

Resilience of Health Systems during a Prolonged Acute Watery Diarrhoea (AWD) Outbreak in the Sudan

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Abstract

Background: Weaknesses in the resilience of national health systems could contribute to increased morbidity and mortality. We assessed the resilience of the health systems in the Sudan during a prolonged outbreak of Acute Watery Diarrhoea (AWD).

Methods: We conducted a qualitative study whereby we interviewed a total of 269 key informants using a standardized framework for assessment of health systems resilience.

Results: Key informants perceived that the health systems demonstrated medium resilience with moderate disruptions in provision of routine medical care at health facilities across the country during the AWD outbreak. The government and some partners re-prioritized, reprogrammed and redistributed the budget allocated for health and medical services in order to respond to the outbreaks. The FMOH designated selected health facilities for treatment of AWD cases; and spared other health facilities for provision of routine medical care. The surveillance system quickly adjusted to active case findings with zero reporting.

The government set up an inter-ministerial committee that provided stewardship, enhanced coordination among sectors and mobilized resources.

Discussion and Conclusions: Building resilience is a context-dependent and iterative process. Surge demand for health care during major outbreaks tends to overtask and disrupt the functions and performance of health systems particularly in resource poor countries. Using an adapted framework that assesses and classifies levels of disruption in the health systems during emergencies, this study found out that the health systems in Sudan demonstrated minimal disruptions (or moderate resilience) throughout the prolonged AWD outbreak. The moderate resilience in the health system could be mainly attributed to the stewardship role played by the government. Yet, the framework used for assessment lacked composite indicators to monitor changes in the level of resilience over time objectively. It is recommended that health policy and decision-makers should engage partners and utilize Emergency Operations Centre (EOC) platform to make timely informed decisions, prioritize interventions and leverage resources to improve the resilience of health systems.

Keywords: Acute watery diarrhoea; Outbreak; resilience; Sudan

Abbreviations

ARC: American Refugee Committee; AWD: Acute Watery Diarrhea; CBOs: Community-Based Organizations; CBS: Community-Based Surveillance; CFR%: Case-Fatality Rate Percent; CSOs: Civil Society Organizations; DGEHA: General Directorate for Emergency, Emergency Humanitarian Action; DGs: Director Generals; EOC: Emergency Operation Center; EMRO: Eastern Mediterranean Regional Office; EWARS: Early Warning and Response System; FGDs: Focus Group Discussions; FMOH: Federal Ministry of Health; FRC: Free Residual Chlorine;

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HAC: Humanitarian Aid Commission; IDP: Internal Displaced Population; IHR: International Health Regulations 2005; IW: International Week; KI: Key Informants; MOF: Ministry of Finance; MOWR: Ministry of Water Resources; MSF: Médecins Sans Frontières; NGOs: Non-Governmental Organizations; NPHL: National Public Health Laboratory; NPP: National Preparedness Plan; NPRP: Preparedness and Response Plan; OD: Open Defecation; ODF: Open Defecation Free; PHE: Public Health Emergencies; RDT: Rapid Diagnostic Test; RRT: Rapid Response Team; SHF: Sudan Humanitarian Fund; SPHL: State Public Health Laboratories; SRCS: Sudanese Red Crescent Society; TCs: Treatment Centers; TOR: Terms of Reference; WHO: World Health Organization; UNICEF: United Nations Children Fund; UNDP: United Nations Development Program; UNOCHA: United Nations Office for Coordination of Humanitarian Affairs

Key Issues

Major outbreaks tend to disrupt the functions and performance of health systems particularly in resource poor countries. We used standardized framework to assess the resilience of the health systems in Sudan during a prolonged outbreak of Acute Watery Diarrhoea (AWD). The result showed minimum disruptions indicating moderate resilience of the health systems. Yet, the tool used for assessing resilience warrants further development.

Introduction

Major outbreaks and other public health emergencies (PHE) are associated with increased utilization of health services and emergency medical facilities. The emergence of unexpected events where a large number of people would need medical attention or services expose the resilience or fragility and the level of preparedness of the national health systems and their ability to provide coherent response and cope with surge demand for health care [1,2].

The responses to PHE could be overwhelming, overtask health care worker (HCWs), rapidly drain resources, stockpiles, force health authorities to suspend operations of many health services and eventually disrupt the functionality of the existing health systems. Health facilities may fail to cope with such events and lose their ability to retain the same control over existing structure and functions; and force decision-makers to reorder their priorities in providing health services [3].

Health system resilience can be defined as the capacity of health systems to absorb, adapt and transform when exposed to a shock such as a pandemic, natural disaster or armed conflict. The resilient health systems would still retain and maintain core functions and structure when a crisis hits. Informed by lessons learned during the crisis, resilient health systems reorganize if conditions require it [3,4].

The health system is considered resilient if it requires minimal changes to its routine functions and established structures during the course of the outbreak. Conversely, a less resilient system would require major adjustment when challenged by significant public health emergencies that would otherwise have been handled with minimum disruption of an established system [5].

Resilience of health system has been recently widely identified as a critical attribute for strong health systems during major outbreaks; especially following the 2014-15 West Africa Ebola epidemic [3,5-7]. However, the operational elements of resilience and ways that a crisis experience can shape resilience are not well described in the literature.

During the period between 1966 and 2014, there were 15 documented outbreaks of Acute Watery Diarrhoea (AWD) in the Sudan. Previous AWD outbreaks were mostly of limited spread affecting 1 -3 States except for 2006, 2011 and 2014 when all States were affected. The first cases of the recent outbreak (2016 - 2018) were linked to cross-border movements in Kassala and Blue Nile States. The AWD outbreak spread to all 18 States and required a multi-sectoral response to bring it to an end. During the period between Aug 2016 to April 2018, the national disease surveillance system reported a total of 36,962 AWD cases, including 823 deaths (Crude case-fatality rate percent [CFR%] = 2.2%).

Objective of the Study

The main objective of this paper is assessing the resilience of the health system in the Sudan during this prolonged outbreak as part of a general evaluation of the response activities instituted by the Government of the Sudan (GOS); and to identify strategic actions needed to improve preparedness and response for future AWD outbreaks.

Material and Methods

We conducted a qualitative study whereby we interviewed a total of 269 key informants as individuals or in a form of Focus Group Discussions (FGD). We interviewed high-level decision-makers, including the Minister, Federal Ministry of Health (FMOH), State Minister of Ministry of International Cooperation, five State Ministers of Health, the Undersecretary of FMOH, and States Ministries of Health, National Health Insurance, Task Force and Rapid Response Teams (RRT) members; Water Resources; Education, Humanitarian Action Commission (HAC), media (Radio and TV) and FMOH Advisory Group Members, Parliamentarians, Country Representatives for UN agencies (WHO, UNICEF, Resident Coordinator (UNDP), and UNOCHA) and Heads of Sub-offices for UNICEF, UNHCR, WHO in some States. selected International Non-Governmental Organizations (INGOs), the Italian Cooperation, MSF Spain, SRCS, OXFAM, ARC, CARE., healthcare workers at Treatment Centres and community members in charge of civil and societal organization (CBOs and CSOs), technical officers in Health and WASH Clusters and Water Resources. We also interviewed individuals who worked in academia, emergency management, local government, health care, law, media, and public health during the response. Similarly, a total of eighteen FGDs were conducted with members of RRTs, healthcare workers, staff of partner agencies and community members. Furthermore, we visited the Water Treatment Plants, water tankers, wells, etc., AWD Treatment Centres at Hospitals and Health Centres, and reviewed data on laboratory testing of water.

The investigators assessed the resilience of the national health system by weighing its ability to maintain core functions during emergencies and its adaptability to changes during the AWD outbreak using a standardized framework used for assessing health systems resilience during the Ebola outbreak in West Africa [4]. Based on these criteria, the level of the health systems disruption was weighed by the investigators into three categories: major (poor resilience), moderate (medium resilience), minimal (strong resilience).

Results

Key informants perceived that the health systems demonstrated medium resilience with moderate disruptions in provision of routine medical care at health facilities across the country during the AWD outbreak. States did not have adequate infrastructure in place to timely respond to and promptly contain the outbreak. Consequently, the outbreak affected all States and it was protracted. The government and some partners reprioritized, reprogrammed and redistributed the budget allocated for health and medical services in order to respond to the outbreaks. The FMOH designated selected health facilities for treatment of AWD cases; and spared other health facilities for provision of routine medical care. Whenever needed, treatment centres (TCs) were setup within the hospital away from regular patients' wards or use nearby temporary shelters or schools. During the outbreak, some health workers; especially members of the RRTs, from different States supported incumbent RRTs in other States. Based on the surveillance and situation reports, the FMOH swapped medical supplies between most and less affected States during the outbreak period. Decision-makers at FMOH supported by Emergency Operation Centre (EOC) facilities had regular access to outbreak data. The surveillance system quickly adjusted to active case findings with zero reporting. Table 1 summarizes the main findings on resilience of the health system during AWD outbreak in Sudan, 2016 - 2018.

The health authorities brought together diverse actors and groups to formulate solutions as well as the ability to transform and adapt the system to the dynamics of the outbreak. There was a national preparedness plan for the rainy season whereby medical supplies were pre-positioned at the State level. The FMOH deployed RRTs that strengthened the SMOH capacity to respond to the outbreak.

The government identified treatment centres and assigned health workers to serve in the treatment centres that helped to minimize disruption to the routine health service delivery during the outbreak. The private health facilities were referring patients to the designated public treatment centres. The fee for service for AWD patients was exempted and covered by the national health insurance during the outbreak. The government set up an inter-ministerial committee that provided stewardship, enhanced coordination among sectors and

S.N	Resilience Criterion	Findings/observations	Degree of Disruption/ Level of adjustment (Major, Moderate, Minimal) ◊
1	Aware §	<ul style="list-style-type: none"> Used sentinel sites for detection of outbreaks (coverage 27%). Laboratory was not part of the routine surveillance system Limited lab capacity to confirm and characterize causative agent Did not timely analyse and interpret data to tailor/adapt response. Irregular/infrequent feedback to States, localities and governmental and other UN partners. (bulletin, alert network, webpage) 	Major
2	Diverse Ω	<ul style="list-style-type: none"> The system continued delivery of routine services including response to other outbreaks (Dengue, measles) Continued to deliver regular services for routine health services 	Moderate
3	Self-regulating Δ	<ul style="list-style-type: none"> Dealt with acute (AWD) and concurrent complex situations (refugee, IDPs, conflict zone, mobile population) that stretched the system with minimal disruption of routine service. FMOH designated selected hospitals for management of AWD cases interfering/freeze or scaling down other services. 	Moderate
4	Integrated §§	<ul style="list-style-type: none"> Different service providers and program partners were involved Limited information sharing (mostly for AWD taskforce members) Coordinated response at federal, state and locality levels Designated focal points at federal, state and locality to coordinate 	Moderate
5	Adaptive ¥	<ul style="list-style-type: none"> Adapted zero reporting and active case finding during the outbreak Did not shift to community event-based surveillance system Transformed/converted existing units/departments to case management centres Established CTCs within existing infrastructure including schools). Did not fully engage hospital clinicians in AWD case management (perceived not as part of routine duty by some clinicians) 	Moderate

Table 1: Summary of the main findings on resilience of the health system during AWD outbreak in Sudan, 2016-2018 (Based on five criteria described by Kruk, et al (2015)) [4].

Legends for table 1: Based on five criteria described by Kruk et al. [4]

§ **Aware:** Aware of potential health threats and risks to the population from biological and non-biological sources. Awareness needs strategic health information systems and epidemiological surveillance networks that can report on both the status of the system and impending health threats in real time, allowing predictive modelling.

Ω **Diverse:** Health systems that have the capacity to address a broad range of health challenges rather than a targeted few are more stable and capable of detecting disturbances when they arise.

Δ **Self-regulating** is the ability to contain and isolate health threats while delivering core health services and avoiding propagating instability throughout the system.

§§ **Integrated:** Resilient health systems bring together diverse actors, ideas, and groups to formulate solutions and initiate action. Sharing of information, clear communication, and coordination of multiple actors are hallmarks of integration and are best achieved by having a designated focal point in the health system.

¥ **Adaptability** is the ability to transform in ways that improve function in the face of highly adverse conditions.

◊ **Major** (poor resilience), **Moderate** (medium resilience), **Minimal** (strong resilience).

mobilized resources. The community mobilized in the response undertakings during the outbreak. The government and some partners had to reprioritize, reprogram and redistribute the budget allocated for health and medical services in order to respond to the outbreaks.

Discussion

Building resilience is a context-dependent and iterative process. A health system is considered resilient if it requires minimal changes to its routine functions and established structures; especially, during the course of the outbreak. Using five criteria to assess the resilience of health systems, the findings of this study indicated that the health systems in Sudan demonstrated minimal disruptions (or moderate resilience) to the routine health service delivery during the AWD outbreak [4]. The moderate resilience in the health system during the outbreak could be mainly explained by the stewardship role played by the government.

Health policy and decision-makers should understand how to rebuild resilient health systems following occurrence of major outbreaks. The FMOH need to engage partners in building sustainable, resilient health systems and outline how the potential workforce capacities of partners get incorporated into the health care delivery system especially during outbreaks and public health emergencies. Involvement of partners provides an insightful picture of how an epidemic might impact society; particularly, containment interventions intended to guard against negative impact of PHEs on the health system and basic societal functions [8].

The AWD outbreak highlighted the need to strengthen the national preparedness plan and maximize use of Emergency Operations Centre (EOC) and collected data to make timely corrective decisions that minimize disruption of routine health services. Future strategies should allow for identifying areas to apply short-term versus long-term interventions and timely targeted policy interventions and what should be in place at local, State and national levels [9,10]. Deterioration in the resilience systems could contribute to increased mortality. It has been estimated that decrease in antenatal care coverage dropped by 22% during Ebola outbreak in Sierra Leone; this decrease in utilization of life-saving health services translates to 3600 additional maternal, neonatal and stillbirth deaths in the year 2014-15 under the most conservative scenario [11].

The AWD outbreak highlighted the need for enhanced and sustainable capacity to plan for and respond to major epidemics and other PHEs. To fulfil essential demands or requirements of an acceptable level of health system resilience, there is need to ensure adequate allocation of resources for response activities and improving and maintaining core functions. Using surveillance data to document the magnitude of the PHEs as well as the cost of the operations during control measures would help health authorities further strengthen the resilience of health systems by drawing more political support [11]. In fact, major outbreaks may occur during profound economic crises which make it difficult for existing health systems to cope adequately. Many countries count on assistance obtained from external donors to mitigate the undesirable impact of the outbreak. During the early phases of major outbreaks, countries may welcome deployment of external RRTs to provide surge capacity support. There are calls for development of regional African strategy of creating multi-national RRT. While establishing better regional capacity, countries need to have sufficient resources to maintain the “resilience” required of the health system [3,12].

Resilience of a health system during PHEs neither implies self-sufficiency and self-reliance at all times nor efficiency in sustaining routine health services during crisis. Externally driven coping strategies included: training of confident HCWs, provision of necessary equipment and enabling, rewarding safe working environment and building mechanisms into routine systems that pre-empt shocks, rather than waiting to respond belatedly to crises [13].

Salient interventions for controlling major AWD outbreaks included: improvement of epidemiological and laboratory disease surveillance, clinical management of cases of AWD, waste management, community mobilization, and staff training [7].

Nevertheless, the complex triad of vulnerability, preparedness and resilience make it difficult to develop specific indicators for gauging the resilience of health systems before and during emergence of major PHEs. It is even more difficult to identify valid specific indicators for the cut-off points for the three different levels of resilience of health systems. The framework used in this study to assess resilience of the health systems during the AWD outbreak in Sudan lacked indicators to assess patient satisfaction of the services provided during the outbreak [4]. The framework used to assess the resilience does not classify the level of resilience (i.e. high, medium or low). Moreover, it does not have monitoring indicators that track changes in the resilience of the health systems over time (i.e. temporal component for different phases of the outbreak). Thus, composite cross-disciplinary metric indicators are needed to measure resilience objectively [10].

Conclusions

Building resilience is a context-dependent and iterative process. Surge demand for health care during major outbreaks tends to over-task and disrupt the functions and performance of health systems particularly in resource poor countries. Using an adapted framework that assesses and classifies levels of disruption in the health systems during emergencies, this study found out that the health systems in Sudan demonstrated moderate disruption (or medium resilience) throughout the prolonged AWD outbreak. Yet, the framework used for assessment lacked indicators to monitor changes in the level of resilience over time objectively. It is recommended that health policy and decision-makers should engage partners and utilize Emergency Operations Centre (EOC) platform to make timely informed decisions, prioritize interventions and leverage resources to improve the resilience of health systems.

Declarations

Ethics approval and consent to participate

Not required because there is no human subject involved.

Consent to publish

Not applicable.

Availability of data and materials

Authors used surveillance and published data. References cited.

Competing Interests

None.

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Authors' Contributions

Dr Ayana Yeneabat prepared the tools used for the study. All authors participated in field visits, interviews, review of surveillance data, and discussions, interpreting observations. H El Bushra preparing the manuscript. All authors reviewed and discussed the manuscript.

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