Development and use of a master health facility list: Haiti’s experience during the 2010 earthquake response

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Collaboration between the Haitian government and NGOs after the 2010 earthquake contributed to a more accurate and complete master health facility list, which helped coordinate emergency response operations as well as strengthen the routine health information system. Open data and social networks facilitated the collection and sharing of health facility information and in maintenance of the list over time.

ABSTRACT
Master health facility lists (MHFLs) are gaining attention as a standards-based means to uniquely identify health facilities and to link facility-level data. The ability to reliably communicate information about specific health facilities can support an array of health system functions, such as routine reporting and emergency response operations. MHFLs support the alignment of donor-supported health information systems with county-owned systems. Recent World Health Organization draft guidance promotes the utility of MHFLs and outlines a process for list development and governance. Although the potential benefits of MHFLs are numerous and may seem obvious, there are few documented cases of MHFL construction and use. The international response to the 2010 Haiti earthquake provides an example of how governments, nongovernmental organizations, and others can collaborate within a framework of standards to build a more complete and accurate list of health facilities. Prior to the earthquake, the Haitian Ministry of Health (Minist`re de la Sante` Publique et de la Population [MSPP]) maintained a list of public-sector health facilities but lacked information on privately managed facilities. Following the earthquake, the MSPP worked with a multinational group to expand the completeness and accuracy of the list of health facilities, including information on post-quake operational status. This list later proved useful in the response to the cholera epidemic and is now incorporated into the MSPP’s routine health information system. Haiti’s experience demonstrates the utility of MHFL formation and use in crisis as well as in the routine function of the health information system.

INTRODUCTION
Accurate and regularly updated master health facility lists (MHFLs) are essential for effective planning, coordination, and delivery of health services, particularly in low- and middle- income countries with extensive external donor presence. MHFLs are also important during disasters because the lack of accurate, usable information is a major obstacle to effective disaster response.1,2 According to the World Health Organization (WHO), an MHFL is a complete list of health facilities in a country (both public and private) with a set of attributes to uniquely identify each facility,3 and it includes basic information about the facility’s services and capacities.

With the release in 2012 of draft WHO guidance on the creation and governance of MHFLs, countries may be considering devoting resources to develop such lists.4 However, there are few documented experiences on the construction or use of MHFLs.

The earthquake in Haiti on January 12, 2010, underscored the need for countries to have an MHFL. At the time of the earthquake, the Haitian Ministry of...
Lack of accurate information is a major obstacle to effective disaster response.

Master health facility lists help emergency response personnel know they are communicating about the same facility.

Broad representation in the Haiti Health Facilities Work Group facilitated coordination while minimizing duplication of efforts.

Health (Ministère de la Santé Publique et de la Population [MSPP]) had a list of public-sector health facilities. However, the MSPP list contained little information about privately managed health facilities—a major part of the health delivery system in Haiti—and it lacked critical attributes needed to uniquely identify facilities.

During the earthquake response, the MSPP worked with the Haiti Health Facilities Work Group (Work Group), composed of a multinational group of organizations and governments, to develop a functioning MHFL, which proved useful during not only the earthquake response but also subsequent events such as the cholera outbreak.

This article reviews the development and use of the MHFL and provides a model for other countries interested in developing similar lists, which are increasingly needed to align donor-supported information systems with national health information systems.

THE NEED FOR A COMPLETE HEALTH FACILITY LIST IN HAITI

The epicenter of the 2010 Haiti earthquake was close to the most densely populated areas of Haiti, including the capital, Port-au-Prince. Approximately 250,000 buildings collapsed, including many hospitals. In the confusion that followed, there was uncertainty about the extent of damage to health facilities as well as a lack of information about the temporary clinics that were rapidly being set up. First responders were uncertain whether they were referring to the same health facility when communicating about the type, status, and capacity of facilities.

The MSPP is responsible for the health of the population and for the delivery of health-related services. At the time of the earthquake, the public health care system included more than 500 health institutions (approximately 30% of the country’s health facilities), ranging from community health clinics providing basic primary services to university hospitals. In addition, there were more than 250 nongovernmental organizations (NGOs) providing a substantial proportion of the primary health services.

Prior to the earthquake, multiple, incomplete, and conflicting health facility information systems existed in Haiti; no entity served as a repository for an up-to-date, comprehensive master list. For example, the Haitian Health Information System (Système d’Information Sanitaire d’Haiti [HSIS]) functioned as a health management information system but was incomplete. Similarly, the Electronic Monitoring, Evaluation and Surveillance Interface for HIV-infected patients (MESI) collected data from public, and some private, health facilities in Haiti but primarily from sites receiving support from the U.S. President’s Emergency Plan for AIDS Relief (PEPFAR).

DEVELOPMENT AND USE OF HAITI’S MASTER HEALTH FACILITY LIST

In the immediate aftermath of the earthquake, the U.S. Department of Health and Human Services (HHS) coordinated the formation of the Work Group in support of the MSPP. The first meeting of the Work Group took place via teleconference 5 days after the earthquake (on January 17, 2010) with representatives from U.S. federal agencies; academia; international, local, and Haitian diaspora NGOs; multilateral organizations; foundations; and businesses (Table 1).

All Work Group activities were coordinated through conference calls and a shared web space. Staff of the MSPP’s Planning and Evaluation Unit (Unité de Planification et d’Évaluation [UPE]) were responsible for the HSIS; they participated in the Work Group and had final determination regarding edits to the MHFL.

Between January 2010 and August 2011, UPE staff collaborated with the Work Group to develop a single, comprehensive list of all public, private, and mixed (public and private) health facilities. The list was standardized, validated, and up-to-date to guide and coordinate the health response to the earthquake. Senior MSPP leadership provided input and direction during several meetings in 2010.

The MHFL’s initial purpose was to address the urgent need for a common list of health facilities in Haiti to ensure all emergency response personnel knew they were communicating about the same facility. The Work Group adapted guidelines on a minimum set of data elements necessary to uniquely identify a health facility, known as a signature domain, to inform the core set of information contained in the MHFL (Box). These elements included:

- A unique identifying code for each facility
- The facility name, address, and type
- The entity that manages/owns the facility
- Each facility’s geographic coordinates
### TABLE 1. Organizational Participation in the Haiti Health Facilities Work Group by Category (N=56)

| Haitian Government | NGOs and Private Consultants |
|-------------------|-----------------------------|
| Ministère de la Santé Publique et de la Population | Arkemie |

| U.S. Government | | |
|-----------------|-----------------------------|
| Department of Defense (DOD) | Association of Haitian Physicians Abroad, Florida Chapter |
| Department of Education | Baertracks |
| Department of Health and Human Services | Christian Connections for International Health |
| Department of Homeland Security | Christian Medical and Dental Associations |
| Department of State | Citizen Command Center Database Team, Citizen Action Team |
| Peace Corps | Communibuild Technologies |
| United States Southern Command (DOD) | CrisisCommons |
| U.S. Agency for International Development | DirectRelief |

| Multilateral Organizations | |
|---------------------------|-----------------------------|
| Geo-Operations Unit, United Nations | Evotech, Inc. |
| International Organization for Migration (IOM)\(^a\) | FortiusOne, Inc. |
| Office for the Coordination of Humanitarian Affairs, United Nations | Global Health Action |
| World Health Organization/Pan American Health Organization | Haitian Mental Health Network |
| United Nations Development Programme | Haiti Village Health |
| World Health Organization headquarters | Humanitarian Medical Aid Direct Relief |

| Academia | |
|-----------|-----------------------------|
| Bloomberg School of Public Health, Johns Hopkins University | ICF International |
| Center for Geographic Analysis, Harvard University | IMA World Health |
| Emory University | InSteDD |
| The George Washington University | InterAction |
| Institute for Global Leadership, Tufts University | Logistics for Health |
| Lincoln Laboratory, Massachusetts Institute of Technology | MEASURE Evaluation |
| Mailman School of Public Health, Columbia University | Medical Mission Exchange |

| Foundations | |
|-------------|-----------------------------|
| Clinton Foundation | OpenStreetMap |
| Google Foundation | Project Medishare for Haiti |

\(^a\) Although IOM is not part of the UN system, it works very closely with the UN specialized agencies and is part of UN Country Teams around the world.
Haiti’s master health facility list was posted to a public Google Site to increase the chances of it being used and updated over time.

Online dissemination of the MHFL helped integrate the unique health facility codes into other data collection efforts.

Haiti’s master health facility list developed for the earthquake response was eventually incorporated into the routine health information system.

BOX. Recommended Data Elements for Master Health Facility Lists

Signature Domain (set of data elements that do not change significantly over time)
- Unique identifier
- Facility name
- Facility type
- Ownership/managing authority
- Location/address
- Geographic coordinates
- Operational status
- Year data collected

Service Domain (set of data elements that provide some basic information on a facility’s services and capacities)
- Core basic services offered
- Number of core medical personnel
- Number of inpatient and maternity beds available

Adapted from the World Health Organization.3

A codebook for the signature domain fields was created building on codes created by the Institut Haïtien de Statistique et d’Informatique (Supplementary Appendix).

The first iteration of the MHFL that contained only the signature domain fields was created on January 29, 2010, by blending the MSPP’s existing HSIS health facility list with partial lists, volunteered geographic information, and local knowledge on the post-earthquake status of health facilities in order to produce a more comprehensive list (Table 2). To improve functionality, the Work Group included standardized names of each facility in English, French, and Haitian Creole. The Work Group verified information by soliciting feedback on a publicly posted version of the MHFL coupled with direct outreach to health facilities by phone or in-person when possible.

In keeping with United Nations recommendations on the coordination of information during humanitarian emergencies, the Pan American Health Organization’s Emergency Operations Center (PAHO EOC) took a lead role in managing the MHFL.10,11 The PAHO EOC published the first iteration of the MHFL and codebook to a public Google Site.12 Posting the list to an open website increased the likelihood that the MHFL and its codes would be used and that those involved in the response would provide feedback to note missing facilities and to correct errors. Contributors through the site included NGOs, members of the Crisis Mappers Network,13 and health facility staff. Between January 29 and March 18, 2010, WHO/PAHO released 6 updated versions of the Master List. Each version of the MHFL included new health facilities, fewer duplicates, and corrected variable values (Table 2).

The MHFL was used widely in the initial earthquake response. In addition to the Google Site, a link to the list was posted to many of the information portals that proliferated following the earthquake. The MHFL was also used as the reference data set for health facilities in the OpenStreetMap (OSM) platform.14,15 OSM updated its health facility layer with each of the 7 versions of the list.16

As the initial effort transitioned from emergency response to reconstruction, stewardship of the MHFL was transferred to Shoreland, Inc., during April 2010.17 Following the cholera outbreak in Haiti in October 2010, fields for cholera treatment centers (CTCs) and cholera treatment units (CTUs) were added. The MSPP used the MHFL to determine which communities lacked health facilities so CTCs and CTUs could be installed to provide care to the affected population.18

In September 2011, the MSPP incorporated data from the MHFL into its routine health information system, which collects information on key services provided and human resources present at each facility. The MHFL formed the basis of the Liste des Institutions Sanitaires, the MSPP’s listing of health facilities in the country,19 which is an updated and more robust version of the HSIS. It was also integrated into the Carte Sanitaire, the MSPP’s service delivery and infrastructure status database.20,21 MEASURE Evaluation and the MSPP’s UPE continue to work collaboratively to update and validate the Liste des Institutions Sanitaires in coordination with the directors of statistics and epidemiology within each of the 10 departments. Health facilities and field hospitals can now be uniquely identified. However, some duplicates and data quality issues remain.
TABLE 2. Evolution of the Haiti Master Health Facility List

| Version     | Date            | Host   | Edits/Additions                                                                 | Comments                                                                                                                                 |
|-------------|-----------------|--------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-earthquake | Before 2010    | The HSIS list was available online through the HSIS website. | Last updated in 2009. No entity served as a repository for an MHFL. The HSIS became the basis for the MHFL, but it was incomplete; it did not cover the non-public sector and had variable reporting from the 750 public health facilities in it. |
| 1           | January 29, 2010 | PAHO   | Information on health facilities from the HSIS was merged with other lists creating a total of +/- 1,260 records. The 2009 HSIS health facility list included the following fields: rank (a number assigned to the facility according to when it was created in the commune); name of the department, district, and commune where the facility is located; name of the facility; category (e.g., dispensary, hospital); and type (public, private, or mixed). Information sources included: HSIS, MESI, USAID, PAHO, PEPFAR, UNOCHA, the Sahana Foundation, MINUSTAH, and Ushahidi. |
| 2           | February 9, 2010 | PAHO   | 7 new health facilities were added. |                                                                                                                                              |
| 3           | February 12, 2010 | PAHO   | New fields were added for damage and operational status information; 39 new health facilities were added (including field hospitals); and 41 duplicate records were removed. |                                                                                                                                              |
| 4           | February 16, 2010 | PAHO   | 63 new health facilities were added; 19 duplicate records were removed; and metadata was updated. | All HealthC_IDs from version 4 remained unchanged, but changes were made to the algorithm used to generate new unique identifiers in the metadata (Supplementary Appendix). |
| 5           | February 26, 2010 | PAHO   | HealthC_IDs (unique identification codes) were added to facilities that previously lacked one. | New information received post-earthquake from MEASURE Evaluation on behalf of the Haitian MSPP was incorporated into the new MHFL. |
| 6           | March 11, 2010   | PAHO   | Region, commune, and department IDs in the MHFL were matched to the MSPP_2010 list; official facility names were added; inaccurate values for the various codes used by the MSPP were corrected; geocodes of numerous MSPP sites were corrected; and about 20 duplicate records were removed. This version included all 2010 MSPP health facilities. | New information received post-earthquake from MEASURE Evaluation on behalf of the Haitian MSPP was incorporated into the new MHFL. |
GOVERNANCE OF A NATIONAL MHFL: OPPORTUNITIES AND CHALLENGES

In routine health system planning, lists of health facilities, generally maintained by ministries of health, help organize information about health systems and are instrumental to answering basic questions such as how health services are distributed in a country and how resources may be allocated to address gaps in health service coverage. These lists facilitate reporting on the condition of health infrastructure and capacity to deliver services, which are key information requirements during a response to a humanitarian crisis, such as a natural disaster. Such lists are also essential for routine health information systems because they allow information about specific health facilities to flow within distributed networks in support of health decision-making.

Challenges

Multiple Sources of Information

In many countries, information about health facilities exists within stand-alone systems designed for discrete purposes. Lack of standardized naming conventions and codes unique to each facility but common across information systems introduces ambiguity to facility identity when comparing or consolidating multiple lists, resulting in duplications. It may be difficult to link multiple sources of information to support decision-making under normal circumstances, let alone during a disaster.

Lack of Procedures

Ministries of health hold an essential ownership, management, verification, and communication function for MHFLs. Several dynamics explain why many ministries of health do not have an adequate MHFL. Procedures for regular updates may be lacking, causing information to easily become out-of-date. It is also common for facility-based health services in low- and middle-income countries to involve a complex array of multilateral, bilateral, public, and private for-profit and not-for-profit organizations. These organizations typically maintain information about the health facilities they support. However, there may be little or no information sharing among these groups or with the ministry of health. This is
certainly the case in Haiti, where coordination between the government and the NGO community has historically been poor.31

Cooperation

Haiti’s MHFL provides a national-level view of Haiti’s health facility infrastructure. The MHFL is updated at one central location by the UPE and consolidates information from the MSPP, WHO/PAHO, HHS/Centers for Disease Control and Prevention (CDC), the United States Agency for International Development (USAID), and the NGO community. Yet some coordination issues remain. Although publicly available, there is a gap in regular updates to the MHFL and ongoing quality control efforts are necessary to maintain and improve the quality of the data and to remove duplicate records.

Opportunities

Open Data and Social Networks

When MHFLs do not exist or are incomplete, responders during crises will need to collect data for immediate purposes. In the case of Haiti, open data, social networks, and volunteered geographic information were major factors that facilitated information flow about health facilities during the earthquake response.15,32–37 In addition, multiple organizations collected information directly from health facilities following the earthquake. However, lack of coordination among these organizations created confusion and overwhelmed health facility personnel. A pre-existing list that was updated at a central location could have mitigated this situation.

Quality Control Processes

The process of integrating data from multiple sources can spawn a proliferation of duplication and errors. For multi-sourced data to be widely accepted as reliable information, quality control processes must be in place to rapidly screen and verify data before it becomes official data. In the case of Haiti, central-level engagement of officers within the health system provided a quality check of the information in each of the iterations of the MHFL. However, validation can best occur with the engagement of appropriate staff at more local levels of health system administration.

Free, Online Access

Web-based repositories for MHFLs, such as Haiti’s or Kenya’s repositories, ensure that lists are available when needed and also can provide a platform for the maintenance of facility data over time.3,21,38 Ease of access to health facility lists increases the likelihood of data use. Data users and generators can then feed information to the system to create a cycle that should improve list completeness and quality over time.

The draft guidance from WHO on how to create an MHFL outlines a standardized process and provides WHO-endorsed standards for data format and data governance.3 The WHO guidelines also provide information on how the content of an MHFL can be made accessible and maintained over time.

CONCLUSION

Having an accurate, regularly updated, and freely accessible national MHFL is important for effective routine planning and the delivery of health care services. During the 2010 Haiti earthquake response, the creation of a functioning MHFL proved useful for coordination and reconstruction efforts including subsequent events such as the cholera outbreak. A pre-populated data set that was comprehensive, accurate, and relatively up-to-date would have greatly facilitated initial relief efforts. Recognizing that disasters can occur anywhere and that accurate data are critical for effective response, countries without lists should develop and maintain an MHFL. Modest efforts in this area could greatly enhance the ability to mount a rapid, coordinated, and effective response.

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REFERENCES

1. McDonnell SM, Perry HN, McLaughlin B, McCurdy B, Parrish RG. Information for disasters, information disasters, and disastrous information. Prehosp Disaster Med. 2007;22(5):406–413. Medline
2. Nickerson J. Views From Beyond the OR [blog on the Internet]. Ottawa (ON): Jason Nickerson. [2012] - . Mapping health facilities in crises: reflections and directions; 2012 Jun 6. [cited 2013 Nov 22]; [about 3 screens]. Available from: http://www.jasonnickerson.ca/blog/2012/06/mapping-health-facilities-in-crisis-reflections-and-directions/
3. World Health Organization (WHO). Creating a master health facility list [draft]. Geneva: WHO; 2012. Available from: http://www.who.int/healthinfo/systems/WHO_CreatingMFL_draft.pdf
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4. World Health Organization (WHO). Culture and mental health in Haiti: a literature review. Geneva: WHO; 2010. Available from: http://www.who.int/mental_health/publications/culture_mh_Haiti_2010/en/

5. Government of the Republic of Haiti. Haiti earthquake post-disaster needs assessment: damage assessment, losses, general and sectoral needs. Port-au-Prince (Haiti): Government of the Republic of Haiti; 2010. Available from: http://documents.worldbank.org/curated/en/2010/03/16394500/haiti-earthquake-pdna-post-disaster-needs-assessment-assessment-damage-losses-general-sectoral-needs

6. World Health Organization (WHO) [Internet]. Geneva: WHO; c2014 [cited 2013 Nov 22]. Countries: Haiti; [about 1 screen]. Available from: http://www.who.int/countries/hi/en/index.html

7. World Bank. Social resilience and state fragility in Haiti: a country social analysis. Washington (DC): World Bank; 2006. Available from: http://siteresources.worldbank.org/SOCIALANALYSYS/1104894-1115795935771/20938696/Haiti_CSA.pdf

8. MAX.gov [Internet]. Washington (DC): Office of Management and Budget; [cited 2013 Nov 22]. Available from: https://max.omb.gov/maxportals/home.do

9. Health Facility Technical Working Group. The signature domain and geographic coordinates: a standardized approach for uniquely identifying a health facility: Chapell Hill (NC): University of North Carolina at Chapell Hill, Carolina Population Center; MEASURE Evaluation; 2007. Available from: http://www.cpc.unc.edu/measure/publications/wp-07-91

10. World Health Organization (WHO). Health cluster guide: a practical guide for country-level implementation of the health cluster. Geneva: WHO; 2009. Available from: http://www.who.int/hac/global_health_cluster/guide/en/

11. Thieren M. Health information systems in humanitarian emergencies. Bull World Health Organ. 2005;83(8):584–589. Medline

12. Haiti Health Facilities [Internet]. [Milwaukee (WI): Shoreland; [cited 2013 Nov 22]. Available from: http://sites.google.com/a/nesspective.org/haiti-health-facilities/home

13. Crisis Mappers: The Humanitarian Technology Network [Internet]. [place unknown]: Patrick Meier; c2014 [cited 2013 Nov 22]. Available from: http://crisismappers.net/

14. WikiProject Haiti [Internet]. West Midlands [UK]: OpenStreetMap; [last modified 2012 Apr 12]. WikiProject Haiti/Status/Hospitals; [last modified 2011 Nov 5; cited 2013 Nov 22]; [about 7 screens]. Available from: http://wiki.openstreetmap.org/wiki/WikiProject_Haiti

15. Soden R, Palen L. From crowdsourced mapping to community mapping: the post-earthquake work of OpenStreetMap Haiti. In: CGOP 2014 – Proceedings of the 11th International Conference on the Design of Cooperative Systems; May 27–30, 2014; Nice, France. Geneva: Springer; 2014. p. 311–326. Available from: https://www.cs.colorado.edu/~palen/palen_papers/HaitiCGOP_Final.pdf

16. HaitiData [Internet]. Washington (DC): World Bank Group. Haiti health facilities before 2010 (structures de santé avant 2010), OSM [15.03.2011] - point. 2012 Jun 2 [cited 2013 Nov 22]; [about 2 screens]. Available from: http://haitidata.org/layers/cnigs_spatialdata_hiti_structure_health_facilities_ante_2010_osm_15032011

17. Shoreland, Inc. [Internet]. Milwaukee (WI): Shoreland; c2014. Travax: Haiti health facilities. [cited 2013 Nov 22]. Available from: https://www.travax.com/resources

18. United Nations, Office for the Coordination of Humanitarian Affairs (OCHA). Haiti: cholera snapshot. [New York]: OCHA; 2012. Available from: http://reliefweb.int/sites/reliefweb.int/files/resources/map_2467.pdf

19. Unité de Planification et d’Evaluation (UPE). Liste des institutions sanitaires. Port-au-Prince (Haiti): Ministère de la Sante Publique et de la Population [Haiti], Projet d’Appui au Développement du Système de Santé en Haïti; 2011.

20. Unité de Planification et d’Evaluation (UPE). Rapport de la carte sanitaire du pays. Port-au-Prince (Haiti): Ministère de la Sante Publique et de la Population [Haiti]; 2011.

21. Ministère de la Sante Publique et de la Population [Haiti]. Cartographie sanitaire d’Haiti. Port-au-Prince (Haiti): Unite de Planification et d’Evaluation; 2010. Available from: http://www.msp.gov.ht/cartographie/index.php

22. Rosero-Bixby L. Spatial access to health care in Costa Rica and its equity: a GIS-based study. Soc Sci Med. 2004;58(7):1271–1284. CrossRef Medline

23. Troisej M, Fadot. [Computerization and the importance of information in health system, as in health care resources registry]. Acta Med Croatian. 2005;59(3):251–257. Croatian. Medline

24. Pan American Health Organization (PAHO). Manual logistical management of humanitarian supply. Washington (DC): PAHO; 2000. Available from: http://www.disaster-info.net/SUMA/english/software/manuals/MISEManualEnglish.pdf

25. AbouZahr C, Boerma T. Health information systems: the foundations of public health. Bull World Health Organ. 2005;83(8):578–83. Medline

26. Skinner R. Integrating location into hospital and healthcare facility emergency management. J Healthc Prot Manage. 2011;27(1):31–35. Medline

27. Noor AM, Alegana VA, Gething PW, Snow RW. A spatial national health facility database for public health sector planning in Kenya in 2008. Int J Health Geogr. 2009;8(1):13. Medline

28. Stansfield SK, Walsh J, Prata N, Evans T. Information to improve decision making for health. In: Jamison DT, Brennan JG, Measham AR, Alleyne G, Claeson M, Evans DB, et al., editors. Disease control priorities in developing countries. 2nd ed. Washington (DC): World Bank; 2006. Chapter 54. Available from: http://www.ncbi.nlm.nih.gov/books/NBK11731/

29. Health Metrics Network. Framework and standards for country health information systems. Geneva: World Health Organization; 2008. Available from: http://www.who.int/healthmetrics/documents/lnn_framework200803.pdf

30. McCoy D, Chand S, Srithar D. Global health funding: how much, where it comes from and where it goes. Health Policy Plan. 2009;24(6):407–417. CrossRef Medline

31. De Córdoba J. Aid spawns backlash in Haiti. The Wall Street Journal [Internet]. 2010 Nov 12 [cited 2014 Jul 19]; [about 4 p]. Available from: http://online.wsj.com/news/articles/SB10001424052702304023804575566743115456322

32. Sarcevic A, Palen L, White J, Starbird K, Bagdour M, Anderson K. “Beacons of hope” in decentralized coordination: learning from on-the-ground medical Twitterers during the 2010 Haiti Earthquake. In: CSCW 12 proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work; February 11–12, 2012; Seattle, WA; 2012. p. 47–56. Available from: http://epic.cs.colorado.edu/wp-content/uploads/Sarcevic_et_al-HaitiMedicalTwitterers.pdf

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33. Goodchild MF. Citizens as sensors: the world of volunteered geography. GeoJournal. 2007;69(4):211–221. CrossRef
34. Liu SB, Palen L. The new cartographers: crisis map mashups and the emergence of neogeographic practice. Cartogr Geogr Inf Sci. 2010;37(1):69–90. CrossRef
35. Heinzelman J, Waters C. Crowdsourcing crisis information in disaster-affected Haiti: special report. Washington (DC): United States Institute for Peace; 2010. Available from: http://www.usip.org/publications/crowdsourcing-crisis-information-in-disaster-affected-haiti
36. Zook M, Graham M, Shelton T, Gorman S. Volunteered geographic information and crowdsourcing disaster relief: a case study of the Haitian earthquake. World Med Health Policy. 2010;2(2):6–32. CrossRef
37. Harvard Humanitarian Initiative. Disaster relief 2.0: the future of information sharing in humanitarian emergencies. Washington (DC): UN Foundation; 2011. Co-published by Vodafone Foundation Technology Partnership. Available from: http://www.unfoundation.org/news-and-media/publications-and-speeches/disaster-relief-2-report.html
38. Ministry of Health (MOH) [Kenya] [Internet]. Nairobi (Kenya): MOH; c2011. eHealth-Kenya facilities; 2013 [cited 2013 Nov 22]. Available from: http://www.ehealth.or.ke/facilities/

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