**The importance of developing rigorous social science methods for community engagement and behavior change during outbreak response**

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**Abstract**

Despite growing international attention, the anthropological and socio-behavior elements of epidemics continue to be understudied and under resourced and lag behind the traditional outbreak response infrastructure. As seen in the current COVID-19 outbreak the importance of socio-behavior elements in understanding transmission and facilitating control of many outbreak-prone pathogens, this is problematic. Beyond the recent strengthening of global outbreak response capacities and global health security measures, a greater focus on the socio-behavior components of outbreak response is required. We add to the current discussion by briefly highlighting the importance of socio-behavior in EVD response, and describe vital areas of future development including methods for community engagement and validated frameworks for behavior modeling and change in outbreak settings.

**Introduction**

Recent large disease outbreaks, including the current COVID-19 pandemic and the Ebola Virus Disease epidemic (EVD) in the Democratic Republic of the Congo (DRC), highlight limitations in global epidemic response. Despite efforts, initial responses to these outbreaks were slow or yielded suboptimal outcomes.1,2 Major efforts are underway to strengthen responses, including establishing rapid vaccine pipelines, new therapeutics, more robust detection methods, and epidemiological characterization of novel pathogens.3 However, anthropological and socio-behavior elements of epidemics which are of prime importance in understanding transmission and control facilitation continue to be understudied, under-resourced, and lag behind traditional outbreak response infrastructure.4,5 Beyond strengthening global outbreak response capacities and global health security measures, a greater focus on socio-behavior components of outbreak response is essential. This article adds to current dialogues by briefly highlighting the importance of socio-behavior elements in EVD response, discussing vital areas of development including methods for community engagement and validated frameworks for behavior change, and proposing research methods to include socio-behavior elements in outbreak settings.5-7

**Social science, community engagement, and the EVD response**

A socio-behavior perspective is fundamental to understanding the historical and ongoing factors that have shaped EVD outbreaks, including historical trauma from western colonization and cultural marginalization of communities within outbreak areas.8-11 Increased fear and lack of control coupled with activities of foreign organizations can lead to actions perceived as infringements on human rights by evoking past colonial activities that quickly degrade trust and respect.12 This is evident from the community perspective and mistrust towards the implemented policies around contact measures and burial practices particularly in Guinea during the West Africa EVD outbreak.13 This understanding then provides context to the documented high levels of (i) mistrust towards responders, typically epidemiologists and clinicians, (ii) attacks targeting healthcare workers and facilities and (iii) decreased health-seeking behavior amongst potential cases in the EVD outbreaks in Western and Central Africa.4,14

In the West Africa EVD outbreak, social science research and community engagement were eventually used to address these challenges and improve response efforts by drawing on previous ethnographic studies as well as field research as part of the resopnse.5,6,9,15,16 These community engagement activities include local staff recruitment for social mobilization activities, working with religious leaders, engaging local journalists and radio, and hosting local community meetings. Effective community engagement, informed by social science research, can ensure that interventions are adapted to and by local communities. This leads to improving outbreak response by decreasing levels anxiety and fear, improving dialogue between responders and communities to ensure effective communication around key public health measures, increasing support and reporting by the community, and encouraging acceptance and implementation of community interventions, which ultimately lowers transmission rates.7,17,18 Documented successes of effective community engagement integrate elements of bottom-up approaches that empower local communities19 and respect both local power dynamics9,10 and cultural norms.6 Involvement of social science research is also important in vaccine and treatment trials for emergent diseases. Such involvement can help address community and participant anxieties as well as hopes for the candidate vaccines or treatments, motivations for participation, and the social, political, economic and historical context of trials.10,20 Further to this, research from the Sierra Leone EVD vaccine trials described how by interacting with various community leaders, researchers understood the fragmented nature of community hierarchies and were able to diversify engagement strategies to reach different populations within the community.10 Therefore, consideration of power dynamics, fairness, and trust in implementing an outbreak response program are thus critical.10 In order to address these elements, there has been the design and deployment of ‘rapid social science’ research/tools in the 2018-2020 DRC outbreak. However, there is still a need for a validated process integrating social science and epidemiological data to support community engagement during outbreaks.11

**Inclusion of socio-behavioral variables into transmission models**

Infectious disease transmission models can estimate a range of outbreak parameters including number of cases, duration, dynamics, and/or impact of control interventions. Model outputs are frequently used to guide response strategies, policies, and resource allocation, and can be powerful tools given appropriate assumptions and variables. Human infectious disease transmission is invariably shaped by individual and population behaviors, yet these variables are rarely if ever included in mathematical transmission models.21 For example, World Health Organization (WHO) data suggests that burial practices were linked to 60-80% of cases in West Africa, resulting in EVDs classification as a behavioral disease.22 Despite the importance of understanding behavior in transmission dynamics, a systematic review found that most models of behavior change are purely theoretical and lack scientific validation.21

Some studies have attempted to find variables for socio-behavior modeling by using cross-sectional knowledge-attitude-practice (KAP) surveys to quantify socio-behavior factors.23,24 KAP studies are easily deployable with quick analysis, making them highly desirable for acute outbreaks. While these studies are useful for some basic modeling, they only indicate general behavioral factors and are unable to explain underlying social factors that shape disease transmission. For example, a KAP study conducted in Liberia found that EVD transmission awareness was poor and education was needed to improve outcomes, but was unable to describe how and to what degree education could modify behavior.23 Similarly, a cross-sectional KAP study conducted during the West Africa EVD outbreak found that myths and stigma affected risk perception and, critically, behavior.24 While data from these studies could be used to improve prediction models of vulnerable populations, they do not elucidate the social forces that need to be understood to affect behavior change.

Building behavior change models requires an understanding of underlying sociocultural structures. For example, while a KAP study may be able to identify burial practices as a risky behavior, it will not explain how to mitigate or shape this behavior positively. Emotions are a principal driver behind the act of participating in funerary rituals reveals that behavior change will be successful only when risky practices are replaced by ritually and emotionally meaningful equivalent safer practices.25 The importance of behavior modeling and adaptation demonstrated by recent EVD outbreaks has created a call for systematic integration of these elements into outbreak response.6,11,26

**Considerations for integrating social science and epidemiological approaches**

Challenges stem from core epistemological differences between traditional outbreak responders, typically epidemiologists and clinicians approaching problems from a scientific paradigm, and social scientists who approach similar problems from a humanistic paradigm; thus effective collaboration is limited. Developments that integrate appropriate social science and epidemiological methodologies have not been fully tested and validated through scientific experimentation.27 Therefore, a more structured and rigorous approach for community engagement and socio-behavior behavior models is crucial for successful outbreak response.5,26

There are a number of theoretical frameworks for context specific research that incorporates socio-behavior elements including alternative randomized controlled trials, process evaluation, multiple case study design, and realist evaluation (context-mechanism-outcome (CMO) studies).28 Of these developing methodologies, realist valuations or CMO studies, present the greatest utility, adaptability, and applied outcomes. CMOs create 1) a generalized theory of how a system works and 2) specific actions/mechanisms that can be taken in described contexts to lead to desired outcomes.29 An advantage of this study design is that theory and specific variables are tested and compared in multiple contexts. Theory and variables from CMOs can be tested by future CMO studies to continue evaluation of underlying theories, interventions, and outcomes. By design, this creates a systematic evaluation enabling necessary validation of research methods through an iterative process. Previously, CMO studies were used to better understand and modify complex socio-behavior interactions such as improving performance of community health workers in humanitarian crises30 or studying influences of social networks on behavior change in adolescent sexual and reproductive health in West Africa.31 Table 1 displays different CMO studies, the contexts they have been used in, and example variables.

Another approach to standardizing variables and outcomes is a system dynamics approach which uses multiple social and epidemiologic inputs to demonstrate the impact behavioral feedback has on outbreak outcomes. A post-hoc system dynamics model using an integrated set of causal relationships from social science research on EVD was able to recreate epidemiologic outcomes reported by the WHO22 and found that behavioral and sociocultural factors are needed to fully interpret transmission dynamics observed in the West African EVD outbreak.

Once standardized, these methods and models could be used for different aspects of response including program design, formative research, community engagement programs, case investigation, socio-behavior models, and post-hoc assessment.32 All such methodologies should be scientifically studied for effectiveness, which presents a challenge for acute outbreak responses since there is no ability to test methods before implementation. One approach to mitigate this would be to test these methods in non-acute settings, where infectious diseases are endemic. This could also address ethical challenges implementing new methods in fragile outbreak settings with already vulnerable populations. While validation of methods/models may involve culturally specific elements, adaptable frameworks like CMO studies, should be used to attempt to standardize across environments.

**Conclusions**

Currently, the WHO lists 50 active social science projects related to the ongoing EVD outbreak in the DRC, Uganda, Rwanda, and Burundi.3 These projects are being used to engage local leaders and track migration patterns and disease transmission.3 These efforts demonstrate the direction that needs to be taken to integrate socio-behavior science into outbreak response while also highlighting the necessity of a systematic approach to validate elements of successful community engagement integration into cohesive response efforts.

This article has 1) highlighted the importance of community engagement and inclusion of socio-behavior models in outbreak response, 2) outlined challenges associated with integrating social science methodologies into outbreak response, and 3) suggested possible solutions for creating scientifically-validated methods/models for integration of social science research including CMO studies and system dynamics. This article reemphasizes rigorously testing and validating methods as crucial. With stronger social science methods, higher quality data will bolster community engagement and behavior change leading to improved outcomes for EVD and future outbreaks.

**Consent for Publication**

The authors grant the right to Disaster Medicine and Public Health Preparedness to publish this piece.

# Declaration of Interest Statement

The authors of this paper receive any payment or reward of any kind for writing this article.

# Competing Interests

There are no competing interests identified in relation to this research. The authors declare that they have no conflict of interest. There are no financial, copyright, trademark or patent implications arising from this research and no organization has any vested interest in this research.

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