ORIGINAL RESEARCH ARTICLE

Maternal and Child Health Services in the Context of the Ebola Virus Disease: Health Care Workers' Knowledge, Attitudes and Practices in Rural Guinea

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Abstract

The objective of this study was to document maternal and child health care workers' knowledge, attitudes and practices on service delivery before, during and after the 2014 EVD outbreak in rural Guinea. We conducted a descriptive cross-sectional study in ten health districts between October and December 2015, using a standardized self-administered questionnaire. Overall 299 CHWs (94% response rate) participated in the study, including nurses/health technicians (49%), midwives (23%), managers (16%) and physicians (12%). Prior to the EVD outbreak, 87% of CHWs directly engaged in managing febrile cases within the facility, while the majority (89% and 63%) referred such cases to another facility and/or EVD treatment centre during and after the EVD outbreak, respectively. Compared to the period before the EVD outbreak when approximately half of CHWs (49%) reported systematically measuring body temperature prior to providing any care to patients, most CHWs reported doing so during (98%) and after the EVD outbreak (88%). The main challenges encountered were the lack of capacity to screen for EVD cases within the facility (39%) and the lack of relevant equipment (10%). The majority (91%) of HCWs reported a decrease in the use of services during the EVD outbreak while an increase was reported by 72% of respondents in the period following the EVD outbreak. Infection prevention and control measures established during the EVD outbreak have substantially improved self-reported provider practices for maternal and child health services in rural Guinea. However, more efforts are needed to maintain and sustain the gain achieved. *(Afr J Reprod Health 2017; 21[1]: 104-113).*

Key words: Maternal and child health, practices, Ebola, Guinea

Résumé

L'objectif de cette étude était de documenter les connaissances, les attitudes et les pratiques du personnel de la santé maternelle et infantile sur la prestation des services avant, pendant et après l'épidémie de MVE de 2014 en Guinée rurale. Nous avons effectué une étude descriptive transversale dans dix districts sanitaires entre octobre et décembre 2015, à l'aide d'un questionnaire standardisé auto-administré. Dans l'ensemble, 299 membres du personnel de la santé (taux de réponse de 94%) ont participé à l'étude, y compris les infirmières et les techniciens en santé (49%), les sages-femmes (23%), les gestionnaires (16%) et les médecins (12%). Avant la survenue de la MVE, 87% du personnel de la santé était directement impliqués dans le traitement des cas fébriles dans l'établissement, tandis que la majorité (89% et 63%) ont envoyé tels cas chez les spécialistes dans un autre établissement et /ou dans un centre de traitement de la MVE pendant et après l'épidémie de la MVE respectivement. Par rapport à la période précédant l'éclosion de la MVE, environ la moitié du personnel de la santé (49%) ont signalé avoir mesuré systématiquement la température corporelle avant de dispenser des soins aux patientes. La plupart du personnel de la santé ont déclaré l'avoir fait pendant (98%) et après l'éclosion de la MVE (88%). Les principaux défis rencontrés ont été le manque de capacité de dépister les cas de la MVE au sein de l'établissement (39%) et le manque d'équipement pertinent (10%). La majorité (91%) du personnel de la santé ont signalé une diminution de l'utilisation des services au cours de l'épidémie de la MVE alors qu'une augmentation était signalée par 72% des interviewées au cours de la période suivant l'éclosion de la MVE. Les mesures de prévention et de lutte contre les infections mises en place lors de l'épidémie de la MVE ont considérablement amélioré les pratiques des prestataires auto déclarés pour les services de santé maternelle et infantile en Guinée rurale. Cependant, des efforts supplémentaires sont nécessaires pour maintenir et soutenir le bénéfice obtenu. *(Afr J Reprod Health 2017; 21[1]: 104-113).*

Mots-clés: La santé maternelle et infantile, de pratiques, de l'Ebola, la Guinée

Introduction

The 2014 Ebola virus disease (EVD) outbreak started in Guinea and spread to Sierra Leone and Liberia, rapidly becoming a global public health emergency[1,2]. A total of 3,804 EVD cases were reported in Guinea as of February 14, 2016, including 211 cases among healthcare workers (CHWs). The case-fatality rates were 67% and 55% in the general population and in CHWs, respectively[3]. CHWs are at higher risk of contracting Ebola than the general population because of their direct involvement in case management[4], particularly those providing obstetric care[5]. In combination with this increased risk, inadequate training and insufficient availability of personal protective equipment has led to desertion of services by CHWs due to fear of contracting infection[6]. In Conakry, Touré et al.[4] found that nearly 18% of CHWs reported no systematic screening for EVD, with the majority (96.6%) not even routinely using gloves[4]. This raised the question of whether the educational efforts themselves were inadequate or whether CHWs were not implementing the infection prevention and control standards learned.

Therefore, understanding the EVD knowledge of CHWs, their experiences providing routine and emergency health care, and their attitudes and practices during the EVD response is important for the prevention and management of any similar future outbreak[10]. This is particularly true for CHWs providing maternal and child health services as women and children were more exposed to and most affected by the EVD outbreak[11]. Further emphasis must also be placed on understanding and overcoming the challenges specific to rural providers, as most EVD cases occurred in rural areas[3]. In Guinea, 55.2% of CHWs nationwide (doctors, midwives and nurses) work in the region of Conakry where only 40% of the country's population lives[7,9], highlighting an insufficient health workforce in areas critical to stemming the EVD outbreak.

In this study, we sought to understand rural CHWs' knowledge, attitudes and comparative practices of maternal and child health service delivery before, during, and after the Guinean EVD outbreak.

Methods

Study design

We conducted a descriptive cross-sectional study. Data collection took place from October to December, 2015.

Study setting

Guinea is located in West Africa and was among the three countries most affected by the 2014-2015 Ebola epidemic[2]. As of 2012, the maternal mortality ratio was estimated at 724 per 100,000 live births and the infant mortality rate at 65 per 1,000 live births[8]. Antenatal care (ANC) coverage is high for at least one visit (85%) while complete vaccination coverage among children aged 12-23 months (37%) and postnatal care (43%) are low[8].

The study was conducted in public health facilities within ten rural health districts located in the Forest and Lower regions of Guinea. The two regions account for 40% of the country's population and were the most EVD-affected regions with 2433 reported EVD cases (64% of the nationwide caseload)[3,7]. The following districts were included: Kissidougou, Guéckédou, Macenta, Nzérékoré and Lola (Forest Guinea), Dubreka, Coyah, Forecariah, Telemele and Kindia (Lower Guinea). The public health infrastructure across the two regions includes two regional and thirteen district hospitals, 172 health centers and 541 health posts.

Study population and selection process

The study population included all health care workers (CHWs) involved in the provision of maternal and child health care services (care providers and managers) in the study health districts. First, the five most EVD-affected health districts in each of the two regions were identified based on the national EVD epidemiological situation report[3]. Second, in the selected districts, all the public health centers and maternities within the two most EVD incident sub-districts/urban communes were included in the study (in total ten maternities and twenty health centers). The study team individually approached all maternal and child health care workers in these facilities

(n=318) to request their participation in the study. Informed consent was sought in a private place and was administered into French. Of the 318 CHWs approached, 299 (94.2%) from ten districts consented to participate and responded to the study questionnaire.

Data collection and variables

We collected data using a standardized self-administered questionnaire that was previously pre-tested among healthcare providers in a maternity hospital in Conakry. Questions comprised a mix of open ended and multiple-choice alone, and were in French. The questionnaire captured healthcare providers' demographic and hospital-related characteristics. We also queried their knowledge about EVD (definition and symptoms), training in Ebola case management, use of protective equipment, case management of conditions with primary symptoms similar to EVD (particularly fever, vomiting or diarrhea), and their care provision practices before, during, and after the EVD outbreak (including temperature measurement, ANC, immunization, and delivery). For each health district included, these periods were defined by the dates the first and last EVD cases were recorded. Information on the challenges CHWs encountered during the EVD outbreak and their opinion on population-based facility attendance (changes in service attendance, reasons for the changes) during and after the EVD outbreak were captured using the same questionnaire.

Data analysis

Study data were entered independently by two data clerks, and were compared and cleaned using Epidata software (version 3.1; EpiData Association, Odense, Denmark). Statistical analyses were performed using STATA 13 (Stata Corp, Texas, and USA). We used proportions (95% confidence intervals) and means ± standard deviation (SD) to summarize the characteristics of the study population. The two-sample z-test was used to compare sample proportion across study periods.

Ethical considerations

The study protocol was approved by the scientific committee of the Department of Public Health, Faculty of Medicine, Gamal University of Conakry and the National Ethics Committee for Health Research in Guinea (N°. 100/CNERS/16).

Results

Profile of maternal and child health care workers in ebola-affected rural Guinea

Most of the 299 respondents were employed in health centres/posts (59.2%), with fewer from district (25.8%) and regional level maternities (15.1%; Table 1). One-third of respondents (33.4%) worked in a delivery unit, while 24.1% and 23.1% worked in antenatal care and immunization units, respectively. Nearly half of the participating CHWs were nurses/health technicians (48.5%), followed by midwives (23.4%), managers (16.1%), and physicians (12.0%). Most CHWs (68.9%) had more than three years' experience at their current work place.

Knowledge on ebola virus disease

Most CHWs (89.3%) reported confidence in identifying a suspected case of Ebola (Table 2). The most frequently cited individual symptoms of EVD included fever (91.3%), vomiting/nausea (83.9%), diarrhoea (82.6%), bleeding (71.2%), headache (67.2%), and fatigue (58.9%). The majority selected the presence of fever and two other symptoms as the most accurate case definition (58.5%), and reported having received training on infection prevention measures (82.6%) and the use of personal protective equipment (87.0%) in the context of Ebola.

Management of cases before, during and after the EVD outbreak

Data on the day to day management of maternal and child health before, during, and after the EVD outbreak are presented in Table 3. Prior to the EVD outbreak, fever cases and those patients presenting with diarrhoea or vomiting were

Table 1: Profile of CHW Providing Maternal and Child Health Services in Rural Guinea, 2015 (N=299)

Respondent Characteristics	Number	Percentage (95% CI)
Health facilities		
Health centre	177	59.2 (53.5-64.6)
District level maternity	77	25.8 (21.1-31.0)
Regional level maternity	45	15.1 (11.4-19.5)
Provider's working unit		
Delivery unit	100	33.4 (28.3-39.0)
Antenatal care unit	72	24.1 (19.6-29.2)
Immunization unit	69	23.1 (18.7-28.2)
Administration	34	11.4 (8.3-15.5)
Paediatric unit	24	8.0 (5.5-11.7)
Provider's position		
Nurse/health technician	145	48.5 (42.9-54.1)
Midwife	70	23.4 (19.0-28.5)
Manager	48	16.1 (12.3-20.6)
Physician	36	12.0 (8.8-16.2)
Sex		
Female	156	52.2 (46.5-57.8)
Male	143	47.8 (42.2-53.5)
Mean age (SD), years		40.8±10.6
Years of experience at this facility		
Less than 12 months	21	7.0 (4.6-10.5)
Between 1 and 3 years	72	24.1 (19.6-29.2)
More than 3 years	206	68.9 (63.4-73.9)

Notes: CHW = Health care workers. SD = Standard deviation

directly managed within the facility by respectively 87% and 88% of CHWs. In addition, 88% and 84% of CHWs declared that, respectively, fever or diarrhoea/vomiting did not prevent them from providing care to patients. However, a statistically significant decline was observed during the EVD outbreak where most CHWs referred cases of fever to another facility or an EVD treatment centre an only 19% of patient presenting with diarrhoea or vomiting were managed within the facility (p<0.001). As compared to the situation during the EVD outbreak, there were statistically significant improvements in reporting of within-facility case management after the EVD outbreak (Table 3). However, the proportion of respondents indicating that potential cases were managed within the facility after the EVD outbreak was lower than during the period before the EVD outbreak.

Care-giving practices before, during and after the EVD outbreak

Compared to the period before the EVD outbreak when approximately half of respondents (48.5%)

Table 2: Maternal and child health care provider knowledge on the Ebola Virus Disease in Guinea, 2015 (N=299)

Variables	Number	Percentage (95% CI)
Do you feel confident to identify a suspected case of Ebola?		
Yes	267	89.3 (85.3-92.3)
No	31	10.4 (7.4-14.3)
Undecided	1	0.3 (0.1-1.9)
If "Yes", what is the best case definition?[a]		
Fever + 2 other symptoms	175	58.5 (52.8-64.0)
Fever + history of contact with an EVD case	161	53.8 (48.2-59.4)
Bleeding	153	51.2 (45.5-56.8)
What are the symptoms of Ebola?		
Fever	273	91.3 (87.6-94.0)
Vomiting/Nausea	251	83.9 (79.4-87.7)
Diarrhoea	247	82.6 (77.9-86.5)
Bleeding	213	71.2 (65.9-76.1)
Headache	201	67.2 (61.7-72.3)
Fatigue	176	58.9 (53.2-64.3)
Stomach pain	116	38.8 (33.4-44.4)
Lack of appetite	103	34.4 (29.3-40.0)
Muscle aches	98	32.8 (27.7-38.3)
Hiccups	91	30.4 (25.5-35.9)
Joint pain	85	28.4 (23.6-33.8)
Difficulty breathing	57	19.1 (15.0-23.9)
Did you receive any training on infection prevention during the EVD outbreak?		
Yes	247	82.6 (77.9-86.5)
No	51	17.1 (13.2-21.7)
Unknown	1	0.3 (0.1-1.9)
Did you receive any training on the use of personal protective equipment during the EVD outbreak?		
Yes	260	87.0 (82.7-90.3)
No	38	12.7 (9.4-17.0)
Unknown	1	0.3 (0.1-1.9)

[a] *n=267. EVD = Ebola virus disease. CI = Confidence intervals*

reported systematically measuring body temperature prior to providing care to patients, the majority (98%) reported doing so during and after (88%) the EVD outbreak (p<0.001). Before the

EVD outbreak, body temperature was typically   measured axillary (81.3%) whereas the majority

Table 3: Self-reported case management practices by maternal and child healthcare providers before, during and after the Ebola Virus Disease outbreak in rural Guinea (N=299)

Variables	Time periods			Time periods		
	Before n (%)	**During** n (%)	**P-value**	**During** n (%)	**After** n (%)	**P-value**
Case management						
How did you generally behave when you received a patient with fever?			<0.001			0.005
It was managed within the facility	259 (86.6)	34 (11.4)		34 (11.4)	111 (37.1)	
Referred to another facility/EVD treatment centre	30 (10.0)	265 (88.6)		265 (88.6)	188 (62.9)	
Undecided	10 (3.3)	0 (0.0)		0 (0.0)	0 (0.0)	
Did fever generally prevent you from providing care to a patient?			*<0.001*			*0.005*
Yes	34 (11.4)	147 (49.2)		147 (49.2)	67 (22.4)	
No	262 (87.6)	151 (50.5)		151 (50.5)	196 (65.6)	
Undecided	3 (1.0)	1 (0.3)		1 (0.3)	36 (12.0)	
How did you generally behave when you received a patient with diarrhoea or vomiting?			*<0.001*			*0.003*
Managed within the facility	262 (87.6)	57 (19.1)		57 (19.1)	124 (41.5)	
Referred to another facility	31 (10.4)	242 (80.9)		242 (80.9)	175 (58.5)	
Undecided	6 (2.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Did diarrhoea or vomiting generally prevent you from providing care to a patient?			*<0.001*			*0.001*
Yes	46 (15.4)	164 (54.8)		164 (54.8)	85 (28.4)	
No	250 (83.6)	105 (35.1)		105 (35.1)	166 (55.5)	
Undecided	3 (1.0)	30 (10.0)		30 (10.0)	48 (16.1)	
Care giving practices						
Systematically measured body temperature			*<0.001*			*<0.001*
Always	145 (48.5)	294 (98.3)		294 (98.3)	263 (88.0)	
Sometimes	90 (30.1)	3 (1.0)		3 (1.0)	8 (2.7)	
Never	64 (21.4)	1 (0.3)		1 (0.3)	0 (0.0)	
Undecided	0 (0.0)	1 (0.3)		1 (0.3)	28 (9.4)	
How was body temperature generally measured			*<0.001*			*0.001*
Axillary	243 (81.3)	11 (3.7)		11 (3.7)	10 (3.3)	
Anal	5 (1.7)	2 (0.7)		2 (0.7)	0 (0.0)	
Buccal	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Thermo flash	0 (0.0)	284 (95.0)		284 (95.0)	261 (87.3)	
Undecided	51 (17.1)	2 (0.7)		2 (0.7)	0 (0.0)	
Systematically wore gloves when measuring temperature						
Always	79 (26.4)	282 (94.3)	*<0.001*	282 (94.3)	255 (85.3)	*0.001*
Sometimes	64 (21.4)	9 (3.0)		9 (3.0)	13 (4.3)	
Never	116 (38.8)	6 (2.0)		6 (2.0)	1 (0.3)	
Undecided	40 (13.4)	2 (0.7)		2 (0.7)	30 (10.0)	
Protective equipment systematically used during ANC and immunization care			*<0.001*			*0.004*
Gloves	213 (71.2)	259 (86.6)		259 (86.6)	229 (76.6)	
Gowns	233 (77.9)	237 (79.3)		237 (79.3)	223 (74.6)	
Glasses	47 (15.7)	148 (49.5)		148 (49.5)	121 (40.5)	
Helmet	34 (11.4)	142 (47.5)		142 (47.5)	92 (30.8)	
Boots	29 (9.7)	130 (43.5)		130 (43.5)	95 (31.8)	
Face screen plastic	11 (3.7)	120 (40.1)		120 (40.1)	89 (29.2)	
Protective equipment used systemaically			*0.023*			*0.001*

during delivery				
Gloves	279 (93.3)	291 (97.3)	291 (97.3)	272 (91.0)
Gowns	249 (83.3)	257 (86.0)	257 (86.0)	231 (77.3)
Boots	118 (39.5)	228 (76.3)	228 (76.3)	191 (63.9)
Glasses	124 (41.5)	224 (74.9)	224 (74.9)	184 (61.5)
Helmet	62 (20.7)	205 (68.6)	205 (68.6)	172 (57.5)
Plastic face screen	36 (12.0)	179 (59.9)	179 (59.9)	150 (50.2)
Challenges in providing maternal and child health services during the EVD outbreak				
No challenges	N.A	14 (4.7)	14 (4.7)	N.A
Difficulty in screening for Ebola cases	N.A	273 (91.3)	273 (91.3)	N.A
Lack of relevant equipment	N.A	130 (43.5)	130 (43.5)	N.A
Drugs/vaccines stock out	N.A	8 (2.7)	8 (2.7)	N.A
Lack of skilled staff	N.A	2 (0.7)	2 (0.7)	N.A

EVD = Ebola virus disease. ANC = Antenatal care. N.A = Not applicable.

Table 4: Self-reported opinion of providers on maternal and child health service attendance during and after the Ebola virus disease outbreak in Guinea, 2015 (N=299)

Variables	During	After	P-value
Changes observed in the use of maternal and child health services since the onset of the EVD			
Increase	13 (4.3)	215 (71.9)	<0.001
Decrease	272 (91.0)	27 (9.0)	
No change	8 (2.7)	19 (6.4)	
Undecided	6 (2.0)	38 (12.7)	
If decrease in use of services after the onset of EVD, what are the reasons? (N=272)			
Lack of trust of users with providers	269 (98.9)	NA	
Fear of contamination in health facilities	247 (90.8)	NA	
Fear of being sent into an EVD treatment centre	225 (82.7)	NA	
Other reasons*	148 (54.4)	NA	
The facility was momentarily closed	23 (8.5)	NA	
If increase in use of services after the EVD outbreak ended, how do you explain this? (N=215)			
Fear of contamination in health facilities has disappeared	N.A	166 (77.2)	
Fear of being sent into an EVD treatment centre has disappeared	N.A	126 (58.6)	
Return of trust of users with providers	N.A	112 (52.1)	
Others**	N.A	61 (28.8)	
Facilities reopening	N.A	12 (5.6)	

*Deadly virus, no treatment, rumours about EVD
**Stigmatisation of EVD patients, certainty to recover from EVD
EVD = Ebola virus disease. N.A = Not applicable.

used an electronic flash thermometer during (95.0%) and after the EVD outbreak (87.3%; p<0.001). The systematic use of gloves during ANC and immunization care increased from 71.2% before the EVD outbreak to 86.6% during (p<0.001) but significantly decreased (76.6%) after the EVD outbreak ended (p=0.001). Similar trends across these periods were observed in the use of gowns during ANC and immunization care (77.9% before vs. 79.3% during and 74.6% after, p=X). The use of gloves and gowns during delivery significantly increased during the EVD outbreak as compared to the period before the EVD outbreak (p=0.023) but decreased in the period after the EVD outbreak compared to the EVD outbreak (p=0.001).

The challenges raised by CHWs regarding the provision of maternal and child health services during the EVD outbreak included: difficulty in screening for EVD cases within the facility (91.3%), lack of relevant equipment (43.5%), drug and vaccine stock-outs within the facility (2.7%), and the lack of skilled staff (0.7%).

Opinion on maternal and child health service attendance during and after the EVD outbreak

The majority of CHWs (91%) reported a decrease in the use of MCH services during the EVD outbreak, but 72% reported an increase in the period after the EVD outbreak (Table 4). The change in services use after the EVD outbreak as compared to the period before the EVD outbreak was statistically significant (p<0.001).

The main reasons for the reported decrease in service use during the EVD outbreak were lack of user trust in health care providers (98.9%), fear of EVD infection at health facilities (90.8%), fear of being sent to an EVD treatment centre (82.7%), and partial closure of the health facility (8.5%). More than half of CHWs reported other related reasons for decrease in service use including the high case-fatality rate of the virus, the non-existence of EVD treatment and other rumours about EVD. As for the increase in the use of services reported after the EVD outbreak, many CHWs said it was due to the decrease of fear of in-facility infections or referral to EVD treatment centres within the community (77.2% and 58.6%, respectively), or to the return of trust in providers (52.1%). Few CHWs (5.6%) reported that the use of services improved because of the reopening of health facilities that closed during the EVD outbreak.

Discussion

The findings of our study on maternal and child health services delivery before, during and after the Ebola virus disease outbreak in Guinea revealed differences in provider-reported practices and case management across these three periods. The study is the first of its kind in Guinea and has important implications for preparedness and management of future epidemics in similar contexts.

Overall, our results suggested that most rural CHWs had received training in infection prevention and use of personal protective equipment during the Ebola outbreak, and expressed high levels of confidence in the identification of possible EVD cases. However, CHWs reported significant alterations to their normal care-giving practices with the onset of the epidemic as they had limited ability to properly screen for EVD during the outbreak.

Ebola diagnosis in rural health facilities was impossible during much of the outbreak; diagnosis of EVD was laboratory-based and required detection of the virus by polymerase chain reaction (PCR), a technology not available at the peripheral health care level. Through the end of the epidemic, no rapid diagnosis test of EVD was available to help differentiate cases with similar symptoms. This unavailability of a reliable diagnostic test in the presence of unspecific but Ebola-related symptoms led to quasi-systematic referral of possible cases by CHWs. This practice may have contributed to worsening the mistrust between users and providers.

Because maternal and child health services carry greater than average infection risk[11], CHWs may have more frequently decided to simply refer patients with potential EVD symptoms for fear of hospital contamination. These referrals were likely motivated by the increase of EVD cases in CHWs that was observed across the country during the outbreak[12,13]. In addition, Barry et al.[14] reported that 72% of acute EVD patients in Conakry presented with malaria comorbidity, further complicating differentiating initial EVD symptoms to those of malaria and childhood respiratory tract infection[14]. As a result, many non-Ebola cases ended up referred as well. This practice may have discouraged the population from seeking care in health facilities, leading to the decrease in the use of health services reported in West Africa, especially for maternal and child health services[15-18]. It may have also created or maintained mistrust and reluctance of the population with health care providers as the latter would be accused of sending patients to Ebola treatment centres against their will[5].

Fortunately, the unintended consequences of these liberal referral practices may be mitigated in future epidemics due to technological innovation. Only recently, promising results of a rapid EVD diagnostic test (RDT) evaluated in Guinea have been published[19]. If approved, the availability of a RDT at rural health facilities would considerably facilitate the screening of

suspected patients in maternal and child health services and reduce unnecessary referrals.

Our results show that infection prevention measures have improved in maternal and child health services because of training efforts deployed by all stakeholders for the control of EVD. Systematic use of gloves and measurement of body temperature improved during and after the EVD outbreak as compared to the period before. However, these efforts were reduced in the period after the EVD outbreak, calling for more follow-up to maintain the gains obtained during the EVD outbreak and at least achieve the level of indicators that existed before the EVD outbreak. Our results are higher than those reported by Toure et al. (2016)[4] in their study of CHWs in Conakry where the use of gloves was not systematic for the majority of CHWs (up to 90%). The discrepancy in results may be due to the studies being done at different points of time. Toure et al's study[4] was conducted early in the EVD outbreak, prior to large scale implementation of training and infection prevention and control (IPC) measures. With time, more efforts were put in place by the Guinean authorities and other stakeholders to integrate international IPC guidelines, build provider capacity and supply health facilities with prevention kits, especially in areas where the incidence of EVD was high[20]. A study in Sierra Leone reported that after the implementation of new infection prevention and control measures such as a triage system, EVD cases in CHWs declined rapidly[21]. In Liberia, the establishment of a national IPC task force under the leadership of the Ministry of Health allowed the standardization of IPC messaging and training of CHWs, leading to the successful containment of the outbreak[22].

HCWs reported a decrease in the use of services during the EVD but an increase after the EVD in their facilities. The negative impact of the EVD on health services utilization, especially on maternal and child health services has been documented in Liberia and Sierra Leone[15-18]. In addition, Thiam et al. (2015)[5] reported that additional factors such as "inadequate communication strategy, misconceptions around the disease, ignorance of local culture and customs and lack of involvement of local communities in the control strategies", have maintained and reinforced the mistrust and reluctance of

communities to engage in EVD control activities.

After the end of the EVD in their areas, HCWs noted improvements in the use of most maternal and child health services. However, some of the reported behaviours were lower in the post-EVD period compared to the EVD period. This is concerning as maintenance of infection control measures is necessary for maintaining high quality care and for rapidly stemming future outbreaks. It is therefore important to maintain the gains from the IPC measures implemented during the EVD outbreak as it might also benefit other infections, resulting in CHWs and their patients being protected not only from EVD but also from other nosocomial and blood transmitted infections such as HIV in hospital settings.

Nearly three quarters of our respondents were nurses/health technicians and midwives, cadres who were at the forefront of maternal and child health provision in rural Guinea during the EVD outbreak. At the time of interview, most CHWs reported working in the same location as they had both before and during the EVD outbreak. However, the number of CHWs in our study areas was low as compared to the rest of the country. The two regions together accounted for 30% of the country's population but had only 16% of the nationwide human resources for health[7,9]. This underscores the need to focus on meeting the need for rural human resources for health, a challenge not unique to Guinea, but critical for optimizing population health and preventing future epidemics.

Limitations

The study has several limitations. Data rely on information provided retrospectively by CHWs through a self-reported questionnaire after the end of the EVD outbreak. Information about practices and attitudes were not directly observed; therefore, they could have been over- or underreported by CHWs or otherwise subject to bias. As our study sample was captured after the EVD outbreak, our participants were limited to those CHWs who survived. We were unable to interview service

users and contrast their views with that of the CHWs.

Conclusion

Our study shows that knowledge of optimal practices for EVD prevention and case management among maternal and child health workforce in rural Guinea differed substantially before, during and after the Ebola outbreak. Infection prevention and control measures established during the EVD outbreak substantially improved self-reported provider practices. However, more efforts are needed to maintain and sustain the gain achieved to optimize health outcomes moving forward.

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