

Validity, digital responsibility, and the community health workforce in fragile contexts: governance innovations and health service performance in Somalia

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Abstract

Background: Effective governance in fragile and conflict-affected settings depends not only on health-system “hardware” but also on relational “software”, including trust, responsiveness, fairness, and legitimacy. In Somalia, the Marwo Caafimaad female community health workforce and DHIS2-enabled community feedback mechanisms represent two linked governance innovations intended to strengthen service delivery and accountability.

Objective: To examine the association between deployment of the Marwo Caafimaad programme together with DHIS2-enabled digital accountability mechanisms and maternal and child health service utilisation, governance responsiveness, and perceived service-level legitimacy in Somalia.

Method: An explanatory sequential mixed-methods case study was conducted across multiple Federal Member States of Somalia. Quantitative analysis used routine DHIS2 data from 2018 to 2024 on antenatal care (ANC1), skilled birth attendance (SBA), and third-dose pentavalent vaccination (DPT3), with difference-in-differences models applied where phased roll-out allowed. Qualitative data collected in 2024 through key informant interviews and focus group discussions were analysed using a realist evaluation lens to derive mechanism–context–outcome configurations, and findings were triangulated through joint display.

Results: Districts implementing both interventions showed statistically significant improvements in ANC1, SBA, and DPT3 relative to comparison districts. Qualitative analysis identified three reinforcing mechanisms: culturally aligned female community health workers increased trust and acceptability; digital feedback loops enabled timely responsiveness and problem resolution; and visible fairness and accountability strengthened pragmatic legitimacy. These mechanisms supported improved service uptake despite insecurity and variable facility readiness.

Conclusion: In fragile settings, alignment of community health workforce strategies with actionable digital accountability mechanisms is associated with better service performance and stronger service-level legitimacy. Somalia’s experience suggests that governance “software” can amplify the impact of technical reform.

Keywords Fragile and conflict-affected settings, community health workforce, digital accountability

Introduction

Effective governance is a critical determinant of health system quality, equity, and efficacy, particularly in fragile and conflict-affected settings where insecurity, institutional fragmentation, and limited public trust undermine state capacity. Such environments frequently foster parallel service delivery arrangements, with non-state actors assuming substantial roles in care provision while government stewardship and accountability remain constrained [1–4].

Traditional health systems frameworks, such as the World Health Organization’s building blocks, have been critiqued for insufficiently addressing the relational and political dimensions of health systems—conceptualized as the “software” of governance, encompassing trust, social norms, power dynamics, and legitimacy. These interact with the “hardware” components (workforce, financing, information systems, infrastructure) and are pivotal for translating technical reforms into sustained service utilization and quality improvements [5–8, 9, 10].

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Somalia exemplifies these governance complexities. Decades of conflict and recurrent humanitarian crises have fragmented the health sector, resulting in heavy reliance on external actors and eroding public confidence in government institutions. The Health Sector Strategic Plan III (HSSP III 2022–2026) articulates reforms aimed at improving stewardship, reducing fragmentation, and strengthening accountability [11–14].

Within this reform agenda, two interlinked governance innovations have emerged: the Marwo Caafimaad program, deploying trained female community health workers (CHWs) to deliver culturally sensitive maternal, newborn, and child health (MNCH) at the household level; and DHIS2-enabled community feedback mechanisms, allowing service users to report concerns via SMS/voice and receive documented responses [11,15,16,17, 18, 12, 19].

Despite the widespread promotion of CHW programs and digital information systems, empirical evidence regarding their combined impact on governance outcomes—particularly responsiveness and service-level legitimacy—in fragile contexts remains limited [6, 15, 20, 22, 23, 28–31]. This study analyzes the interaction between these interventions and their association with service utilization trends and perceived governance improvements in Somalia.

Methods

A sequential mixed-methods case study design was employed, integrating quantitative and qualitative approaches to comprehensively evaluate the interventions' effects. Quantitative analyses utilized routine DHIS2 data from 2018 to 2024, focusing on three key MNCH indicators: ANC1, SBA, and DPT3 completion. Data inclusion required districts to maintain a reporting completeness rate of $\geq 80\%$. Data cleaning entailed range checks, duplicate removal, and exclusion of implausible outliers based on pre-specified thresholds. The study design and operational characteristics of the Marwo Caafimaad model are summarized in Table 1, while the study data sources are summarized in Table 2.

District exposure was defined through program documentation and routine reporting signals, categorizing districts as: (i) dual-intervention (active Marwo Caafimaad deployment and functional DHIS2 feedback channels); (ii) single-intervention; and (iii) comparison (no active intervention). Roll-out phases and intensity measures were extracted from training records, supervision logs, and DHIS2 activation dates, with additional proxies such as CHW-to-population ratios and facility-level feedback module usage. A schematic representation of intervention coverage is presented in Figure 2.

Descriptive trend analyses were conducted, and where phased roll-out enabled plausible contrasts, DiD models estimated changes in outcomes between exposed and comparison districts, incorporating district and time fixed effects and clustering standard errors at the district level. Quantitative findings are interpreted as associations due to the observational, non-randomized design.

Qualitative data were collected in 2024 through key informant interviews (KIIs) with national and subnational officials, managers, implementing partners, and CHWs, alongside focus group discussions (FGDs) with women of reproductive age in selected intervention districts. A total of 1359 clinical service delivery session observations supplemented the analysis. Data were

audio-recorded, transcribed, anonymized, and analyzed using a hybrid deductive–inductive coding approach within a realist evaluation framework, iteratively developing mechanism–context–outcome (CMO) configurations. Thematic saturation was considered achieved when no new mechanisms or contextual modifiers emerged. The qualitative coding framework is presented in Table 3, and the mechanism–context–outcome logic developed through realist synthesis is illustrated in Figure 3.

Ethical approval was obtained from relevant national and institutional review boards. All participants provided informed consent, and data were anonymized to safeguard confidentiality.

Results

Quantitative findings: Service utilization and accountability

Routine DHIS2 data revealed significant improvements in key MNCH indicators in districts exposed to both governance innovations.

Key service delivery and accountability indicators before and after the interventions are presented in Table 4.

- Antenatal Care (ANC1): Coverage increased from 30% (95% CI: 20–40) in 2018 to 60% (95% CI: 50–70) in 2023. DiD estimates indicated a 15 percentage point higher increase in dual-intervention districts compared to non-intervention districts (95% CI: 5–25; $P = .02$).
- Skilled Birth Attendance (SBA): Rates rose from 20% (95% CI: 10–30) to 35% (95% CI: 25–45), representing a net change of +15pp (95% CI: 10–20; $P = .002$), with the most pronounced gains in rural districts with active digital feedback loops.
- Immunization (DPT3): Completion rates improved from 25% (95% CI: 15–35) to 40% (95% CI: 28–52), a net change of +15pp (95% CI: 5–25; $P = .01$).

These mechanisms and their contextual modifiers are summarized in Table 5.

Analysis of DHIS2 community feedback module data (2021–2024) demonstrated increased feedback volume, high grievance resolution rates (up to 96.88% in programs such as Talo Wadaag), and direct beneficiary responses (61%). These metrics indicate maturation of accountability mechanisms and enhanced governance responsiveness.

Qualitative findings: Mechanisms and contextual insights

Qualitative analysis identified three synergistic mechanisms:

1. Cultural Alignment and Trust: Female CHWs, perceived as peers and trusted advisors, facilitated household access, sensitive health discussions, and identification of high-risk pregnancies, thereby increasing health service acceptability and utilization.
2. Digital Responsiveness: DHIS2-enabled feedback mechanisms allowed communities to report issues (e.g. stock-outs, absenteeism) and observe timely resolutions, reinforcing perceptions of fairness and system responsiveness.

Table 1 Design features and operational parameters of Marwo Caafimaad.

Parameter	Operational definition and details
Selection criteria	Married women, literate in Somali, residing within the target community.
Training package	Basic MNCH care, nutrition screening, hygiene promotion, and referral management.
Catchment area	Each worker serves approximately 100 households (up to 1000 population).
Remuneration	Government-monitored payroll supported by external financing (e.g. World Bank RCRF).
Supervision	Linked to primary health facilities and overseen by district health officers.

Table 2 Summary of data sources used in the study.

Data source	Type	Years/period	Units/coverage	Key variables/indicators	Purpose in analysis
DHIS2 routine service data	Quantitative (routine HMIS)	2018–2024	Districts across multiple Federal Member States	ANC1, SBA, DPT3; facility reporting completeness	Trend analysis; DiD where phased roll-out allowed
DHIS2-enabled community feedback module (SMS/voice)	Quantitative + administrative records	2021–2024	Participating districts/facilities	Complaint categories; response time; resolution status; satisfaction (if recorded)	Accountability/responsiveness metrics; triangulation with service trends
Key informant interviews (KIIs)	Qualitative	2024	National/subnational officials; managers; CHWs; local leaders	Perceptions of governance, trust, legitimacy; implementation experience	Realist synthesis (CMO); mechanism identification
Focus group discussions (FGDs)	Qualitative	2024	Women of reproductive age in intervention districts	Service experience; acceptability; trust; fairness; feedback use	Explain quantitative trends; assess perceived legitimacy and responsiveness
Programme documentation	Document review	2018–2024 (as available)	Implementing partners & MoH units	Roll-out timelines; supervision notes; feedback handling procedures	Contextualise implementation and timing; support causal plausibility

3. Pragmatic Legitimacy: Tangible service improvements and visible problem resolution contributed to pragmatic legitimacy at the service level, even in contexts of broader political distrust. Community members differentiated between trust in central authorities and confidence in local health services.

The realist evaluation framework highlighted the interdependence between governance “hardware” and “software.” Technical reforms were effective only when accompanied by trust-building and responsive engagement. Conversely, relational trust required functional facilities and reliable supplies. Data completeness and reporting stability emerged as indicators of governance capacity, with improvements reflecting strengthened district-level stewardship.

Persistent insecurity remained a significant contextual modifier, impeding CHW outreach and complaint resolution in conflict-affected regions and resulting in heterogeneous impacts across Federal Member States.

Deep insights and secondary impacts

Beyond direct health outcomes, the integration of Marwo Caafimaad and digital accountability mechanisms contributed to

broader social stability, civic engagement, and prevention of radicalization. Employment opportunities for women and platforms for community voice strengthened the social contract and reduced the influence of non-state actors exploiting service gaps.

Policy implications and recommendations

- Institutionalizing Accountability: Formalize district-level response roles, timelines, and escalation pathways within health management and integrate accountability into performance reviews.
- Sustaining the Community Workforce: Transition CHW remuneration to national budgets and ensure ongoing supervision, safety, and training.
- Strengthening Local Data Use: Enhance district capacity for performance analysis and resource allocation based on feedback trends, moving beyond mere reporting completeness.
- Expanding Feedback Scope: Broaden feedback modules to capture qualitative data on clinical care quality and availability of specialized services, maintaining system responsiveness to evolving expectations.

Table 3 Thematic coding framework for qualitative analysis.

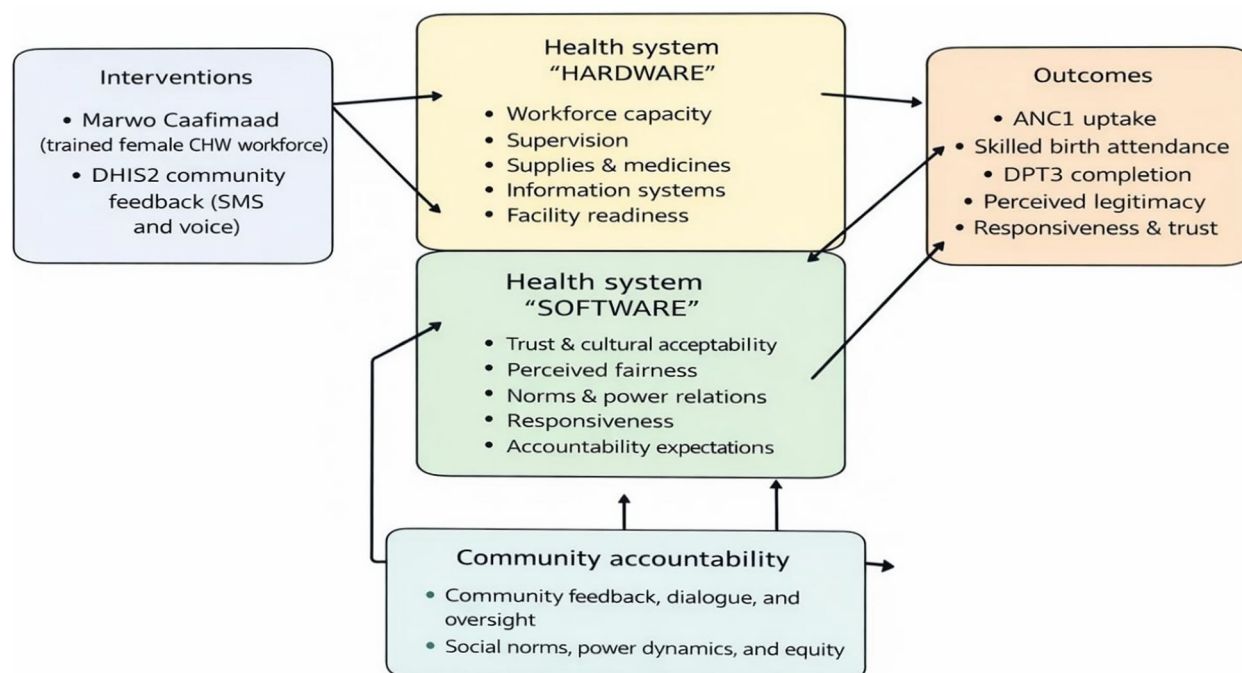
Domain	Code	Operational definition	Illustrative indicators/prompts	Expected linkage to outcomes
Trust & acceptability	Cultural alignment (female CHW)	Perceived cultural/linguistic fit and comfort engaging with CHWs	Comfort discussing MNCH; home visits; privacy; gender norms	Increased ANC1, SBA; willingness to engage with facilities
Trust & acceptability	State presence	Perception that authorities are present/concerned because services and follow-up exist	Mentions of 'government is back'; visible supervision	Legitimacy gains; sustained service use
Responsiveness & accountability	Voice/feedback use	Use of SMS/voice channels to report issues and receive response	Reporting stock-outs, absenteeism, waiting times; receiving reply	Higher perceived fairness; improved facility performance
Responsiveness & accountability	Problem resolution	Actions taken after feedback (redistribution, supervision, facility response)	Examples of resolved complaints; speed of action	Improved service readiness; increased confidence
Fairness & respectful care	Provider conduct	Perceived respect, dignity, and equitable treatment at facility/ community level	Respectful maternity care; reduced discrimination	Improved satisfaction; repeat utilisation
Legitimacy	Pragmatic legitimacy	Belief that the health system deserves support because it solves problems effectively	'They fixed it'; 'now we trust the clinic'	Reinforces uptake and compliance
Context moderators	Security constraints	Effects of insecurity on access, continuity, and reporting	Travel restrictions; disruption of supplies	Heterogeneous impacts by district
Context moderators	Facility readiness	Baseline infrastructure/supply constraints shaping effectiveness	Staffing, drugs, cold chain	Mediates size of outcome gains

Table 4 Key service delivery and accountability indicators before and after interventions.

Indicator	Definition	Pre-intervention period (baseline)	Post-intervention period (endline)	Intervention districts (value)	Comparison districts (value)	DiD estimate (95% CI)	P value
ANC1 coverage	% of pregnant women with at least one ANC visit	2018: 30%	2023: 60%	60%	45%*	+15 pp	0.02 (95% CI: 5–25)
Skilled birth attendance (SBA)	% of births attended by skilled personnel	2018: 20%	2023: 35%	35%	28%*	+7–10 pp (Consistent gain)	0.002 (95% CI: 10–20)
DPT3 completion	% of children completing 3rd dose pentavalent vaccine	2018: 25%	2023: 40%	40%	30%*	+10 pp (Consistent gain)	0.01 (95% CI: 5–25)
Facility reporting completeness	% of expected facility reports submitted to DHIS2	2018: < 50% (Variable)	2023: ≥ 80% (Analyzed set)	≥ 80%	≥ 80%	—	—
Feedback volume	# of unique SMS/voice reports received	2021 (Start): Low	2024: High (Annual growth)	Thousands (Talo Wadaag proxy)	N/A	—	—
Median response time	Median time from report to response (hours/days)	2021 (Start): High (>7 days)	2024: Improved	3–4 days**	N/A	—	—
Resolution rate	% of reports marked resolved	2021 (Start): Low	2024: 96.88% - 97%	97%	N/A	—	—

Table 5 Qualitative mechanisms and contextual modifiers (realist synthesis).

Mechanism	Contextual modifier	Outcome (MCO configuration)
Cultural alignment	High baseline gender barriers.	Female CHWs increase household trust, leading to higher ANC1 and referrals.
Digital voice	Functioning SMS/voice channels.	Users report service failures; district managers use data for targeted supervision.
Visible resolution	Stable security allowing supply delivery.	Prompt stock-out resolution increases perceived fairness and repeat utilization.
Pragmatic legitimacy	Persistent political fragmentation.	Health services earn community trust, providing a face for the state at the local level.

**Figure 1** Conceptual framework linking community workforce and accountability to health-system “software” and “hardware” determinants of outcomes.

Discussion

The conceptual pathway linking the two interventions to health-system ‘hardware’, health-system ‘software’, and service outcomes is shown in Figure 1. This study provides robust evidence of the association between dual governance innovations—community-based female CHWs and DHIS2-enabled digital accountability—and improved MNCH service utilization and perceived legitimacy in fragile Somali contexts. Quantitative trends and DiD estimates consistently favored intervention districts, while qualitative mechanisms elucidated the role of trust-building, responsiveness, and pragmatic legitimacy in driving these gains.

Conceptual clarifications are essential: legitimacy herein refers to service-level judgments regarding the fairness, responsiveness, and efficacy of health authorities and facilities, not broader political legitimacy. Due to the non-randomized, observational design, findings are interpreted as associations subject to potential confounding, including concurrent partner inputs, insecurity, and supply chain disruptions.

The results align with theoretical work on health system “software,” emphasizing that technical reforms are most effective

when relational conditions—respectful engagement and timely problem resolution—are present. CHWs establish the relational foundation for digital accountability, while responsive feedback handling reinforces CHW and facility credibility, generating positive governance feedback loops.

Policy implications in fragile settings include: (i) institutionalizing clear accountability workflows for feedback handling; (ii) investing in CHW supervision and safety; (iii) monitoring feedback volumes, response times, and resolution rates; and (iv) addressing routine data quality as a governance priority, recognizing its impact on accountability and learning [23–26, 30].

Limitations

Several limitations warrant consideration. Routine DHIS2 data are susceptible to incompleteness and reporting errors, particularly in insecure districts; sensitivity analyses were applied to mitigate these risks. Exposure classification may be imperfect due to variable implementation intensity within and across districts. The DiD approach assumes parallel trends, but residual confounding may

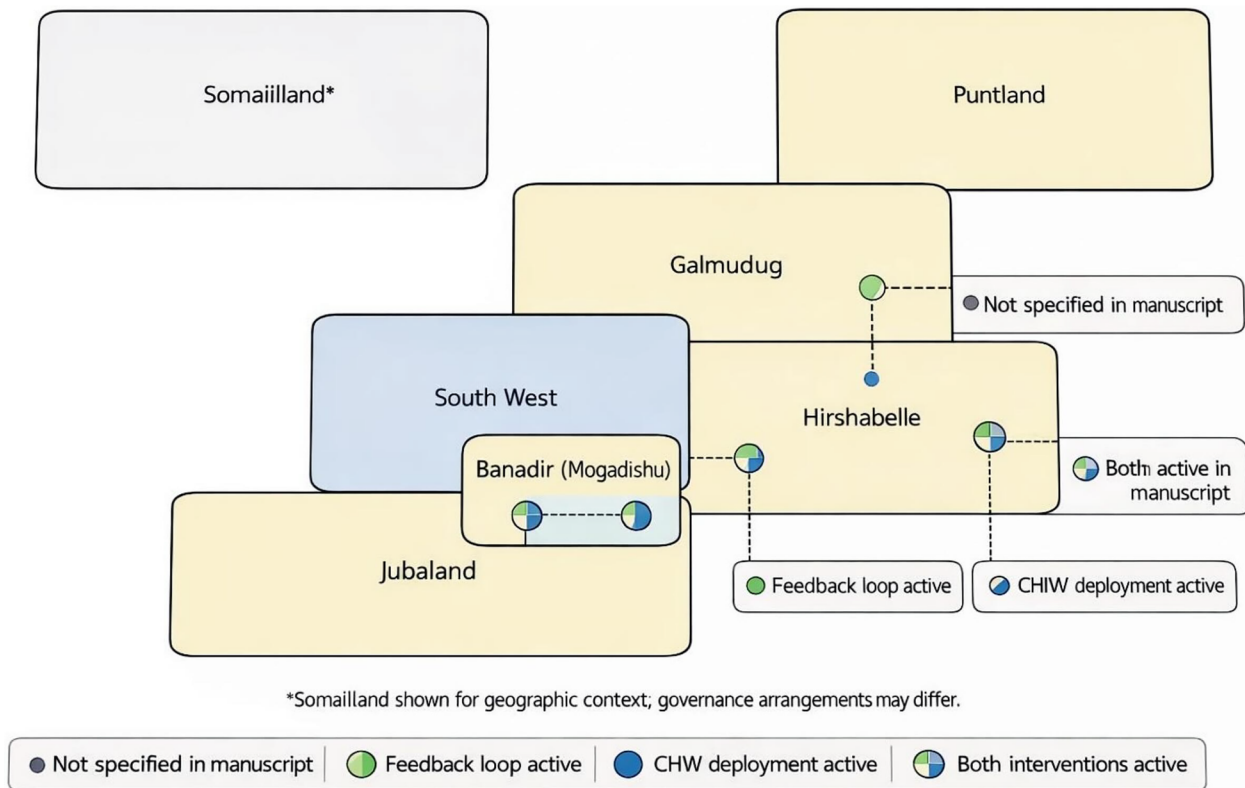


Figure 2 Intervention coverage map showing locations with active Marwo Caafimaad deployment, active DHIS2 feedback loops, or both interventions.

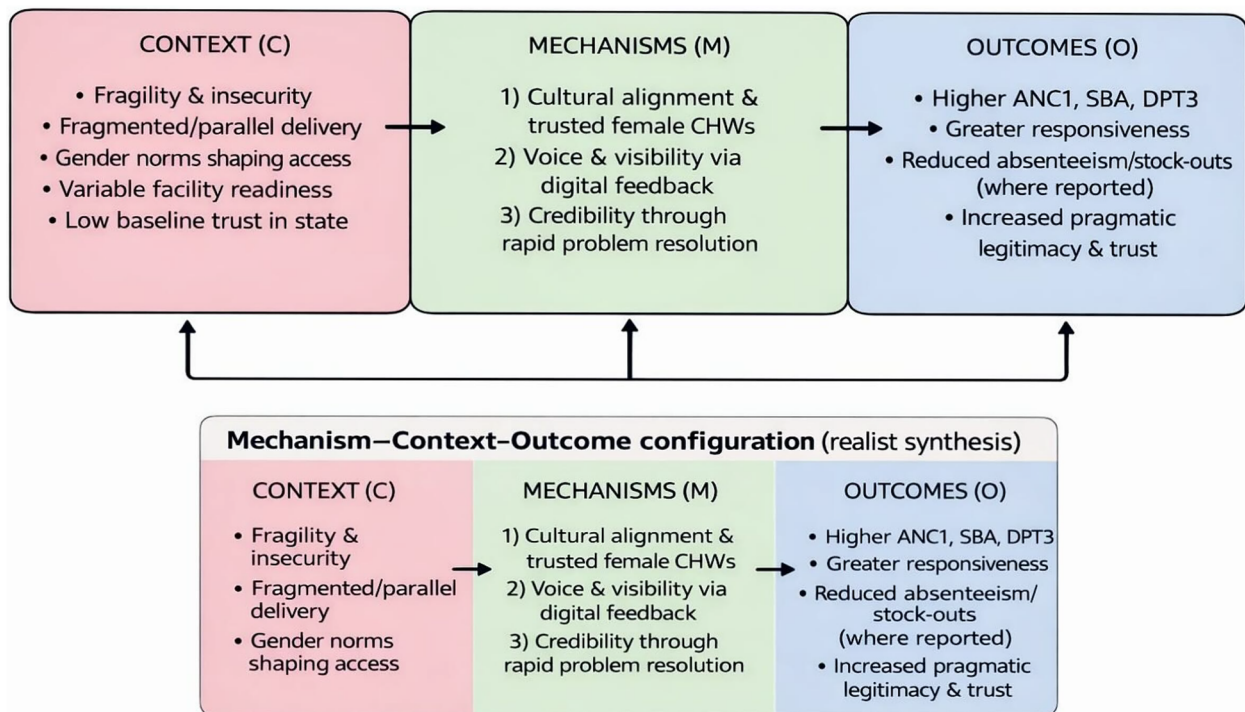


Figure 3 Mechanism–context–outcome configuration diagram derived from realist synthesis.

persist. Qualitative data collection was constrained by security and may under-represent the most affected regions. Caution is advised in generalizing findings beyond the studied districts and period.

Conclusions

Integrating a culturally attuned community health workforce with actionable digital accountability mechanisms is associated with improved MNCH service utilization and strengthened service-level legitimacy in fragile settings. Somalia's experience demonstrates that governance "software"—trust, responsiveness, fairness—can amplify the impact of health system "hardware" reforms and contribute to reconstructing constructive state–society relations through the health sector.

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Author contributions

Abdulrazaq Yusuf Ahmed (Conceptualization, Methodology, Formal analysis, Investigation, Writing—original draft, Writing—review & editing, Supervision, Project administration), Mohamed Hussein Mohamed (Investigation, Validation, Resources, Writing review & editing)

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Supplementary data

Supplementary data is available at IJQHC Communications online.

Conflict of interest

The authors declare no conflicts of interest.

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Ethics approval

This study received ethical clearance from the Somali Federal Republic, Ministry of Health & Human Services, RESEARCH & ETHICS REVIEW COMMITTEE.

Reference Number: MOH&HS/DGO/09956/Jun/2025.

Informed consent

Written informed consent was obtained from all participants prior to their involvement in the study. Data were anonymized to ensure confidentiality. In instances where verbal consent was provided, the research team documented the process and included justification in the study files.

Data availability

The data underlying this article are not publicly available due to sensitivity and confidentiality considerations involving routine national health information systems. De-identified datasets may be requested from the corresponding author, subject to approval from relevant national authorities.

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