including guidelines for the deployment of FMTs in emergency settings; assessing the nature of health services offered and available by FMTs and in health facilities in emergencies; the establishment

of an international registration system for FMTs, including their capabilities and capacities as evaluated using a standardized template based from HeRAMS; and an emphasis that the role of FMTs is to support and reinforce the national health care system, rather than replace it.

This thesis contributes to this work most directly by providing validation of the comprehensiveness of the HeRAMS checklist of health services, which has been proposed as one part of an organizing framework for pre-screening FMTs prior to an emergency. Additionally, this thesis provides clarity on the implementation of assessment tools for use in future emergencies and the information needs of operational agencies with regard to the availability of health services. In short, the results indicate that it is technically feasible to collect this information and it is of value to those responsible for coordinating and delivering humanitarian health interventions in emergencies.

Humanitarian Assistance and Health Systems Strengthening

There are clear reasons why humanitarian assistance should be closely linked to long-term health systems strengthening ambitions: a humanitarian response can quickly mobilize vast sums of donor funds that may otherwise have not been committed and the emergence of countries from conflict or in the recovery from a sudden onset disaster may be an opportunity to ‘reset’ political and economic agendas, allowing for the redevelopment of previously weak health infrastructure. This approach, however, assumes that both the health system and the political climate are in a state of transition toward stability and good governance. Furthermore, it assumes

that all actors have a vested interest and commitment in the rebuilding of the health system through the strengthening of public resources.

There are a variety of reasons why health systems strengthening ambitions may not be compatible with humanitarian interventions. Central to virtually all humanitarian agencies (particularly those operating in conflict zones) are the principles of neutrality and impartiality, which provide a mechanism of security for organizations operating in dynamic settings and which seek to promote equitable access to health services for vulnerable populations. There is an obvious tension that emerges between agencies that have long traditions of operating independently and carefully guard their principles of neutrality, and supporting government-run health facilities. Furthermore, the goal of humanitarian assistance is generally not perceived to accomplish long-term reforms of a disrupted health system, so much as it is to reduce short-term mortality and to supplement for gaps the health system. The linkage to long-term health systems strengthening from humanitarian response is, therefore, logical but may not be grounded in the pragmatic realities of the mandate of many operational agencies.

Furthermore, the funding models for humanitarian assistance and international development are notably different. Frequently, the goal of humanitarian assistance is to alleviate short-term mortality through rapid interventions; comparatively, longer-term development strategies may have links with humanitarian assistance, but these linkages are not always transparent, and funding for humanitarian assistance may be shorter than required for the long-term recovery of the health system. (19)

Increasingly, however, humanitarian coordination is being undertaken with a purview

for longer-term development plans, which are being implemented as early recovery strategies. (20) In an emergency, life-saving interventions are unquestionably the major priority for all partners involved in the response; however, affected populations quickly begin to look for ways to rebuild their lives and re-establish essential services, such as the delivery of health services. Balancing the need to address immediate health priorities with the need to leverage financial and material support for rebuilding disrupted health systems early on in the response and recovery is one of the leading challenges for the humanitarian system.

This thesis should be viewed as recognizing this tension between providing interventions to reduce short-term mortality and those that lay the foundation for rebuilding a stronger health system. While the funding challenges associated with this transition have yet to be entirely resolved, there is reason for cautious optimism in initiatives such as the Early Recovery Cluster to bridge this divide. This thesis contributes to this overall strategy by providing clarity to the information needs of humanitarian providers with a responsibility for rebuilding health systems, as well as providing a detailed assessment of the tools and indicators used to determine gaps and capacities within disrupted health systems, enabling a more sophisticated approach to humanitarian and early recovery funding.

Strengths and Limitations

This dissertation provides an analysis of assessment tools for evaluating the availability of health services in emergencies, analyzed through complementary frameworks of health systems strengthening and minimum standards for humanitarian assistance. While there is growing interest in comprehensive approaches to

humanitarian assistance across the spectrum of disrupted health systems, very little work has been conducted in this area. As a result of the approach used in this study, this dissertation has several important strengths.

First, one of the major strengths of this dissertation is that it examined the comprehensiveness and adequacy of assessment tools deployed during recent humanitarian emergencies to provide important information on the availability and capacity of essential health services. While many concerns have been raised regarding the lack of coordination and the inequitable distribution of health services during emergencies, there has been little effort to reconcile the gaps in information that lead to these problems. The methods used in this dissertation provide preliminary results to begin to respond to these gaps, grounded in a broad health systems strengthening framework to provide comprehensiveness to the results. This approach produced important findings concerning the strengths and weaknesses of current field-based methods deployed during recent emergencies, as well as evidence of the technical feasibility of collecting these data under difficult conditions.

Second, the data collected for this study were derived from real-time, field-based evaluations of systems in place during ongoing emergencies. This approach grounds the findings in a pragmatic operational context, rather than having been conducted as a desk review. This was important for understanding the challenges of collecting the data of interest to this study, as well as the potential limitations imposed by challenging environments.

Third, the use of both qualitative and quantitative approaches in this dissertation provides needed perspectives on the collection, comprehensiveness, and

use of health systems data in emergency settings. This responds to a priority information need identified by other authors, (21) and should be operationalized to adapt existing information tools (such as HeRAMS) in similar contexts.

There are several important limitations that should be considered in interpreting the findings of this work. This project took place in two very different operational environments, which is an important factor in understanding the strengths and weaknesses of the assessment tools included in this evaluation. The nature of the emergencies in Haiti (a fragile state that was affected by an earthquake, internal population displacement, and a cholera epidemic) and the Darfur region of Sudan (characterized by genocide, massive internal population displacements, deliberate under-development of basic social services, and frequent outbreaks of communicable diseases) and the contexts and timelines in which they occur are notably different. Furthermore, the scale of the humanitarian response generated in each of these countries is very different, though this appears to have had an inverted effect on the results of this study, with the monitoring systems developed in Darfur being more comprehensive in their reporting of health services than those in Haiti.

The challenge of comparing one emergency to another is not unique to this thesis, but rather to the field of disaster and complex emergency research, in general. No two emergencies are alike, and the differing baseline characteristics of countries, regions, conflicts, and disasters makes comparative analyses very difficult. Furthermore, major humanitarian emergencies such as in Haiti are relatively infrequent and highly unpredictable, making their prospective study difficult, if not impossible. As a result of this complexity, research findings and lessons learned must

be interpreted with some degree of caution and within the appropriate context. What works in Haiti may not work in Sudan, and vice-versa. For example, the use of open data platforms (popular in Haiti) would likely not be suitable for use in Sudan, where the government is considerably more restrictive.

Additionally, during the conduct of this research, several limitations were placed on me that were outside of my (or anyone else's) control. This research was conducted under difficult field conditions and in insecure areas, which restricted my ability to conduct research in different regions. My movement was dependent on the generous use of vehicles and lodging (occasionally in the form of a modified shipping container) provided by collaborating agencies, and the conduct of this project was not the main priority of operational field staff. In Sudan, my arrival coincided with a state of particular insecurity that limited access to in-country transportation to the Darfur region, which subsequently limited the amount of time I was able to spend there. Additionally, travel permits for this region were difficult to obtain, and travel authorization was only given for a short period of time.

Undoubtedly, additional field visits to different countries may have yielded different perspectives and, potentially, more generalizable results based on the different contexts. However, the logistical constraints of doing so were prohibitive in this instance, as travel to insecure regions requires careful consideration of basic necessities such as in-country travel, accommodations, security, and emergency procedures. In the context of this study, additional sites were not feasible because of these and other considerations, such as a lack of desire on the part of operational

agencies to take on a field researcher who may be perceived as a burden to operational staff.

All of these factors potentially limited the depth of the data that could be collected. Additional time may have led to additional interviews and, subsequently, perspectives from additional key informants; however, these limitations were reasonably mitigated by optimizing the use of the resources available at the time, and conducting multiple interviews and field visits in a short timeframe. All available contacts in-country were explored, and interviews or meetings were arranged with all contacts who were available.

An additional limitation relates to the analytical frameworks used throughout this thesis, including the health facilities assessment criteria developed in the first manuscript, the Sphere Humanitarian Charter and Minimum Standards in Humanitarian Response, and the Global Health Cluster Suggested Set of Core Indicators and Benchmarks by Category. While the Sphere standards have been integrated into humanitarian practice and gained traction as a minimum standard across multiple humanitarian agencies, none of the included frameworks have been used as an analytic framework for evaluating the comprehensiveness of interventions in the manner described in this thesis. This is more of a novel use of these standards and guidelines than it is a limitation, though the applicability of these frameworks is undoubtedly open to critique and comment.

Recommendations for future research and practice

This dissertation provides a field-based evaluation of health services assessment tools used during major humanitarian emergencies, including the World Health

Organization-supported Health Resources Availability Mapping System in Sudan. While there is interest in applying this tool in future emergencies, experience in its use is lacking and further evaluations are needed in sudden onset disasters, similar to Haiti, where health information systems are established *de novo* and the influx of humanitarian assistance is large.

The results of this dissertation reveal that there are promising practices that could address information gaps within disrupted health systems for assessing the location, capacity, and functionality of health facilities. An area for future research will involve conducting real-time evaluations of the application of these systems during the initial stages of a sudden onset disaster to determine the adequacy of similar information systems in providing relevant information during states of rapid transition within the health system.

A critical area of urgent development is to determine the kind and number of indicators that can pragmatically be collected during the initial stages of disaster response, where the full complement of HeRAMS indicators may be too large to accurately collect, or may place an undue burden on field staff. An initial HeRAMS (iHeRAMS) has been proposed, however the details of this have not been adequately described to apply them in a coordinated fashion. Similarly, the HeRAMS indicators have been proposed as a framework to guide the classification of foreign medical teams as part of an international pre-deployment roster. The application of this system to these teams will require consideration to determine its accuracy and the transferability of these data to field-level operations.

Beyond this, careful consideration needs to be given to how to avoid the duplication of existing health information systems during emergencies, but also how to extract useful data from existing systems and provide updated data on the status of the health system following a sudden onset disaster and, consequently, a change in the baseline data. The first manuscript of this dissertation identified a large number of health facility assessment tools, all of which could potentially provide relevant baseline data of use during an emergency. However, the large number of indicators used in most of these tools present an obvious limitation to the application of these assessments in an emergent context. Rather, consideration must be given as to how to effectively input useful information into these systems, or how best to align them with emergency-oriented information systems such as HeRAMS. Developing a process for the evolution of datasets from different time periods (pre-crisis, emergency response, recovery) would address significant barriers in transferring information, and would reduce the duplication and redundancy of multiple datasets, as was seen in Haiti. These proposals require significant investment, however, including piloting different information systems in different countries and contexts, as well as establishing strategies for integrating information management processes into disaster response and disaster risk reduction plans in countries at high risk for natural disasters.

Closely related to these recommendations is a need to ensure that future assessment methodologies systematically include local capacities and perspectives. While the focus of this thesis has been on developing indicators and tools that can be applied universally, it is essential that these tools be adaptable to local contexts, including local health systems and health priorities. Within this, developing

methodologies that engage and empower local communities will be essential for ensuring that needs assessments correspond to local capacities and reflect the priorities of affected communities, which should, in turn, correspond with longer-term health system strengthening. Interestingly, the Tsunami Evaluation Coalition's review of needs assessments following the 2004 tsunami noted that assessments conducted by national Ministries of Health in affected countries were often timely, coordinated, and of a good standard, further emphasizing the need to ensure that local responders and resources are featured prominently in the conduct of needs assessments. (22)

Conclusion

Throughout the process of this dissertation, I endeavored to examine pragmatic and useful approaches for collecting information on the functioning of disrupted health systems. Accomplishing this required substantial input from dedicated field staff in Haiti and Sudan, as well as in Canada, to ensure that the results of this dissertation reflected not only an approach that was academically and scientifically sound, but practical for application in the field. I believe that this dissertation has revealed that the answer to seemingly straightforward questions such as "where are the hospitals, are they functioning, and what services and capacities do they have?" is far more complicated than the questions reveal. Within this complexity, however, lies opportunity for improving the coordination of humanitarian assistance and, ultimately, improving the health interventions that are offered to some of the world's most vulnerable populations whose lives have been disrupted by natural disasters, chronic poverty, armed conflict, and a myriad of other circumstances. I am indebted to all of the participants in this study who gave generously of their time, their insight, and their help

to make this project possible. In listening to their stories, I have contributed to both the research and practice of population health research and practice during major emergencies and am confident that this work is only the beginning.

References

1. Rapid establishment of an internally displaced persons disease surveillance system after an earthquake --- Haiti, 2010. *MMWR Morb. Mortal. Wkly. Rep.* 2010 Aug 6;59(30):939-45.
2. Tappero J, Tauxe R. Lessons Learned during Public Health Response to Cholera Epidemic in Haiti and the Dominican Republic. *Emerg. Infect. Dis.* 2011 Nov;17(11):2087-93.
3. Bradt DA, Drummond CM. Rapid epidemiological assessment of health status in displaced populations--an evolution toward standardized minimum, essential data sets. *Prehosp Disaster Med.* 2003 Mar;18(1):178-85.
4. World Health Organization. Health Cluster Guide. Geneva, Switzerland: Inter-Agency Standing Committee; 2009.
5. Pan American Health Organization. Health response to the earthquake in Haiti January 2010: Lessons to be learned for the next massive sudden-onset disaster. Washington, DC: Pan American Health Organization; 2011.
6. World Health Organization. Global Health Cluster tools [Internet]. 2010 [Accessed Jun 17 2013]. Available from: http://www.who.int/hac/global_health_cluster/guide/tools/en/
7. Echoka E, Kombe Y, Dubourg D, Makokha A, Evjen-Olsen B, Mwangi M, et al. Existence and functionality of emergency obstetric care services at district level in Kenya: theoretical coverage versus reality. *BMC Health Serv Res.* 2013 Mar 25;13(1):113.
8. Inter-Agency Standing Committee. Operational guidance for coordinated assessments in humanitarian crises. Inter-Agency Standing Committee; 2012.

9. Thieren M. Health information systems in humanitarian emergencies. *Bull World Health Organ.* 2005;83:584–9.
10. World Health Organization. *International health regulations, second edition.* Geneva, Switzerland: World Health Organization; 2005.
11. Wilson K, Tigerstrom B von, McDougall C. Protecting global health security through the International Health Regulations: requirements and challenges. *Can. Med. Assoc J.* 2008 Jul 1;179(1):44–8.
12. Edward, A, Matsubiyashi, T., Fapohunda, B., Becker, S. A comparative analysis of select health facility survey methods applied in low and middle income countries. Chapel Hill, NC: MEASURE Evaluation; 2009. Report No.: Working Paper: WP-09-11.
13. Depoortere E, Checchi F, Broillet F, Gerstl S, Minetti A, Gayraud O, et al. Violence and mortality in West Darfur, Sudan (2003–04): epidemiological evidence from four surveys. *Lancet.* 2004 Oct;364(9442):1315–20.
14. Legros D, Brown V. Documenting violence against refugees. *Lancet.* 2001 May 5;357(9266):1429.
15. Magone C, Neuman M. *Humanitarian negotiations revealed: The MSF experience.* Paris: Columbia University Press; 2012.
16. Pavignani E, Colombo S. *Analysing disrupted health sectors: A modular manual.* Geneva, Switzerland: World Health Organization; 2009.
17. Garfield R, Blake C, Chatainger P, Walton-Ellery S. *Common needs assessments and humanitarian action.* London, UK: Humanitarian Practice Network; 2011.

18. Pan-American Health Organization. Proceedings of the WHO/PAHO technical consultation on international foreign medical teams (FMTs) post-sudden onset disasters (SODs) December 7-9, 2010 Havana, Cuba. 2011.
19. Percival V, Sondorp E. A case study of health sector reform in Kosovo. *Confl. Health*. 2010 Apr 16;4(1):7.
20. Financing Task Force of the Cluster Working Group on Early Recovery. *Financing for Early Recovery: Highlighting the Gaps*. 2008.
21. Turner T, Green S, Harris C. Supporting evidence-based health care in crises: What information do humanitarian organizations need? *Disaster Med. Public Health Prep*. 2011;5:69–72.
22. De Ville de Goyet C, Morinière L. *The role of needs assessment in the tsunami response*. Stockholm, Sweden: Tsunami Evaluation Coalition; 2006.

Appendix 1 – MEDLINE/Embase Literature Search Strategy

1. exp "Delivery of Health Care"/
2. health resources/ or "health services needs and demand"/ or health services accessibility/ or healthcare disparities/
3. exp Health Planning/
4. 1 or 3
5. exp "Equipment and Supplies"/
6. exp Health Facilities/
7. exp Health Services/
8. exp Health Manpower/
9. exp Health Personnel/
10. 6 or 7 or 8 or 9
11. Supply & Distribution.fs.
12. 10 and 11
13. 5 or 12
14. 4 and 13
15. service\$ provision assessment.ab,ti.
16. service\$ availability mapping.ab,ti.
17. (health facilit\$ adj (census or assessment\$ or map\$)).ab,ti.
18. health resource\$ avail\$.ab,ti.
19. 15 or 16 or 17 or 18
20. 14 or 19
21. Developing Countries/
22. exp africa/ or exp caribbean region/ or exp central america/ or exp latin america/ or exp south america/ or exp asia, central/ or exp asia, southeastern/ or exp asia, western/ or exp china/ or "democratic people's republic of korea"/ or mongolia/ or exp indian ocean islands/ or exp melanesia/ or exp micronesia/ or exp polynesia/
23. 21 or 22
24. 20 and 23
25. 4 and 12
26. 19 or 25
27. 23 and 26
28. remove duplicates from 27

Appendix 2 – University of Ottawa Health Sciences and Science Research Ethics Board Approval Certificate

File Number: H09-11-01

Date (mm/dd/yyyy): 08/02/2012



Université d'Ottawa **University of Ottawa**
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Peter	Tugwell	Medicine / Medicine	Supervisor
Amir	Attaran	Law	Co-Supervisor
Jason	Nickerson	Health Sciences / Others	Student Researcher

File Number: H09-11-01

Type of Project: PhD Thesis

Title: Analyzing Disrupted Health Systems: Methods, Indicators and Practice for Health Resources and Service Availability Assessment in Crises

<u>Approval Date (mm/dd/yyyy)</u>	<u>Expiry Date (mm/dd/yyyy)</u>	<u>Approval Type</u>
10/12/2011	10/11/2012	Ia

(Ia: Approval, Ib: Approval for initial stage only, I: Conditional)

Special Conditions / Comments:

Approval was granted for recruitment and data collection may begin in Haiti, Sudan, and South Sudan. (Kenya is no longer considered a research site, as per Mr. Nickerson's email dated August 2nd, 2012.)

Letters of permission/support from the following participating research sites and international organizations were received:

- Global Health Clusters, World Health Organization (permission received)
- International Federation of the Red Cross (permission received)

1

550, rue Cumberland, pièce 154 Ottawa (Ontario) K1N 6N5 Canada
550 Cumberland Street, room 154 Ottawa, Ontario K1N 6N5 Canada
613-562-5387 • Téléc./Fax 613-562-5338
<http://www.research.uottawa.ca/ethics/index.html>
<http://www.recherche.uottawa.ca/deontologie/index.html>

Appendix 3 – Letter of Permission from the Canadian Society for International Health



June 25, 2013

To Whom It May Concern,

The Canadian Society for International Health gives permission for Jason Nickerson to use, with proper attribution, the Canadian Society for International Health's image: CSIH Approach to Health Systems Strengthening in the publication of his thesis and subsequent manuscripts.

Sincerely,

[Signature]

Janet Hatcher Roberts
Executive Director, CSIH