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paper text:

Original Research Article 2 3 Ebola preparedness of health 4 facilities in the Greater Accra 5 Region of Ghana 6 7 **ABSTRACT** 8 **Aim:** This study sought to evaluate the preparedness of health facilities in Greater Accra, Ghana's second most populated region, for a possible EVD outbreak, and identify issues of policy and public health relevance. **Study design:** The study followed a cross-sectional design pattern. **Place and Duration of Study:** The study was carried out in Greater Accra over a period of 4 months. **Methodology:** 64 health facilities (32 government and 32 privately owned) in eight districts were selected for this study. Data was obtained using a semi-structured questionnaire administered to hospital administrators and analyzed qualitatively. **Results:** Four hospitals in two metropolitan areas were considered adequately resourced to admit EVD patients and had protocols for managing disease cases with surveillance and logistical supplies available. Twenty-one other facilities comprising 17 hospitals, 2 polyclinics and 2 health centers were prepared to attend to initial EVD cases before referring suspected cases to the four adequately resourced hospitals. The remaining 39 health facilities (61) had no capacity for EVD management. **Conclusion:** Health facility preparedness for handling potential EVD cases is inadequate in the region, mostly among private hospitals. Considering geographical distances, transportation challenges and irregular ambulance services, more health facilities should be resourced for EVD case management. 9 10 11 12 13 14 15 **Keywords:** Ebola virus disease; surveillance; response; health facilities; health care workers; Ghana . 1.

15 **INTRODUCTION** Ebola virus disease (EVD) is a fatal viral disease

22 **caused by** specific **viruses** under **the** genus **Ebola** 16 **virus**

in the family filoviridae [1].

9 **There are** five **species of the Ebola virus** namely **the** Bundibugyo 17 **Ebola virus, the** Zaire **Ebola virus, the** **Fai Ebola virus, the** Sudan **Ebola virus** and **the** Reston **Ebola** 18 **virus** [2]. **The**

8 **main symptoms of** EVD **include** **fever, headache, vomiting,** diarrhoea, **muscle pain,** 19 **stomach pain, and inexplicable bleeding or bruising. Ebola**

is confirmed to be transmitted through two main routes: (1) through direct contact with a symptomatic infected

patient (e.g. bodily fluids, saliva), and (2) through direct contact with contaminated objects. The

disease causes significant morbidity and mortality in human and non-human primates, with human fatality rates reaching 90% during outbreaks of the Zaire subtype

with an

incubation period between 2 and 21 days

[3].

The first documented outbreak of the Ebola virus disease (EVD) started in

September

1976, at the Yambuku Mission Hospital near Bumba in Northern Zaire, now the Democratic Republic of Congo

[4]. By October 1976,

280 fatal human cases of the known viral hemorrhagic fever had been documented around Yambuku, with some occurring later in Kinsasha, along

with 38 serologically confirmed 28 survivors [4]. The

Reston Ebola virus has never been proven

17to cause disease in humans but only in 29 non-human primates

[5], whereas the other four subtypes have been documented to cause human 30 diseases. The Zaire Ebola virus strain particularly has been associated with over half of the entire 31 Ebola virus outbreaks in the past decades [6]. 32

4Although all previous EVD outbreaks occurred in Central Africa, a new epidemic began in the West 33 African nation of Guinea in late 2013 and was confirmed by the World Health Organization (WHO) in 34 March 2014 [3]. The

16disease later spread to neighboring countries such as Liberia, Sierra Leone and

35 Nigeria, with a few imported cases reported in Spain

23and the United States of America

[7]. The 36

4magnitude of the outbreak, especially in Liberia and Sierra Leone, was most likely underestimated, 37 due in part to affected individuals

13being cared for outside the hospital setting early on in the epidemic

38 [8]. From February 2014 until November 2014, the disease claimed over 2500 lives in the West 39 African sub-region, with Serra Leone and Liberia recording the highest cases [9]. 40 As a neighbour to the countries affected by the recent EVD outbreak, Ghana had (and probably 41 continues to have) a high threat of spread of the virus due to regular human and animal migration. In 42 fact, Ghana was the country with the highest probability of EVD importation in the 2014 outbreak, 43 based on computational simulation using air traffic connection data [10]. Responding to this threat, 44 Ghana's Ministry of Health, in collaboration with the WHO Regional Office for Africa institutionalized 45 measures to ensure the prevention and immediate containment of disease importation to prevent 46 spreading. These measures included: (i) resourcing the regional and district level Public Health 47 Emergency Committees to develop, update and implement reliable epidemic resource plans (ii) 48 training of frontline healthcare staff in safety precautions and EVD disease surveillance, management 49 and public sensitization, (iii) establishment of referral centres for the provision of specialized 50 diagnosis and care of possible cases, (iv) improvement of conditions at primary health facilities to 51 enhance the capacity for initial disease handling prior to transfer of cases to the referral centres and 52 the provision of personal protective equipment (PPE) [11]. 53 It however remains largely unknown the extents to which different categories of hospitals in the 54 country are resourced to respond to potential future EVD epidemics. Thus, this study sought to 55 evaluate the level of preparedness of health facilities in the Greater Accra region of Ghana towards 56 addressing possible EVD outbreaks. 57 58 2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY 59 2.1.

11Study Area 60 The study was carried out in eight administrative metropolitan and municipal areas of the Greater 61 Accra region of Ghana. The

7region is bordered on the north by the Eastern region, on the east by 62 Lake Volta, on the south by the Gulf of Guinea, and on the west by the Central region of Ghana. The 63 Greater Accra region

comprises 16 administrative areas. The centre

60 of population of the region is 64 located in the Greater Accra metropolitan area, which comprises the Accra metropolitan, the Tema 65 metropolitan, the Adenta municipal, the Ashaiman municipal, the Ledzokuku municipal, the Ga East 66 municipal, the Ga West municipal, and the Ga South municipal

assemblies [12]. 67 68 Fig 1: A schematic illustration of the geographical distribution of the municipal and 69 metropolitan areas where the study was conducted. 70 71 72 2.2 Study Design 73 The study design followed a cross sectional survey pattern, selecting 8

19 out of the 16 administrative 74 districts in the region.

Using strategic random sampling technique, eight hospitals (comprising four 75 government - and four privately-owned) were selected from each participating municipal within the 76 Greater Accra region. In total, sixty-four (64) hospitals were selected for the study. 77 78 2.3 Data collection 79 A well-structured, closed ended questionnaire was administered to each participating hospital 80 administrator to record demographic characteristics followed by knowledge of EVD. It was a face-to- 81 face interview system that lasted a maximum of 45 minutes for each session. The knowledge section 82 included questions related to communicability, symptomatology and diagnostics. The administrators 83 were selected to fill the questionnaire because they were aware of the facilities available at the 84 hospitals and in some cases they were paramedics as well. 85 86 2.4 Data Analysis 87 Data obtained was entered into Microsoft excel 2010 version and later exported into the Statistical 88 Package for Social Science (SPSS) version 24 for analysis. 89 90 91 92 93 3. RESULTS AND DISCUSSION 3.1. PARTICIPANTS CHARACTERISTICS 94 We selected the most populated metropolitan and municipal areas in the Greater Accra region, 95 assuming that the possibility of spread of EVD would be highest in these areas. 96 A total of sixty-four questionnaires were distributed among health facilities within the eight (8) divisions 97 in the Greater Accra Region as illustrated in the figure below. 98 99 Table 1: Distribution of health facilities within the Areas Metropolitan and municipal areas

	Gover nment Hospitals	Priva te Govern ment Polyclinics/ Clinics	Priva te Governm ent Health Centers	Priva te Total Facilities
Accra	4	4	0	0
Adenta	1	1	2	3
Ashiaman	3	4	1	0
Ga East	4	4	0	0
Ga South	1	4	0	3
Ga West	2	3	2	0
Ledzokuku Krowor	3	4	0	0
Tema	4	3	0	0
TOTAL	22	27	5	3

101 102 3.2 SUPPLIES 103 The majority of respondents from both government and private hospitals (87.5% and 84.4% 104 respectively)

1stated that PPEs (i.e. masks, gloves, eye protection) were easily accessible to 105 healthcare workers particularly in frontline areas.

Among the 55 respondents who confirmed the 106 availability of PPEs, only 11 hospitals (17.2%) admitted to have processes

1in place for regular checks 107 (i.e. expiry date) on PPE items to ensure their appropriate usage.

19 (34.6%) out of the 55 108 respondents had the full complement of isolation gowns. Most of the respondents (82.8%) reported 109 that even though they had supplies of PPE, they were still uncertain about their ability to combat the 110 disease or care for affected cases. 111 112 3.3 WILLINGNESS TO ADMIT EBOLA PATIENTS 114 In general, 64 health facilities were included in this study. Four (4) hospitals (6.3%) (3 out of the 32 115 government facilities and 1 out of the 32 private facilities) were fully equipped to handle EVD cases in 116 the Greater Accra Region. Some hospitals (33%)

2reported that they would prefer transferring Ebola 117 patients to a regional facility rather than treating them within their own facility. These preferences 118 differed substantially by hospital type and size.

The figure below illustrates further. 119 120 121 Fig 3: Willingness of facilities to handle EVD cases 122 123 3.4. AVAILABILITY OF WRITTEN PROTOCOLS 124 Most respondents (49 out 64 hospitals, thus, 76.6%)

2reported that their facility had written protocol for 125 managing and testing suspected Ebola patients. Out of

the 76.6% health facilities, seven (7) facilities 126 (14.3%) reported that they reviewed their protocols very often while twenty four (24) facilities (49.0%) 127 occasionally reviewed their protocol. Nine (9) facilities (18.4%) rarely reviewed their protocol while 128 nine (9) other facilities (18.4%) never reviewed their

protocol. Fifteen (23.4%) of the health facilities 129 had no written protocol in place for the assessment of EVD cases. 130 131 3.5. EBOLA HEALTH CARE TEAM AND GUIDELINES 132 29 (45.3%) health facilities had specific team of healthcare personnel to care for Ebola patients while 133 35 (54.7%) lacked such personnel. The difference between the two groups was observed to be 134 statistically significant ($P < 0.001$). The majority of facilities (52; 81.25 %) were aware of national 135

1 guidelines in place for implementation of appropriate measures upon the notification of a suspected 136 case of EVD

and 15 facilities had developed their own internal guidelines in addition to the national 137 guidelines. 138 3.6. COMMUNICATION 140 Communiqués that provided

1 information on Frequently Asked Questions (FAQs) in response to the 141 EVD outbreak had been implemented in all the

four (4) hospitals that admitted EVD suspected cases 142 and in all the twenty-one (21) facilities that will refer EVD cases.

1 Visual tools such as PPE teaching 143 posters and videos in respective languages were available and had been disseminated in

these 144 facilities. Internal communication mechanisms were also in place providing regular updates to 145 healthcare workers. 146 147 3.7. TRAINING ACTIVITIES OF HEALTHCARE WORKERS 148 Information on

1 training activities to ensure that healthcare workers were informed about standard 149 precautions

and information relating to visitors that visit health facilities

1and their awareness of cough 150 etiquette and hand hygiene

were assessed.

1Preparedness activities in response to the EVD outbreak 151 incorporated education and training.

14 out of 25

1hospitals that would manage EVD patients had 152 plans in place to conduct regular in-house training, to ensure that the necessary systems were put in 153 place.

1Evidence of training activities to ensure healthcare workers were informed about standard 154 precautions was observed in all of the

facilities enrolled in the study. Table 2 below further illustrates. 155 Table 2: Prevention Strategies for Health Care Workers and Visitors to Health Facilities 156 Vigilance and awareness of healthcare workers and visitors to Health facilities Facilities that would admit and treat EVD patients (Have Functional isolation units) (4, (6.25%)) Facilities that would refer EVD patients (Not having functional isolation units) (21, (32.81%)) Facilities that cannot handle EVD patients (39, (60.94%)) In place Action Needed In

1place Action Needed In place Action Needed There is evidence of training to ensure all healthcare workers (HCWs) know about standard precautions and isolation precautions

4 0 21 0 39 0

1HCWs are aware of cough etiquette and hand hygiene

4 0 21 0 39 0

1Patients are aware of cough etiquette and hand hygiene

4 0 21 0 39 0

1Visitors are aware of cough etiquette and hand

4 0 21 0 39 0 hygiene

1There are training teams in place who can rapidly train all staff in hospital on infection control

4 0 21 0 31 8

1Training and exercises are conducted periodically to ensure staff competency and safety in use of PPE

4 0 21 0 37 2

1Where applicable, training and competency assessment is planned for staff handling human waste management e.g. the use of the autoclave machine

4 0 21 0 35 4 157 158 For the purpose of comparing the preparedness of facilities within both the government and private 159 health sector in the handling of suspected Ebola cases, nine (9) cardinal

parameters were selected. 160 The table below gives an illustration of information gathered. 161 162 Table 3: Preparedness of Government and Private Health Facilities in Respect of EVD. Comparison of Government (n = Private (n = 32) P-value Preparedness 32) (%) (<0.05) (%) Ebola Preparedness 78.13 37.5 0.0010 Outbreak Management Team 56.25 25.0 0.0109 Available Protocol for Management of 56.25 34.38 0.0789 EVD Available PPE Education Available 75.00 34.38 0.0011 Equipped for EVD Outbreak 71.88 37.50 0.0057 Ebola Care Supply 53.13 18.75 0.0042 Admit EVD Suspected Cases 25.00 9.38 0.0000 Have Intensive Care Units 15.63 6.25 0.0001 Have Microbiology Laboratory 18.75 6.25 0.0004 163 164

2This survey showed a substantive degree of preparation for the screening, diagnosis, and 165 management of

EVD cases with the larger hospitals reporting a higher level of preparedness. 166 Regardless of the number

2of respondents that indicated that they would prefer to transfer Ebola 167 patients to specialized treatment centres rather than care for them

at their facility, some showed 168 further

2preparation efforts indicating recognition of the importance of their ability to effectively

prepare 169 as well.

5The government is stepping up efforts at containing any Ebola case that may rear its head in 170 the country.

Four operational isolation centres' were noted during the study in Greater Accra. The 171 Isolation centres had

5 facilities such as wards, changing rooms for male and female infected persons, 172 change rooms, a cadaver holding bay, among others.

173 174 Ghana has a fragile health systems, with majority of medical staff concentrated in the Greater Accra 175 region [13]. The surveillance system is also fragile, with challenges identified in collection, analysis 176 and reporting of data and intelligence. The Ebola virus is of great risk to health care workers. It is a 177 serious nosocomial disease which requires strict infection control procedures.

18 Contact with body fluids 178 of an infected person is probably the

major mode of spread. Ghana has a peculiar risk in view of the 179 combination of a varied number of factors which have the potential to facilitate importation of the virus 180 and trigger an outbreak, one of which is the intense traffic between Ghana, Nigeria and Liberia, as 181 well as with other neighboring countries. It is estimated that on the average, 30 flights land and depart 182 from the Kotoka International Airport on a daily basis, transporting around 4,000 to 10,000 183 passengers on daily basis. Air, land and sea border crossing are frequent. An estimated 57 approved 184 entry points are used daily, and the number of unauthorized crossing points is estimated to be higher 185 than the approved ones. There are measures for screening at the borders / points of entry. The 186 resources needed to manage the entry borders are; staff for public health issues and case 187 management, resources for screening (material and logistic), isolation unit, quarantine facilities, and 188 ambulance on standby at the heavy entry points. The resources needed to manage the nations' 189 borders such as staff for public health issues and case management, resources for screening 190 (material and logistic), isolation unit, quarantine facilities, and ambulance on standby at the heavy 191 entry points, should be made readily available. 192 193 Education is the most effective means to prevent the spread of the Ebola virus. One of the problems 194 in past outbreaks was lack of knowledge. It is therefore important for the public to understand the 195 disease and its mode of transmission in order to curb it. The Centre

20 for Disease Control and 196 prevention enhanced its guidelines for care of

patients with viral haemorrhagic fever in 1995 and has been working to implement these practices in small rural communities all over the world [14]. Ebola 198 Virus Disease (EVD) is inevitable and will continue to

emerge in communities in Africa and perhaps 199 around the world. This is a disease that can be contained with the first few victims. People first have 200 to recognize the disease early so that it does not spread. 201 202 Although the current outbreak has ended in most countries in West Africa,

10 **we must not forget that 203 many features of this tragic outbreak strongly reinforces the benefit of continued investment in global 204 health security efforts.**

Preparedness, vigilance and community awareness will be crucial to the 205 success in the fight against complex public health crises like Ebola. The public and medical personnel 206 should be aware of the early signs and symptoms of the Virus. They should know the measures that 207 should be taken in order to prevent themselves from acquiring and spreading the disease. 208 209 210 211 4. CONCLUSION This study revealed

1 **that the general preparedness levels for management of potentially suspected 212 cases of Ebola virus disease are only partially adequate in hospitals. Hospitals designated for 213 admitting EVD suspected and proven patients had more frequently implemented Infection Control 214 Preparedness activities than hospitals that would subsequently transfer potential EVD cases to other**

215 centers. The government hospitals were evidently adequately resourced and more prepared 216 especially in terms of facility availability than the private hospitals. This calls for a framework aimed at 217 future efforts to improve the general preparedness of hospitals in Greater Accra and other regions as 218 the case may demand. 219 220 221 CONSENT "All authors declare that

12 **written informed consent was obtained from the Hospital Administrators for 222 publication of this experimental report and**

accompanying images". 223 224 225 ETHICAL CLEARANCE The study was granted permission by the Greater Accra Regional Directorate of the Ghana Health 226 Service. All participants provided their consent prior to participation. 227 228 229 230 231 REFERENCES 1. Kuhn JH, Becker S, Ebihara H, Geisbert TW, Johnson KM, Kawaoka Y, Lipkin WI, et al.. Proposal 232 for a revised taxonomy of the family Filoviridae: classification, names of taxa and viruses, and 233 virus abbreviations. Arch Virol. 2010 Dec; 155 (12): 2083-103. doi: 10.1007/s00705-010-0814-x. 234 235 2. Omoleke Semeleh Akinwale, Ibrahim Mohammed, and Yauba Saidu. Ebola Viral Disease in West 236 Africa: A Threat to Global Health, Economy and Political Stability. J Public Health Africa.2016; 237 7(1): 534. doi: 10.4081/jphia.2016.534 3. Baize S, Pannetier D, Oestereich L. Emergence of Zaire Ebola virus disease in Guinea. N Engl J 239 Med 2014; 371:1418-1425. 240 4. Sanchez A, Hotchkiss RS, Coopersmith CM, IE. Prevention of lymphocyte apoptosis--a potential 241 treatment of sepsis? Clin Infect Dis 2001; 41 Suppl 7:S465. 242 5. Nakayama Eri and Masayuki Saijo. Animal models for Ebola and Marburg virus infections. Front 243 Microbiol. 2013; 4: 267. doi: 10.3389/fmicb.2013.00267 244 6. Nishiura H, Chowell G. Early transmission dynamics of Ebola virus disease (EVD), West Africa, 245 March to August 2014. Euro Surveill. 2014;19(36):pii=20894. Available online: 246 <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20894> 247 7. WHO. Ebola Situation Report - 26 November 2014 248 8. World Health Organization. Ebola situation report, 2014.Current ebola-situation-report, 2014 249 9. Suresh Rewar and Dashrath Mirdha. Transmission of Ebola Virus Disease: An Overview. Annals 250 of Global Health. 2014; 80:444-451 251 10. Gomes MF, Pastore YPA, Rossi L, Chao D, Longini I, Halloran ME, et al. Assessing the 252 international spreading risk associated with the 2014 West African Ebola outbreak. PLoS Curr 253 2014; 6: 117. 254 11. Adokiya MN and Awoonor-Williams JK. Ebola virus disease surveillance and response 255 preparedness in northern Ghana. Glob Health Action. 2016; 9(1):29763. doi: 256 10.3402/gha.v9.29763. 257 12. Government of Ghana: "Greater Accra". 258 [Http://www.ghana.gov.gh/index.php/about.ghana/regions/greater-accra](http://www.ghana.gov.gh/index.php/about.ghana/regions/greater-accra). Accessed 5th May, 259 2016. 260 13. Ghana Health Workforce Observatory (GHWO): Human Resources For Health Country Profile. 261 2011 Edition. 262 14. Centre for Disease Control. Update: Outbreak of Ebola viral haemorrhagic fever-Zaire. Journal of 263 the American Medical Association. 1995; 274 (5): 373-374. 264 UNDER PEER REVIEW 1 UNDER PEER REVIEW 27 UNDER PEER REVIEW UNDER PEER REVIEW 100 UNDER PEER REVIEW 113 UNDER PEER REVIEW 139 UNDER PEER REVIEW UNDER PEER REVIEW UNDER PEER REVIEW 197 UNDER PEER REVIEW 238