Determinants of disaster preparedness among public health facilities in Juba City, South Sudan

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ABSTRACT

Introduction: In times of disaster, the primary duties of the health sector are to save lives, minimize permanent disability, deliver medical care to the injured, and mitigate the risks of disease and mortality from health hazards. The success in delivering these responsibilities relies on the uninterrupted functionality of health services. The study aimed to evaluate the influence of resource availability, health workers' capacity, technological integration, and institutional policy on disaster preparedness in public health facilities in Juba City, South Sudan.

Method: This study used a cross-sectional research design. The target population comprised healthcare and administrative workers at three major public health facilities in Juba City. The study used descriptive and inferential statistics to analyse the quantitative data.

Results: 148 participants responded to the study questionnaire out of a sample size of 162 respondents. Most respondents 123, (83%) disagreed that their facility had sufficient funding for disaster preparedness activities. Furthermore, 105 (71%) disagreed that specific budgets were allocated to improve disaster preparedness, and 99 (67%) believed that financial constraints significantly impact their facility's ability to prepare for and respond to disasters. A small proportion (71; 48%) reported that staff were regularly trained on the guidelines. The reported insufficient funding for preparedness activities was significantly associated with a facility's inability to initiate a response plan within the recommended timeframe ($\chi 2=15.24$, $p<0.001$).

Conclusion: The overall state of readiness is significantly hampered by systemic deficiencies, with the absence of formal institutional policies and severe financial constraints as the most profound challenges. These foundational weaknesses created a cascading effect, leading to inadequate material resources, challenges in maintaining stable, motivated human resources, and a disconnect in general information.

Keywords: disaster, health sector, resources, preparedness, Juba City, South Sudan

Introduction

Globally, health facilities are fundamental components of emergency response plans and must enhance their capabilities and capacities for emergency preparedness well before any disaster.[1] In times of disasters, the primary duties of the health sector include saving lives, minimizing permanent disability, delivering medical care to the injured, and mitigating the risks of disease and mortality resulting from illness or other health hazards.[2] Unfortunately, in many instances, health facilities are inadequately prepared for unforeseen disasters.

In Juba City, public health facilities were inadequately prepared for unforeseen disasters.[3] Chronic underfunding of the health sector by the government has worsened significantly over the past decade, negatively affecting the performance of public health facilities.[4] This study examined the factors influencing disaster preparedness in public health facilities in Juba City, South Sudan, which is a critical step towards enhancing health system resilience. The objectives of the study were to evaluate the influence of resource availability, health workers' capacity, technological integration, and institutional policy on disaster preparedness.

Method

This was a cross-sectional study. The target population was 270 healthcare and administrative workers at three public health facilities in Juba City. Yamane's formula, with a 5% margin of error, was used to calculate a sample size of 162 respondents.

A structured self-administered questionnaire was used to collect data on the study variables (independent variables: availability of resources, health workers' capacity, technology integration, and institutional policy; and dependent variables: Time to Initiate Response, Adherence to Regulatory and Standard Guidelines, and Performance in Simulations and Training Drills).

The collected data were sorted, cleaned, coded, and entered into SPSS version 25; p-values < 0.05 were considered significant.

The results were presented in descriptive tables and the results of bivariate and logistic regression analysis. Since the targeted population was heterogeneous, a stratified sampling method was used to select the three health facilities (PHCU, PHCC, and a hospital), thereby capturing variation across healthcare levels.

Results

148 participants responded to the study questionnaire. The largest proportion of respondents, 61 (41%), was within the 26-35 years age bracket. Disease outbreaks emerged as the most frequently reported event, cited by 76 (51%) respondents. A substantial proportion of health workers, 46 (31%), had less than one year of work experience. Most respondents 123, (83%) disagreed that their facility had sufficient funding for disaster preparedness activities. Furthermore, 105 (71%) disagreed that specific budgets were allocated for improving disaster preparedness, and 99 (67%) agreed that financial constraints significantly impact their facility's ability to prepare and respond during disasters (Table 1).

Regarding response initiation, although 99 (67%) of staff were aware of critical time objectives, only 70 (47%) facilities could initiate a response within the seven-day timeframe for detection, one day for notification, and seven days for response (Table 2). Regarding compliance with guidelines, a substantial majority, 108 (73%) of

Table 1. Demographic characteristics of respondents (N=148)

Characteristic	Category	n (%)
Sex	Male	70 (47)
	Female	78 (53)
Age (years)	19 – 25	18 (12)
	26 – 35	61 (41)
	36 – 45	42 (28)
	Above 45	27 (18)
Education	Certificate level	33 (22)
	Diploma level	52 (35)
	Graduate/Degree	44 (30)
	Postgraduate	16 (11)
	Others (First Aid)	3 (2)
Work experience (years)	Less than 1	46 (31)
	1 – 5	40 (27)
	6 – 10	38 (26)
	Over 10	24 (16)
Types of disasters	Flooding	25 (17)
	Disease outbreaks	76 (51)
	Heat wave	21 (14)
	Drought	2 (1)
	Wildfire	0 (0)
	Hailstorms	0 (0)
	Landslides	0 (0)
	Earthquakes	0 (0)
	Civil war	24 (16)
	Others (Specify)	0 (0)

respondents, agreed their facility consistently adhered to local and national Disaster Preparedness and Response (DPR) guidelines. Despite this high level of adherence, a smaller proportion, 71 (48%), reported that staff were regularly trained on these guidelines (Table 2).

Concerning training and drills, only 63 respondents (43%) agreed that staff were trained in disaster response and drills (Table 2). A notable 98 (66%) of staff members felt that participating in simulations and training drills significantly improved their preparedness for an actual disaster situation (Table 2). This observation suggests that, despite a relatively low frequency of reported training and drills, those that are conducted are highly valuable and effective for staff, indicating that increasing the frequency and scope of the simulations and drills could boost overall preparedness and staff confidence, even if other systemic issues persist.

Table 2. Descriptive statistics of the dependent variables on disaster preparedness (N=148)

Statements	Disagree n (%)	Agree n (%)
Time to initiate response		
The facility can initiate its DPRP within seven days, as recommended by local disaster management authorities 7-1-7 (investigate within 7days, report within a day, and respond within 7 days) timelines.	78 (53)	70 (47)
The time it takes for our facility to mobilize resources for disaster response is adequate to meet the needs of the situation.	88 (59)	60 (41)
The facility staff members are aware of the critical time objectives for initiating different phases of the disaster response.	49 (33)	99 (67)
Communication with external emergency services is established promptly according to our disaster response plan.	86 (58)	62 (42)
Compliance with guidelines		
The facility consistently adheres to local and national disaster preparedness and response guidelines.	40 (27)	108 (73)
The facility staff members are regularly trained on regulatory and standard guidelines relevant to disaster preparedness and response.	77 (52)	71 (48)
The disaster preparedness and response plans are regularly audited for compliance with regulatory and standard guidelines.	93 (63)	55 (37)
Feedback from compliance audits is effectively used to improve our disaster preparedness and response plans.	69 (47)	79 (53)
Training and drills		
Staff are trained in disaster response and in drills.	85 (57)	63 (43)
Participants in simulations and training drills demonstrate a high level of competence in their designated roles.	67 (45)	81 (55)
Simulations and training drills are realistic and cover a wide range of potential disaster scenarios.	72 (49)	76 (51)
The performance in simulations and training drills is systematically evaluated to identify areas for improvement.	69 (47)	79 (53)
Lessons learned from simulations and training drills are effectively integrated into our disaster preparedness and response plans.	80 (54)	68 (46)
Staff members feel that participating in simulations and training drills significantly improves their preparedness for an actual disaster situation.	50 (34)	98 (66)

Regarding staffing levels, only 69 (47%) agreed that there was sufficient staffing for emergencies (Table 3). Although a higher proportion, 85 (57%), indicated an adequate number of specialized healthcare workers for disaster response, a significant majority, 98 (66%), disagreed that staffing levels remain stable during emergencies, and only 57 (39%) agreed that staff allocation was effectively adjusted during a disaster (Table 3).

The material resources assessment indicated significant deficiencies, with 98 (66%) respondents disagreeing that their facility possessed adequate physical infrastructure to manage large-scale health emergencies (Table 3). A notable positive outlier in resource availability of reliable access to utilities (water and electricity), with the majority 101 (68%) agreeing. However, this contrasts sharply with the significant 94 (64%) disagreement on the availability

Table 3. Descriptive statistics of the independent variables on disaster preparedness (N=148)

Statements	Disagree n (%)	Agree n (%)
Health workers capacity		
The current staffing level at our health facility is sufficient to manage emergencies and disasters effectively.	79 (53)	69 (47)
The facility has an adequate number of specialized healthcare workers (e.g., Lab techs, Paediatricians, health experts) for disaster response.	63 (43)	85 (57)
The staffing levels in our facility remain stable and unaffected by emergencies or disasters.	98 (66)	50 (34)
The allocation of staff across various departments within our facility is effectively adjusted in response to a disaster.	91 (62)	57 (39)
Resources Availability		
The physical infrastructure of our facility (e.g., buildings, beds, wards) is sufficient to accommodate an influx of patients during a disaster.	98 (66)	50 (34)
The facility has reliable access to utilities (e.g., water, electricity) essential for disaster response.	47 (32)	101 (68)
Technology Integration		
The technology infrastructure in our facility adequately supports disaster preparedness efforts	94 (64)	54 (36)
The facility has sufficient access to the technological resources necessary for responding to disasters.	102 (69)	46 (31)
Technological tools are readily available in our facility for staff to use in disaster preparedness activities.	105 (71)	43 (29)
The facility has Data management systems in place that allow for efficient tracking and monitoring of public health risks.	44 (30)	104 (70)
Technology has improved the decision-making process in disaster preparedness and response at our facility	58 (39)	90 (61)
Technological integration supports a more coordinated approach to disaster management across different departments.	49 (33)	99 (67)
The use of technology facilitates the quicker adoption of public health strategies in the aftermath of a disaster.	63 (43)	85 (57)
Institutional policy		
The facility has a disaster preparedness committee.	100 (68)	47 (32)
The committee has a budget allocated for disaster preparedness.	109 (74)	35 (24)
The facility has a Disaster Preparedness and Response Plan (DPRP)	89 (60)	59 (40)

Table 4. Bivariate analysis

Independent Variable (Key Indicator)	Dependent Variable (Aspect of Preparedness)	Chi-square (χ^2)	p-value
Financial Resources (Sufficient Funding)	Ability to initiate response within 7 days	15.24	<0.001
Institutional Policy (Has DPRP)	Adherence to guidelines	18.51	<0.001
Health Worker Capacity (Staff Motivation)	Effectiveness of training drills	9.87	0.002

of reliable communication systems specifically for disaster response (Table 3).

While a high majority, 104 (70%), agreed that their facility had data management systems for tracking public health risks, only 54 (36%) agreed that the current technological infrastructure adequately supports preparedness, and even fewer, 46 (31%), agreed that access to technological resources, such as communication devices and early warning systems, was sufficient (Table 3). Additionally, only 43 (29%) agreed that technological tools were readily available for staff use. Furthermore, 90 (61%) agreed that technology had improved decision-making, 99 (67%) agreed that it supported a more coordinated approach, and 85 (57%) agreed that it contributed to the quicker adaptation of strategies (Table 3).

Regarding institutional policy, a significant majority, 100 (68%) of respondents disagreed that their facility has a disaster preparedness committee, and even fewer, 35 (24%) agreed that such a committee has a budget allocated for disaster preparedness (Table 3). Furthermore, 89 (60%) disagreed that their facility had a formal DPR Plan, indicating that disaster preparedness is largely informal or ad hoc rather than systematically integrated into the facility's operations (Table 3).

Both descriptive and inferential statistical analyses showed institutional policy and financial constraints had a strong, statistically significant negative association with a facility's inability to initiate a timely disaster response and mobilize resources adequately. This finding provides statistical evidence for the link between financial resources and preparedness outcomes. The reported insufficient funding for preparedness activities was significantly associated with a facility's inability to initiate a response plan within the recommended timeframe ($\chi2=15.24$, $p<0.001$). Similarly, the lack of formal policies was statistically linked to lower preparedness ($\chi2=18.51$, $p<0.001$).

Multiple binary logistic regression analysis

Multivariable binary logistic regression was employed to identify independent predictors of disaster preparedness, while controlling for other variables (Tables 4 and 5). For this analysis, the dependent variable, "Disaster Preparedness," was converted into a binary outcome (e.g., "Prepared" vs. "Not Prepared" using the Likert scale from the "Time to Initiate Response," "Compliance with Guidelines," and "Training and Drills" categories. Similarly, the independent variables from the Likert scale were transformed into binary categories (e.g., "Sufficient Funding" vs. "Insufficient Funding," "Has DPRP" vs. "No DPRP"). The Likert scale responses "strongly disagree and strongly disagree" were considered as disagree, while "agree, moderately agree, and strongly agree" were regarded as agree.

The descriptive and inferential statistics confirmed that institutional policies and financial resources were among the strongest independent predictors of preparedness. The Odds Ratios (OR) quantified the magnitude of influence for each determinant. The analysis revealed that facilities with a Disaster Preparedness and Response Plan (DPRP) had an Odds Ratio of 3.49 ($p=0.001$), indicating they were nearly 3.5 times more likely to be prepared than those without one, holding other factors constant. Similarly, the Odds Ratio for "Sufficient Funding" was 2.66 ($p=0.002$), indicating that facilities with adequate financial resources were 2.66 times more likely to be prepared than those with insufficient funding.

Discussion

Demographic characteristics: The largest proportion of respondents fell within the 26-35 age bracket, suggesting a workforce predominantly in its younger-to-middle career stages, balancing experience with potential for long-term development. In terms of education, diploma holders represented the largest group, 52 (35%), followed closely by graduate/degree holders, 44 (30%), indicating a varied educational background. A notable observation was that a substantial proportion of health workers, 46 (31%), have less than one year of experience, which could be indicative of a high turnover rate or a recent expansion

Table 5. Multivariate analysis

Variable	Odds Ratio	p-value
Institutional Policy: Has DPRP		
No Disaster Preparedness & Response Plan (DPRP) (ref)	1	
Has DPRP	3.49	0.001
Financial Resources: Sufficient Funding		
Insufficient Funding (ref)	1	
Sufficient Funding	2.66	0.002
Health Worker Capacity: Highly Motivated Staff		
Low Motivation (ref)	1	
Highly Motivated Staff	2.05	0.013
Technological Integration: Adequate Tech Infrastructure		
Inadequate Tech Infrastructure (ref)	1	
Adequate Tech Infrastructure	1.57	0.072
Significance P<0.05		

of the workforce.

Influence of resource availability on preparedness: Financial resources emerged as a major constraint on effective disaster preparedness, with 123 (83%) respondents reporting insufficient funding. This appeared to directly contribute to deficiencies in physical infrastructure and the procurement of adequate medical supplies. The bivariate and multivariate analyses confirm that financial deficiency is a significant negative predictor of overall preparedness, with facilities that have sufficient funding significantly more likely to be prepared. This aligns with a study conducted in Nigerian healthcare facilities that revealed inadequate funding, poor allocation, and mismanagement of available funds dedicated to disaster preparedness as critical barriers to acquiring necessary supplies and implementing disaster preparedness programmes. These findings suggest an urgent need for increased financial investment and improved financial management systems. [5,6]

Influence of institutional policies on preparedness: The absence of an institutional disaster preparedness policy is another critical finding, with 89 (60%) disagreeing that their facility has a formal Disaster Preparedness and Response Plan (DPRP). The binary logistic regression analysis confirmed institutional policies as one of the strongest independent determinants of disaster preparedness, with the presence of formal plans that provide a clear framework to drive preparedness efforts. This finding is supported by a study conducted in Ethiopian hospitals, which identified that the lack of formal plans and committees hindered disaster preparedness.[7,8]

Influence of health workers' capacity on preparedness: A significant concern is the overall staffing levels and their stability during emergencies, suggesting that staff retention during crises is lacking. Furthermore, the low reported motivation among health workers to participate in preparedness activities indicates that even when staff possess skills, a lack of motivation can lead to reduced engagement and reluctance to participate effectively. This is consistent with a study that identified insufficient staffing as a significant challenge in disaster management and maintaining quality of care.[9]

Influence of technological integration on preparedness: Despite the existence of data management systems and data security, a significant deficiency in overall technological infrastructure, access to communication gadgets and early warning systems, and the general availability of technological tools for staff use in disaster preparedness. This "digital divide" implies that while internal data management might be available, the ability to disseminate information in a timely manner, communicate in real time during crises, and provide proactive early warning is severely hindered. Other studies report disparities between basic ICT infrastructure and specialized disaster technologies in low- and middle-income countries.[10] Despite these infrastructure limitations, most respondents recognized that technology had improved decision-making, indicating that even the limited technological integration that exists is highly valued and recognized for its positive impact. This suggests that targeted investment in disaster-specific technological infrastructure could

significantly amplify preparedness benefits.[11,12]

Recommendations

The study first recommends an urgent need for policy formalization and the establishment of disaster-preparedness committees within each public health facility, with clearly defined roles and responsibilities. This recommendation aligns with the foundational principles of effective disaster management advocated in their guide for developing hospital disaster preparedness plans.[13]

Secondly, ensure dedicated financial investment for disaster preparedness activities. Highlighted financial constraints as a major barrier to disaster risk reduction in low- and middle-income countries.[14]

Thirdly, implement comprehensive workforce planning to ensure adequate staffing and retention, preventing the system from being overwhelmed during disasters. A study found insufficient staffing to be a major gap in disaster management.[15]

Conclusion

The overall state of readiness is significantly hampered by systemic deficiencies, with the absence of formal institutional policies and severe financial constraints as the most profound challenges. These foundational weaknesses created a cascading effect, leading to inadequate material resources, challenges in maintaining stable, motivated human resources, and a disconnect in general information.

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