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Health workers' knowledge of zoonotic diseases in an endemic region of Western Uganda

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Abstract

Many factors, including lack of knowledge, influence diagnosis and reporting of disease in Sub-Saharan Africa. Health Care workers (HCWs) are in constant interaction with communities and play an important role in the prevention, diagnosis and treatment of infectious diseases, including zoonoses. We determined knowledge of HCWs regarding cause, vector, transmission, diagnosis and clinical symptoms of five zoonotic diseases: anthrax, brucellosis, rabies as well as Ebola and marburg haemorrhagic fevers in endemic western Uganda. This was a descriptive cross-sectional study among HCWs based at health centres in and around Queen Elizabeth Conservation Area, Western Uganda. A self-administered questionnaire was used to measure knowledge of these five most common zoonoses recently recorded in the area. Data were captured as true if the responses were correct or false if incorrect. Analyses were in STATA and inferential statistics by cross-tabulation, and a chi-square *P*-value of less than 0.05 was considered significant. A majority (114/140; 81.4%) of the respondents had heard about zoonoses. The most accurately identified zoonoses were anthrax (128/140; 91.4%) closely followed by rabies (126/140; 90%), while only 21 (15%) respondents knew that cryptosporidiosis was zoonotic. Up to 20% (28/140) and 12.8% (18/140) thought that malaria and HIV, respectively, were zoonotic. There was poor overall knowledge of the endemic diseases brucellosis among all the participants, where only 1.4% (2/140) knew its causative agent, clinical symptoms and transmission. There was a total lack of knowledge (0%) about anthrax and Ebola whereby none of the 140 HCWs knew all the three above aspects required to be knowledgeable for each of the two diseases. Generally, there was poor knowledge of the five zoonoses. We recommend that medical curricula incorporate training on zoonotic and other emerging diseases, and continuing medical education regarding zoonoses should be designed for the HCWs practicing in hotspot zones.

KEYWORDS
Health care workers, One health, Zoonoses

1 | INTRODUCTION

Zoonoses are diseases transmissible between animals (domestic and wildlife) and humans. Around 60% of all human diseases and 75% of emerging infectious diseases are zoonotic (Woolhouse & Gowtage-Sequeria, 2005). In aggregate, zoonoses have high impacts on human health, livelihoods, animals and ecosystems. In the first global synthesis of the impact of zoonotic diseases, it was estimated that in least developed countries, 20% of human sickness and death was due to zoonoses or diseases that recently jumped species from animals to people (Molyneux et al., 2011).

In Africa, brucellosis, bovine tuberculosis, anthrax, sleeping sickness, and rabies are still widespread (Barrett, 2006; Hambolu et al., 2014; Hang'ombe et al., 2012; Mfinanga et al., 2003). Current data for East and Central Africa (Grace, Jones, McKeever, & Pfeiffer, 2011) show that 14 of the top 25 zoonoses have important wildlife reservoirs across many regions, including eight of the top 14 zoonoses, namely gastro-intestinal zoonoses (such as taeniasis and echinococcosis), leptospirosis, rabies, leishmaniasis, toxoplasmosis, Q fever, trypanosomosis and anthrax. In neighbouring countries such as Tanzania, African trypanosomiasis, plague, rabies, brucellosis, anthrax and echinococcosis have been documented as being among the most common zoonoses (Shirima et al., 2003). For some of the other zoonoses, such as Ebola and marburg haemorrhagic fevers, wildlife may play an important role in some epidemiological circumstances. Where a wildlife interface exists, zoonoses control is much more complex.

In Uganda, several outbreaks of emerging/re-emerging zoonoses have recently occurred, with Plague (CDC, 2009), Ebola (Mbonye et al., 2012; WHO, 2012a, 2012b) and anthrax (Bazeyo et al., 2009) being the most notable; but cases of endemic zoonoses such as bovine tuberculosis, trypanosomiasis, echinococcosis, rabies and brucellosis are frequently reported (Fevre et al., 2005; Kasiita, Mugisha, Rweog, & Asiimwe, 2012; Makita et al., 2008; Oloya et al., 2008; von Wissmann et al., 2014). In communities neighbouring national parks, there is a further risk of zoonotic disease spill over from wildlife to humans directly, or from wildlife to domestic animals and then to humans (Calvignac-Spencer, Leendertz, Gillespie, & Leendertz, 2012). Among people most vulnerable to zoonoses, studies have shown a general lack of knowledge about these diseases—their transmission and prevention. For instance, a study in Tanzania among livestock keeping communities revealed that of households that practised at least one risk activity for transmission of zoonoses, there was general lack of knowledge about the diseases (Shirima et al., 2003). In Uganda, a recent study among pastoral communities of Nyabushozi, Kiruhura district, showed only moderate general knowledge of the endemic disease, brucellosis (Kansiime, Mugisha, et al., 2014). It is important to note that studies have focused on Knowledge Attitudes and Practices (KAP) of community members for most zoonotic diseases and when clinical workers are targeted then diseases focused on are mainly HIV and malaria (Kansiime, Mugisha, et al., 2014; Kazoora, Majalija, Kiwanuka, & Kaneene, 2016).

Impacts

- No other study has assessed knowledge of health care workers regarding endemic zoonoses in Uganda
- Knowledge of zoonotic diseases profoundly affects the quality of preventive, diagnostic and curative services provided by the health care workers.
- Medical curricula should incorporate training on zoonotic and other emerging diseases, while refresher courses and continuing medical education regarding zoonoses should be designed for the health workers practicing in hotspot zones.

Health care workers (HCWs) are in constant interaction with the communities and play an important role in the diagnosis and treatment of infectious diseases, including zoonoses. They also positively influence prevention and control of these diseases through health education and promotion activities. While data on level of awareness of zoonoses among vulnerable populations are available, very little is known about how knowledgeable HCWs are with respect to symptom recognition and diagnosis, in endemic settings within Uganda and the region. In an earlier study carried out in Tanzania, it was shown that medical practitioners in rural health facilities had poor knowledge of transmission of sleeping sickness and clinical features of anthrax and rabies in humans compared to their urban counterparts (John, Kazwala, & Mfinanga, 2008). Therefore, their knowledge of zoonotic diseases profoundly affects the quality of preventive, diagnostic and curative services they provide in the communities. This study aimed at determining the knowledge of HCW regarding common zoonotic diseases in the Kasese district, Western Uganda.

2 | MATERIALS AND METHODS

2.1 | Study area

This was a descriptive cross-sectional study carried out among primary HCWs who serve populations that live in and around the Queen Elizabeth Protected Area (QEPA) ecosystem. The QEPA lies astride the equator on the floor of the western arm of the East African Rift Valley along the latitudes of 0°39′36″ North, 30°16′30″ East, in the western part of Uganda. QEPA forms part of an extensive transboundary system that includes Kibale National Park to the northeast, Rwenzori Mountains National Park to the northwest and is also contiguous with Virunga National Park in the Democratic Republic of Congo. The history of establishment indicates that the northern area was occupied by pastoralists in the 1920s. To date, there are over 150,000 people living in eleven fishing enclaves inside the park,

while the pastoralist population was estimated at about 25,000 by 2015 (Kasese District Local Governments Records). The pastoralists live adjacent to the park and illegally graze inside the park, creating a very porous wildlife–livestock–human disease interface. The total population of the district is estimated at about 720,000 (estimates from the Uganda Bureau of Statistics, 2016). The sub-counties with pastoralist communities are served by four lower level health centres, and there are two major hospitals that serve the general population in the district.

2.2 | Data collection

In this study, a HCW was defined as medical personnel working in the primary health centres level II, III and IV and these included medical officers (general practitioners), clinical officers (diploma in clinical medicine), registered nurses, midwives, enrolled nurses, pharmacy attendants and laboratory technicians. Participants were consecutively sampled at each health unit visited. We visited each health unit once and only considered HCWs present on the day of visit so as to

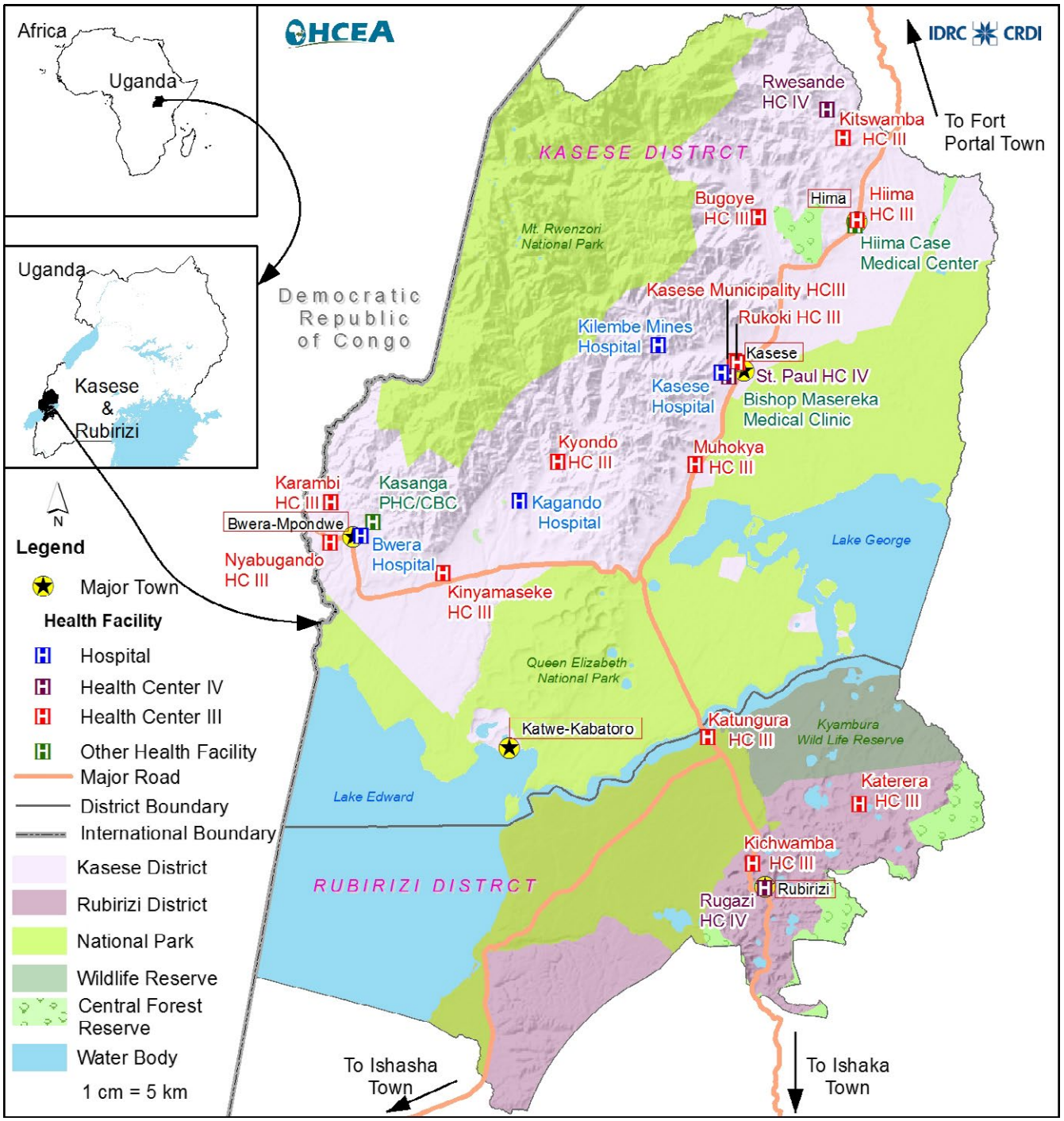

FIGURE 1 Map of Kasese showing the health centres that participated in the study [Colour figure can be viewed at wileyonlinelibrary.com]

avoid biased answers on a repeat visit. In total, 140 participants were recruited. All consenting HCWs at hospitals and functional health centre level II and III (Figure 1) present on the day of interview participated. Information was passed on to the in-charges of the health centres a day before the interview to have as many HCWs as possible present. On the day of the interview, a self-administered questionnaire with closed ended questions was given to the participants to fill while the investigator waited to retrieve after filling. The questionnaire aimed to explore participants' socio-demographic characteristics, to gauge whether they could identify zoonotic diseases from a list of 18 mixed zoonotic and non-zoonotic diseases, as well as to explore their knowledge of the causes, clinical features, transmission and diagnosis of five key zoonotic diseases (anthrax, rabies, Ebola, marburg and brucellosis) that have been reported in the study area and/or the neighbourhood in the recent past. The questionnaire was pre-tested on 10 individuals in a similar population in a One Health demonstration site in Hoima district (Dreyfus et al., 2016). The focus of the questionnaire was on HCWs knowledge considered important for identification and diagnosis of the above zoonoses. On transmission, the emphasis was on knowledge of causative agent, vectors and reservoirs as well as mode/routes of transmission, while on clinical features questions were asked about pathognomonic features/symptoms of the above zoonoses in humans as well as their differential diagnoses. The time to fill the questionnaire was set at 30 min, arrived at as the average time recorded during the pre-testing.

2.3 | Data management

All responses to the questions on knowledge of the zoonoses were assessed in relation to information provided by a standard zoonoses text book (Martin, Hubbert, & Hagstad, 2008) and was assigned as: "True" if the response was the same or closely similar to the documented, or "False" if it was not. The expectation was that the HCWs would tell that plague, Ebola, tuberculosis (TB), brucellosis, anthrax, marburg, yellow fever, rabies, dengue, bovine TB, sleeping sickness, listeriosis, cysticercosis, toxoplasmosis and cryptosporidiosis would be identified as zoonotic, while HIV/AIDS, malaria, and measles would be identified as non-zoonotic. All filled questionnaires were checked for completeness. Collected data were coded and entered into Epi-Data software version 3.1. The file was then exported to Microsoft Excel for further cleaning and finally exported to STATA software Version 12 for analysis.

2.4 | Data analysis

The outcome variable was knowledge. We tested for knowledge of causative agent, vectors and reservoirs, mode of transmission, diagnosis, main clinical symptoms and differential diagnoses. To assess the overall knowledge of the participants regarding each of the five zoonoses, three aspects of each disease were considered: causative agent, clinical symptoms and transmission. This was premised on the assumption that HCWs should know these three aspects of a disease to be able to make a correct diagnosis, manage the case, as well as give patients health educational messages to prevent spread of the disease in communities. Analysis involved descriptive statistics and data were presented in form of frequency distribution tables. Inferential analysis was by cross-tabulations, and it only determined the relationship between the knowledge of the listed zoonoses and level of medical training. Associations were statistically significant at a $p < 0.05$.

2.5 | Ethical considerations

The study protocol was approved by the Research and Ethics Committee of the School of Public Health, Makerere University. Permission to carry out the study was obtained from the District Health Officer Kasese, Medical Superintendents of the Kagando and Bwera hospitals and the officers' in-charge of the other health units that participated. Written informed consent was sought from each participant prior to involvement in the study. Participants were assured that their lack of accurate knowledge would not in any way impact their practice, but rather that all information would be confidential and results would help to identify possible training needs.

3 | RESULTS

3.1 | Socio-demographic characteristics

A total of 140 Primary HCWs participated in the study and were included in the analysis. There were 5 medical officers, 15 clinical officers, 18 registered nurses, 74 enrolled nurses and 28 laboratory technicians. Majority of the respondents (88/140, 62.9%) were female. The age range of the respondents was 19–58 years, with a median of 29. Majority (77/140; 52.8%) were enrolled nurses, while only five participants (3.6%) were medical officers (Table 1).

3.2 | General knowledge of zoonoses

HCWs were asked general questions about zoonotic diseases, especially regarding source of these diseases. While a majority (114/140; 81.4%) of the respondents had heard about zoonotic diseases, most of them (125/140; 89.3%) thought that these diseases are only transmitted from animals to man and not vice versa. Furthermore, when HCWs were asked to mark diseases, on a list of 18, they thought were zoonotic in nature the most correctly identified across all HCW cadres were anthrax (128/140; 91.4%) closely followed by rabies (126/140; 90%), while only 21 HCWs (15%) knew that cryptosporidiosis is zoonotic. Twenty-eight HCWs (20%) thought that malaria was zoonotic and 20 (12.8%) thought HIV/AIDS was zoonotic (Table 2). The expectation was that.

3.3 | Knowledge of cause, vector, transmission, diagnosis and clinical symptoms of five common zoonotic diseases

HCWs were asked to list the causative agent, vector, transmission routes, symptoms and diagnosis of Ebola, marburg, brucellosis,

anthrax and rabies. Analysis showed varied responses between the different HCWs, with a majority not knowing the different aspects of Ebola (Table 3). Additionally, differences in knowledge between the different cadres of HCWs were statistically significant for causative agent, vector and diagnosis ($p < 0.001$). For example, while 8/15 (53.3%) of the clinical officers knew the causative agent, only 12/61 (19.7%) of the enrolled nurses knew the causative agent. Most of the HCWs did not know about the diagnosis of Ebola, including 10/28 (35.7%) of the laboratory technicians who would be expected to be knowledgeable (Table 3). There was a general lack of knowledge of the causative agent, symptoms and diagnosis of brucellosis for all the categories of HCWs. None of the five medical officers knew the causative agent of brucellosis, while only one of the 15 clinical officers knew the causative agent of brucellosis. Additionally, only 6/28 (21.4%) of the laboratory technicians could tell how to correctly diagnose brucellosis in the laboratory. There was a general lack of knowledge of causative agent, diagnosis and symptoms of anthrax among all the categories of HCWs. Clinical officers were generally less knowledgeable about anthrax, with none of the 15 knowing the causative agent, while none of the five medical officers could tell symptoms or suggest a diagnosis for anthrax. There was a statistically significant difference in knowledge about diagnosis of the diseases among participants ($p = 0.03$). There was a difference in the level of knowledge of marburg between the HCWs with the most significant difference being on the knowledge of the causative agent of the disease ($p = 0.003$). Knowledge about rabies was exhibited across the board for only two sub-scales: the vector and route of transmission. Generally, apart from medical officers, laboratory technicians were more knowledgeable about the vector (15/28, 53.6%) and transmission (13/28, 46.4%) of rabies compared

TABLE 1 Socio-demographic characteristics of the 140 Primary HCWs that participated in the study

Characteristics	Frequency (*n*)	Percent
Sex		
Female	88	62.9
Male	52	37.1
Age group		
19–24	36	26.71
25–34	47	33.57
35–44	36	26.43
45–58	21	14.29
Qualification		
Medical officers	5	3.60
Clinical officer	15	10.71
Registered nurse	18	12.95
Enrolled nurse	74	52.52
Lab technician	28	20.14

TABLE 2 Ability to correctly identify the disease as zoonotic or non-zoonotic

	Participants correctly indicating if disease is zoonotic or not				
	MO (5)	CO (15)	RN (18)	EN (74)	LT (28)
Diseases	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Malaria	4 (80)	13 (86.7)	17 (94.4)	54 (73%)	24 (85.7%)
Plague	4 (80)	11 (73.3)	13 (72.2)	48 (64.9%)	19 (67.8%)
Ebola	5 (100)	13 (86.7)	17 (94.4)	64 (86.5%)	28 (100%)
HIV/AIDS	5 (100)	13 (86.7)	17 (94.4)	59 (79.7%)	26 (92.8%)
Tuberculosis	3 (60)	11 (73.3)	2 (11.1)	16 (21.6%)	6 (21.4%)
Brucellosis	4 (80)	13 (86.7)	15 (83.3)	66 (89.2%)	20 (71.4%)
Measles	5 (100)	14 (93.3)	17 (94.4)	68 (91.9%)	25 (89.2%)
Anthrax	5 (100)	14(93.3)	17 (94.4)	68 (91.9%)	24 (85.7%)
Marburg	4 (80)	13 (86.7)	15 (83.3)	62 (83.8%)	26 (92.8%)
Dengue	1 (20)	5 (33.3)	6 (33.3)	18 (24.3%)	19 (67.8%)
Yellow fever	1 (20)	2 (13.3)	2 (11.1)	56 (75.7%)	11 (39.3%)
Rabies	5 (100)	14 (93.3)	15 (83.3)	69 (93.2%)	23 (82.1%)
Bovine TB	4 (80)	13 (86.7)	11 (61.1)	35 (47.3%)	21 (75%)
Sleeping sickness	2 (40)	8 (53.3)	6 (33.3)	36 (48.6%)	10 (35.7%)
Listeriosis	0 (0)	2 (13.3)	1 (5.5)	12 (16.2%)	12 (42.8%)
Cysticercosis	3 (60)	3 (20)	3 (16.7)	7 (9.5%)	15 (53.6%)
Toxoplasmosis	3 (60)	5 (30)	1 (5.5)	17 (23%)	15 (53.6%)
Cryptosporidiosis	0 (0)	4 (26.7)	2 (11.1)	10 (13.5%)	5 (17.8%)

Note. Yes: correct response; No: wrong response about identity as zoonotic disease. MO: medical officer; CO: clinical officer, RN: registered nurse; EN: enrolled nurse, LT: laboratory technician, HCWs: health care workers.

TABLE 3 Participant's knowledge of causative agent, vector, transmission, symptoms and diagnosis of five key zoonotic diseases in the study area

	Correct knowledge of disease aspects by HCW				
	MO (5)	CO (15)	RN (18)	EN (74)	LT (28)
Disease	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Ebola					
Agent	3 (60%)	8 (53.3%)	6 (33.3%)	12 (16.2%)	6 (21.4%)
Vector	4 (80%)	6 (40%)	8 (44.4%)	14 (18.9%)	12 (42.8%)
Transmission	3 (60%)	5 (33.3%)	9 (50%)	27 (36.5%)	16 (57.1%)
Diagnosis	1(20%)	2 (13.3%)	2 (11.1%)	0 (0%)	10 (35.7%)
Symptoms	2 (40%)	4 (26.7%)	7 (38.9%)	23 (31.1%)	12 (42.8%)
Brucellosis					
Agent	0 (0%)	1 (6.7%)	0 (0%)	3 (4.1%)	3 (10.7%)
Transmission	4 (80%)	9 (60%)	12 (66.7%)	37 (50%)	21 (75%)
Diagnosis	2 (40%)	3 (20%)	0 (0%)	3 (4.1%)	6 (21.4%)
Symptoms	3 (60%)	1 (6.7%)	3 (16.7%)	7 (9.4%)	1 (3.6%)
Anthrax					
Agent	2 (40%)	0 (0%)	3 (16.7%)	4 (5.4%)	3 (10.7%)
Transmission	2 (40%)	3 (20%)	5 (27.8%)	12 (16.2%)	9 (32.1%)
Diagnosis	0 (0%)	2 (13.3%)	0 (0%)	2 (2.7%)	5 (17.8%)
Symptoms	0 (0%)	2 (13.3%)	1 (5.6%)	4 (5.4%)	3 (10.7%)
Marburg					
Agent	3 (60%)	3 (20%)	4 (22.2%)	9 (5.4%)	5 (17.8%)
Vector	1 (20%)	4 (26.7%)	5 (27.8%)	11 (14.9%)	4 (14.3%)
Transmission	2 (40%)	5 (33.3%)	5 (27.8%)	11 (14.9%)	12 (42.8%)
Diagnosis	1 (20%)	4 (26.7%)	2 (11.1%)	4 (5.4%)	3 (10.7%)
Symptoms	1 (20%)	3 (20%)	3 (16.7%)	9 (12.2%)	3 (10.7%)

Note. Yes: knowledgeable; No: not knowledgeable. CO: clinical officer, EN: enrolled nurse, LT: laboratory technician, MO: medical officer; RN: registered nurse; HCW: health care workers.

to the other HCWs. The most significant difference in knowledge of rabies across the HCWs was exhibited for the sub-scale symptoms ($p = 0.001$). The knowledge of HCWs across each domain for the different diseases is summarized in Table 3.

3.4 | Overall HCWs knowledge of the five zoonotic diseases

To assess the overall knowledge of the HCWs regarding each of the five zoonoses, three aspects of each disease were considered: causative agent, clinical symptoms and transmission. This was premised on the assumption that participants should know these three aspects of a disease to be able to make a correct diagnosis, manage the case, as well as give patients health education messages to prevent spread of the disease in communities. There was poor overall knowledge of brucellosis among all the participants, where only 2/140 (1.4%) knew the causative agent, clinical symptoms and transmission of the disease. There was a total lack of knowledge of anthrax and Ebola among all the participants where by none of the 140 HCWs could tell all the three aspects required to be knowledgeable. However, analysis for marburg haemorrhagic fever showed that 9/140 (6.4%) HCWs were knowledgeable, while only 5/140 (3.6%) were knowledgeable for rabies (Table 4). Medical officers showed fair knowledge in only rabies (2/5; 40%); clinical officers showed fair knowledge in only marburg (3/15; 20%); registered nurses had fair knowledge of marburg (2/18; 11.1%), while, generally, enrolled nurses showed fair knowledge in three diseases: marburg (3/74; 4%), rabies (3/74; 4%) and brucellosis (2/74; 2.7%).

4 | DISCUSSION

Knowledge of causative agent, transmission and clinical symptoms of diseases (including those zoonotic in nature) enables not only diagnosis and reporting but also their control (John et al., 2008). Zoonoses are causing prolonged and unnotified human suffering (Kansiime, Mugisha, et al., 2014). Adequate knowledge of causative agents, vectors/animal reservoirs and transmission routes enables practitioners to focus on key areas related to the disease and hence reach the definitive diagnosis easier and early enough for prompt management of the disease as well as designing of health education packages for the communities to prevent disease spread. Where

TABLE 4 Overall knowledge of participants regarding the five zoonotic diseases studied

	Overall level of knowledge by HCWs									
	MO (5)		CO (15)		RN (18)		EN (74)		LT (28)	
Disease	High	Low	High	Low	High	Low	High	Low	High	Low
Brucellosis	0	5	0	15	0	18	2	72	0	28
Anthrax	0	5	0	15	0	18	0	74	0	28
Ebola	0	5	0	15	0	18	0	74	0	28
Marburg	0	5	3	12	2	16	3	71	1	27
Rabies	2	3	0	5	0	18	3	0	0	0

Note. High: High knowledge; Low: low knowledge; CO: clinical officer, EN: enrolled nurse, LT: laboratory technician, MO: medical officer; RN: registered nurse; HCW: health care workers.

malaria is endemic, for example, diseases such as brucellosis and anthrax have been under-diagnosed because of their similarities in clinical presentations (Crump et al., 2013; Kansiime, Rutebemberwa, et al., 2014; Makita et al., 2008). Surveillance and control of zoonoses depend largely on the level of understanding of the diseases by the frontline HCWs. It is therefore important to assess HCWs' knowledge of zoonoses that have significant socio-economic impact on human life.

Most of the participants (125/140; 89.3%) did not know the definition of a zoonotic diseases. When the participants were asked to identify zoonoses from a mixed diseases list, the most easily identified were anthrax (128/140; 91.4%), Ebola (127/140; 90.7%), rabies (126/140; 90%), marburg (120/140; 85.7%) and brucellosis (118/140; 84.3%). However, it was surprising to find that some HCWs thought that the common diseases such as malaria (23/140; 16.4%) and HIV/Aids (20/140; 14.3%) were zoonoses. In a similar study in Kenya, rabies was the most commonly identified and discussed zoonosis (Omemo, Ogola, Omondi, Wasonga, & Knobel, 2012). The difference could be due to the fact that Uganda has had several outbreaks of the listed zoonoses in the recent past compared to Kenya (Bazeyo et al., 2009; Mbonye et al., 2012; WHO, 2012a, 2012b).

When the HCWs were asked specific questions about causative agents, vectors, diagnosis and clinical symptoms of the five commonly identified zoonoses, the least knowledge was exhibited in the causative agent and diagnosis of the diseases. Ebola haemorrhagic disease was the most known of the five diseases. This may not be surprising given that Ebola outbreaks in Uganda have raised a lot of publicity (Mbonye et al., 2012). On the other hand, and most surprising was that 10 (35.7%) of the 28 laboratory technicians did not know how to diagnose Ebola. In Nigeria, a health facility-based cross-sectional study was conducted among HCWs across Lagos State during the 2014 Ebola outbreak, 72.5% of 637 participants had good knowledge of Ebola, whereby medical officers were the most knowledgeable (Oladimeji et al., 2015). In contrast, only one of the five medical officers in the current study could correctly tell how to diagnose Ebola disease. The stark difference between Kasese, where this current study was conducted, and Lagos state might be due to the fact that the Lagos study was carried out during the outbreak of West Africa that had been widely publicized.

Despite being a common zoonotic disease in this setting, brucellosis was not well known by the study participants. For example, none of the five medical officers and only one of the 15 (6.67%) clinical officers knew the causative agent of the disease, and only seven of the 140 participants (5%) knew the causative agent. In a similar study in Tanzania, 92.3% of urban based HCWs knew about the transmission of brucellosis compared to 66.7% of their rural counter parts. In the current study, the knowledge of transmission of brucellosis was 59.3%, comparable to that among rural HCWs in Tanzania (John et al., 2008). However, knowledge of symptoms/clinical features for the disease in the current study (15/140; 10.7%) was much lower than that observed in the Tanzania study where 66.7% of urban and 50% of rural HCWs were knowledgeable. It is therefore worrying that rural-based HCWs in Uganda do not know about such a common disease as brucellosis, while, comparatively, up to 80% of agro-pastoralists in Kiruhura district, Uganda, were knowledgeable about cause, transmission and clinical symptoms of the disease (Kansiime, Mugisha, et al., 2014). A possible explanation for better knowledge among the agro-pastoralists compared to the HCWs is that Kiruhura is an endemic area for brucellosis and as a result these communities could be constantly getting health education packages about the disease (Kansiime, Mugisha, et al., 2014).

Anthrax was the most frequently identified zoonosis in the current study. However, it was worrisome that none of the clinical officers knew the causative agent, and that none of the five medical officers knew clinical symptoms or the diagnosis of the disease despite the recent 2004/5 and 2010 outbreaks (Bazeyo et al., 2009; Coffin, Monje, Asiimwe-Karimu, Amuguni, & Odoch, 2015; Wafula, Atimnedi, & Charles, 2008). Only 11(7.8%) HCWs knew the causative agent. In a study in Kenya, 76.4% of participants were knowledgeable with the above aspects of anthrax (Omemo et al., 2012). In Tanzania, 69.2% urban-based and 93.7% rural-based HCWs knew about transmission of anthrax, while 35.7% of urban-based and 75% of rural-based HCWs knew clinical symptoms. At the same time, only 43.7% urban based and 58.8% rural based knew about diagnosis of anthrax (John et al., 2008). There was generally fair knowledge of the different aspects of marburg haemorrhagic fever, with transmission (25.7%) being the most known aspect. This was surprisingly a low figure given that there were cases of marburg reported at Kagando

(a major hospital in the study area) in 2014 and HCWs in this region were trained (https://bioprepwatch.com/countermeasures/medical/cdc-doctors-without-borders-assist-uganda-with-marburg-containment/339,700/).

Rabies is a common disease in the study area with 90 dog bites and 30 deaths reported in 2013 alone (https://www.thebigfixuganda.org/1/post/2014/06/rabies-outreach-in-kasese.html). However it was surprising that participants were less knowledgeable about the disease. None of the clinical officers knew how to diagnose the disease, while none of the laboratory technologists knew a single symptom of the disease, while only one medical officer could tell its diagnosis. In the Tanzania study, 93.7% of urban-based and 94.7% rural-based HCWs knew transmission of rabies; 43% urban based and 85% rural based knew about its clinical features, while 33.3% urban-based and 60% rural-based HCWs knew about the diagnosis of rabies. Clearly, there is a general lack of knowledge about rabies in the current study area.

Participants were asked to list the causative agent, clinical symptoms and transmission of each disease as a measure of the overall knowledge. Only those who correctly listed the three aspects for each zoonosis were considered knowledgeable for a particular disease. There was poor overall knowledge of brucellosis among all the HCWs, where only 2/140 (1.4%) knew the causative agent, clinical symptoms and transmission of the disease. There was a total lack of knowledge (0%) of anthrax and Ebola among all the HCWs. Only 9/140 (6.4%) HCWs were knowledgeable about marburg haemorrhagic fever, while 5/140 (3.6%) were knowledgeable for rabies. Generally, there was poor overall knowledge of the studied zoonoses. A similar study among public health workers in Kenya showed that participants had good knowledge of rabies, anthrax and taeniasis but deficient in brucellosis, Echinococcosis, and rift valley fever (Omemo et al., 2012). In Tanzania, it was found that HCWs in the rural areas had poor overall knowledge of how sleeping sickness is transmitted to humans; there was poor knowledge on clinical features of anthrax and rabies (John et al., 2008). Inadequate knowledge of any aspect of a disease is a potential contributing factor to misdiagnosis and underreporting. If a practitioner is not well informed of how the diseases manifests or does not know how to investigate for its presence, there is a higher chance of misdiagnosis. Adequate knowledge of animal reservoirs and transmission routes enable practitioners to focus on key areas related to the disease and hence reach the definitive diagnosis easier and earlier enough for prompt management and the control of further spread of the disease in the communities. The lack of knowledge of the five zoonoses among HCWs in the study area given the endemic nature of some of the diseases (anthrax, rabies and brucellosis) in this setting is a great concern. Uganda now has a one health platform, with a technical working group comprised of experts from the ministries of health; Agriculture, Animal Industry and Fisheries; Water and Environment; Uganda Wildlife Authority; the private sector and the academia. It is hoped that these will increase cooperation across the sectors as well as create awareness so as to reduce incident cases of zoonoses in the country.

A limitation in this study was the small number of functional health units, some of which were found empty or with one HCW (especially level II centres) on the day of visit. Additionally, the veracity of the responses was based on a textbook which might have introduced a bias in knowledge of diagnosis since some tests mentioned in the book may not always be available in developing countries, and therefore a different response given by the HCW may not reflect lack of knowledge, but rather lack of availability.

5 | CONCLUSION

Generally, there was poor knowledge of the five zoonotic diseases among the HCWs in the study area. We recommend that medical curricula incorporate training on zoonotic and other emerging diseases. Refresher courses and continuing medical education regarding zoonoses should be designed for the HCWs practicing in hotspots. There is also a need for integrated planning and response strategies that allow for cross-learning between public health, veterinary and wildlife sectors in endemic regions.

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CONFLICT OF INTEREST

None declared.

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