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Research Article

Socio-Economic Practices and EVD Transmission in Tanzania: Insights from Cross-Border Regions

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Abstract

Background: Ebola virus disease is a rare but severe, often fatal in humans with an average mortality rate of 50% [1]. Several outbreaks have been reported in some of the African countries with the worst scenario in West Africa in 2014-2016 [2]. The most recent outbreak was confirmed in Uganda and subsequently the government of Tanzania issued an alert requesting all high-risk regions to take all necessary precautions. Human interactions during socio-economic activities play an important role in the transmission of Ebola virus disease [3]. Objectives: The study was conducted to explore the influence of socio-economic practices of people living in border areas identified as high-risk regions on Ebola virus disease transmission. These regions include Kagera, Mwanza, Kigoma, Songwe and Zanzibar. **Methodology:** The study design was an anthropological socio-economic ethnography that employed a range of data collection methods including observation (114), in-depth interviews (66), key informant interviews (75) and focus group discussions (31). Study participants included teachers, students, traditional healers, community health workers, transporters, health care workers, journalists, and influential persons. **Results:** The result of the study unveiled multiple socio-economic activities that may enhance Ebola virus disease transmission among individuals, namely, travel and transportation, trading activities, fishing, agriculture, and tourism activities. **Conclusions:** High interactions among people with community members during socio-economic activities may enhance Ebola virus disease transmission. The study recommends considering factors that drive interactions among people during economic activities when planning for preventive measures against Ebola disease transmission.

Keywords: Socio-economic; Ebola virus; Ebola virus disease; Ebola outbreak; Transmission; Economic activities; Border regions

Strengths and Limitations of this Study

- Qualitative study that unveiled the unique vivid experiences of socio-economic practices associated with EVD transmission among community members in border regions in Tanzania.
- The comprehensive anthropological socioeconomic ethnography methodology, incorporated diverse data collection tools that facilitated a profound insight into socio-economic practices and their impact on the transmission of Ebola virus disease.
- Generalizability to large population can be difficult due to limited sample size used and contextual regional differences in Tanzania.

Introduction

The Ebola virus disease (EVD), is caused by an infection with one of a group of viruses, known as Ebola viruses that are found primarily in sub-Saharan Africa. Although Ebola disease is rare, people can get the disease through contact with an infected animal (bat or nonhuman primate) or a sick or dead person infected with an Ebola virus. The name Ebola originated from the Ebola River in the Democratic Republic of the Congo (DRC) where the first Ebola virus was reported in 1976 [4]. The etiology of the Ebola virus (EBOV) is thought to be fruit bats (family Pteropodidae) that are considered a reservoir of the EBOV. The bats spread EBOV to chimpanzees, gorillas, and monkeys; then a spillover to human's sets in. Human-to-human transmission occurs via blood, body fluids, and contaminated objects, handling of dead bodies during funerals, and even sexual transmission after recovery [5,6].

The virus is relatively rare but very severe and often highly fatal in humans. Between 1976 and 2018, the reported case-fatality rate was between 40 and 100% [7]. In recent years, several outbreaks have been reported in some African countries [8-10] with the West Africa of 2014-16 being the most devastating outbreak of the virus ever recorded [11]. The re-currency of EVD in the African region particularly in Uganda in 2022 raised concerns and warrants a detailed exploration to understand the role of socio-economic practices of people living in border regions that are identified as high-risk regions for Ebola transmission. Countries with high risk of EVD transmission are those with geographical proximity to countries where Ebola has been earlier confirmed. The East African Countries, including Tanzania, are therefore at higher risk due to potential cross border spill-over of EVD following the frequent movements of populations across border countries caused by day-to-day economic activities.

Immediately as the EVD was confirmed in Uganda, the Tanzania government identified the border regions such as Kagera, Mwanza, Mara, Geita and Kigoma as being the most-at-risk of EVD [12]. Other regions also included as the most-at-risk of EVD were those with large airports and bus terminals such as Dar es Salaam, Arusha, Kilimanjaro, Songwe, Mbeya and Dodoma due to their proximity and the incoming passengers from neighboring countries.

EVD emergency requires rapidly generated information to inform the design, contextualization of interventions and implementation of effective and appropriate actions. Evidence indicates that, increasing the efficiency of public health interventions requires rigorous confirmation about the effectiveness

of interventions to change behaviors and their determinants and how they impact health outcomes [13]. Knowledge, Attitude, and Practice (KAP) studies are famous to assess awareness and knowledge of a particular disease. However, several KAP studies on EVD among populations have been conducted in high-risk countries [8,10,14,15]. Unfortunately, anthropological data on EVD vulnerability and response preparedness in Tanzania are lacking. It is, therefore, imperative that social science data are collected and translated in real-time to help inform planning and targeted interventions to prevent further infections and EVD transmission in the community.

The prevention and treatment of EVD involve multiple interventions and collaboration from several stakeholders. In a nutshell, they include surveillance, infection prevention, and control practices, case management, contact tracing, community engagement, social mobilization, safe burials, and a good laboratory service [11]. However, besides strengthening the health systems, at the community level various socio-economic factors that characterize different exposures and outbreak of EVD must be considered when designing any intervention to prevent EVD outbreaks. Some reports indicate that economic factors play an important role in the transmission of EVD [16,17]. We anticipate that, this study will provide relevant information to inform context specific preparedness efforts across the economic system and key dimensions which affect EVD outbreaks.

Methods

This was a qualitative study through which researchers examined, made interactions, and observed study participants in their settings, hence, ethnographic research [18]. A grounded theory principle of constant comparison was applied to investigate socio-economic processes influencing vulnerability to EVD. The intention of using such methodology was to immerse and bring about a deeper understanding of the daily life of people in the studied communities. Moreover, a grounded theory emphasis on comparative methods helped the study teams [ethnographers] to compare data from the beginning of the research, not after all the data were collected. That is, data collection and analysis happened simultaneously and recursively. We started with an observation, analysed the information/ made sense of what was seen. Based on emergent learning decisions were made about where, how, and from whom to collect data next. In essence, the use of grounded theory principles systematically guided the research teams to probe beneath the surface and dig into the scene, thereby focusing, structuring, and organizing the research process. Such methodology gave analytical priority to anthropological issues while attending to other secondary dimensions.

Data collection

We employed a series of data collection approaches over the period of 15 days. Data was collected from 5 study sites which include Kagera, Mwanza, Kigoma, Songwe and Zanzibar. Kagera and Mwanza regions are at closer borders to Uganda which is currently experiencing the EVD outbreak. Kigoma, and Songwe share borders with the Demographic Republic of Congo (DRC) which has a history of frequent EVD outbreaks. Zanzibari is particularly suited for the study due to high influx of people vising for business, officials, and tourism. In each study site, we started the data collection exercise by employing non-participant observation to potentially identified areas. The potential areas were those considered to have high human interactions due to economic and /or socio-cultural activities that may make the community vulnerable to EVD transmission in case of outbreak. The observation was followed by In-Depth Interviews (IDIs), Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) to potentially identified individuals following the findings from the observations. A total of 114 observations were conducted across the 5 study sites, 66 IDIs, 75 KIIs and 31 FGDs.

Observation method

In all sites, we used the first five days of data collection to conduct the observations to uplift issues grounded in the real lives of the communities. Subsequently, these issues were used as a guide to sample participants for IDIs, KIIs and FGDs. The research team, in a non-participant way, observed and/or interacted with the study participants in their real-life environment. Accordingly, observations were made at different areas like specifically at marketplaces and bus terminals identified to have high economic activities and thus high interactions of people. These observations warranted obtaining a deeper understanding of the social economic activities and surrounding the communities. In addition, observations enhanced the gaining of first-hand information on actual economic activities models as they occur in the natural settings and help to ascertain the level of preparedness for preventing and combating the EVD.

A checklist and extensive description of important scenarios were used to facilitate the collection of data through observations. Furthermore, observations were complemented by informal conversations with different community members based on issues emerging as needing more insights. Observations continued simultaneously with other data collection techniques: the IDIs, KIIs and FGDs.

In-Depth Interview (IDI)

Based on the findings from observations we purposefully identified prominent persons such as those involved in transportation (of passengers), food sellers, fishermen as well as motorcycle drivers “famously known as Bodaboda” literally meaning people crossing borders. During the IDIs, some participants referred the interviewer to other participants who were not initially identified

from the observations. Ultimately, we ended up conducting both purposeful and chain referral sampling. Sampling was made in such a way that multiple angles of the issue under consideration were obtained. The IDIs aimed at uplifting among others the underlying opinions, meaning, the perceived risk to EVD infections, beliefs, and attitudes towards preventive measures. Furthermore, the IDIs aimed at understanding the coping mechanisms in case of disease outbreak and at preferred sources of information.

In each team, an experienced social scientist facilitated the IDIs, and they were guided by the developed data collection guides. The social scientist was accompanied by a research assistant who was digitally recording the conversation upon the consent of the participant and taking field notes. The IDIs were conducted in a quiet and comfortable environment arranged for by the participant. Each IDIs lasted for about 45 and 60 minutes.

Key informant Interview (KII) method

Based on the findings using both the observation and IDIs, we purposefully selected few individuals sought to have more information with regards to a particular economic activity. This included group leaders of bus drivers and motorcycles as well as small businesses in markets and bus terminals. The KIIs aimed at enriching and understanding deeper what was seen from observations and IDIs. These were focused on understanding the socio-economic practices and how they are key drivers to EVD transmission and prevention. The KII aimed to elicit not only the participants' perceptions and understanding of EVD and its preventive measures but also their opinions and views about prevailing communication structure and preferences while reflecting on their socio-economic norms.

In each team conducting the KIIs, a senior research team member accompanied by a research assistant facilitated the process to digitally record the conversation upon consent of the informant and taking field notes. The duration for each KII lasted for an average of between 30 and 60 minutes.

Focus Group Discussions (FGDs) method

Informed by findings from the observation and field notes from IDIs and KIIs, we conducted a Focus Group Discussions (FGDs) with motorcyclists, food vendors and petty traders, both men and women aged 24 and above. An experienced social scientist facilitated the FGDs in each site. The group discussions were aimed to elicit the required information from the participants. A research assistant responsible for note taking and audio recording upon consenting by the participants accompanied the social scientist. The FGDs explored information on the community awareness on causes of EVD and its preventive measures, perceived risk to EVD infections, socio-economic activities as uplifted in observations, IDIs, and KIIs. Furthermore, group discussants were propounded to discuss on communication channels and structures in the community and their preferences and other culturally embedded practices that in one way may promote the occurrence and transmission of EVD. The FGDs lasted for between 60 – 90 minutes.

Data analysis

Both data collection and analysis took place simultaneously using grounded theory. We conducted data analysis concurrently with the observations. Daily summary forms were utilized to identify key thematic areas emerging from the study for real time information use. The observation findings helped us to conduct sampling for IDIs, KIIs and FGDs. Data analyses were conducted in a stepwise manner as the findings informed the next step for data collection. Before data collection, we developed a codebook from the study objectives. The codebook was developed and was enriched by including new emerged codes during the analysis. For that matter, our analytic approach used both deductive and inductive strategies.

Upon completion of data collection from all sites, all audio tapes were transcribed verbatim before further analysis. Prior the coding process, the team randomly picked different transcripts from each site and scanned them to get familiarization of the data. Coding process involved open, axial, and selective coding [19]. The process was done in pairs for the first five transcripts to agree on emerging codes and for improving the codebook.

After the transcripts, the team regrouped and discussed the codes and finalized the codebook after the joint concurrence on the codes. After this stage, coding continued whereby at this point each individual member coded different transcripts from different sites with the guidance of the agreed codebook. Although at this stage, the codebook was termed as final, with analysis new codes that emerged were listed and discussed and agreed at the end as new codes or part of the existing codebook. All individuals started with open code and this part was completed by sorting and grouping of similar codes in a team's meetings. After grouping of similar codes, naming, and renaming of some codes through abstraction process, axial coding started.

From the axial coding, we developed several sub-categories. Memos were written about conceptual and theoretical ideas that emerged during data analysis. Data collection and analysis continued until theoretical saturation regarding the socio-economic activities and their implications to the prevention or transmission of Ebola is reached [20,21]. Through constant comparison of the emerged 59 sub-categories, we further abstracted them to develop generic categories. From the generic categories, selective coding was done to enrich and refine them. The selective coding process involved identification and description of the central phenomenon (prevention of Ebola outbreak) or generic categories within the

data that best capture the perspectives of study participants [19,21]. Finally, through constant comparison we came up with five core categories (mid-range theories) which emerged as related to EVD transmission, prevention, and control. With the support of succinct quotes, we present our results from sub-categories, generic categories to core categories (mid-range theory or theories). The core categories that emerged are shown below:

- Business and trade
- Travel and transportation
- Fishing
- Agriculture
- Tourism
- Hunting

Patient and public involvement

Patient and/or the public were not involved in the design, or conduct, or report, or dissemination plans of this research.

Results

This study found multiple socio-economic processes that might promote transmission of Ebola disease in the border regions. Such social economic activities include trading activities, travel and transportation, fishing, agriculture, tourism services and hunting and bush meat consumption.

Trading activity

This study found that trading activity is the major socio-economic activity that promotes the transmission of Ebola virus. Multiple trading activities that might promote the transmission of Ebola viruses were reported which include both petty and other large businesses. Large marketplaces like open markets where various shops are found or where sellers and buyers from different places meet for business purposes, were perceived to attract mass gathering. In the border regions for example there has been attraction to businesspersons and women from different sides of the country and neighboring countries. There has been exchange of various products among merchants from neighboring countries and the local people.

Participants explained that people who are visiting such market are at risk of being infected with EVD. This is because participants believed that the market attracts people from all over the villages from both sides of the countries which leads to the congestion of people. For example, one participant explained that in most cases sellers whisper to buyers as they bargain on prices of commodities. Whispering involves them coming very close to each other and most of the time physical contact occurs. Another participant added as narrated:

…. the whole process of choosing commodities in the market involves a lot of touching, one person touches almost five fresh fish to find the best one and buys only one, even in clothes people do the same and sometimes they put on the clothes to see if they fit… (FGD, Participant 5, Mwanza).

Additionally, the study revealed that the business of providing accommodation to visitors can promote transmission of the disease in several ways. Firstly, the guests come from different places outside the country including from the neighboring countries; and yet no screening is routinely done. Secondly, the guests excrete body fluids through sweating and sexual encounters and yet the guest house/ lodging/ hotel attendants touch and clean the beddings without gloves.

Similarly, some participants mentioned that there are women who engage in commercial sex and who are mostly coming from neighboring countries and other regions in the country. They are mostly found in famous streets and sometimes in bars, lodges, and hotels. The study further revealed multiple kinds of petty business that might promote transmission of EVD among individuals. Food vending activities, for example, have been seen as a source of income to women in the border regions. This study found that food vending to be a popular social-economic activity conducted by women who commonly are known by the Kiswahili language as mama lishe or mama ntilie. These businesswomen are found in different centers like markets, hospitals, and bus stands. Participants perceived that food vending services are one of the risk factors of Ebola transmission. Food services are a source of gatherings and in case of Ebola outbreak people will infect each other. Similarly, lack of running water in food stalls may also be another factor for increased risk of EVD Transmission.

Additionally, food vending business might be a risk factor for transmission of Ebola between food vendors and their customers or among customers themselves as the study found that they are using the same kitchen utensils, plates etc. One respondent explained that:

Another economic activity is food vending where, they cook and sell food and tea, customers share the utensils, for example, the customer has come and used a spoon or a cup, and he hold that spoon with his hand and food vendor will have to wash it so she will hold it with her hands and another custom will come and hold it and she will be already infected (FGD, Participant 5, Bukoba).

Furthermore, in our observation in the health centers, we found out that relatives were coming to buy food and drinks for their relatives who were sick.

Similarly, this study found that many passengers arrive from different parts of the country to the border regions and at the bus stand. Most of these passengers while waiting for their relatives seek to have food from Mama Ntilie. The food vendors do not take precautions for the arriving passengers at their places. Likely, at the marketplaces where there is a congestion of people, Mama Ntilie cooks in an open (in the sun) areas while sweating and serving the food to the customers without any precautions. Another business that promotes the transmission of Ebola virus involves selling and consumption of local brews. In the border regions local brews bring the community members together to celebrate and share love to each other. It is common to people in the border regions during the evening to gather in different local clubs to share brews and exchange ideas. In this study, participants declared that selling local brew is an income generation activity on the sides of sellers but at the same time creates a risk to Ebola transmission among drinkers as illustrated by one respondent as follows:

…another economic activity is selling local brews in local clubs where many people from different places come together as part of social life, and they normally share on glass or cup of local brew, and this increases the likelihood of the EVD transmission…. (FGD, Participant 7, Bukoba)

Furthermore, it was also reported and observed that in the main bus stands in the border regions there are a larger number of young men and women who engage in selling different products such as drinking water, cosmetics, and snacks to the passengers who are boarding different buses. Participants gave a notion that even petty trade like selling of vegetables, fish, food can attract gatherings, and in those gatherings, people might infect each other, one of them said. This is evident as in the comment below:

…you find a large percentage of men and women deal with petty entrepreneurial activities…when you go to the shop you buy every kind of product. So, you can find more than 20 women and men all in that place, this one sorting carrots, this one sorting what, the other one returns this, taking this, doing that…I see this can cause the spread of the virus (KII 4, Bukoba).

Another type of petty business that is suspected of transmitting EVD is the money cash points where mobile transactions are conducted.

Furthermore, in this study another petty business involved salons and nail making. During observation, researchers found that service providers were seen using shaving machines without sterilizing them and for the case of women saloons; they used sharp tools to make women hair without even washing them or exchanging them. Likewise, on the activity of making nails for women, in a time of washing customer's nails, the nail maker used the same tools used for another customer without sterilizing them.

Travel and transportation

The riskiest transportation activity identified by the interviews, observation and discussions was the use of motorbikes which in Kiswahili is commonly known as bodaboda. Normally, people prefer the use of this popular means of transportation as the easiest means of transport. Bodaboda were reported to transport both goods and people from several places including border areas.

Indeed, they were reported and observed carrying passengers from different points starting to the main bus stand, hospitals and health centers, and marketplaces. Locally the Bodaboda and Bajaji are the quick trusted transport means especially in areas with no public transport like the buses. The increased risk to Bodaboda is on the way they carried the passengers. It is not uncommon to find a motorbike with the capacity of one passenger carrying up to four people all together. This practice of carrying more than one passenger on a motorcycle is locally known as "Mishikaki". The process of carrying more than one passenger increases the risk of EBOLA transmission as one of the FGD participants narrates.

"… You may find that one motorcycle carrying up to four passengers, this process involves sitting tight and touching each other so if one of them is infected others are at risk of EVD…" (Mwanza, FGD 3, Participant 8).

Likewise, Bodaboda were also seen carrying patients to hospitals while relatives seated behind supporting the patients. After they drop the patients, they could carry another passenger and share the same helmet which was worn by a patient, and this increases the risk of Ebola transmission.

Generally, motorbikes were perceived to promote the transmission of Ebola viruses due to their tendency to transport goods and passengers from one country to another through porous borders. Furthermore, in bus stands it is common in the border regions to see young men and women escorting customers to the bus stands to board different buses. In the Main buses, there are different booking offices which have got number of formal and informal agents, many of the booking offices are located around the main bus stand, and they sometimes attract customers to bargain for bus fares but in between, a customer arrives at the office there are middlemen known as "Madalali" to mean agents in Kiswahili. The middlemen in these areas have one task of bargaining the customers to board on the buses they choose, the process involves one passenger being escorted by more than one agent and some time he/she is assisting the passenger to carry the luggage. This process of touching and assisting the luggage increases the risk of EVD transmission in these areas.

Moreover, in different transport points and stations there are normally people who act as luggage carriers. These individuals carry different items and luggage during customer arrival. It

revealed that there are different men/women who work as porters to assist them with luggage in all points of entry starting from the airport, seaports, and bus stand and sometimes in the markets. Participants in both the interviews and discussions pointed out that this activity increases the risk of Ebola transmission since the porters are in groups and sometimes sit in groups waiting for customers.

Agricultural Activities

Participants perceived that agricultural activities that involve cultivating in groups and sharing various farm tools may lead to transmission of Ebola in case of an outbreak. Similarly, in some places, farmers may give a break during which they may drink local brew by sharing the same jug or cups which may also expose them to Ebola virus transmission. One interviewee remarked as follows:

For example, you find that maybe in the villages a person has a large area, he wants to prepare a corn field, so he goes and invites a group of women to a party, the women will gather there and start planning on how to cultivate that place. Then one of them may bring a hoe and so on, and then later they may start doing the work. And later on, they eat the food in one plate and the disease can spread by that way (KII, Bukoba).

Additionally, in some sites like Missenyi, participants claimed that during cultivation, laborers are overcrowded into a car (lorry) when they are carried to and from the plantations. During such travel laborer's frequently come into physical contact with each other as they sweat and thus in times of EVD they might infect each other more easily.

Hunting Activities

This study finds out that hunters usually do illegal hunting as a source of income, and they also share the wild meat among themselves and their neighbors so if the wild meat is infected with Ebola the disease will be transmitted to humans. For example, in one focus group discussion one of the participants quoted saying that:

…….. when they come back with the killing, people congratulate them and they cut the meat into pieces and give it to whoever is present……..they are given alcohol, they are given food and eat together... it is one of the ways of spreading the Ebola disease... (FGD, Participant 2, Women 25 years or above, Bukoba).

Fishing activities

In the lake zone and island regions, Fishing activity was found to be among the important economic activities of people in the study areas namely Mwanza, Kagera, Kigoma and Zanzibar. The study revealed that communities in the lake zone and in Border regions depend much on fishing activities and it was evident that it is a risk activity, which may lead to transmission of Ebola since it involves bringing different groups of people into contact. In Lake Victoria, for example, fishers get in contact with different fishermen from different countries, Uganda and may sometimes assist each other. Additionally, while going to the lake to fish, it was explained that one boat can carry as many fishers as it can, which increases the risk of Ebola transmission among fishers. In the interview with fishermen, one of them pointed out that it is common for them to share things like clothes, cigarette, drinking water and even food during fishing process while they are in the lake. The reason given is that they (fishers) trust each other as brothers. Moreover, participants explained that during selling of fish, the buyers may touch the fishes with bare hands and if not satisfied he/she hands them over to the seller. A participant in the FGD had this to say:

…sometimes you find the fish buyers choosing fish by touching and leaving it and when another one comes, she/he does the same thing and if he/she takes it may have been contaminated and it increases the risk of EVD transmission… (FGD 3, Participant 6, Mwanza).

Moreover, the study found that seating together in groups while charting and waiting for the time to fish and exchanging ideas is common among fishers in the lake.

Hunting and consumptions of bush meat

In this study it was reported that residents in some communities particularly those live places near forest are hunters and consumers of various kinds of wild animals like antelope, monkeys, and wild boar. The study showed that the tendency of hunting and consumption of bush meat puts many individuals to be infected with EVD. This is because wild animals and consumption of bush meats are the major risky source for an EVD transmission from animals to human. The comment below justifies this claim:

There are people who tend to hunt and consume bush meat, and there are few individuals who tend to consume such meat after they buys from the hunters who usually sell to them whenever they hunted (KII 3, Misenyi).

Tourism

In this study, it was perceived that tourism activities, whether local or international, promote the transmission of Ebola virus. Participants explained that tourism activities involve people travel from one place or country to another, and thus with cosmopolitan, there is more likely to for the EVD transmission among tourists and local people as one participant quoted saying that:

There is a tendency of tourists to travel from Uganda for example to visit our country in Zanzibar in particular. Thus, there is a huge interaction among our countries with our neighbors like Uganda,

Rwanda, and Burundi and thus if there is an EVD outbreak its transmission among individuals will be easier (IDI 10, Zanzibar).

Discussion

This study found that socio-economic activities may highly promote the transmission of Ebola viruses among individuals. This study found six major socio-economic activities which include travel and transportation, trading activities, fishing, agriculture, hunting wild animals, and tourism activities. Modern transportations have played a greater role in the movement of goods and people from place to place at a faster pace, however, this in turn has opened the way to the spread of infectious diseases worldwide [22].

In this study, it emerged that, transport activities like bodaboda services and using public transport are considered as important transportations in all places in Tanzania. Through observation and several participants from all sites it revealed that the community uses local public transports such as minibuses and motorcycles as they facilitate their movement to various places like market, hospital, farms and anywhere else. Due to economic reasons many people in Tanzania are greatly dependent on such public transport as their major means of transportation. In such transport, it is a common practice to find minibuses are overcrowded in which physical contacts are feasible.

Apart from the local transport, in Tanzania, there is international transportation which involves transportation of various goods to and from Tanzania to other neighboring countries including Uganda and DRC. This accounts to a very high-risk practice that opens countless opportunities to EVD transmissions in the Tanzanian communities. Due constant movement of travelers from DRC to Tanzania for trade and refugee purposes, the likelihood for EVD outbreak in Tanzania is very high [23].

Similarly, in the previous Ebola outbreak in West Africa transportation played a greater role in the spread of EVD as people moved from one place to another through various means of transportation [22]. For the prevalent use of public transport and its associated risks in promoting EVD transmission, the appropriate authorities should consider providing EVD – related education that highlights the potential risks associated with various practices that might occur on public transport.

Our findings are in line with other studies conducted in Sierra Leone which showed an increase of people in transport services which increases the transmission of Ebola [24]. In the same vein, a study conducted during the 2014-2016 Ebola outbreak in West Africa found that urbanization and population mobility were key factors in the spread of the virus, and that this was compounded by the lack of effective infection control measures in health facilities [25].

Trade activity involves mass gathering in exchange of various goods. In this study, nearly all visited regions participants claimed pointed out that in border regions there are business activities that might promote the spread of EVD. Tanzania borders Uganda and Kenya to the north, Zambia, Malawi, and Mozambique to the south; and Rwanda and Burundi to the west.

The trading activities in the border regions involve people crossing the border from one country to another for trading purposes without any restrictions. Cross-border trades are particularly very common in Songwe, Mbeya, Kagera and Kigoma regions borders. According to Richards et al., Koindu region in Sierra Leone, had many cases of EVD in May-June 2014 and was a major booster of the epidemic because of its involvement in intense cross-border trade [26]. Most markets in the border regions were reported to have human congestion. Therefore, given that EVD was previously reported in Uganda and DRC, there is high risk for the EVD outbreak in Tanzania. According to the IFRC, based on the proximity to the EVD outbreak area and strong social economic ties with Uganda, Tanzania is among the most risk countries prioritized by WHO for preparation and readiness to control in case of the outbreak [27]. Therefore, these regions with the highest interactions of people from one country to another for trade activity on the border, are most vulnerable to Ebola outbreaks.

Interestingly the study found that a group of sellers may run from one arriving car to another to try to win the customers. These behaviors of sellers were perceived to promote Ebola virus transmission because such behaviors involve physical touching and friction among sellers during their competition for buyers. Similar findings in Liberia by Lamin, et al. [28], found that in the 2014-2016 Ebola outbreak, informal workers, including motorbike taxi drivers and market traders, were more likely to engage in behaviors that put them at risk for Ebola virus infection. Our findings are in line with studies conducted by Onyekuru, et al. that found out that trade activities contribute much too elevated risks of transmission of infectious diseases due to social interactions among community members disease [29]. Study conducted in Sierra Leone by Richards, et al. [26] showed that the interaction in the marketplaces increased transmission of Ebola and death in the societies. The study brings the importance of checking and understanding the nature of business done around and inside the main bus stands and borders due to the presence of huge interaction and the presence of many people traveling to and from different regions and countries.

Agriculture is a principal backbone of the country's economy.

However, in this study, in some places like in Misenyi district in Kagera region, it revealed that large plantations involved laborers that sometimes come from various places including outside the country. It was revealed that the large plantations like sugar cane productions attract many people to work in-group while clearing or cultivating the farm. This communal means of working in plantation activities involves many people who live in camps and who usually share different farm equipment and foodstuff.

Interestingly, it was reported that when they go for work on plantations and when they return to their camps, these laborers usually are carried while overcrowded in the cars (Lorries). Participants perceived that during such travel laborer's frequently come into physical contact with each other while they sweat and thus in times of EVD they might infect each other more easily. Additionally, in some sites, it revealed that some people cultivate in groups and who tend to shake hands and share hoes. In this activity there is sweating, and sweating people can infect each other as they shake hands and share the cultivation tools.

To get prepared for EVD outbreak, this implicitly suggests there is a need for the responsible ministry for agriculture to provide alternative strategies to cultivation in times of EVD so that to avoid the impact of EVD outbreak to the agriculture as happened in other affected countries like Guinea, Liberia, and Siera Leone [30]. More specifically, for instance Glennerster and Suri [31] reported that there was large decrease in the number of agricultural traders in Sierra Leone after the outbreak of an EVD as compared to before the outbreak.

Fisheries are also important to Tanzania's economy, sources of income, export revenue and millions of jobs among people [32]. Notwithstanding due to various challenges facing the fishing sector, in this study it revealed that fishing is among the economic activity that promotes the transmission of Ebola viruses. Illegal fishing and trafficking of fishes and fisheries products across country's borders, are the major challenges facing the sector [32]. This study found that some fishers in the border regions like in Bukoba, may sometimes either cross borders or meet with other fishers from the neighboring country Uganda while fishing on Lake Victoria is that to assist each other in their work.

In similar vein, it revealed that usually many fishers are overcrowded on one boat while they are going for fishing in the lake. Some fishermen in the interviews pointed out that it is common for them to share things like clothes, cigarate, drinking water and even food during fishing process because they are in the lake, and they trust each other as a brother. In the same vein, the study also showed that, the process of selling fish during the morning at the beach attracts many customers from different places to choose and purchase the fishes. In the process of choosing for good fishes, the fishes are touched by many customers who bargain for the prices, and this increase the risk of EVD. These practices call for the need for provision of information and education to the fishers and other community members in the risk factors for the EVD outbreak. Similar results were also obtained in Sierra Leone where traders infected with the disease when they come in contacts with local people in the market centers and in the main roads when they were seeking for rice and food products [26].

Evidence shows that EVD originated from bush animals particularly antelopes, chimpanzees and buts and can be transmitted to human beings when he or she comes into physical contact with those wild animals. In this study it was reported that residents in some communities are hunters of bush meat especially those living nearby forests. Hunting, touching and consumption of bushmeat such as antelope and monkeys were perceived as a high-risk practice as the wild animals may harbor Ebola virus. In some communities, it was claimed that because of greed for profit, businesspeople may hunt wild animals like monkeys and sell them as grilled meat to the public. Previous studies have reported similar findings showing that Sub-Saharan Africa rural areas, bushmeat has been considered for a long period as the favorite source of protein [33,34], because it is easy for many people in the rural areas to access bushmeat given its proximity to the wildlife [35,36]. This suggests the provision of information and education on the potential risk of consuming bush meat.

Like many other countries in the world, economically Tanzania relies on the tourism sector. Breakthrough Attorneys [37] states that, Tanzania is ranked 10th in Africa for tourism growth and on average the sector contributes 17.2% of the national GDP. Tanzania has many tourism attractions including the Kilimanjaro Mountain, Zanzibar Island, and various historical sites where many tourists arrive each year for tourism purposes. In this study, it was perceived that tourism activities, whether local or international, promote the transmission of Ebola virus. Participants explained that tourism activities involve people traveling from one place or country to another. This process may influence the infected person with EVD to spread the disease to the place he or she arrives or stays for the vacation. Reflecting on Nigeria, for example, the EVD outbreak was caused by the infected Liberian who visited Nigeria by airplane [22].

Conversely, unlike reported findings in Sierra Leon by Jalloh [38] who reported that shaking hands as the causes led to increase the transmission of EVD, in this study, participants did not mention about handshaking with visitors as potential risky behavior that might promote the transmission of Ebola viruses. Tanzanians are commonly known for their hospitality which involves shaking hands with foreigners as a sign of love and care for them. Given

handshaking is among the practices of EVD transmission, it will be so important for information and education on alternative means for showing hospitality to the visitors. This explicitly suggests that EVD is a threat to the tourism industry. In due regard, the relevant authorities should be prepared guidelines for handling the tourism industry in times of the EVD outbreak. Otherwise, the tourism sector will be greatly affected and whenever necessary will be required for closure.

Conclusion

An EVD is a rare globe disease that mostly affected several countries in Africa. EVD has major impacts on social economic activities which plays a significant role in any country's GDP. Ebola is an unpredictable disease; the outbreak occurs anywhere around the globe and at no definite time. This study has shown that there are multiple socio-economic activities that might promote Ebola virus's transmission among people in border regions in Tanzania as they interact among themselves daily. This implicitly suggests that in times of an EVD outbreak, these border regions will act as a major booster of the epidemic. This is based on the involvement in intense interactions with individuals from neighboring countries in terms of cross-border trade, sports and games, porous borders, money exchange, fishing, and agriculture.

The lesson learnt from affected African countries like Uganda, DRC, Liberia, Sierra Leone, Gabo, Nigeria, and Ghana, showed that EVD has greatly affected trade, tourism, agriculture, mining, and fishing sectors. Similarly, with lesson learnt during the COVID – 19 pandemics, Tanzania should consider taking necessary prior precaution before the outbreak. As a regard, future outbreak control strategy must be focused on safe conduct of various socio-economic activities that may promote EVD transmission and provide relevant information and education on potential risk for these activities in promoting EVD transmission. The country must be prepared to improve its capability for the prevention and treatment of any potential EVD outbreak in the future.

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Ethical Approval

Ethical approval was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Institutional Ethical Review Board referenced as "MUHAS-REC-11-2022-1442". Permission to conduct the study in selected regions was obtained from Ministry of Health and President's Office Regional Administration and Local Government (PORALG) and thereafter from the respective Regional Administrative secretary (RAS) and District authorities, Ward Executive Officer (WEO) and Street Executive Officer (VEO). A written informed consent was obtained from every participant before commencing an interview or an FGD. Prior to their participation, participants gave informed consent to participate in the study before taking part.

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