Community Engagement in the Ebola Response: A Retrospective Mixed Methods Analysis of the Social Mobilisation Action Consortium (SMAC) Engagement in Sierra Leone

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Abstract

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Introduction. During the 2014-15 Ebola outbreak in Sierra Leone, the Social Mobilisation Action Consortium (SMAC) used the Community Led Ebola Action approach to trigger collective action at a community level, in an effort to influence behavior change and reduce transmission of Ebola. **Aims.** This analysis examines the bylaws prioritized by communities through the SMAC engagement, to understand breadth and scope as well as geographic and temporal trends. **Methods.** Data was collected by community mobilizers through triggering and follow up community visits. An inductive approach was used to develop a set of codes to describe these bylaws, which were used in a linear supervised learning model to code the full set of bylaws. Bylaws were grouped into codes and broader categories, which were analyzed over time, geography, and visit type. **Results.** Categories of bylaws, specifically Reporting and Individual Contact bylaws, increased as a proportion of total bylaws at national and provincial levels. Reporting of target behaviors were not significantly different between trigger and follow up visits. Kambia offers a unique case study to examine the trends in bylaws placed in context of a regional initiative, The Northern Push. **Discussion.** The SMAC dataset offers an opportunity to understand how communities related to the Ebola outbreak by their expressed priorities, through a community engagement and

behavior change intervention. Community engagement as a behavior change tool is particularly relevant for COVID-19 pandemic and the Ebola outbreak in the Democratic Republic of Congo.

INTRODUCTION

The 2014-2015 Ebola outbreak in West Africa was declared a Public Health Emergency of International Concern by the WHO on August 8, 2014. By the end of the outbreak, 11,310 were dead in the three most affected countries -- Guinea, Liberia, and Sierra Leone -- out of a total 28,616 cases.[1] The outbreak capitalized on a perfect storm of circumstances: few numbers of healthcare providers, weak national health and disease surveillance systems as a result of decades of civil unrest, traditional burial ceremonies that put participants at high risk of transmission, and low trust in the government response and Western medicine.[2]

Ebola is readily transmitted through contact with bodily fluids of infected humans and animals, and thus can be significantly reduced by effective behavioral changes, including regular hand washing, safe burial practices, and enhanced surveillance activities.[3] Transmission is also influenced, positively or negatively, by other factors with relevance to the West Africa context, such as the practice of traditional medicine, fear and obstruction of modern health interventions, including reporting and health seeking behavior, and stigma of health workers and survivors.[4]

Transmission of Ebola during the 2014 West Africa and 2018 Democratic Republic of Congo outbreaks -- both occurring in post-colonial contexts -- was exacerbated by distrust in institutions, negatively influencing compliance with social and behavior change messages.[5] Community engagement, specifically focusing on involving trusted community members in response efforts and facilitating collective action at the local level, offers a potential solution to build trust within communities and positively influence behavior change outcomes.[6, 7] Community-based approaches have been shown to be effective in reducing transmission of Ebola[8, 9] and are now recognized by international agencies as a critical component to reduce spread of disease.[10, 11]

As the Ebola outbreak escalated in Sierra Leone, social mobilization and community engagement became an increasing priority of the response. At the national level, the National Ebola Response Centre managed a seven-pillar response. The Ministry of Health and Sanitation and UNICEF co-led the Social Mobilization pillar, with the mandate to coordinate partners and focus on community awareness and

behavior change.[12] With this priority, the Social Mobilisation Action Consortium (SMAC) was formed to mobilize collective action at the community level, targeting behavior change and disease reduction.[13]

Social Mobilisation Action Consortium (SMAC)

SMAC was a consortium of several local and international NGOs, in partnership with the Ministry of Health & Sanitation and UKAid. They included Restless Development Sierra Leone, GOAL, the United States Center for Disease Control and Prevention, BBC Media Action, and Focus 1000. The members of the consortium brought diverse and unique expertise across prevention and control, mass media, social mobilization, and community engagement. To address the EVD outbreak, one-directional messaging was not sufficient. The theory of change underlying SMAC's initiatives was based on the foundation that to reduce disease transmission, communities must be engaged and empowered in the response. It was contextualized and formalized through the Community Led Ebola Action (CLEA) approach, based on Participatory Learning and Action programming in HIV and AIDS contexts and Community Led Total Sanitation (CLTS), which was developed to mobilize communities to eliminate open defecation through their own analysis and action.[13, 14] The CLEA approach utilized trained community mobilizers to trigger collective action within communities. SMAC engaged 2,500 community health mobilizers and provided a 5-day training facilitated by GOAL and Restless Development, before engaging in communities. Training included learning about Ebola, the CLEA approach, facilitation, data collection, and psychosocial wellbeing.

The SMAC program consisted of direct and repeated interaction with communities. The first interaction with a community is referred to as the *triggering event*, meant to trigger collective action. Equipped with training and the CLEA guide[15] community mobilizers facilitated a workshop that supported the development of community driven action plans, with collective buy-in and ownership. This was done with consent from the village leaders (political, religious, etc.), and engaged a representative group from the community. The second and all subsequent engagements were conducted as supportive follow up visits to address any barriers to communities' implementation of their bylaws. The number of follow up visits in each community varied, but the visits by mobilizers were meant to keep momentum, track changes in the action plans, and learn best practices that can be shared with other communities. The trigger workshops

specifically encouraged two proven target behaviors, safe burials and reporting, which were the two behavior outcomes tracked in follow up visits. The data collected by mobilizers at each community visit tracked community action plans and behavior adoption in over 12,000 communities across 13 districts from November 2014 through December 2015.

METHODS

Aims

This secondary data analysis of the SMAC community action plans had two primary research aims. The first (RA1) was to describe the breadth and scope of the Community Action Plans against Ebola across 13 districts in Sierra Leone between December 2014 and December 2015. The second (RA2) was to evaluate geographic and temporal trends in Community Action Plans across the same geographic scope and time frame. These aims were developed in partnership with SMAC team members, in service to the broader hypothesis that community engagement strengthens behavior change in an emergency public health setting.

Data Collection

SMAC data were collected between November 2014 and December 2015, across 13 districts in Sierra Leone (Kenema district was not included). They were collected by approximately 2,500 community mobilizers, from 35,730 unique community visits. These data were collected on both paper-based forms from November 2014 through September 2015, and digitally from April to December 2015.

Qualitative data collected included commonly expressed concerns, risk perception, and community bylaws. Quantitative data collected included behavior outcomes (number of seriously sick individuals, number of deaths, number of seriously sick individuals reporting to authorities within 24 hours of symptom onset, number of safe burials conducted, community behaviors), as well as suspected deaths and number of survivors. For the purposes of these research aims, a subset of variables from the SMAC dataset was used, with data analysis focused on the community by-laws recorded by the community mobilizers. Data from paper reports was pulled from the prompt “What bye-laws have been developed on

Ebola in this community? Please any examples of bye laws implementation". Data from digital reports were pulled from the variable recorded as "Action Points".

Each visit could include multiple bylaws. For the analysis, we created a list of all individual bylaws for coding purposes, with the rest of the data intact including a unique visit identifier. This allows for re-aggregation of all bylaws and codes within a given visit after coding, as was done for the Target Behavior analysis.

Classification of Bylaws

We used an inductive approach to code bylaws by the behavior described, using randomly selected bylaws to remove any bias by ordered data. [16] Codes were assigned to specific behaviors using as much detail as possible so as to retain the ability for capturing nuance and detail in the analysis. This was balanced with maintaining general enough codes to allow for sufficient accuracy of the supervised learning model. 55 codes were ultimately identified to describe the bylaws prioritized by communities. Each bylaw received a singular code. Codes were grouped into 5 categories (Individual Contact, Social Distance, Monitoring and Surveillance, Reporting, and Community Protective), which was informed by expert opinion and SMAC partners. These groupings allowed for broader categorical analysis. The Individual Contact category represents the codes that involve individual protective behaviors that reduce or prevent contact with others, which is the primary mode of EVD transmission (touching the sick, washing hands, touching dead bodies, etc.). The Social Distance category is made up of codes that reference reducing or prohibiting any gatherings such as going to the market, entertainment, sports/games, etc. The Monitoring and Surveillance category are codes that refer to how the community is monitoring for Ebola through house to house visits, quarantining, checkpoints, etc. The Reporting category is made up of codes that refer to reporting disease or death. Finally, the Community Protective category is a collection of behaviors codes that require communal commitment such as strangers or visitors, a community task force, and adherence to bylaws.

For the purposes of this analysis, the following levels of data are used: 1) bylaws, representing the raw data, 2) codes, representing the coded bylaws, which are specific but still include some level of grouping,

and 3) categories, which represent codes grouped into themes that allow for broader trend analysis. The coding allows for hypothesis-driven manipulation of categories for future additional analysis.

An initial training set of randomly ordered bylaws were coded until new codes were no longer identified. Codes were independently validated and reconciled. A linear support vector machine learning model was trained using a total of 2,500 manually coded bylaws and was used to code the remaining bylaws. The model was trained to 95% accuracy. All bylaws with "NA" (*i.e*., missing data) were removed after coding. All codes that made up less than 1% of total bylaws were manually checked, as the model had a harder time accurately attributing these codes.

Spatial and Temporal Analyses

We explored trends in bylaw codes and categories across geography and time. For temporal trends, data were aggregated by month, between November 2014-December 2015. For spatial trends, data were aggregated at district and province levels. Provinces with their component districts were as follows: Eastern Province (Kailahun, Kenema, and Kono districts), Western Area (Western Area Rural and Western Area Urban), Southern Province (Bo, Bonthe, Moyamba, and Pujehun districts), and Northern Province (Bombali, Kambia, Koinadugu, Port Loko, and Tonkolili districts), as seen in Figure 8.

Bylaw codes and categories were analyzed as a proportion of the total bylaws within each unit of measurement - time (month), geography (national, province, district) or visit type (Trigger, Follow Up). This allows for relative trend analysis of bylaw codes and categories, since absolute numbers of bylaws or visits were not consistent across time, geography, or visit type.

Bylaws were dichotomized as a binary variable representing whether or not the bylaw was a target behavior. Target behaviors for this analysis were any bylaws in the Reporting category, or the Safe Burial code. Similar spatial and temporal trends were explored. A X^2 test and post hoc analysis was used to evaluate the relationship between the number of target behaviors and by both visit type (i.e., Trigger versus Follow Up visits) and province.

RESULTS

35,730 community visits between November 01, 2014 and December 31, 2015 were included in this analysis. A total of 99,445 bylaws were recorded from these visits.

55 bylaw codes were developed, grouped into 5 discrete categories of behaviors (*Table 1*). As a proportion of the total, these categories were: Individual Contact (55.86%, n=55,547), Community Protective (19.42%, n=19,320), Reporting (9.48%, n=9430), Social Distance (7.16%, n=7,120), and Monitoring and Surveillance (6.67%, n=6,634). A sixth category, Other, captured miscellaneous bylaws that did not fit within the five primary categories (0.61%, n=606). Finally, bylaws that were illegible represent 0.78% of the data (n=788). The breakdown of bylaw codes within these categories over time is available in *Figure 7*.

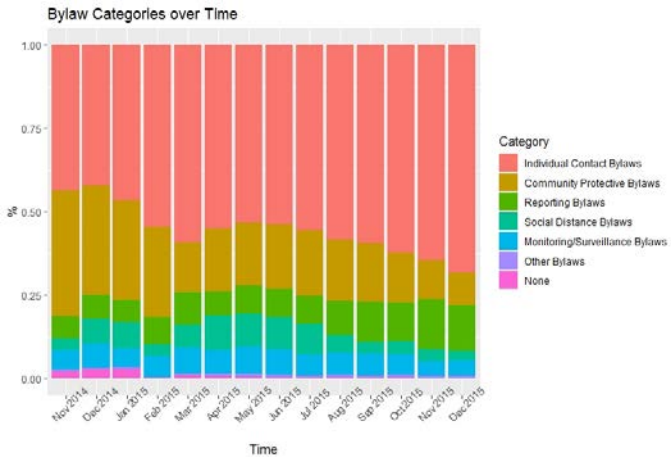

Figure 1. Bylaw categories over time as a proportion of total bylaws

Temporal Results

Bylaw categories showed a noticeable trend over time, aggregated at the national level. Individual Contact bylaws constituted 43.6% (n=467) of total bylaws in November 2014, and the proportion increased over the 12-month period to 68.2% (n=1975) of total bylaws in December 2015. In comparison, Community Protective bylaws made up 37.6% (n=402) of bylaws in November 2014, which decreased to 9.6% (n=279) of the bylaws in December 2015. Reporting bylaws, representing one of the target

behaviors, doubled in proportion from 6.7% (n=72) to 14% (n=402) of bylaws over the same period of time. Other categories showed slight but not as noticeable trends.

Province level results also revealed differentiated trends. Community visits in the Western province, where Freetown is located, were associated with 77.4% of the bylaws recorded (n=77,015). This was followed by the Northern (12.5%, n=12,411), Southern (7.3%, n=7,294), and Eastern (2.7%, n=2725) provinces. Bylaw categories disaggregated by province showed differences in trends, the most prominent of which was in the Northern province. For action plans in the Northern province, the proportion of bylaws in the Reporting category showed an increase in proportion from 7.2% (n=52) in November 2014 to 26.7% (n=27) in December 2015. Additionally, Community Protective bylaws, which were driven almost exclusively by visitor and stranger bylaws, decreased from 36.8% (n=264) to 4.0% (n=4) of bylaws reported in action plans across the Northern province. The Western province showed a increase in the Reporting category from February to December 2015, from 4.6% (n=4) to 13.5% (n=377) of bylaws each month. Similarly, Individual Contact saw a steady increase from April to December 2015, from 52.9% (n=3,744) to 68.4% (n=1,909) of bylaws each month.

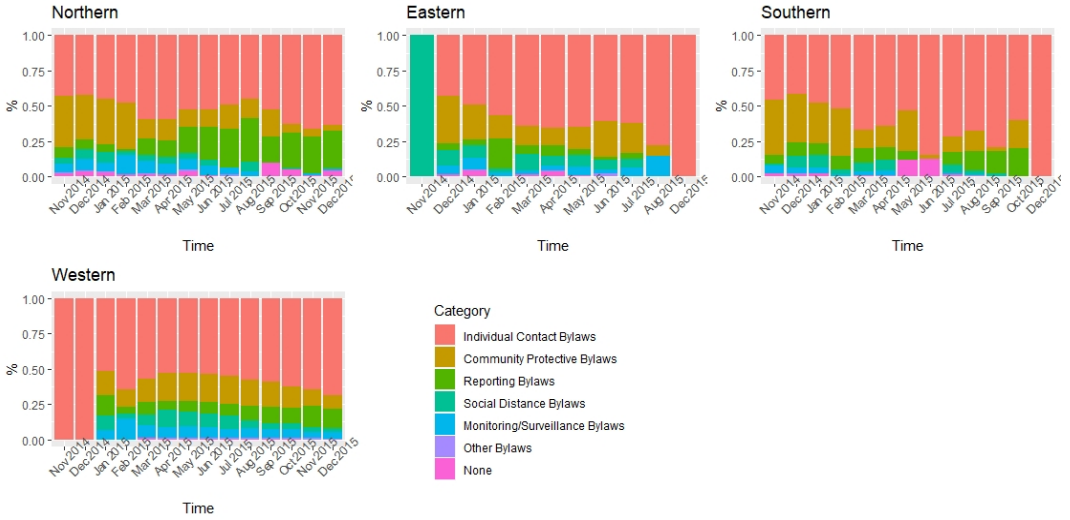

Figure 2. Bylaw Categories over time by Province, as a proportion of total bylaws each month

Target Behaviors

Priority target behaviors, on which significant attention during mobilizer training and triggering event meetings was placed, were identified as reporting the sick or dead, and safe burials. These bylaws made up 9.5% (n=9,423) and 7.4% (n=7,392) of the total recorded bylaws, respectively. Each visit was coded as including either 0, 1, or 2 bylaws. These visits were also identified as either a Trigger or Follow-up visit. A X^2 test of independence shows that there is no significant association between visit type and number of target behaviors (X^2 (2, N=36,675) = 4.50, p=.11), when aggregated at a national level.

Target Behaviors differ significantly by Province, (X^2 (6, N=36,675) = 235.8, p<0.001). Post hoc analysis using pairwise comparisons with Bonferroni corrections confirms statistical independence between each province (p<0.001). The Northern province recorded the highest proportion of target behaviors of all four provinces (43.5%, n=2,058).

Figure 3. Target Behaviors by province as a proportion of total bylaws

Kambia District

Kambia District offers an opportunity to explore trends in bylaw categories and target behaviors within a more specific context. Along with Port Loko, Kambia was a focus of Operation Northern Push, an initiative spearheaded by the National Ebola Response Centre in partnership with the UN to strengthen

surveillance and contact tracing after a resurgence of cases in June 2015.[17] The Northern Push relied heavily on the public to report people with symptoms or community deaths. The bylaws that reflect these behaviors are included in the Reporting category of the data (codes: Report Sick, Report Dead, Call 117).

Visits in Kambia recorded a higher proportion of Reporting category bylaws than other districts (15.9%, n=323 in Kambia compared to the district with the next highest proportion of Reporting bylaws, Bo, with 12.0%, n=197). Kambia received an additional 10 trained surveillance officers (SOs) in February 2015, increasing the total to 16 in the district. By April, there were 25 total SOs in Kambia.[18] Reporting bylaws increased as a proportion of total bylaws each month starting in March through August 2015 from 15.3% (n=21) to 31.0% (n=9). Interestingly, SOs were present through the first week in September, and Kambia saw a decrease in Reporting bylaws down to only 19.0% (n=8) the same month, although the total number of bylaws documented at that time point was low.

We see a similar trend in Target Behaviors (Reporting & Safe Burials) in Kambia. Compared to the first three months of recorded bylaws, there was a spike in total Target Behaviors in March, which remains relatively consistent through December with the exception of August where 100% of bylaws are Target Behaviors. Additionally we see an increase in 2 target behaviors recorded per visit increase to a peak in September 2015 to 72.7% (n=9).

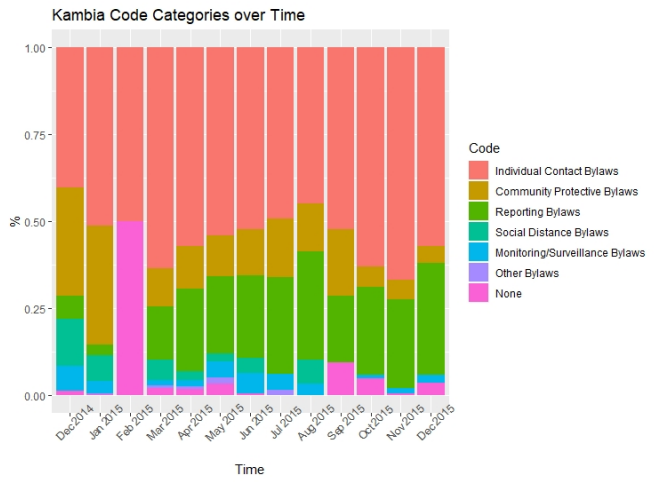

Figure 4. Bylaw categories over time, as a proportion of total bylaws each month, in the district of Kambia

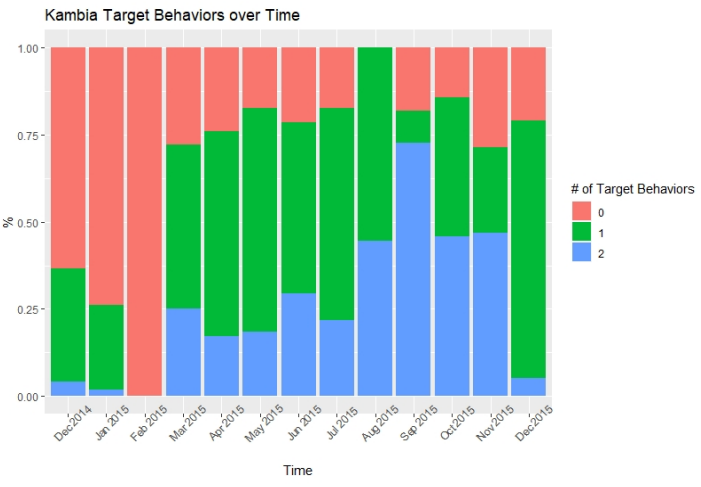

Figure 5. Target Behaviors over time, as a proportion of total bylaws each month, in the district of Kambia

DISCUSSION

These findings describe the content and scope of the bylaws prioritized by communities during the 2014-2015 Ebola outbreak in Sierra Leone. 55 distinct codes showed a wide range of bylaws, the frequency and proportions of which changed and shifted over time as the outbreak progressed. Trends across both codes and categories demonstrated measurable changes in community priorities over time, which become relevant when placed in context of the time and place of the outbreak. In Kambia, for example, we can learn about the prioritized behaviors in a district that was targeted for increased surveillance and reporting behaviors. We observed that reporting behaviors were prioritized more in Kambia than in other districts that were not a target for this push. Additionally, the Northern region showed a higher proportion of target behaviors, which may be associated with this push as well.

As discussed, there is evidence to suggest that effective behavior change is accelerated by community engagement. [12] Although this analysis does not measure behavior outcomes, it does provide insight into the behaviors that communities were prioritizing during the outbreak. Over the course of the outbreak, we see an increase in both Reporting and Individual Contact bylaws, both effective behavior categories that reduced transmission of Ebola. This is likely a reflection of response initiatives, such as the Northern Push, as well as direct SMAC engagement. Such findings are particularly relevant for two recent emergency health settings. The first is the COVID-19 pandemic, which has a different transmission pathway from Ebola, but which similarly requires intentional and sustained behavior change to reduce transmission such as washing hands, wearing masks, and social distancing. COVID-19 presents an opportunity for global and national action plans to integrate community engagement as a key pillar to the response, treating communities as critical actors in managing a health emergency.

This analysis and the CLEA approach are also relevant for the ongoing Ebola outbreak in the Democratic Republic of Congo (DRC) which has a history of repeated outbreaks but in varied areas of the country with unique contextual challenges, despite a growing toolkit of response strategies, namely a vaccine. It may be assumed that when pharmaceutical interventions are available, community engagement is not as critical to influence behavior change, [19] yet the DRC has served as an example where a vaccine is available but transmission persisted due to civil unrest and mistrust between local populations and the

national and international communities. In particular, evidence shows that in the DRC where there is mistrust and belief in misinformation, willingness to accept the Ebola vaccine was low. [5] In this context, community engagement to empower communities for more effective efforts at encouraging behavior change remains critical.

Understanding the results of the CLEA approach through the content and trends in community bylaws supports further application of the approach as well as opportunities to focus additional research. The CLEA model is important in an outbreak setting because of both process and outcomes. Mistrust in institutions is a barrier to behavior change, and this model seeks to approach behavior change through collective action at the community level, an important procedural shift. Further analysis of the bylaws and behavior outcomes would provide insight into what prioritized bylaws are correlated with significant changes in behavior, allowing for enhanced and refined approaches to community engagement in future Ebola outbreaks and other similar infectious diseases.

There are additional lessons to be gleaned from the content of the bylaws themselves, for example the range of bylaws described include both effective and ineffective behaviors to reduce Ebola transmission. Ineffective behaviors prioritized by the community indicate that misinformation and rumors may be influencing what communities prioritize in their action plans, and potentially impacting behavior and disease outcomes.

Finally, additional research is required to understand how the CLEA approach may have contributed to curbing disease transmission. Evaluation of this data subset, through understanding the relationship between prevalence of specific bylaws or categories prioritized by communities, and epidemiological data, would contribute to this analysis.

There are limitations to this analysis. The data were collected by community mobilizers, and although they participated in extensive training that included data collection, the bylaws were interpreted and recorded through their lens, not as direct quotes. Additionally, the data were collected at the beginning of the outbreak on paper forms, transitioning to digital in the latter half of the program. This prevented

analysis at more specific geographic units due to difficulty in matching entries from different visits at the same community.

This is an initial analysis of the bylaws identified by communities during the Ebola outbreak in Sierra Leone. These bylaws are an outcome themselves, offering a window into how communities related to the outbreak through their stated priorities, considering how time and place may have influenced these. SMAC's aim, to trigger collective action, is given shape by describing the scope and trends of the action plans themselves. Understanding the collective action of communities, and their trend towards effective preventative behavior, suggests engagement at the community level was an important component of the Ebola response in Sierra Leone.

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Table 1. Frequency and Proportion of Bylaw Codes, organized by category

CODE	%	Freq	DESCRIPTION
INVDIVIDUAL CONTACT			
Hygiene/Cleanliness	2.55%	2533	General reference to cleanliness, either at a household level, or community level
Hand Washing	13.11%	13038	Reference to hand washing
Touching the Sick	1.20%	1191	Reference to not touching the sick
Sick in the home	8.59%	8547	Reference to not allowing or caring for sick people in the home, isolating them
Dead Bodies	15.69%	15606	Reference to prohibiting the touching or washing dead bodies, including isolating them
Safe Burials	7.43%	7392	References which include a safe burial, no common burials, contacting burial team, no visiting of funeral homes
Contact with others	3.02%	3004	References to reducing or prohibiting physical contact with others in the community
Eating Bush Meat	1.94%	1931	References to prohibiting consumption of bush meat.
Hand Shaking	1.66%	1653	Reference to shaking hands
No alternative practices	0.45%	446	References prohibition of alternative healing practices to treat Ebola, or traditional practices
Sex/Prostitution	0.14%	143	No sexual intercourse or prostitution
Pregnancy	0.03%	26	Do not deliver a pregnant woman
Fighting	0.04%	37	No fighting
REPORTING			
Reporting the sick	3.41%	3394	References to reporting the sick
Reporting death	0.74%	734	References to reporting deaths in the community
Calling 117	5.32%	5295	Calling 117 or other external resource for support
Medical Advice	0.01%	7	Abiding by medical advice, going to medical professionals
MONITORING/SURVEILLANCE			
Quarantined Homes	2.07%	2062	References to quarantined homes and related visiting policies
House to House Visits	2.37%	2352	References to house to house visits in search of the sick (some outliers why house to house visits)
Curfew	0.45%	448	References related to any time restriction on entrance/departure into the community after a particular time. Includes bike traffic after hours
Ebola Checkpoints	1.26%	1253	References to checkpoints for entry into the community

Movement	0.40%	399	References to staying within the community, not sleeping elsewhere, reducing movement, not crossing borders
Thermometer	0.10%	97	Use of thermometer or temperature gun
Swabbing	0.02%	23	Requiring swabbing after death
COMMUNITY PROTECTIVE			
Strangers/Visitors	15.66%	15570	References to reducing or not allowing strangers in the home or community
Behavior of Children	0.10%	101	References to behavior of children (ie not gathering at waterside)
Reducing Stigma	0.60%	600	References to reducing the stigma for survivors or health workers
Learning about Ebola	0.71%	702	References to learning about EVD, engaging religious leaders
Communal Behavior	0.22%	217	References to community engagement in EVD prevention, community meetings, etc.
Youth Task Force	0.25%	250	References to mobilizing youth in the community
Community Task Force	1.16%	1153	References to mobilizing community task forces
Adherance to by-laws	0.44%	440	References to adhering to bylaws set out by the community
Public Urination/Open Defecation	0.09%	86	References to prohibiting public urination or open defecation
No sick in the community	0.20%	201	References no sick people in the community
SOCIAL DISTANCE			
Public Gatherings	5.49%	5455	References to prohibiting public gatherings and overcrowding, including initiation activities and traditional ceremonies
Soccer/Games	1.40%	1394	References prohibiting playing soccer, other games or activities in the street
Cinema/Entertainment	0.21%	205	References not attending the cinema or other forms of entertainment
Jamaat	0.06%	58	Suspending all Jamaat activities
Gym	0.01%	8	Attending the gym, physical exercise
OTHER/NONE			
No code	0.79%	788	
Reduce Ebola	0.05%	51	General references to reducing Ebola
Housing Protection/Tenant Protection	0.01%	6	References protecting tenants from eviction
Complacency	0.04%	43	No action, community was complacent
Road Work	0.02%	24	Road work for emergencies
Dogs	0.01%	12	Dogs in chains
Surge Operation	0.03%	34	Surge operation in progress, or continued, by WHO
Clothing	0.05%	50	References to headties or long sleeves, covering up

Mercury Line	0.03%	31	Monitor mercury line
Substances	0.01%	6	Alcohol, smoking, weed
Water Source	0.01%	10	Protecting the well/water source
Secret Society	0.10%	97	Reference to prohibiting secret societies and related behaviors
Traditional Ceremony	0.01%	14	Reference to no traditional ceremony
Drug Administration	0.01%	5	Secret drug administration
Street Light	0.22%	223	A community street light

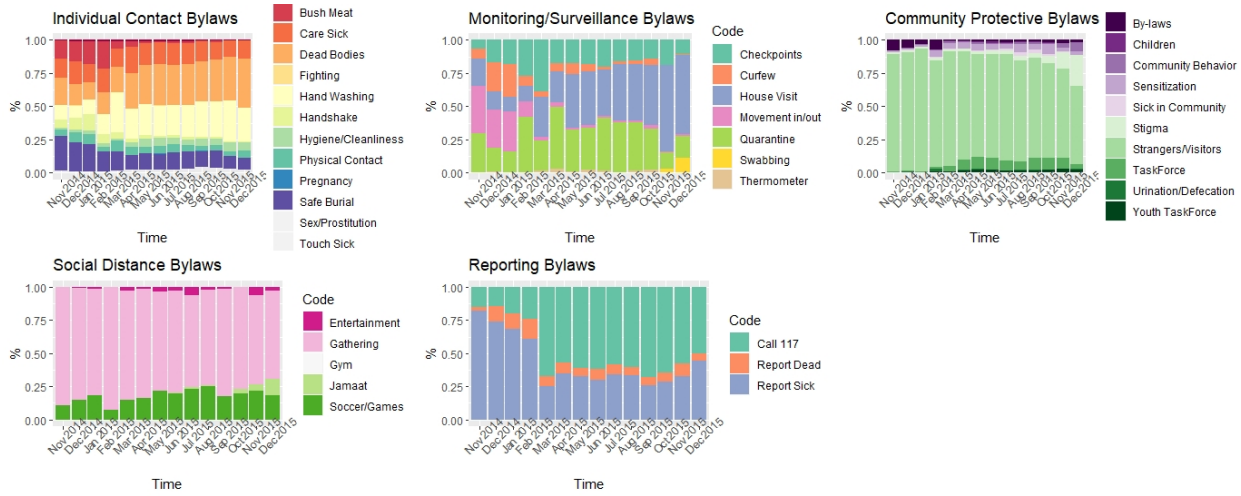

Figure 4. Categories of Bylaws, disaggregated by bylaw code, over time as a proportion of totaly bylaws each month

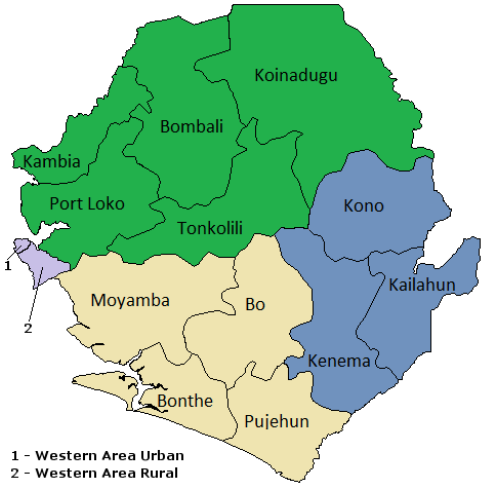

Figure 7. Districts and Provinces of Sierra Leone, creative commons license by Androm75