



## Sociospatial Networks and Trans-Border Epidemic Surveillance in West Africa: The Ebola Outbreak of 2014-2015 in Perspective

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### **Abstract**

**Background:** The study of social networks in the context of epidemiology is not new in the literature. However, most of these studies are based on official trade and migration statistics. Otherwise, they focus on a sample population within a national territory. Hence, there is the dearth of scholarly writings on the place of sociospatial networks in epidemic surveillance across state boundaries with remarkable informal transnational flows. This is particularly the case in West Africa, where trans-border interactions are predominantly unofficial. It is against this backdrop that this paper examines this phenomenon using the West African Ebola outbreak of 2014-15 as a case study.

**Methods:** The paper adopted a content and context analysis of public health records in the

affected countries as well as geographical data on transnational social spaces in West Africa.

**Results:** The study opens up a new dialogue on the need for a contextual approach to epidemic control in West Africa. It reveals that the preoccupation of the existing trans-border surveillance system with the official ports of entry is ineffective in the face of the progressive densification of transnational social networks in the region.

**Conclusion:** This work shows that tackling epidemics such as Ebola at geostrategic locations of sociospatial networks is a sine-qua-non for effective transborder disease surveillance in West Africa.

**Keywords:** Ebola, Epidemic Surveillance, Public Health, Sociospatial Networks, State Boundary, Transnational Flows, West Africa.

### **INTRODUCTION**

Ebola Virus Disease (EVD) is associated with fever, bleeding, diarrhoea, high morbidity, and mortality rate. It first evolved in the Democratic Republic of Congo in 1976 and became endemic in Sub-Saharan Africa, especially in countries such as the DRC, Uganda, Sudan, and Gabon. The contamination of human population with EVD since the 1970s has been traced to rural poverty as well as urbanisation processes that necessitated the encroachment of human population into the domain of

predominantly distinct animal species.<sup>1</sup> Thus, human impact on the natural environment seems to foster the increased frequency and spread of Ebola outbreaks.<sup>2</sup> In this respect, the Guinea rainforest has been ravaged by deforestation and has shrunk to less than one-fifth of its original size. In Liberia, more than half of the forests have been traded off to logging companies and Sierra Leone is seriously threatened by deforestation. Thus, environmental degradation and natural resource exploitation is believed to have triggered the Ebola outbreak of 2014-2015.<sup>3,4</sup>





While studies on the natural origin and taxonomy of Ebola abound in the literature, the analysis of epidemic surveillance across state boundaries has been delimited by over-concentration on official migration and health statistics. This trend of disease monitoring in public health shows that a detailed study of the sociospatial pattern of transborder transmission of infectious diseases in the regions experiencing remarkable informal transnational flows is lacking in the literature. This is particularly the case in West Africa, where informal social networks transcend national boundaries with public health implications. It is on this note that this paper uncovers the sociospatial dimension of trans-border epidemic surveillance in West Africa using Ebola as a case study.

#### **SOCIOSPATIAL NETWORKS IN EPIDEMIC SURVEILLANCE: A CONCEPTUAL FRAMEWORK**

The prevention and control of infectious diseases are cumbersome due to the increased fluidity of global relations. The advancement of transportation technology and communication networking between global hubs and nodes of economic-functional regions provide conduits of opportunities for pathogen transmission during infectious disease outbreaks. The reduction of the geographic distance between people due to social interactions enhances the speed of disease morbidity during outbreaks.<sup>5</sup> This phenomenon showcases the importance of place and space in epidemic surveillance. Thus, the centrality of individuals (nodes) and the social ties (relationships) between them in visualizing social networks in epidemiology.<sup>6</sup> In the context of the present study, the social nodes

constitute individuals involved in transborder activities and their ties with business partners, friends and family members across state boundaries.

Underpinned by the spatial dimension of social networking, this work asserts that sociospatial networks are major channels of epidemic diffusion. This had been illustrated historically during plague pandemics in which *Yersinia Pestis* was diffused across the globe through maritime trade networks.<sup>7,8</sup> In addition, the Influenza pandemic of 1918-1919 provides a striking example of pathogen propagation globally through military deployment and migration.<sup>9</sup> The outbreak of Ebola in West Africa presents a similar pattern of pathogen transmission across nodes of regional socioeconomic networks in the adjacent borderlands of Guinea, Liberia and Sierra Leone as well as official ports of entry.

#### **RETHINKING THE WEST AFRICAN EBOLA EPIDEMIC, 2014-2015: A SOCIOSPATIAL NETWORK ANALYSIS**

The 2014 EVD epidemic in West Africa started in the Gueckedou prefecture in Guinea, a major regional trading centre.<sup>4</sup> The epidemic spread to Liberia by the end of March; to Sierra Leone in May and Nigeria in July. After the initial transboundary transmission of the virus from an animal to a human being, human to human transmission occurred through exposure to the patient's bodily fluid.<sup>10-13</sup> The origin of the West African EVD outbreak has been traced to the village of Meliandou (Gueckedou District), an environment eroded by extreme deforestation due to mining and timber operations accounting for more than 80% loss of forest resources. Health officials

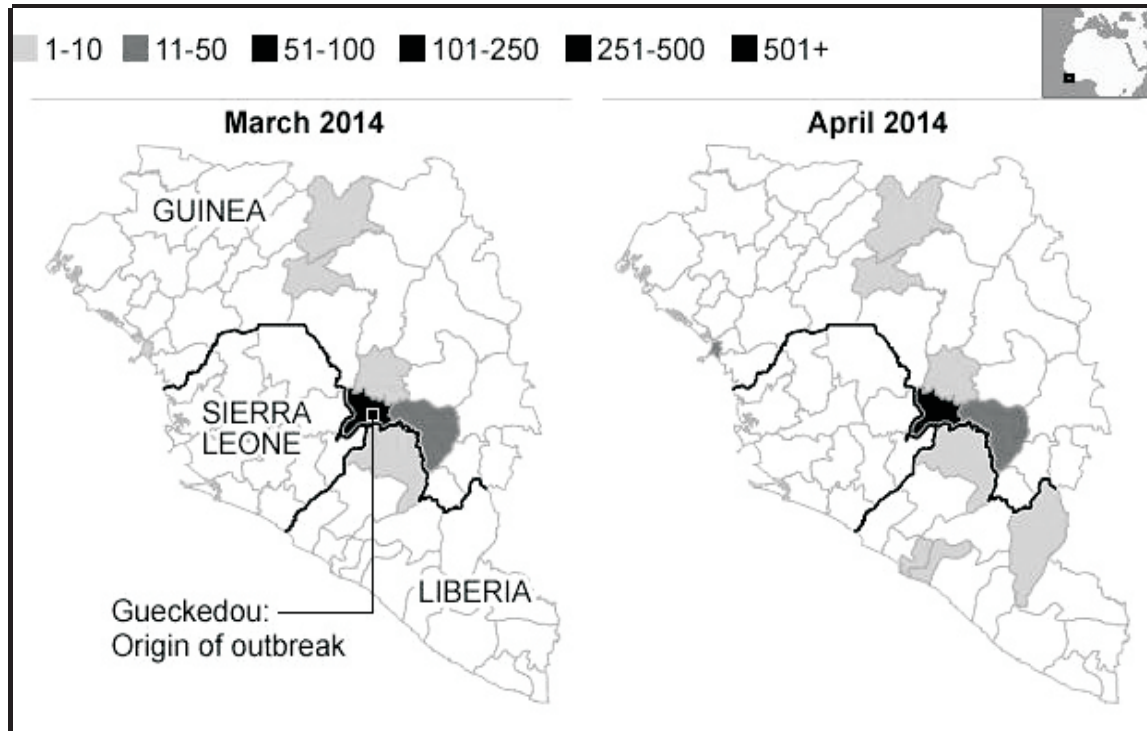


believed that this brought infected wild animals such as distinct species of fruit bats into communion with the human population.<sup>4</sup> The subsequent transmission of the virus in West Africa was channeled through intra-regional migration, rural-urban migration and care given in homes and hospitals. The initial infections were complicated by poor diagnostic and disease surveillance facilities.<sup>14</sup> These cases were thought to be malaria, an endemic disease in the region, thereby making health officials vulnerable to the disease. Thus, poor handling of patients, equipment and pharmaceutical materials in hospitals and healing homes are believed to have contributed enormously to the epidemic spread.<sup>15</sup> Furthermore, conspiracy theories suggest that harsh quarantine services, as well as bioterrorism stimulated stiff resistance to bio-medical intervention in the affected areas.<sup>16,17</sup>

This work uses a relational approach for the mapping of Ebola outbreak across borders in West Africa from 2014 to 2015. This perspective showcases Ebola diffusion through sociospatial networks of embedded and brokerage linkages that facilitate resource sharing across state territories. This social capital often concentrates on the nodes and hubs of inter-regional trade in West Africa with attendant implications for public health at the regional level. It has been observed that the 'social networks affect health through a variety of mechanisms, including (1) provision of social support, (2) social influence (e.g. norms, social control), (3) social engagement, (4) person to person contacts (e.g. pathogen exposure), and (5) access to resources'.<sup>6</sup>

Social networks have been used to access scarce resources across borders in West Africa over time. On the gender note, West African women play a major role in cementing social ties between economic-functional regions such as borderlands and interior locations. Indeed, since the economic crisis of the 1980s, transborder trade offers a refuge for many. While women's participation in petty trading is not new to West Africa,<sup>18</sup> they are being increasingly involved in transborder trading in the region.<sup>19-22</sup> Consequently, the ties of women in homes on the one hand and their transborder businesses on the other, lends weight to the vitality of these 'nodes' in the regional economy and epidemic transmission in West Africa. This seems to have accounted for the vulnerability of women during and after the Ebola outbreak.<sup>23</sup> Hence, building a surveillance system around this transnational context provides insight on the necessary public health intervention in the region.

Whereas trans-border disease surveillance in West Africa focuses on official ports of entry and hinterland border routes, the pattern of transnational intercourse across state boundaries in the region undermines this top-down approach to trans-border epidemic control. It is in these borderlands that inter-regional communion is at the highest level with implications for epidemic proliferation - the pull factors being differential valuation and interstate inequalities. This was the case in the adjacent spaces under the strong influence of borders such as Gueckedou located at an intersection between, Guinea, Liberia, and Sierra Leone (the origin of the 2014 Ebola outbreak in West Africa) (Figure 1).



**Figure 1.** A Map showing the Location of Gueckedou borderland and Ebola early Outbreak  
**Source:** WHO, National Health Ministries and HDX (2014)

The existence of bifurcated culture areas in adjacent borderlands in West Africa facilitates informal transnational flows.<sup>24 25</sup> This technically undermines official border closure as an effective epidemic control measure in West Africa. These regional trans-border dynamics inform Nuttall's assertion that in the face of the Ebola epidemic, implementing travel bans seems attractive; people in countries, far from the troubled region may be cajoled into a false sense of security, believing EVD can never reach them if flights are halted.<sup>26</sup> However, in practice, trans-border migration occurs on a daily basis, not only by airplane, but traversing porous land borders or on ships trading goods up and down maritime borders. This circumstance renders travel restrictions,

border closure, and mass quarantines less effective.<sup>27</sup> This circumstance suggests that the improvement of health services in these transportation and communication corridors is a centerpiece of any effective intervention.

A progressive densification of socio-spatial networks has been observed in economic functional regions of West Africa based on mental maps (figure 2). These are spaces of exceptional cross-border interactions and a potential target for public health intervention. Indeed, border crossers had observed the presence of multiple official and non-official border traffic between Foya District, Lofa County, abuts Sierra Leone and Guinea allows sustained human and material



flows between the economically interdependent cities of Foya, Liberia with a population of 19,522 and Gueckedou, Guinea with a population of more than 221,000. While a vibrant cross border trade in palm oil, rice, and other agricultural produce creates informal employment for local commercial bikers, food and beer vendors, and boatmen who ferry traders across the maritime border, the social and economic connectivity between these borderland communities

facilitated the transmission of EVD into Foya, Liberia on Monday, March 24, 2014.<sup>28</sup> According to the World Health Organization (WHO), 'while the first health worker infected with Ebola in this epidemic was from Gueckedou, Guinea in January 2014, the first one in Liberia occurred in March 2014 in Lofa and in June 2014 in Port Loko and Kailahun (1 day apart), Sierra Leone'.<sup>29</sup> This scenario puts border towns and cities in the central place of epidemic control in the region.

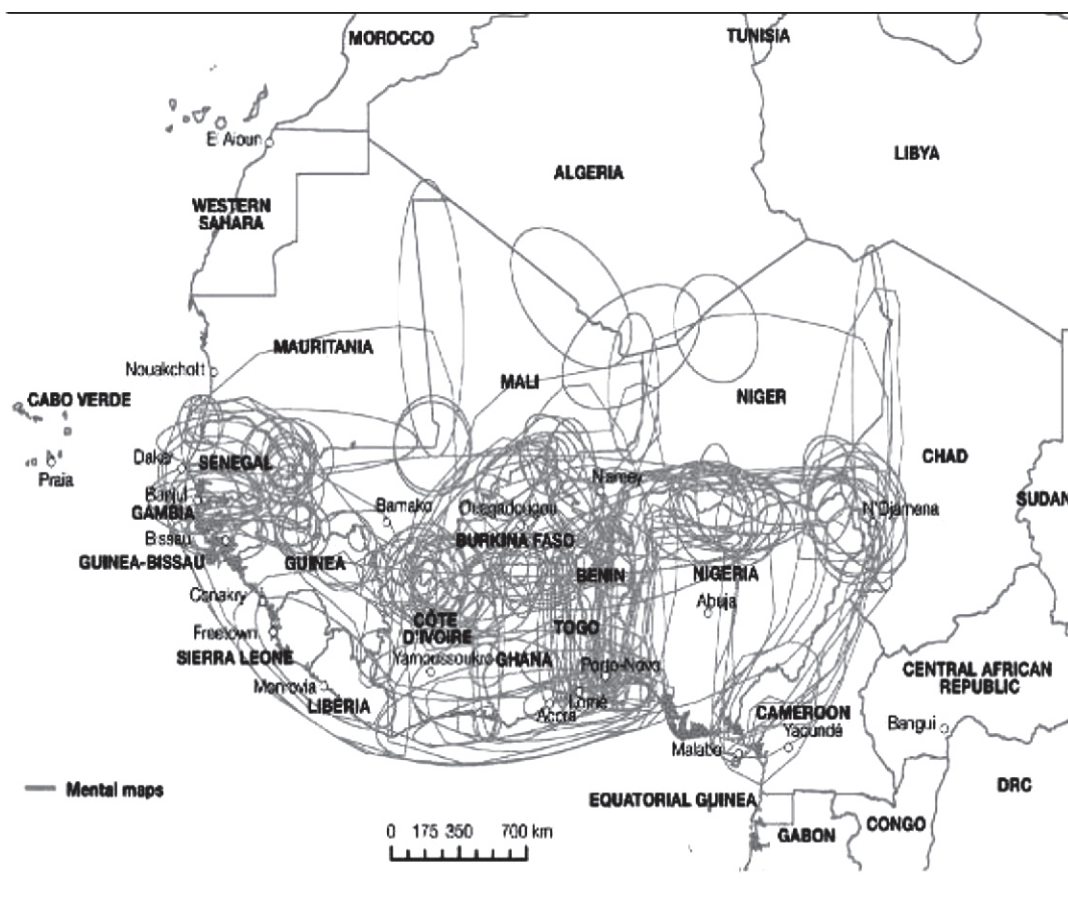


Figure 2. Mental maps of West Africa

Source: OECD 2017, p. 199.<sup>30</sup>



The intensification of informal transborder activities in West Africa is not unconnected with high poverty level and the search for economic opportunities at the state margin. This is often a product of natural resource degradation and climate change, inadequate access to land, housing, and food. As noted by International Fund for Agricultural Development (IFAD), poor rural people face major risks in relation to ill health, climate variability and poor governance.<sup>31</sup> For instance, Guinea with a population of 12,043,898; Liberia, 4,396,873; Sierra Leone, 6,205,382 and Nigeria, 178,516,904 are besieged with approximately 4,934,184 (Guinean), 1,508,940 (Liberian), 2,478,264 (Sierra-Leonean) and 50,010,839 (Nigerian) rural poor people. This statistics amounts to 64.7%, 67.7%, 66.1% and 52.8% of the overall national poverty lines respectively.<sup>32</sup> What more? in search of opportunities, translocal residential mobility of West Africans between rural and urban areas, especially in border regions creates conduits for disease transmission during epidemic outbreaks. Indeed, African border towns and cities are spaces of flows characterised by a complex network of transnational and translocal commitments and loyalties.<sup>33-34</sup>

Poor epidemic surveillance and health services in the West African borderlands ensured the porosity of these areas in the face of the outbreak. As noted by the International Organization for Migration 'well-managed borders that are sensitive to health needs can facilitate access to health services on both sides of the border, while ensuring that there is no risk of transmission'.<sup>35</sup> Guinea with a population of about ten million people accounts for an estimated 4 million people living below US\$1 per day and without

inadequate access to safe water and health care services. The over-concentration of public health expenditure in urban centers and in particular the capital city (Conakry) has led to poor public health services at the state margins. For instance, two-third of Guinean health workers is based in Conakry serving a meager one-fifth of the country's overall population. The Doctor/population ratio stands at 1:18355, Nurses/population ratio is 1:6018 in the district of Guéckédou, Guinea before the outbreak.<sup>36</sup> This situation has deteriorated in the post-Ebola era, as Guinea and Gueckedou, in particular, lose many of its health workers to EVD. By late May 2015, Guinea had lost a total of 78 health workers (Doctors, Nurses, and Midwives) to Ebola.<sup>37</sup> The regional disparity in healthcare provisions between the state center and the periphery was made worse by the outbreak. This phenomenon unveils West African borderlands as important geostrategic targets of public health intervention before and during epidemic outbreaks in the region.

## **CONCLUSION**

The interconnectivity of human population unveils the embodiment of an epidemic transmission in sociospatial networks. The traditional measures of abating the importation of infectious diseases involve public health practices associated with border control, port health surveillance, verification of official medical records, history of risk exposure, and the detection of symptoms. This paper reveals that these formal approaches are insufficient in the face of informal transnational linkages that straddles state borders in West Africa. Thus, tackling infectious diseases such as Ebola at geostrategic spaces of sociospatial networks like border towns and cities constitutes



important control mechanism in the region.

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