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Community Engagement and Involvement in Lassa Fever Control: Implementation, Governance, and Community Outcomes in Selected Districts in Sierra Leone

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Abstract This study examined the factors influencing the effectiveness of institutional and community support systems, focusing on guidance and counselling services in secondary schools and Community Engagement and Involvement (CEI) in Lassa fever control in Sierra Leone. The guidance and counselling component employed a mixed-methods cross-sectional design involving 128 respondents from selected secondary schools in Pujehun District. Data were collected through questionnaires and interviews and analysed using descriptive statistics, multiple linear regression, and qualitative analysis. Findings revealed inadequate counselling infrastructure, weak professional capacity, and substantial barriers, including inadequate materials (74.2%), high pupil–counsellor ratios (71.8%), lack of trained counsellors (69.4%), socioeconomic constraints (68.0%), and limited technology (67.2%). Monitoring and follow-up showed the strongest association with career development ($\beta = 0.165$, $p = .073$), although no individual availability or professional-capacity variable significantly predicted career development ($p > .05$). The CEI component demonstrated significant differences in the depth and quality of community engagement between Lower Bambara and Njaluahun. Training coverage was higher in Lower Bambara (73.0% vs. 55.4%; $\chi^2 = 4.4$, $p = .037$), while co-production was substantially greater (63.5% vs. 28.6%; $\chi^2 = 17.8$, $p < .001$). Lower Bambara also recorded higher effectiveness (median 13.5 vs. 9.0; $p < .001$), trust (median 13.0 vs. 11.0; $p < .001$), surveillance cooperation, and timely case reporting. Qualitative findings highlighted trusted local intermediaries, bidirectional communication, and co-production as important mechanisms. The findings demonstrate that formal availability of services or structures alone does not guarantee effectiveness. Sustainable outcomes require adequately trained personnel, sufficient resources, institutional support, regular and responsive implementation, meaningful participation, and strong local ownership. Strengthening professional capacity, infrastructure, monitoring systems, community co-production, trusted communication, and institutional support is therefore essential for improving both educational counselling and community-based public health interventions in Sierra Leone.

Keywords: *Guidance and counselling, Community Engagement and Involvement (CEI), professional capacity, service availability, community co-production, career development, Lassa fever control, community trust, surveillance cooperation, institutional support, Sierra Leone*

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1. Introduction

Lassa fever is a significant public health concern in West Africa, caused by the Lassa mammarenavirus and transmitted mainly through contact with food or household items contaminated by the multimammate rat (*Mastomys natalensis*) [1,2], with person-to-person transmission occurring particularly in healthcare settings [3]. Its severity ranges from mild febrile illness to multi-organ failure and death, with case fatality rates of 15–25% among hospitalised patients [4,5], highlighting the importance of prevention, early detection, community-based surveillance, and effective outbreak response. Control therefore requires integrated measures, including environmental sanitation, rodent control, risk communication, infection prevention, early healthcare

seeking, and sustained community participation. Community Engagement and Involvement (CEI) enables communities to identify health priorities, disseminate information, report suspected cases, and implement preventive measures, while meaningful engagement can strengthen trust, intervention acceptance, and community ownership; conversely, poor communication, misinformation, stigma, and mistrust can undermine Lassa fever control efforts.

West Africa, particularly Nigeria, Sierra Leone, Liberia, and Guinea, bears the greatest Lassa fever burden. In Sierra Leone, Kenema District in the Eastern Region has historically been the epicentre of transmission, hosting Africa's only dedicated Lassa fever ward and a long-standing surveillance and research programme [4,6,7]. Persistent transmission is sustained by the ecology of the Mastomys reservoir, environmental sanitation conditions, household practices, and socioeconomic constraints on healthcare access [8,9]. Lassa fever control requires far more than clinical management. Environmental sanitation, rodent control, risk communication, community-based surveillance, infection prevention, and sustained community participation are essential components [10,11]. Community engagement and involvement (CEI) enables communities to contribute to identifying health priorities, disseminating information, reporting suspected cases, and implementing preventive measures. Meaningful engagement can strengthen trust, improve acceptance of interventions, and promote community ownership [12,13], whereas inadequate communication, misinformation, stigma, and distrust can undermine disease-control efforts [14,15].

Sierra Leone's experience with the 2014–2016 Ebola epidemic demonstrated the critical importance of community trust, effective communication, and the involvement of local leaders in public health responses [14,15,16]. Misinformation, fear, and institutional distrust undermined early containment, while community engagement, particularly through trusted local actors, ultimately supported acceptance of interventions and improved cooperation with surveillance [15,16]. These lessons carry direct relevance to Lassa fever control, where endemic transmission demands sustained rather than episodic community partnership [17,18]. Although community engagement is increasingly recognized as essential, there is limited evidence from Sierra Leone on how CEI is embedded within Lassa fever control systems and how it influences community-level outcomes. This study therefore addresses two research objectives:

- To examine the processes, strategies, and governance arrangements through which CEI was implemented and embedded within the Lassa fever response in Kenema District.
- To assess the influence of embedded CEI on trust, communication, community participation, surveillance, and health-seeking behaviour in endemic Lassa fever control.

2. Methods

2.1. Study Design

A realist-informed mixed-methods design was employed, in which a comparative cross-sectional survey ran parallel to semi-structured key informant interviews and focus group discussions [19,20,21,22]. This allowed quantitative patterns of CEI implementation and outcomes to be elicited alongside qualitative accounts of the processes and contextual conditions producing those patterns. The theoretical orientation was realist evaluation [19,23,24], which moves beyond asking whether an intervention works to examining what works, for whom, and under what circumstances. The approach was comparative and case-based, treating Lower Bambara and Njaluahun as contrasting cases selected for their differing implementation ecologies.

2.2. Setting

The study was conducted in two chiefdoms in Sierra Leone's Eastern Region: Lower Bambara Chiefdom (Panguma) in Kenema District, and Njaluahun Chiefdom (Segbema) in Kailahun District. Both areas are endemic for Lassa fever and have been sites of sustained outbreak response and research-partner engagement [4,6,7]. Lower Bambara has had more intensive and prolonged engagement with external research partners (Tulane University, PARES), higher coverage of formal CEI training, and a more established community-based surveillance infrastructure. Njaluahun has a different coordination profile, with comparatively stronger District Health Management Team (DHMT) leadership and less external research-partner presence. These differences made the two sites suitable as contrasting cases within a realist comparative framework [19,24].

2.3. Participants, Sampling, and Recruitment

Purposive sampling was employed to ensure information-richness and coverage of relevant subgroups [25,26], reflecting the study's focus on relational governance rather than statistical representativeness. Three populations were targeted: (i) district health system officials; (ii) representatives of partner institutions; and (iii) community-level actors including community health workers (CHWs), health facility staff, traditional and religious leaders, Lassa fever survivors, women's group leaders, youth leaders, traditional birth attendants, Community Action Group members, community engagement volunteers, and household heads. Recruitment continued until all identified eligible actors in both chiefdoms had been approached, guided by information saturation principles [27]. The final survey sample comprised 130 respondents: 74 from Lower Bambara and 56 from Njaluahun.

2.4. Data Collection

Quantitative data were collected between June and July 2026 using a structured questionnaire administered face-to-face by trained data collectors fluent in English, Krio, and Mende. The instrument captured socio-demographic and professional characteristics; CEI implementation processes, governance arrangements, and communication approaches; respondent positioning on an engagement continuum from information-sharing to community

empowerment; and perceived changes in case reporting timeliness, facility attendance, and surveillance cooperation. Seven semi-structured key informant interviews (KIIs) and focus group discussions (FGDs) were also conducted, with all sessions audio-recorded with informed consent.

2.5. Composite Indices

Four composite indices were constructed to summarise key dimensions of CEI performance: an Implementation index (depth and breadth of engagement activities and governance arrangements), an Effectiveness index (perceived improvements in surveillance, health-seeking, and programme outcomes), a Trust index (community–health system relational quality), and a Sustainability index (institutionalisation and ongoing engagement capacity). Each index was computed as a sum score across relevant questionnaire items. Given the ordinal nature of component items and non-normal distributions, indices were treated as continuous non-parametric variables [24,22].

2.6. Statistical Analysis

Quantitative data were analysed using SPSS v29 (IBM Corp., Armonk, NY). Chi-square tests examined associations between chiefdom and categorical variables. Where tables were sparse, significance was confirmed using Monte Carlo exact tests. For composite indices, Mann-Whitney U tests with rank-biserial correlation coefficients (rb) were used as effect size measures. Differences across participant categories were examined using Kruskal-Wallis tests. All tests were two-tailed, $\alpha=0.05$. Qualitative data were analysed using Braun and Clarke's six-phase reflexive thematic analysis [28] with the associated 16-item checklist [29]. Transcripts were uploaded to Dedoose (SocioCultural Research Consultants, LLC) for coding. An initial deductive framework was developed from the study objectives and realist CMO constructs [19,20], then refined inductively. Qualitative and quantitative findings were integrated at the interpretation stage [21,22].

2.7. Ethical Considerations

Ethical approval was obtained from the Njala University Institutional Review Board (NURB). Administrative authorisation was secured from the Kenema DHMT, Kenema Government Hospital, and chiefdom authorities. Written and verbal informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki [30].

3. Results and Discussion

3.1. Demographics of the Respondents

A total of 130 respondents participated in the survey, comprising 74 respondents from Lower Bambara and 56 from Njaluahun. The sample was predominantly male in both chiefdoms. Men constituted 71.6% of respondents in Lower Bambara and 64.3% in Njaluahun, while women constituted 28.4% and 35.7%, respectively. The mean age was 44.3 years (SD 12.8) in Lower Bambara and 42.5 years (SD 9.0) in Njaluahun (Table 1). Educational attainment varied between the two settings. In Lower Bambara, 20.3% of respondents reported no formal education compared with 7.1% in Njaluahun. Senior secondary education was the most common level in Lower Bambara (27.0%), whereas certificate and diploma qualifications were relatively more common in Njaluahun. Overall, 26.2% of respondents had senior secondary education and 20.0% had diploma-level education. Tertiary qualifications were uncommon in both chiefdoms. Respondents represented multiple actors within the Lassa fever surveillance and response system, including Community Health Workers, health facility staff, Lassa fever survivors, community members, Community Health Officers, traditional and religious leaders, Community Action Groups, community engagement volunteers, household heads, women's group leaders and youth leaders. This diversity enabled the study to capture perspectives from both formal health-system actors and community-level participants as seen in Table 4.1 below.

Table 1. Socio-Demographic Characteristics of Respondents by Chiefdom

Variable	Lower Bambara	Njaluahun	Total
Sex			
Female	21 (28.4%)	20 (35.7%)	41 (31.5%)
Male	53 (71.6%)	36 (64.3%)	89 (68.5%)
Age (years), Mean ± SD	44.3 ± 12.8	42.5 ± 9.0	43.5 ± 11.3
Education level			
No formal education	15 (20.3%)	4 (7.1%)	19 (14.6%)
Primary	0 (0.0%)	2 (3.6%)	2 (1.5%)
Junior secondary	15 (20.3%)	9 (16.1%)	24 (18.5%)
Senior secondary	20 (27.0%)	14 (25.0%)	34 (26.2%)
Certificate	7 (9.5%)	12 (21.4%)	19 (14.6%)
Diploma	14 (18.9%)	12 (21.4%)	26 (20.0%)
Bachelor's degree	1 (1.4%)	3 (5.4%)	4 (3.1%)
Master's degree	1 (1.4%)	0 (0.0%)	1 (0.8%)
Doctorate	1 (1.4%)	0 (0.0%)	1 (0.8%)

Note. Continuous variables are Mean ± SD (age bands converted to midpoints); categorical variables are n (%), computed column-wise within each chiefdom.

3.2. Engagement and Role Characteristics of Respondents by Chiefdom

The findings indicate that CEI involved a diverse range of health, community, and leadership stakeholders, with Community Health Workers (19.2%), health facility staff (16.9%), and Lassa fever survivors (16.2%) being the largest groups. Participant composition did not differ significantly between Lower Bambara and Njaluahun (χ^2 = 13.5, df = 13, p = 0.411), indicating broadly similar stakeholder representation. Participants also had substantial experience, averaging 7.4 ± 3.9 years in their current roles and 5.9 ± 3.6 years in the Lassa fever

response (Table 2).

However, CEI participation frequency differed significantly between the communities ($\chi^2 = 14.9$, df = 3, p = 0.002). Overall, 48.5% participated occasionally. Lower Bambara had higher daily (12.2% vs. 3.6%) and weekly (24.3% vs. 7.1%) participation, whereas Njaluahun had higher monthly participation (39.3% vs. 16.2%) and slightly higher occasional participation (50.0% vs. 47.3%). The results suggest that CEI was broadly inclusive across both communities but more frequent and sustained in Lower Bambara, highlighting the need to strengthen regular and institutionalized engagement, particularly in Njaluahun.

Table 2. Engagement and Role Characteristics of Respondents by Chiefdom

Variable	Lower Bambara	Njaluahun	χ^2	df	p	Total
Participant category			13.5	13	0.411	
Community Health Worker	14 (18.9%)	11 (19.6%)				25 (19.2%)
Health facility staff	12 (16.2%)	10 (17.9%)				22 (16.9%)
Lassa fever survivor	13 (17.6%)	8 (14.3%)				21 (16.2%)
Community member	8 (10.8%)	7 (12.5%)				15 (11.5%)
Community Health Officer	2 (2.7%)	7 (12.5%)				9 (6.9%)
Religious leader	4 (5.4%)	3 (5.4%)				7 (5.4%)
Traditional leader	5 (6.8%)	1 (1.8%)				6 (4.6%)
Community Action Group member	2 (2.7%)	4 (7.1%)				6 (4.6%)
Community engagement volunteer	4 (5.4%)	2 (3.6%)				6 (4.6%)
Household head	4 (5.4%)	0 (0.0%)				4 (3.1%)
Traditional birth attendant	2 (2.7%)	2 (3.6%)				4 (3.1%)
Women's group leader	2 (2.7%)	0 (0.0%)				2 (1.5%)
Youth leader	1 (1.4%)	1 (1.8%)				2 (1.5%)
Other	1 (1.4%)	0 (0.0%)				1 (0.8%)
Years in current role, Mean ± SD	7.6 ± 4.1	7.2 ± 3.6				7.4 ± 3.9
Years in Lassa response, Mean ± SD	6.5 ± 3.9	5.2 ± 3.0				5.9 ± 3.6
CEI participation frequency			14.9	3	0.002	
Daily	9 (12.2%)	2 (3.6%)				11 (8.5%)
Weekly	18 (24.3%)	4 (7.1%)				22 (16.9%)
Monthly	12 (16.2%)	22 (39.3%)				34 (26.2%)
Occasionally	35 (47.3%)	28 (50.0%)				63 (48.5%)

Note. Continuous variables are Mean ± SD (bands converted to midpoints); categorical variables are n (%). Chi-square tests association between the categorical indicator and chiefdom.

3.3. Implementation, Governance Arrangements and Embedding of CEI

The findings indicate that Community Engagement and Involvement (CEI) was established within the Lassa fever response through training and institutional coordination, but implementation varied between chiefdoms. Overall, 65.4% of respondents had received CEI training, with significantly higher coverage in Lower Bambara (73.0%) than Njaluahun (55.4%) ($\chi^2 = 4.4$, df = 1, p = 0.037) (Table 3), indicating unequal access to capacity-building [30]. The District Health Management Team (DHMT) was the most frequently identified coordinating organization (50.0%), followed by PARES (26.2%) and Tulane University (19.2%). Perceptions of the lead coordinating organization differed significantly between chiefdoms ($\chi^2 = 16.1$, df = 5, p = 0.007), with DHMT particularly prominent in Njaluahun. Community leaders (0.8%) and joint coordination (1.5%) were rarely identified, suggesting limited community-led or shared governance [24]. CEI had a recognizable institutional and coordination structure, but disparities in training and limited community representation indicate the need for more equitable capacity-building, clearer institutional roles, and stronger community participation in governance and decision-making to ensure sustainable and effective Lassa fever response [31,32].

Table 3. Coordination and Training Infrastructure for CEI Embedding, by Chiefdom

Variable	Lower Bambara	Njaluahun	χ^2	df	p	Total
Received CEI training			4.4	1	0.037	
Yes	54 (73.0%)	31 (55.4%)				85 (65.4%)
No	20 (27.0%)	25 (44.6%)				45 (34.6%)
Lead coordinating organisation			16.1	5	0.007	
District Health Management Team	32 (43.2%)	33 (58.9%)				65 (50.0%)
PARES	28 (37.8%)	6 (10.7%)				34 (26.2%)
Tulane University	13 (17.6%)	12 (21.4%)				25 (19.2%)
Kenema Government Hospital	0 (0.0%)	3 (5.4%)				3 (2.3%)
Community leaders	0 (0.0%)	1 (1.8%)				1 (0.8%)
Joint coordination	1 (1.4%)	1 (1.8%)				2 (1.5%)

Note. Categorical variables are n (%). Chi-square tests association between each indicator and chiefdom.

These findings suggest that the two chiefdoms were not completely equivalent in their implementation environments. In particular, the higher level of CEI training and the greater presence of PARES in Lower Bambara constituted potentially important contextual differences for interpreting subsequent findings. However, these differences should not be interpreted as evidence

that CEI implementation as a whole was statistically different between the two chiefdoms. The composite Implementation index had the same median score of 7.0 in both Lower Bambara and Njaluahun, with no statistically significant difference (p=0.143). Similarly, the Sustainability index had a median of 7.0 in both settings (p=0.787).

This distinction is important because the evidence suggests differences in particular implementation conditions and depth of engagement, rather than a simple absence of CEI implementation in the comparison site.

3.4. Implementation and Governance Arrangements of CEI by Chiefdom

Table 4.4 shows that the health facility committee was the most commonly engaged governance structure, reported by 73.1% of respondents, while community action groups were least reported (1.5%). This pattern was similar across Lower Bambara (73.0%) and Njaluahun (73.2%), with no significant chiefdom difference ($\chi^2 = 2.1$, df = 3, p = 0.552) (Table 4). The high reliance on health facility committees suggests that CEI is primarily anchored within existing health-system structures rather than broader community-based organisations [13]. Regarding CEI meeting frequency, the highest proportion of respondents reported that meetings occurred during outbreaks only (41.5%), while weekly meetings were least common (4.6%). Although outbreak-only engagement was higher in Lower Bambara (45.9%) than Njaluahun (35.7%), the difference was not statistically significant ($\chi^2 = 7.3$, df = 4, p = 0.122) (Table 4). This pattern suggests that CEI activities may be more reactive than routine, potentially limiting sustained community engagement during periods when there is no active outbreak [33,34]. The decision-making process was strongly characterised by joint community-health decision-making, reported by 93.8% of respondents, making it the highest category [35]. In contrast, traditional leaders and NGOs independently making decisions were least reported (0.8% each). There was no significant difference between the chiefdoms ($\chi^2 = 2.3$, df = 4, p = 0.678). The predominance of joint decision-making indicates a relatively collaborative governance model, with communities and health workers apparently sharing responsibility for CEI-related decisions [11]. The most notable chiefdom difference was observed in the engagement continuum stage ($\chi^2 = 17.8$, df = 3, p < 0.001). Overall, co-production was the most frequently reported stage (48.5%), suggesting that nearly half of respondents perceived communities and health actors as jointly developing or implementing CEI activities. However, co-production was substantially higher in Lower Bambara (63.5%) than Njaluahun (28.6%). In Njaluahun, participation was more common (35.7%), while community empowerment remained relatively low overall (5.4%). Information sharing was also more common in Njaluahun (25.0%) than Lower Bambara (13.5%).

The findings indicate that CEI governance is characterised by strong joint decision-making and substantial co-production, but engagement remains heavily dependent on health facility structures and is often activated during outbreaks [36,37]. The significant difference in engagement stage between the chiefdoms suggests that the depth of community involvement varies considerably. Strengthening routine engagement mechanisms, expanding community-based governance structures, and moving engagement beyond information sharing and participation toward sustained co-production and empowerment could improve the embedding of CEI in Lassa fever control.

Table 4. Implementation and Governance Arrangements of CEI, by Chiefdom

Variable	Lower Bambara	Njaluahun	χ^2	df	p	Total
Governance structure engaged			2.1	3	0.552	
Chiefdom authorities	16 (21.6%)	12 (21.4%)				28 (21.5%)
Health facility committee	54 (73.0%)	41 (73.2%)				95 (73.1%)
Village development committee	2 (2.7%)	3 (5.4%)				5 (3.8%)
Community action group	2 (2.7%)	0 (0.0%)				2 (1.5%)
CEI meeting frequency			7.3	4	0.122	
Weekly	5 (6.8%)	1 (1.8%)				6 (4.6%)
Monthly	20 (27.0%)	15 (26.8%)				35 (26.9%)
Quarterly	7 (9.5%)	14 (25.0%)				21 (16.2%)
When requested	8 (10.8%)	6 (10.7%)				14 (10.8%)
During outbreaks only	34 (45.9%)	20 (35.7%)				54 (41.5%)
Decision-making mode			2.3	4	0.678	
Joint community-health decision	69 (93.2%)	53 (94.6%)				122 (93.8%)
Community decided	1 (1.4%)	2 (3.6%)				3 (2.3%)
Health workers decided	2 (2.7%)	1 (1.8%)				3 (2.3%)
Traditional leaders decided	1 (1.4%)	0 (0.0%)				1 (0.8%)
NGO decided	1 (1.4%)	0 (0.0%)				1 (0.8%)
Engagement continuum stage			17.8	3	< .001	
Information sharing	10 (13.5%)	14 (25.0%)				24 (18.5%)
Participation	16 (21.6%)	20 (35.7%)				36 (27.7%)
Co-production	47 (63.5%)	16 (28.6%)				63 (48.5%)
Community empowerment	1 (1.4%)	6 (10.7%)				7 (5.4%)

Note. Values are n (%). Chi-square tests association between each implementation indicator and chiefdom.

The qualitative findings suggest that the deeper CEI observed in Lower Bambara was supported by community-embedded intermediaries, particularly community health workers (CHWs) and Lassa fever

survivors. CHWs promoted dialogue and mutual understanding rather than simply delivering instructions, while survivors provided credible, relatable experiences that reduced fear and encouraged open discussion.

Engagement was also characterised by bidirectional communication, with CHWs acting as bridges between communities and health workers. This strengthened mutual trust and allowed community perspectives to influence health-system decisions, helping explain the higher level of co-production observed quantitatively in Lower Bambara.

Participants further described a shift from externally driven activities toward community ownership, where communities increasingly developed plans, organised activities, and reported suspected cases themselves. CEI was also perceived by some participants as becoming part of routine Lassa fever activities rather than remaining a temporary project intervention. However, this perceived routinisation should be interpreted cautiously because the quantitative sustainability index showed no significant difference between the chiefdoms. Overall, the findings indicate that trusted local intermediaries, two-way communication, co-production, and community ownership were important mechanisms underlying deeper CEI.

3.5. Influence of Embedded CEI on Trust, Communication, Surveillance and Health-Seeking

The findings demonstrate that differences in CEI implementation were associated with significant differences in surveillance, reporting, collaboration, trust, and health-seeking outcomes between Lower Bambara and Njaluahun. Overall, 59.2% of respondents reported that suspected cases were reported within 1–2 days, with significantly more timely reporting in Lower Bambara ($\chi^2 = 54.9$, $p < 0.001$) (Table 5). Similarly, 46.2% reported slightly earlier attendance at health facilities, with significantly greater improvement in Lower Bambara ($\chi^2 = 32.9$, $p < 0.001$) (Table 5). The largest difference was observed in community surveillance cooperation ($\chi^2 = 109.5$, $p < 0.001$), with 52.3% overall describing communities as very cooperative and only 0.8% reporting resistance; Lower Bambara recorded particularly high cooperation (91.9%). Collaboration (47.7%) was the most frequently reported improvement associated with CEI, followed by increased trust (30.8%), while improved care-seeking was least reported (2.3%). Overall, the results suggest that stronger and more sustained CEI was associated with greater community cooperation, timelier case reporting, improved trust and collaboration, and earlier healthcare seeking, with Lower Bambara generally demonstrating stronger outcomes than Njaluahun [11,38].

3.6. Comparison of Composite Outcome Indices across Chiefdom and Participant Category

Table 6 compares the median composite indices for implementation, effectiveness, trust, and sustainability between Lower Bambara and Njaluahun. The findings indicate that effectiveness showed the largest chiefdom difference, while implementation and sustainability were similar across the two chiefdoms [39]. The effectiveness index recorded a higher median in Lower Bambara (13.5) than Njaluahun (9.0), with a large rank-biserial effect ($rb = 0.87$) and a statistically significant difference ($p < 0.001$). This indicates substantially stronger perceived effectiveness of CEI activities in Lower Bambara. The significant category-level result ($p = 0.038$) further suggests that effectiveness also varied according to participant category [9].

Similarly, the trust index was higher in Lower Bambara (median = 13.0) than Njaluahun (median = 11.0), with a moderate effect ($rb = 0.61$) and statistically significant chiefdom difference ($p < 0.001$) (Table 6). However, the category-level difference was not significant ($p = 0.260$), suggesting that the observed trust difference was primarily associated with chiefdom rather than participant category.

In contrast, the implementation index had identical median scores in both Lower Bambara and Njaluahun (7.0), with a small effect ($rb = 0.14$) and no significant chiefdom difference ($p = 0.143$). Likewise, the sustainability index had identical medians of 7.0 in both chiefdoms, with virtually no chiefdom effect ($rb = -0.03$; $p = 0.787$) (Table 6). Nevertheless, sustainability differed significantly across participant categories ($p = 0.016$). The results indicate that CEI was perceived as substantially more effective and associated with greater trust in Lower Bambara, whereas basic implementation and sustainability levels were comparable across the two chiefdoms. This pattern suggests that differences in the quality and depth of engagement, rather than simply the presence of CEI structures, may explain the stronger community outcomes observed in Lower Bambara [11,40].

The qualitative findings from Njaluahun indicate that CEI was present but was characterised by more conditional and intermittent participation than in Lower Bambara. Community members relied on CHWs, Facility Management Committees, radio, and health workers for Lassa fever information, with trust strengthened when messages from multiple sources were consistent. This suggests a process of multi-source credibility checking rather than the stronger relational trust observed in Lower Bambara.

Participation in Njaluahun allowed community members to provide suggestions, but it was not consistently institutionalised within decision-making structures. This helps explain the quantitative finding that engagement was concentrated more on information sharing and participation, while Lower Bambara demonstrated substantially greater co-production. Overall, the findings suggest that the key difference was not the absence of CEI in Njaluahun, but rather the depth, consistency, and institutionalisation of community involvement.

3.7. Integrated Quantitative–Qualitative Findings and Explanatory Interpretation

Table 7 integrates the quantitative and qualitative findings to explain how differences in CEI contributed to varying community outcomes between Lower Bambara and Njaluahun. The findings show that the depth and quality of engagement, rather than the mere presence of

formal CEI structures, were central to observed differences. The substantially higher level of co-production in Lower Bambara (63.5% vs. 28.6%, $p < 0.001$) (Table 7) was supported qualitatively by reports of joint planning, decision-making, and community ownership. This suggests that deeper engagement strengthened community responsibility for Lassa fever prevention and response [41,42,43].

Similarly, trust was significantly higher in Lower Bambara (median 13 vs. 11, $p < 0.001$) (Table 7). Qualitative accounts highlighted CHWs and Lassa fever survivors as trusted community-based actors who facilitated communication between communities and health services. Their close social relationships with community members appeared to strengthen relational trust and improve acceptance of health interventions. The higher effectiveness score in Lower Bambara (median 13.5 vs. 9.0, $p < 0.001$) was also consistent with qualitative evidence that CEI had become more routine, responsive, and internally accepted. This suggests that engagement was increasingly incorporated into everyday Lassa fever response activities rather than functioning only as an externally driven intervention [44,45,46].

The qualitative findings further explain the significantly better early case reporting and surveillance cooperation observed in Lower Bambara. Community members described organising themselves and reporting suspected cases early, while dialogue-based engagement strengthened their willingness to cooperate with surveillance activities. Thus, community ownership, trusted mediation, and relational legitimacy appear to have supported improved surveillance behaviour. Importantly, implementation and sustainability scores were similar between the two chiefdoms, despite major differences in effectiveness, trust, and engagement depth [47,48]. This indicates that formal CEI structures alone may be insufficient to produce strong community outcomes. Rather, the findings suggest that the quality, depth, relational nature, and institutionalisation of engagement may be more important than simply having CEI structures in place.

Table 5. Surveillance and Health-Seeking Outcomes of CEI, by Chiefdom, with Chi-Square Tests

Variable	Lower Bambara	Njaluahun	χ^2	df	p	Total
Case reporting timeliness (surveillance)			54.9	3	< .001	
Immediately	18 (24.3%)	2 (3.6%)				20 (15.4%)
Within 1 to 2 days	55 (74.3%)	22 (39.3%)				77 (59.2%)
After several days	1 (1.4%)	10 (17.9%)				11 (8.5%)
Only when severe	0 (0.0%)	22 (39.3%)				22 (16.9%)
Change in facility attendance (health-seeking)			32.9	2	< .001	
Much earlier	37 (50.0%)	13 (23.2%)				50 (38.5%)
Slightly earlier	37 (50.0%)	23 (41.1%)				60 (46.2%)
Slightly later	0 (0.0%)	20 (35.7%)				20 (15.4%)
Activity most improved			4.4	4	0.353	
Early case reporting	41 (55.4%)	30 (53.6%)				71 (54.6%)
IPC practices	28 (37.8%)	18 (32.1%)				46 (35.4%)
Community meetings	1 (1.4%)	4 (7.1%)				5 (3.8%)
Referral	3 (4.1%)	4 (7.1%)				7 (5.4%)
Contact tracing	1 (1.4%)	0 (0.0%)				1 (0.8%)
Community surveillance cooperation			109.5	4	< .001	
Very cooperative	68 (91.9%)	0 (0.0%)				68 (52.3%)
Mostly cooperative	5 (6.8%)	23 (41.1%)				28 (21.5%)
Mixed	1 (1.4%)	10 (17.9%)				11 (8.5%)
Limited	0 (0.0%)	22 (39.3%)				22 (16.9%)
Resistant	0 (0.0%)	1 (1.8%)				1 (0.8%)
Overall improvement attributed to CEI			21.8	4	< .001	
Increased trust	25 (33.8%)	15 (26.8%)				40 (30.8%)
Collaboration	43 (58.1%)	19 (33.9%)				62 (47.7%)
Communication	4 (5.4%)	5 (8.9%)				9 (6.9%)
Reporting	2 (2.7%)	14 (25.0%)				16 (12.3%)
Care seeking	0 (0.0%)	3 (5.4%)				3 (2.3%)

Note. Values are n (%). Chi-square tests association between each outcome and chiefdom; empty rows and columns dropped before testing. Sparse tables should be confirmed with a Monte-Carlo exact test.

Table 6. Comparison of Composite Outcome Indices across Chiefdom and Participant Category

Composite index	Lower Bambara	Njaluahun	Effect (rb)	Arm p	Category p
Implementation	7.0	7.0	0.14	0.143	0.460
Effectiveness	13.5	9.0	0.87	< .001	0.038
Trust	13.0	11.0	0.61	< .001	0.260
Sustainability	7.0	7.0	-0.03	0.787	0.016

Note. Values are medians. Arm comparison is the Mann-Whitney U test (rank-biserial effect size); category comparison is the Kruskal-Wallis test across role groups with at least five respondents.

Table 7. Integrated quantitative-qualitative findings and explanatory interpretation

Quantitative finding	Qualitative explanation	Emerging mechanism	Interpretation
Co-production: 63.5% vs 28.6%, p<0.001	Community members described joint planning and ownership	Community ownership	Deeper engagement created greater responsibility for Lassa response
Trust median: 13 vs 11, p<0.001	CHWs and survivors described as credible community actors	Trusted mediation	Relational proximity strengthened trust
Effectiveness median: 13.5 vs 9, p<0.001	Participants described CEI becoming routine and responsive	Internalised commitment	Engagement became incorporated into everyday response
Immediate/early reporting substantially higher in Lower Bambara	Community actors described organising and reporting early	Community ownership + trusted mediation	Greater ownership supported earlier surveillance
Surveillance cooperation significantly higher in Lower Bambara	Participants described dialogue rather than command	Relational legitimacy	Communities were more willing to cooperate with surveillance
Similar Implementation/Sustainability scores	Formal structures existed in both sites	Structural presence alone insufficient	Depth and quality of engagement may matter more than formal structures

4. Conclusion and Recommendations

The study concludes that effective CEI is critical to Lassa fever control, but its success depends on the depth, continuity, quality, and institutionalisation of community participation rather than the mere existence of formal structures. Lower Bambara recorded significantly higher co-production, effectiveness, and trust than Njaluahun, together with stronger surveillance cooperation, earlier reporting, and improved healthcare seeking. Trusted CHWs and Lassa fever survivors, two-way communication, joint decision-making, and community ownership were important contributors. Similar implementation and sustainability scores across the chiefdoms further demonstrate that formal structures alone are insufficient. CEI should be institutionalised within routine Lassa fever prevention and surveillance, supported by regular training, sustainable financing, and stronger community representation in decision-making. CHWs, survivors, traditional and religious leaders, women, and youth should be actively supported as community partners. Regular meetings, feedback mechanisms, clear reporting channels, and two-way communication should replace predominantly outbreak-driven engagement. Monitoring should focus on the quality and depth of engagement, including trust, co-production, empowerment, surveillance, reporting, and health-seeking outcomes. Future research should use longitudinal and multi-district approaches to assess the sustainability of CEI and its long-term contribution to Lassa fever control.

Conflicts of Interest. The authors declare no conflicts of interest.

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