

Changing attitudes and behaviour towards bats by communities that live close to bat roosts after the 2013 Ebola viral disease outbreak in West Africa

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Background The 2013 Ebola virus disease (EVD) that hit parts of West Africa has been described as one of the largest outbreaks in recent decades. The outbreak was triggered by the spillover of pathogens from bats to human populations. In Ghana, bats pose a significant risk to humans because interactions between bats and human beings are common, and the henipahvirus and Ebola virus have been discovered in bats and in pigs. We investigated whether there had been a change in the way people who live close to bat roosts interact with bats in the wake of the 2013 EVD outbreak.

Methods Questionnaires were distributed to 544 respondents drawn from five communities that live close to large bat roosts in southern Ghana. The data were analysed using descriptive statistics and χ^2 tests.

Results The results show that a little over half of the respondents had changed the way they interact with bats as a result of the 2013 EVD outbreak. The reasons given by those who had not changed the way they interact with bats are that: EVD is not present in Ghana, bat meat when cooked properly pose no danger, and the belief that bats do not harbour viruses.

Conclusions We conclude that public health education should be intensified to address the misconceptions that people still have about EVD.

Ebola Virus Disease (EVD) is a haemorrhagic disease with high fatality. The symptoms among others include fever, vomiting, and bleeding. Although there have been EVD outbreaks in the past four decades, the 2013 outbreak in parts of West Africa has been described as unprecedented both in scope and magnitude (1, 2). Three countries in West Africa – Guinea, Sierra Leone, and Liberia – were severely affected. During the 24 months of the outbreak, 28,625 Ebola cases were diagnosed, of which 11,325 people died yielding a case-fatality rate of 39.5% (1). There were reported cases across seven other nations on three continents (1, 3). Considering the magnitude of the pandemic, the World Health Organisation (WHO) declared a Public Health Emergency of International Concern (PHEIC) on August 8, 2014 (1). The outbreak devastated the already weak health systems and economies of the affected countries (4, 5).

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It was reported that the patient zero in the 2013 EVD outbreak was a two-year old boy who came into contact with the droppings of bats (1, 6). Apart from EVD, bats have been implicated in other diseases such as the *Nipahvirus* outbreak in Malaysia and Singapore in 1998 and 1999 (7-9) and severe acute respiratory syndrome (SARS). The evidence so far indicates that the outbreaks occurred when people were exposed to the scratches, faecal droppings, urine, and the blood of bats (6, 8).

Bats are very common in Ghana; large bat colonies have been found in several parts of the country including cities, towns and villages. For instance, bat colonies have been reported from Accra, Kumasi, Kyebi, Afram Plains, Ve Golokuati, Tanobaose and Oforikrom (10-13). The straw-coloured fruit bats (*Eidolon helvum*), epaulette fruit bats (*Epomophorus gambianus*) and hammer-headed bats (*Hypsignathus-monstrous*) are especially common (14). It is estimated that the *Eidolon helvum* that roosts at Accra and Tanobaose could contain over one and three million individuals respectively (15). In southern Ghana where bats are widely consumed, it is estimated that 128,000 of them are sold as bushmeat each year (10). The Techiman market in the Brong Ahafo region is noted for its bushmeat market where a wide range of wild animal carcasses, including bats, are sold (12). Bats are hunted also for ritualistic purposes. At Oforikrom and Buoyem, hunting of bats is part of their annual festival celebrations (12).

In spite of the fact that human-bat interaction is common in Ghana, most Ghanaians do not associate bats with diseases. A study conducted before the 2013 Ebola outbreak showed that Ghanaians did not associate bats with diseases (13, 14, 16). At Accra and Tanobaose, where bats were widely hunted and consumed, participants in the Ohemeng et al. (14: 190), study intimated that they had been consuming bats for a very long time and that none of those who consumed bat meat had ever been sick from consuming bat meat. According to a participant: "if someone became sick after eating bat, then it means that person was already sick or about to get sick. I have not heard anything like that. No, not at all". The aim of this study therefore was to investigate whether there has been a change in the view that bats do not harbour diseases and how people interacted with bats had changed after the 2013 EVD outbreak. Though there has not been an outbreak of EVD in Ghana, bats still pose a significant risk to the population because the *henipavirus* (both *nipah* and *hendra* virus) (17, 18) and Zaire EBOV (ZEBOV) (15) have been discovered from a colony of *Eidolon helvum* in Accra, and also from pigs in Ve Golokuati, suggesting a transference from bats to animals (15). This means that a jump of the virus from bats and livestock to humans is possible.

METHODS

The study communities

Five communities from southern Ghana were selected for the study. These are Tanobaose in the Brong Ahafo region, Ve-Golokuati, Kpeve and Gbefi-Tornu in the Volta region and Accra in the Greater Accra region. These communities were chosen because they had large bat roosts. Please refer to Ohemeng et al. (14) and Ayivor et al. (16) for detailed description of Tanobaose, Accra and Ve Golokuati. An interesting story was told about the origins of the bats at the 37 Military Hospital. According to the respondents, the bats accompanied a chief from the Eastern Region who was admitted at the hospital. When the chief died the corpse was removed at night as is the custom when a chief dies. The bats, not knowing that the chief had died and had been removed (because bats feed at night and return to roost in the day) have remained there ever since waiting for their chief. At Gbefi-Tornu, thousands of *Epomophorus gambianus* roost in mango trees located in people's homes. Similarly, Kpeve hosts thousands of *Eidolon helvum*, which roost in huge silk cotton trees (*Ceiba pentandra*) within the community.

Data collecting

The study employed the survey design in which participants answered questions during a single interview. The sampling method used was based on purposive sampling. Communities with

large bat colonies were identified in southern Ghana. We then selected five of them from the various ecological zones and also on rural or urban types. Tanoboase is rural and also in the transition zone, Ve-Golokuate, Kpeve and Gbefi-Tornu are also rural and in the Volta representing the forest and transition and Accra is urban and represents the coastal belt. The systematic random sampling was used in four of the study site with the exception of Accra. At Accra, participants were purposively recruited from workers at the 37 Military Hospital, the Department of Parks and Gardens and the Military Barracks (the bat roosts are located here) and not from the larger population. The criteria for inclusion were that participants should be 18 years and above and must be willing to take part in the study. Participants were approached and the study explained to them. Those who agreed to take part were then interviewed face-to-face. Thus, the recruitment rate was 100%. The instrument used to collect the data were closed and open-ended questionnaire and included questions on the demographic characteristics of participants, uses of bats, risk and exposure of participants to bats, bat conservation and management, risk communication messages, and changes in behaviour towards bats.

The data were coded and analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 21 (IBM Corporation, Armonk, New York, USA). Descriptive statistics and simple frequencies were used to analyse the data. A χ^2 test was conducted to test the statistical significance of changes in the behaviour of participants.

Ethical consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of the Noguchi Memorial Institute for Medical Health at the University of Ghana. The ethical clearance number is Study Number 002/13/14, Internal Number 1796. Consent was sought from all the respondents before the questionnaires were administered. The respondents who were literate signed the consent forms while the non-literates were made to thumb-print.

RESULTS

Demographic characteristics of respondents

In all 554 participants took part in the survey. This included 148 from Accra, 163 from Tanoboase, 125 from Ve-Golokuate, 72 from Kpeve and 46 from Gbefi-Tornu. Females constituted 46.4% and males 53.6% of the sample. The participants were aged between 18 and 55 years. On the level of education of respondents, 16.2% had primary/middle school level education, 35.1% Junior High School education, 22.0% Senior High School level education, and 8.4% had tertiary level education. With respect to religious affiliation, majority of the respondents (88%) were Christians, while 7.7% were Muslims (Table 1). The main occupation of participants was farming (34%) and trading (17.3%), reflecting the fact that the communities were all rural except Accra. Occupations designated under 'other' constituted 19.1%, and this included military personnel, teachers, gardeners, and midwives, most of whom worked in Accra.

Contact with bats

Since the communities studied were close in proximity to bat roost, we wanted to know whether the participants came into direct contact with bats and the nature of the contact. The findings show that some of the participants came into direct contact with the bats. This was mainly through hunting, consumption, and the droppings of bats. More than a third (38.1%) of the respondents specified that they consumed bat meat, while over two-thirds (61.9%) did not consume bats. The main method of preparation was boiling or roasting (65.5%), and frying (9.0%). About 36.6% indicated that they killed the bats themselves, 31.7% obtained it from hunters, and 11.0% said they bought it from the market. About

Table 1. Demographic characteristics of respondents

VARIABLE	FREQUENCY	%
Community:		
Accra	143	26.7
Tanoboase	163	29.4
Ve-Golokuati	125	22.6
Kpeve	72	13
Gbefi	46	8.3
Total	554	
Sex:		
Male	291	53.6
Female	252	46.4
Total	543	
Age:		
<15	27	5
16-25	105	19.3
26-35	121	22.3
36-45	100	18.4
46-55	103	19.0
>56	87	16.0
Total	543	
Educational level:		
No Education	89	18.3
Primary/Middle School	79	16.2
JHS	171	35.1
SHS	107	22.0
Tertiary	41	8.4
Total	487	
Religion:		
Christian	468	88.0
Muslim	41	7.7
Traditional religion	18	3.4
Other	5	0.9
Total	532	

JHS – Junior High School, SHS – Senior High School

20.7% indicated that they obtained it from food vendors, on their farms, and household meals. The weapons used to hunt the bats included guns, sticks, nets, and catapults. As is consistent with other studies (13, 14), men were more inclined to consume bats more than women. While 68.6% of the men consumed bat meat, only 31.4% of women did. Furthermore, older respondents were more inclined to consume bat meat more than younger respondents. More respondents between the ages of 46 to 55 (20.8%) were found to consume bats more than people from other age groups; this was followed by respondents in the 36–45 age bracket (19.8%).

Perception that bats can cause diseases

Table 2. Demographic characteristics and perception that bats cause diseases

VARIABLES	YES		NO		Total
	%	N	%	N	
Name of community					
Accra	23.8	93	27.8	37	130
Tanoboase	28.9	113	35.3	47	160
Ve Golokuati	25.1	98	24	18	122
Kpeve	13.6	53	10.5	14	67
Gbefi-Tornu	8.7	34	8.3	11	45
Sex:					
Female	45.7	177	48.9	64	241
Male	54.3	210	51.1	67	277
Educational level:					
No Formal	18.2	64	2.9	24	88
Primary	18.2	64	9.6	11	75
JHS	34.5	121	38.3	44	165
SHS	19.7	69	27.0	31	100
Tertiary	9.4	33	4.3	5	38
Consumption of bats:					
Yes	35.2	135	50.0	66	201
No	64.8	249	50.0	66	315

JHS – Junior High School, SHS – Senior High School

We wanted to find out whether participants thought bats harbor diseases. The majority of the respondents, 74.6% of the respondents indicated that bats can be the source of diseases, while 25.4% did not think that bats carry diseases. Of the participants who responded in the affirmative, 45.7% (177) were females and 54.3% (210) were males. Additionally, 18.2% (64) of the participants with no formal education mentioned that bats harbor diseases, and 9.4% of participants with tertiary education indicated yes to the question. Of the participants who indicated that they consume bats (201) 67.2%, that is 135 mentioned that there is a link between bats and diseases, while 32.8% (66) did not think that there is an association between bats and diseases. On the other hand, of those who said bats carry diseases, 35.2% consumed bats and 74.4% did not consume (Table 2). We did not find any statistical significant differences in the responses among the various communities ($\chi^2_4 = 4.831, P = 0.31$). About the type of diseases bats may carry, majority of them indicated Ebola; while others mentioned rabies, malaria, tetanus and typhoid fever.

Knowledge of Ebola

As indicated above, the 2013 EVD outbreak in parts of West Africa was of global proportions, so we tested the knowledge of respondents on EVD. Knowledge on EVD was near universal, with 95.9% indicating that they had heard of EVD. The mode of transmission as indicated by the participants included bites and consumption of bats, and other bushmeat such as monkeys, cane rat (grass-cutter/*Thyromys swinderianus*). Others also mentioned that EVD is airborne and could be transmitted when an individual comes into contact with an infected person. The source of knowledge was through the media, family, friends, and educational institutions. In the media, the radio was the major source of information for most of the participants (86.2%).

Changes in interaction with bats

One of the objectives of this study was to investigate whether there have been changes in the way people interact with bats (hunting, consuming, processing) in the two years since the EVD outbreak in parts of West Africa. Of the participants studied, 51.2% that is 261 indicated that they had changed the way they interact with bats, while 48.8% (248) indicated that they had not changed the way they interacted with bats. However, a χ^2 test indicates that the change in interaction was not statistically significant ($\chi^2 = 0.279, N = 516, P = 0.597$). Of the 261 participants who said they had changed their behaviour in the last two years, 46.7% are females and 53.3% are males. Furthermore, 21.5% of participants with no formal education mentioned they had changed the way they interact with bats, while 19.0% primary school leavers, 32.1% JHS, 20.7% SHS, and 6.8% with tertiary level education also indicated same. Of the 201 participants who indicated that they eat bat meat, 40% indicated that they had stopped consuming bats, while 36.1% said they had not stopped bat meat consumption. The change in interaction with bats was similar across all age groups. In the 15–25 age group 21.2% had changed their interaction while 19.0% had not, in the 46–55 age group 20.5% had changed and 18.5% had not changed, and in the 55 and above age group, 16.6% had changed and 15.3% had not changed.

On the other hand, in the 26–35 age group 18.9% had changed while 23.4% had not changed. Likewise, in the 36–45 age group; 18.1% had changed and 19.4% had not changed. Changes were also observed in some of the communities. While changes were observed in Accra, Tanoboase, and Ve Golokuati, no changes were observed in Kpeve and Gbefi-Tornu (Table 3).

Of those who indicated they had changed how they interact with bats in the last two years, 78% cited the fear of being infected with Ebola as the main reason for the change. On the contrary, of those who indicated that they had not changed how they interact with bats, 23.3% maintained that bats do not carry any disease, 4.8% intimated that bats pose no danger when properly cooked, 4.1% said Ebola was not yet in Ghana and another 4.1% disclosed that bat meat was scarce that was why they had stopped consumption. Other reasons given were religious beliefs, that they (respondents) are used to the bats and have put in place safety measures. It is worthy to note that 32.2% of those who indicated that they had not changed their behavior said they rarely encounter bats and 18.5% said they have never consumed bat meat (Table 4).

Table 3. Demographic characteristics and change in interaction

COMMUNITY	YES		NO		TOTAL
	%	N	%	N	
Accra	47.3	62	52.7	69	131
Tanoboase	64.6	104	35.4	54	161
Ve Golokuati	56.3	67	43.7	52	119
Kpeve	38.7	24	61.3	38	62
Gbefi-Tornu	16.3	7	83.7	36	43

Table 4. Reasons for change in interaction with bats

Reasons for change	HAVE YOUR BEHAVIOUR CHANGED?		
	Yes	No	Total
Fear of contracting Ebola/carry disease	193 (78.8%)	6 (4.1%)	199 (50.9%)
Bats carry no disease	4 (1.6%)	34 (23.3%)	38 (9.7%)
Proper cooking makes it safe	0 (0.0%)	7 (4.8%)	7 (1.8%)
Religion	2 (0.8%)	3 (2.1%)	5 (1.3%)
No Ebola in Ghana	0 (0.0%)	6 (4.1%)	6 (1.5%)
Safety measures taken	0 (0.0%)	2 (1.4%)	2 (0.5%)
Rarely come into contact with them	8 (3.3%)	47 (32.2%)	55 (14.1%)
Do not eat them	6 (2.4%)	27 (18.5%)	33 (8.4%)
Scarcity of bats	6 (2.4%)	6 (4.1%)	12 (3.1%)
Used to them now	26 (10.6%)	7 (4.8%)	33 (8.4%)
Total	245	145	390

DISCUSSION

The aim of this paper was to find out whether the risk perception about bats have changed after a major EVD outbreak in neighbouring countries in 2013. The findings indicate that knowledge about EVD was near universal, with 95% of the respondents indicating that they had heard about Ebola. Furthermore, participants exhibited the right knowledge about the mode of transmission of EVD. They indicated that EVD is transmitted through contact with infected bats, monkeys and cane rat, and through direct contact with infected persons. This corroborates research conducted by Adongo and colleagues (19) and Gbogbo and Kyei (20) on the knowledge about EVD. They found that awareness and knowledge about EVD was high among the participants studied. A similar study conducted in Nigeria also showed a high level of awareness and mode of transmission among study participants (21). This is because the media's reportage on the outbreak was extensive, though no EVD was recorded in Ghana. In addition, Ghana was selected as the command centre from where the international community sent aid to the affected countries. Some Ghanaians also joined volunteers in the effort. No wonder the findings show that majority of the participants identified radio as the source of information and knowledge about EVD.

Further, the extensiveness of the public health campaign influenced the risk perception of the majority of the participants who indicated that bats could cause diseases. The diseases mentioned by the participants included EVD, rabies, malaria, tetanus and typhoid. This is in sharp contrast to a previous study conducted in three of the study areas—Tanoboase, Ve Golokuati and Accra—where majority of the participants did not associate bats with diseases (13, 14). In that study, one of the reasons participants gave for their perception was that they had been consuming bat meat for a long time and yet nobody had been taken ill.

Changes in behaviour has proved to be useful in containing and preventing infectious diseases. Rubin GJ, Amlôt R, Page L and Wessely S (22) are of the view that in the event of a disease outbreak, people are more likely to change their behaviour if they perceive that the recommended behaviour is helpful, that there is the high likelihood that they may be affected, that the illness has severe consequences, and that the illness is difficult to treat. Behavioural changes also result when the level of anxiety and worry is high and people perceive that the government is providing clear and sufficient information. In this study, more than half of the participants

changed their behaviour because they perceived that there was a high likelihood of them being affected and were aware of the devastation caused by the disease in the affected countries. A substantial number of participants (78.8%) who stated they have changed the way they interact with bats cited the fear of being infected with Ebola as the reason for a change in behaviour.

While a little over half of the participants had altered their behaviour since the 2013 Ebola outbreak, 48.8% had not made changes to their behaviour. Of that number, 23.3% still did not believe that bats can cause diseases, and others also indicated that cooking properly the meat would kill any viruses if any, and still others thought that EVD was not yet in Ghana. A major challenge in public health campaign is that high knowledge about a disease normally do not correspond to behaviour change. As Rubin and Amlôt (22) observed, convincing people that a threat is real and therefore they should change their behaviour could be difficult. In their study on the perception and change in behaviour after the 2009 swine flu outbreak, they found a limited change in behaviour among study participants. Most of their participants had not changed the frequency of hand washing, disinfecting and had not discussed plans with a “flu friend”. Furthermore, misconceptions about new and emerging diseases can also contribute to people not changing their behaviour. In a study on the perception of EVD in Ghana, Adongo PB, Tabong PT-N (19) found that there were misconceptions among study participants on the causes of EVD. Some of the misconceptions they detailed were that EVD was spiritually caused, was transmitted through mosquito bites and was airborne. Though misconception of EVD did not feature in our study, it could be a contributing factor to people not changing how they interact with bats.

CONCLUSIONS

This study set out to explore the changes in behaviour among people who live close to bat roost after the 2013 Ebola outbreak in parts of West Africa. The findings indicate that knowledge about the EVD was very high among the participants. Though some of the participants had made changes to the way they interact with bats, a sizeable number had not. This is due to participants’ belief that they did not think they were at a high risk. The findings show that there is still a lot of public health education to be done about the mode of transmission of Ebola viral disease to deal with misconceptions. The education should be detailed, drawing on the culture and beliefs of the people, and it must also be continuous whether there is a disease outbreak or not.

The limitation of the study is that the sample size is small to allow for generalizability of the findings. In addition, the study areas do not reflect all of the features (culture, religion, etc) of Ghana. Thus, the findings of the study cannot be generalised to the rest of the country and beyond.

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