Health System Adaptability at Primary Level Care in the Time of COVID-19: Experiences From Ethiopia

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Research article

Keywords: COVID-19, Health system resilience, Adaptability, Primary Health Care, Ethiopia

Posted Date: October 9th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-88250/v1>

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Abstract

Background

COVID-19 is a global public health emergency, that has had massive implications on the ability of health systems to avail essential services both during and after the emergency. An effective response thus requires an agile health system that can adjust, reorganize, transform or modify in response to shocks and stress, and to recover quickly in the aftermath. This study aims to identify the major attributes that health systems needed to be adaptable in early stages of the COVID-19 pandemic, as observed in selected primary health care facilities in Ethiopia.

Methods

This study employed a retrospective cross-sectional study design based on the 'ready, willing and able' framework for health system resilience. The assessment used two independent, concurrently administrated instruments. A total of 163 health centers were visited from April to June 2020.

Results

The overall mean score for COVID-19 preparedness was 73.1 ± 16.1 standard deviation (SD) and it ranged from 28.9 to 99.9 out of 100. The mean score for the 'ready' dimension of preparedness was 75.1 ± 19.1 SD, for the 'willing' dimension it was 61.6 ± 24.6 SD and for the 'able' dimension the score was 82.8 ± 21.0 SD. Multivariable linear regression analysis showed that levels of functionality of governing, and management systems, integration of emergency responses into the routine system, and prior experience of implementing quality improvement efforts were positively associated with COVID-19 preparedness.

Conclusion

Health system resilience is a result of investments made prior to any incidents to ensure that the system is prepared for unpredicted shocks. Early adaptation required to contain the effects of COVID-19 may be considered as a litmus test to understand the capacity of primary health care facilities in Ethiopia to withstand future health system stressors.

Background

Early in the COVID-19 pandemic, the WHO advised all countries to be prepared for containment, including active surveillance, early detection, isolation and case management, contact tracing and prevention of the onward spread of the infection (1). For any health care system, such emergencies have massive implications for essential services to not only continue during the crisis, but then to recover and resume usual operations (2).

The availability of great strategies alone is insufficient in response efforts as availability of adequate resources both human and financial, and ability to handle supply chains for essential products that are

required during an emergency are also essential elements (3). COVID-19 greatly stressed both well-resourced and underfunded health systems to a breaking point. In the past, this kind of stress was seen mostly in under-resourced settings against epidemics such as cholera, drug resistant tuberculosis, Ebola and Zika (4). COVID-19 demonstrated the short-term vulnerabilities of all national health systems, has threatened each system's ability to handle COVID-19 in the long term, and has jeopardized each system's ability to not only provide routine services, but to respond to other current and future health emergencies (3).

Having a resilient health system with the capability of the public health and health care systems, communities, and individuals, to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities is critical. These require preparedness with a coordinated and continuous process of planning and implementation that relies on measuring performance and taking corrective action (4–6). Well prepared systems show timely and optimum adaptability with changes in one or several aspects of the health system, and possibly temporary actions (7). It requires strengthening health systems both before and during an outbreak, including the metrics of health system performance, in order to provide guidance for actors involved in the response activities (4). Most of the literature described the general attributes of a resilient health system, but no implementation frameworks were identified that could translate these elements into specific capacities that health system actors can employ to improve resilience to outbreaks including COVID-19 in a variety of settings (8–10).

In Ethiopia, reinforcing a community-centered primary care approach is emphasized in the national health sector transformation plan (HSTP) as a way of strengthening community, health facility and health system resilience and minimizing health risk of emergencies. Emergency preparedness is among the main national public health emergency management (PHEM) strategic initiatives (11). While preparedness of health centers for COVID-19 response is recognized as critical, questions remain about how to define, quantify, measure, and assess preparedness (8,12,13).

COVID-19 has already deteriorated essential health service delivery nationwide in Ethiopia within an already fragile health system. A March 2020 report showed a significant decrease in ANC, contraceptive acceptance rate, MCV1 and Penta-3 as well as HIV testing (14). This has happened despite Ethiopia's early January 2020 COVID-19 preparation and response at national and sub-national levels by establishing an Incident Management System (IMS) under the national Public Health Emergency Operation Center (PHEOC). Ethiopia reported its first confirmed case on March 13, 2020; a day after the WHO declared the COVID-19 as a pandemic (15). Following the case buildup, the country has developed various guiding documents including: *'The Inter-personal Communication (IPC) interim guideline for health care settings'*(16), *'Ethiopian health care facility COVID-19 Preparedness and response protocol'* (17) and the *'MOH essential care services guideline during COVID-19'*. The recommendations from these documents entail changes that should happen in the health system at all levels. Translating these policy recommendations into practice needs proper orientation and technical support at all levels.

The USAID Transform: Primary Health Care Activity as part of its pandemic response adaptation developed a checklist and protocol for project staff to measure specific capacities, capabilities and processes and support health facilities to improve their COVID-19 preparedness. This is based on the concept of resilient health systems and incorporated new recommendations from the national COVID-19 guiding documents (16,17). As in any emergency preparedness, preparation for COVID-19 response is not a one-time activity and is rather linked to complementary prior investments to strengthen all components of the health system building blocks to help the health system quickly adapt to situations. This study aims at identifying the major attributes for quick, early adaptations observed to implement recommendations in the time of COVID-19 in selected primary health care facilities.

Materials And Methods

Study settings

Ethiopia has a three-tier health service delivery system. The primary level consists of primary health care units (health posts, health centers, and primary hospitals); secondary level services are provided by general hospitals; and tertiary services by specialized hospitals (11). A health center (HC) is staffed with an average of 20 technical staff and it provides both preventive and curative services. A HC and five satellite health posts (HPs) constitute a Primary Health Care Unit (PHCU) and these entities provide services to approximately 25,000 people, altogether. USAID Transform: Primary Health Care covers a total of 425 districts in the five regions of Ethiopia, (Oromia, Amhara, SNNP, Sidama and Tigray) where a total of 117 primary hospitals and 1,837 health centers provide health care to 53 million people.

Interventions

The project uses different approaches to improve public health service delivery and management. These approaches include onsite mentoring, coaching and supportive supervision to the project intervention districts, health offices and facilities. After the emergence of COVID-19, the project designed a COVID-19-specific onsite monitoring and support checklist to be used by the supervising team concurrently with the routine clinical supportive supervision checklists. The COVID-19 specific tool aims to systematically assess and support health facilities for COVID-19 adapted service delivery as per the national recommendations. The focus areas include facility administrative change requirements, safe service delivery, patient flow, staff motivation, optimization of service delivery, and essential supplies. Both routine and COVID-19 related checklists were organized to frame two-way discussions between supervisors and health workers (HWs) at each health facility. Each question has a definition, decision points and response recording space to inform an improvement plan. A supervisor is expected to follow the checklists and record the findings and work with the staff and management of the health facility towards improvements on the identified problems.

Study design and instruments

The study employed a retrospective cross-sectional study design. The assessment used the two independent instruments: the existing routine clinical checklist and the COVID-19 checklists, to be concurrently administrated at the health centers. A conceptual framework for public health emergency preparedness system improvement was used to categorize the COVID-19 questionnaire (instrument one), into major domains: ready, willing, and able, (table 1) with the overlap point being the nexus of preparedness (figure 1). The framework defines “readiness” as the status of being available for prompt functional response, action, or service, by virtue of possessing the structural support and resources to enable timely responses; “willing” as the status of being motivated and confident, and “able” as the status of having the operational knowledge and skills to perform a task successfully (12). Selected data from the routine supportive supervision checklist (instrument two), were categorized into seven major domains by considering the project’s intervention efforts for routine health services (table 2). The questions in both instruments were binary (true or false) response types. Although the checklists are now routinely used, the data for this study was collected from April to June 2020. During this period, a total of 163 health centers were visited out of the 1,837 in the project implementation regions (8.9%).

Data collection

Technical experts from the project have used both checklists to systematically assess and support health facilities on routine service delivery and COVID-19 adaptations applying the recommended safety procedures. As they assess and support, they enter the data from both checklists on-site using tablets to access an online electronic system. The system allows the questionnaires to be programmed and it follows skip patterns based on previous responses. Both checklists required: 1) interviews with the relevant health workers to assess knowledge and practice, 2) observation of the availability of functional equipment, drugs, and other materials, and 3) review of medical records.

Variables of interest

The dependent variable of this study is health facility “preparedness” to respond to the COVID-19 pandemic. Selected indicators define three domains of preparedness: ‘readiness’, ‘willingness’ and ‘ability’. A high-quality preparedness and response are expected to occur where most of the requirements for the three constructs are satisfied and when the overlap among them is maximum. The dependent variable is measured at the continuous level. A high composite score of the three domains suggested better facility preparedness in terms of prevention and response to the COVID-19 pandemic (table 1).

Level of “readiness”, “willingness”, and “ability” of health facilities are expected to vary depending on several factors. Based on literatures and observations, potential independent variables were identified. Components that define each category of independent variable were taken from the routine supportive

supervision checklist (instrument 2) and other relevant national databases. The categorization was done based on program implementation experience (table 2).

Data analysis

Data were managed using a web-based system, DHIS2, and exported to SPSS version 25 for statistical analysis of both descriptive and inferential statistics. Descriptive statistics were used to analyze the dependent and independent variables. A standard multiple linear regression analysis was used to understand whether facility preparedness to the COVID-19 pandemic can be predicted based on the seven independent variable domains listed in Table 3. The analysis was also used to determine how much of the variation in COVID-19 preparedness can be explained by the independent variables, and the relative contribution of each of these independent variables in explaining the variance. All assumptions of the multiple regression test were validated before significance testing, the level of which was set at $P < 0.05$.

Ethical considerations

The study used aggregate secondary program data. The results of the study did not include the name of the health facilities and other specific site identifiers. The JSI Research and Training Institute, Inc. internal Institutional Review Board (IRB) determined that this activity is exempt from human subjects' oversight (IRB #20-39E). Facility permissions were secured from the health center management and verbal consents were also sought from the health workers.

Results

Facility Description

A total of 163 health centers that were visited from April to June 2020 were included in the study. Most facilities were located more than five kilometers away from district capitals, 119 (73.0%), with an average distance of 16.5 ± 15.4 standard deviation (SD) kilometers from a facility to the district capital. One hundred and fifty-seven, (96.3%) of the facilities had access to roads and 45, (27.6%) of facilities were staffed as per the standard (table 3).

Facility performance

Descriptive statistics were performed to determine the means and standard deviations of the dependent and independent variables. The minimum score of COVID-19 preparedness in this study was 28.9 and the maximum was 99.9. Accordingly, the mean score for the 'ready' domain was 75.1 ± 19.1 SD; for 'willing' it was 61.6 ± 24.6 SD; and for 'able' it was 82.8 ± 21.0 SD. The overall mean total score of the COVID-19 preparedness outcome was 73.1 ± 16.1 SD. Table 4 summarizes facilities' 'supportive supervision'

category scores. Of note is that almost half of the facilities visited, (47.2%) had integrated emergency responses with existing routine services and 62.6 percent of them are in districts with vulnerability to emergencies.

Multivariable linear regression analysis

Standard multiple regression was conducted to predict facility preparedness to the COVID-19 pandemic given the seven independent variables listed in Table 2. We found linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. We also found independence of residuals, as assessed by a Durbin-Watson statistic of 1.688. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentized deleted residuals greater than ± 3 standard deviations, no leverage values greater than 0.2, and values for Cook's distance above 1. The assumption of normality was met, as assessed by a Q-Q Plot. The multiple regression model significantly predicted COVID-19 preparedness ($F(7, 155) = 10.137, P < .0005$). R^2 for the overall model was 31.4% with an adjusted R^2 of 28.3%. Functional governing and management system, integration of emergency response with existing routine services, district vulnerability to emergencies and quality improvement efforts added significantly to the predication ($P < .05$). Regression coefficients and standard errors can be found in table 5.

Multivariable linear regression analysis showed that level of functionality of governing, and management system was positively associated with COVID-19 preparedness. An increase in facility governing and management system score was significantly associated with better performance in facility preparedness to COVID-19. Integration of emergency response with existing routine services was also positively associated with COVID-19 preparedness and facilities with integration of emergency response with existing routine services scored 5.434 higher than facilities with no integration of emergency response with existing routine services. Facilities that are in emergency vulnerable districts were negatively associated with COVID-19 preparedness when compared with those in non-emergency districts. The multiple regression equation also predicts that the more facilities are implementing quality improvement efforts the better they are prepared to function well during emergencies like COVID-19.

Discussion

The Ethiopian health system, along with every health system in the world, is experiencing major challenges in coping with the COVID-19 pandemic. The pre-existing health system vulnerabilities typical of low to middle income country have exacerbated these challenges (18). Monitoring and supporting health facility preparedness is a high priority, as is defining COVID-9 preparedness in the midst of the shifting pandemic (9,19). In Ethiopia, the implementation-oriented checklists developed by the project have effectively operationalized the concept of resilient health systems and the new recommendations from the national guiding documents, including the '*Ethiopian health care facility COVID-19 Preparedness*

and response protocol'. Project and health sector staff can now measure specific capabilities and processes and to provide onsite support to health facilities. Apart from this primary purpose, the data generated has also provided a way to quantify preparedness in terms of 'readiness', 'willingness', and 'ability'.

The study found that health facilities performed better in the 'ability' (82.8%) dimension of preparedness measurement criteria, followed by 'readiness' (75.1%). The 'willingness' dimension was found to be the lowest, (61.6%) reducing the overall preparedness score to 73.1%. This aligns with the literature, which underscores the importance of health worker psychological safety in serving as pre-requisites for organizational resilience (20). During normal circumstances, working in health care is recognized to be emotionally distressing (21). With the arrival of COVID-19, fighting a lethal virus, particularly with PPE shortages and thus contacting a virus, has amplified emotional distress experienced by health care workers (22). A growing body of pandemic literature has also reported concerns in regard to lack of reassurance, support, and acknowledgment from leaders, for the unprecedented levels of emotional distress experienced by frontline health care workers during COVID-19 (23).

The results have also showed disparity in the levels of preparedness: the minimum score of COVID-19 preparedness was 28.9 while the maximum was 99.9. Functional governing and management system including leadership development, integration of emergency response with existing routine services, district vulnerability to emergencies and quality improvement efforts were important factors explaining these huge differences. This underpins the importance of prior investment to improve health system structures and functionality before any crisis. Similar studies have also shown that facilities with strong governance practices perform well in times of challenges including during outbreaks (24). Quality improvement efforts, especially when they become an intrinsic part of the health facility's work, are expected to bring unceasing efforts of key actors (e.g., health care professionals, patients and their families) (25,26). This is expected to help health facilities to make adaptations that will lead to better patient outcomes during the COVID-19 epidemic (27). The findings of this study are consistent with this as health facilities with functional QI process were found to be better prepared than the others.

In this study health facilities in hotspot priority districts were found to be less prepared for COVID-19 response than the others. This is likely to be due to the poor system capacity in hotspot districts which is further stretched by other emergencies. Periodic hotspot classification is carried out by Ethiopia's National Disaster Risk Management Commission (NDRMC) to categorize districts according to levels of vulnerability. It is derived using expert judgment related to six multisector indicators, agreed upon at regional and federal levels, including agriculture, nutrition, and markets. Even though it is primarily an indication of food security, risk of disease outbreaks and health system capacities are also important considerations in classifying districts (28). Institutions with previous experiences of integrating emergency response to the development efforts were found to be better prepared in this study. This could be due to personal, institutional and sector level experiences in managing emergencies in the past. Globally, however, there is limited evidence on how previous experience on emergencies helps primary health care facilities to be better prepared for the current pandemic (29).

Limitation to this study include that this is a cross-sectional assessment and did not assess prospective change in service provisions during the COVID-19 epidemic in Ethiopia. This assessment and support focused on COVID-19 preparedness at the health facility level. System wide preparedness, however, is equally important in creating an enabling environment. There are therefore several additional components that should be considered, including: core health system capabilities; infrastructure and transportation; financing; barriers to care; communication; collaboration and partnerships; leadership; surge capacity; and risk communication. Even though achieving health system resilience requires numerous processes, mechanisms, policies and actions from a variety of different health system actors, the scope of this study was limited to the health sector only. In addition, the study did not consider the 'ready', 'willing', and 'able' framework when initially designing the COVID-19 supervision checklist.

Conclusion

Health system agility requires investments made before crisis incidents erupt. The ability of the Ethiopian health facilities to withstand COVID-19 may be considered as a litmus test to understand health system functionality. This study found that efforts to improve the leadership and governance practices at the lower level, and introduction of process improvement cycles which require review of existing data and implementation of new change ideas, are important to enhance early health system agility during a crisis. Experiences of integrating emergency responses as part of the routine system was also found to be an important contributor for early agility of the health system during other crises. In contrast, vulnerable districts require more consistent attention, which is essential for planning and prioritization purposes, at the early stages of emergencies when resources can easily be mobilized in response to any crises. Moreover, considering the extended presence of the COVID-19 pandemic now and the scope of this study, it is good to conduct large scale studies which will be useful in strengthening the overall emergency response and future preparedness for similar outbreaks.

Abbreviations

ANC: Antenatal Care; AYHD: Adolescent and Youth Health and Development; DHIS: District Health Information System; FMOH: Federal Ministry of Health; FP: Family Planning; HP: Health Post; IMNCI: Integrated Management of Newborn and Childhood Illnesses; IPLS: Integrated Pharmaceutical Logistics System; QA: Quality Assurance; QI: Quality Improvement; PHC: Primary Health Care; PHCU: Primary Health Care Unit; PNC: Post Natal Care; PPE: Personal Protective Equipment; RUTF: Ready to Use Therapeutic Feeding; SD: Standard Deviation; USAID: United States Agency for International Development; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate

JSI Research and Training Institute, Inc. Institutional Review Board (IRB) has determined that this activity is Exempt from human subjects' oversight (IRB #20-39E).

Consent for publication

Not Applicable

Availability of data and materials

All relevant data are within the paper and its Supporting Information files.

Competing Interest

None declared

Funding

USAID Transform: Primary Health Care is a United States Agency for International Development (USAID) funded health program under cooperative agreement number of AID-663-A-17-00002. The program is implemented by a consortium of organizations which includes Pathfinder International, JSI Research & Training Institute, Inc., EnCompass, Abt Associates Inc., and Ethiopian Midwives Association in collaboration with local Government and Non-government partners. The funder does not have any role in the design of this study, data collection, analysis and writing of the manuscript. The authors' views expressed in this study report do not necessarily reflect the views of USAID or the United States Government.

Authors' contribution

BFD & IAB contributed for the conception of the study; YA, IAB, ZT, BFD & MAK contributed for the design of the study; IAB contributed for data cleaning and formal analysis. YA, IAB, ZT, & BFD contributed for drafting of the manuscript. MAK, BFD, AE, SMD, AR, AST & FR managed the project. All authors have read and approved the final document.

IAB: the corresponding author submitted the manuscript for publication.

Acknowledgements

The authors thank Heran Demissie and Kristin Eifler for English language and technical editing. The Authors do also thank the cluster level staff who collected the information.

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Tables

Table 1: Dependent variable category components

Category	Components
Ready	<ul style="list-style-type: none"> · Availability of functional COVID-19 response team · Assigned infection prevention and control focal person or a team for COVID-19 · Assigned crowd supervisor · Health facility arrangement and spacing of recommended measures for patients and attendants · Availability of functional hand washing facility around the gate · Health facility keeping 1.5 to 2 meters between beds in the regular emergency department care and in all wards and minimizing attendants and care givers · Health facility posting enough COVID-19 related signage, posters etc. with clear messaging · Health facility transmitting key COVID-19 related messages, (education, audio, TV etc.) · Availability of an efficient system to identify suspected cases in pre-triage area · Availability of a designated place or room to isolate suspected cases · Health facility providing masks for suspected cases · Availability of a clear protocol in place for targeted referrals · Health facility monitoring key EHS indicators weekly to optimize services · Awareness of the MOH's COVID-19 supplies recommendations · Availability of register to record information on suspected cases in the isolation site
Willing	<ul style="list-style-type: none"> · Levels of staff absenteeism, turnover and unplanned leave taken by staff that are not 'sick' · Staff recognized and encouraged by the woreda, zone, or region's leadership in the past 3 months (ask the director) · Staff get duty and other allowances on time and as per their entitlement · Health facility assign HWs with high risks (e.g., those with chronic illness) to less risky tasks or find other safe options · Staff motivation to continue providing services
Able	<ul style="list-style-type: none"> · Staff oriented on COVID-19 IPC measures · Correct use of approved PPE · Service providers meet hygiene standards (i.e., wash their hands properly or use alcohol-based hand sanitizer or change gloves after each client contact) · Availability of COVID-19 protocol and guideline documents · FP, ANC, delivery, PNC, IMNCI/ICCM, EPI, AYHD, nutrition, and chronic illness service delivery as per the new COVID-19 adapted recommendations

Table 2: Independent variable category components

Category	Components
Functional governing and management system	<ul style="list-style-type: none"> · Health facility led by a functional governing board · Availability of standard service management guidelines for services
Community and facility relationship	<ul style="list-style-type: none"> · Health facility exercising any of the community feedback collecting mechanisms and town hall meetings · Availability and use of social behavior change communications (i.e., demand creation) plan · Health facility works together with the lower level government administration
Use of data for decision making	<ul style="list-style-type: none"> · Synthesized evidence by performance review team utilized for decision making at the HC · Health facility using data for planning and monitoring quality improvement
Integration of emergency response with existing routine services	<ul style="list-style-type: none"> · Availability of a stabilization center (SC) to treat complicated SAM cases · Health facility systematically tracking nutrition and emergency supply status at catchment health posts
District vulnerability to emergencies	<ul style="list-style-type: none"> · District hotspot classification carried out by the national disaster risk management commission (NDRMC) by considering various multisectoral risks and capacities
Quality improvement efforts	<ul style="list-style-type: none"> · Trained health workers providing service as per the standard guidelines · Health facility implementing IPLS standards to ensure uninterrupted supply chain management · Health facility having an established QI team and assigned a focal person for QI · Availability of a monitoring mechanism for compliance to standards · Availability of infection prevention procedure guidelines
Frequency of supportive supervision	<ul style="list-style-type: none"> · Number of supportive supervision made to the facility (Project staff and or public sector staff)

Table 3: Characteristics of facilities in the study (n=163)

Characteristics	Number (percent)
Average catchment population	26838
Facility location	
> 5 km away from the district capital	119 (73.0)
within 5 km of the district capital	44 (27.0)
Access to roads	157 (96.3)
Access to internet	26 (16.0)
Availability of technical staff as per the standard	45 (27.6)
Average # of health posts under the health center	5.7

Table 4: Facility independent variables score (n=163)

Category	Mean	SD
Functional governing and management system	78.2	32.9
Community and facility relationship	63.4	33.6
Use of data for decision making	64.1	40.3
Previous emergency experience	47.2	50.1
Facility woreda vulnerability to emergency	62.6	48.5
Quality improvement efforts	70.1	29.3
Frequency of supportive supervision	3.6	1.7

Table 5: Multiple regression results for COVID-19 preparedness

	Unstandardized Coefficients		Standardized Coefficients	Sig.	95.0% CI for B	
	B	SE	Beta		LB	UB
Constant	53.802	3.621		.000	46.649	60.954
Functional governing and management system	.080	.040	.164	.045 ^a	.002	.159
Community and facility relationship	-.009	.039	-.018	.825	-.087	.069
Use of data for decision making	-.011	.033	-.026	.753	-.077	.055
Integration of emergency response with existing routine services	5.434	2.349	.169	.022 ^a	.795	10.074
District vulnerability to emergencies	-9.773	2.436	-.295	.000 ^a	-14.586	-4.961
Quality improvement efforts	.199	.050	.363	.000 ^a	.101	.298
Frequency of supportive supervision	1.077	.680	.112	.115	-.266	2.419
^a Statistically significant.						

Figures

Figure 1

Ready, willing, and able: A Framework for public health emergency preparedness system A conceptual framework for public health emergency preparedness system improvement used to categorize the COVID-19 questionnaire (instrument one), into major domains: ready, willing, and able, with the overlap point being the nexus of preparedness.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1.xlsx](#)