

Relational Mechanism in Community-Based Health Information System Governance: Implications for Alignment and Community Health Outcomes

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Background and Purpose: Effective governance of Health Information Systems (HIS) is critical to improving health outcomes, yet the practices underlying the CBHIS governance relational mechanism and their relationship with alignment and community health outcomes remain poorly understood. This study sought to identify these practices and examine their interrelationships with alignment and community health outcomes.

Methods: A mixed-methods study employing a convergent parallel design was conducted across two purposively selected sites with established experience in CBHIS implementation and use. Quantitative data were collected using 164 semi-structured questionnaires and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). Qualitative data were thematically analysed using ATLAS.ti (v24).

Results: Validity and reliability testing identified nine practices associated with the CBHIS governance relational mechanism, while qualitative analysis revealed two additional practices, collectively constituting core governance practices required for alignment. The study also validated six indicators measuring community health outcomes. Results showed a positive and statistically significant relationship between the CBHIS governance relational mechanism and community health outcomes, with the exogenous construct exerting a positive influence on the endogenous construct, confirming the model's predictive relevance.

Conclusions: This study identified key practices associated with the CBHIS governance relational mechanism that support alignment between the Community-Based Health Information System (CBHIS) and community health outcomes. Notable practices include stakeholder engagement, data review meetings, dialogue days, community health chalkboards, and the use of Information, Education, and Communication (IEC) materials, which enhance collaboration and information sharing within community health systems. These practices show potential to improve community health outcomes. However, the findings should be interpreted cautiously due to the use of purposive sampling and the inclusion of only two study sites. The results therefore provide preliminary insights and highlight the need for further validation across broader contexts using more representative sampling approaches.

Keywords: Alignment, Community-Based Health Information System Governance Relational Mechanism, Community Health Outcomes, Health Information System, Governance

1 Introduction

The use of Health Information Systems (HIS) is increasingly prevalent across various tiers of healthcare, including community healthcare settings. Community-level HIS encompass Electronic Community Health Information Systems (eCHIS), Mobile-Jamii Afya Link (MJali), Integrated Community Health Information System (iCHIS), and the Smart Health application, among others. These applications are commonly known as Community-Based Health Information Systems (CBHIS). They enable the collection, analysis, and reporting of community health data.

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Although the implementation of CBHIS applications is on the rise, existing literature has reported suboptimal performance and limited value derived from digital health integrations. Several interventions aimed at reversing these trends have been tabled. Developing and implementing a context-specific HIS governance is one of them. Evidence collectively suggests that effective governance of HIS is crucial for the successful integration and use of HIS systems. It is also an essential determinant of positive health outcomes and proper health system functioning [1], [2], [3], [4], [5], [6]. HIS Governance is operationalised through the implementation of structures, processes, relational mechanisms, and their corresponding context-specific practices, which are necessary for alignment to occur [5], [7], [8], [9], [10]. Research indicates that organisations with effective IT governance programs achieve a minimum of 20% higher earnings than those with less effective governance, even when pursuing identical strategies [11].

Over the past decade, several Community-Based Health Information Systems (CBHISs) have been implemented in Kenya, including the electronic Community Health Information System (eCHIS), which is currently being rolled out across all 47 counties. The literature reflects ongoing efforts to examine CBHIS governance. While some studies such as [12] have addressed general aspects of CBHIS governance, research to date [13] has primarily focused on the structural mechanism and its relationship with alignment and community health outcomes. In contrast, the governance processes and relational mechanisms remain underexplored. This study, therefore, investigates the specific practices underpinning the relational mechanism and their interactions with CBHIS–community health alignment, referred to as the alignment, and outcomes. There is therefore a need to identify these practices and examine their interrelationships with health outcomes, consistent with prior research calling for deeper examination of the “how” and “why” of relationships between health IT governance mechanisms and health performance [8], [14], [15].

This study pursued two objectives: (1) to identify the practices associated with the CBHIS governance relational mechanism that are essential for achieving alignment, and (2) to examine the interrelationships among the CBHIS governance relational mechanism, alignment, and community health outcomes. To enhance contextual understanding, a pre-study involving key informants from the Department of Health in Nairobi City County was conducted to explore and identify relevant governance practices. Insights from this pre-study informed both the selection of practices and the focus of the literature review. The following section, therefore, reviews existing literature on HIS governance and health outcomes.

2 Literature Review

2.1 Health Information System (HIS) Governance

Information Technology (IT) governance entails the establishment of practices across structural, process, and relational mechanisms to ensure alignment between IT and an organisation’s vision, mission, strategy, and objectives, thereby promoting value creation and sustainability [16]. In the healthcare context, effective governance of Health Information Systems (HIS) is critical to achieving improved health system performance and health outcomes. HIS governance is operationalised through governance structures, processes, and relational mechanisms, together with their associated practices. The following section, therefore, reviews existing literature on practices associated with the HIS governance relational mechanism.

2.2 Practices Associated with the HIS Governance Relational Mechanism

The CBHIS governance relational mechanism encompasses active stakeholder engagement, collaborative interactions, and the communication practices used to convey governance decisions. While communication is recognised as vital for HIS implementation, its specific mechanisms and effectiveness remain underexplored in community-based contexts. [15] highlight the role of timely, accurate, bidirectional communication, such as prompt emails, in supporting Health Information Exchange (HIE) and broader health system initiatives. Yet, their analysis focuses on formal organisational settings, leaving questions about adaptation and responsiveness at the community level.

Building on this, existing literature identifies a range of practices associated with the HIS governance relational mechanism, including informal IT–business executive interactions, enterprise-wide communications, co-location of IT and business functions, leadership messaging, and capacity-building initiatives [17]. Although these practices are credited with fostering shared understanding, executive

support, and organisational coordination, existing literature often assumes a straightforward, uniform impact on alignment, overlooking the complex, context-dependent factors that may influence their effectiveness. This perspective neglects contextual complexities, such as organisational culture, stakeholder heterogeneity, and resource constraints, that may mediate or moderate outcomes. Similarly, [18], [19] highlight the role of effective communication and stakeholder engagement in data warehouse initiatives; yet, these studies focus on structured enterprise environments, which may not reflect the informal dynamics and social norms critical to the success of community-based health systems.

In community health settings, inclusive dialogues and stakeholder participation are increasingly recognised as central to success. [20] emphasise the importance of community consultations in implementing Ward-Based Outreach Teams (WBOTs), illustrating that relational practices must extend beyond formal organisational hierarchies. Similarly, [21] demonstrates that disseminating IT policies and guidelines through multiple channels, including low-tech solutions such as community ‘chalkboards’, can enhance adoption and compliance, highlighting the need to adapt relational practices to the realities of local contexts. These findings collectively suggest that while traditional governance frameworks provide valuable guidance, they may be insufficient to capture the nuanced relational dynamics in community-based health systems.

To address these gaps, the present study conducted pre-study interviews with key community health informants, resulting in the identification of three additional practices that complement those reported in the literature. These findings underscore the importance of contextualised, adaptive, and multi-level relational governance practices in supporting CBHIS alignment and use. By synthesising prior research with empirical insights, this study contributes a more nuanced understanding of the CBHIS governance relational mechanism, emphasising that effective governance is not solely a function of formal structures and processes but is contingent upon ongoing communication, collaboration, and stakeholder engagement tailored to the community context. Table 1 summarises the full set of practices and their sources, integrating both literature and pre-study findings.

Table 1. HIS Governance Practices and their Sources

S.No.	Indicator	Source
1	CBHIS stakeholders’ identification	[22], [5], [12], [20], [17], [23], [24]
2	CBHIS executive-level communication	[15], [17]
3	Data Use & Review Meetings	[25]
4	Dialogue days	[20], [25]
5	Action days	This study’s pre-study (January-February 2024)
6	Community Meetings (Barazas)	[20], [24], [25]
7	Community Health Digital Scorecard	This study’s pre-study (January-February 2024)
8	Community ‘chalkboard’	[21], [25], [26]
9	Information Education Communication (IEC) materials	This study’s pre-study (January-February 2024)

2.3 Outcomes of Health Information Systems

Existing literature highlights several healthcare benefits associated with the utilisation of Health Information Systems (HIS) across different levels of care. Community-Based Health Information Systems (CBHIS) have been shown to enhance healthcare coordination and management in critical contexts, such as monitoring and treatment of tuberculosis, tracking drug defaulters, including Continuing Complex Care (CCC) patients, providing antenatal care (ANC) information, and reporting immunisation coverage for children under five [25]. Implementation of eCHIS, for instance, has been associated with a reduction in errors during house-to-house registration by Community Health Workers (CHWs), improving data quality and lowering operational costs [23], [27], [28]. Studies also indicate that community health HIS interventions increase engagement and utilisation of health services, evidenced by rises in hospital deliveries, immunisation coverage, effective distribution of medications (e.g., analgesics, deworming agents, multivitamins), and dissemination of treated bed nets [24] [25]. Furthermore, CBHIS has been shown to strengthen accountability and performance management at the community level [12]. Table 2 summarises these HIS outcomes alongside their corresponding literature sources.

Table 2. HIS Outcomes and their Sources

S.No.	Indicator	Source
1	Improved community healthcare coordination	[12], [25], [28], [29]
2	Improved community health data, information quality and availability.	[27], [28]
3	Reduced community health operational costs	[23], [27]
4	Increase in efficiency and effectiveness in delivering community health services	[24], [25], [27], [30]
5	Improvement in community health engagement in health	[5], [12], [25], [27], [28], [31]
6	Improved accountability and performance management	[12], [25], [32]

2.4 Research Conceptual Model

CBHIS governance mechanisms comprises of structures, processes, and relational mechanisms, as and their associated practices are considered essential for achieving alignment between community health initiatives and CBHIS, ultimately enhancing community health outcomes. This perspective is supported by prior studies such as [2], [5], [6], [8], [8], [23], [33].

This study focuses specifically on the interrelationship between the CBHIS governance relational mechanism and community health outcomes. Existing research highlights that relational mechanisms of health IT governance are critical for achieving and sustaining alignment [15], while organisational communication is key to improving healthcare and IT alignment [33]. Furthermore, implementing practices associated with the HIS governance relational mechanism is widely regarded as a prerequisite for deriving value from HIS investments [17].

Building on this evidence, the study hypothesises that the practices linked to the CBHIS governance relational mechanism are necessary for alignment to occur, and that once alignment is established, the relational mechanism (exogenous construct) positively influences community health outcomes (endogenous construct) (link c). To capture this dynamic, the study integrates the IT Governance Theory with the Strategic Alignment Model (SAM), as neither framework alone adequately addresses the research problem. The conceptual model is presented in Figure 1.

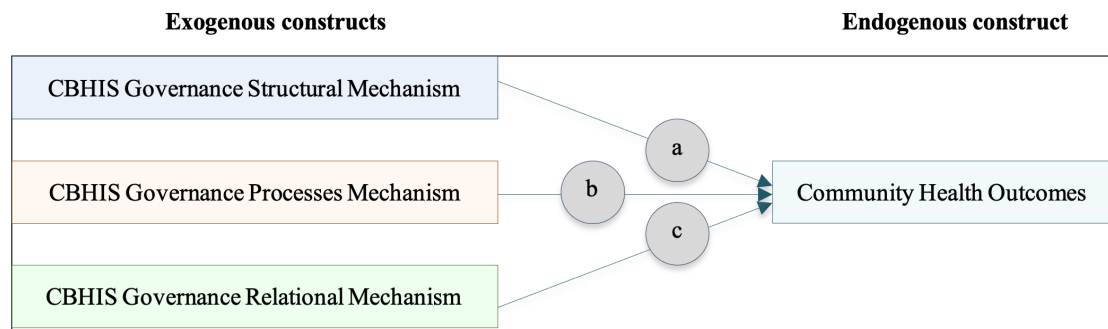


Fig. 1. Research conceptual model

3 Research Methodology

3.1 Pre-study

Before the main data collection, a pre-study was conducted in Kibra Sub-County, Nairobi County, between January and February 2024. The primary aim of this pre-study was to refine the research questionnaire and identify potential ambiguities in the study design. A total of 28 participants took part in the exercise, comprising the County Community Health Focal Person (CCHFP), County Health Records and Information Officers (CHRIOs), County Health IT Officers, the Sub-County Community Health Focal Person (S-

CCHFP), Sub-County Health Records and Information Officers (S-CHRIOs), and Community Health Assistants (CHAs).

3.2 Data collection and survey instrument

This study, informed by a pragmatic perspective, utilised a mixed-method research strategy with a convergent parallel research design. Kisumu County and Makeni County were deliberately selected from a total of 47 counties based on their experience in the establishment and utilisation of CBHIS. The study population comprised 321 officers selected from various strata. The research utilised Yamane's formula by taking a 95% confidence interval and a +/- 5% margin of error, resulting in a sample size of 179 respondents. Both probability and non-probability sampling methods were employed to select respondents from various strata. The study utilised semi-structured questionnaires for data collection.

The data collection instrument consisted of a semi-structured questionnaire organized into several structured sections to ensure clarity, ethical compliance, and comprehensive data capture. Section A provided a general introduction to the study, including the researchers' contact details (email and mobile phone number) for any inquiries or clarification. Section B focused on informed consent, giving respondents the option to either agree or decline participation in the study. Section C contained a respondent information sheet, which offered clear definitions and explanations of key terms used in the research to promote a shared understanding. Section D captured respondents' demographic information, including variables such as county, sub-county, level of education, and age bracket. Section E was divided into two parts: Part 1 comprised closed-ended items designed to measure indicators of the CBHIS governance relational mechanism, while Part 2 included open-ended questions that allowed respondents to provide additional insights or information not captured in the structured items. Similarly, Section F focused on measuring community health outcomes, with Part 1 containing structured indicators and Part 2 providing an open-ended component for respondents to elaborate further on issues they considered relevant. This structured yet flexible design enabled the collection of both quantitative and qualitative data, thereby enhancing the depth and validity of the findings.

Ten research assistants (one in every sub-county) were trained and issued with printed semi-structured questionnaires. A total of 179 printed data collection instruments were issued to study respondents between February and June 2024. Table 3 presents the study population, sampling strategies employed, and sample sizes.

Table 3. Study population, sampling techniques and sample sizes

Project	Stratum	Population	Sampling Method	Sample
Kisumu County	County Executive Committee Member – Health	1	Purposive	1
	County Executive Committee Member – IT	1	Purposive	1
	Chief Officer – Health	1	Purposive	1
	Chief Officer – IT	1	Purposive	1
	Directors of Health Services	3	Purposive	1
	IT Directors	3	Purposive	1
	County Health Records & Information Officers (CHRIOs)	1	Purposive	1
	Sub-County Health Records & Information Officers (S-CHRIOs)	7	Purposive	7
	County Community Health Focal Persons (CCHFPs)	1	Purposive	1
	Sub-County Community Health Focal Persons (S-CCHFPs)	7	Purposive	7
	Community Health Assistants/Officers (CHAs/CHOs)	198	Random	101
Makeni County	IT Officers	7	Purposive	7
	County Executive Committee Member – Health	1	Purposive	1
	County Executive Committee Member – IT	1	Purposive	1
	Chief Officer – Health	1	Purposive	1
	Chief Officer – IT	1	Purposive	1
	Directors of Health	3	Purposive	1
	IT Directors	1	Purposive	1

	County Health Records & Information Officers (CHRIOs)	1	Purposive	1
	Sub-County Health Records & Information Officers (S-CHRIOs)	6	Purposive	3
	County Community Health Focal Persons (CCHFPs)	1	Purposive	1
	Sub-County Community Health Focal Persons (S-CCHFPs)	6	Purposive	3
	Health IT officers	8	Purposive	4
	Community Health Assistants/Officers (CHAs/CHOs)	60	Random	30
	Total	321		179

3.3 Data Analysis (Tools, Type of Analysis, and Statistical Tests Used)

Prior to data analysis, the indicators measuring the CBHIS governance relational mechanism were coded as RM1 to RM9, while those assessing community health outcomes were coded as CHO1 to CHO6. The coding process was conducted using Microsoft Excel to ensure consistency and facilitate subsequent data handling.

Data analysis was conducted using SmartPLS software through Partial Least Squares Structural Equation Modelling (PLS-SEM) to analyse and validate the relationships between constructs associated with CBHIS governance relational mechanisms and community health outcomes. PLS-SEM was considered more appropriate than Covariance-Based Structural Equation Modelling (CB-SEM) because the primary objective of the study was prediction rather than theory confirmation, as supported by [34]. Furthermore, PLS-SEM is suitable for modelling complex relationships among latent constructs and can effectively handle both formative and reflective measurement models.

The analysis involved the estimation of both the measurement and structural models. In terms of measurement model specification, the CBHIS governance relational mechanism was conceptualised as a formative construct because its indicators collectively define the construct. In contrast, community health outcomes were modelled as a reflective construct, where the indicators are viewed as manifestations of the underlying latent variable. To assess the quality of the measurement model, the reliability of the reflective measurement scales was evaluated using Cronbach's alpha and composite reliability to ensure internal consistency. Convergent validity was assessed using Average Variance Extracted (AVE), while discriminant validity was examined using three widely accepted techniques: the Fornell-Larcker criterion, the Heterotrait–Monotrait (HTMT) ratio, and cross-loadings.

To determine the statistical significance of indicator weights and path coefficients, a bootstrapping procedure with 5,000 resamples was performed. This non-parametric approach enhanced the robustness of the results by providing confidence intervals and significance levels for the estimated parameters.

Furthermore, qualitative data collected during the study were analysed thematically using ATLAS.ti (Version 24). This involved coding textual data, identifying emerging patterns, and developing themes that complemented and enriched the quantitative findings.

4 Research Findings

Out of 179 distributed semi-structured surveys, 164 were completed and returned, yielding a response rate of 91.6%.

4.1 Identification and Validation of Construct Indicators

To begin with, the dependability and accuracy of the indicators and constructs were evaluated in conformity with previous research [35]. The researchers analysed the weights of the indicators on their corresponding constructs. The increased loadings indicated a greater shared variance between the construct and its corresponding indicator relative to error variance. Table 4 demonstrates that all items exhibited substantial and statistically significant loading ($P < 0.05$) on their corresponding constructs. The t-statistics for the corresponding indicator weights were positive and significant.

The dependability of scales was evaluated through Cronbach's alpha and composite reliability (ρ_c). The Cronbach alpha and composite reliability scores for the two constructs surpassed the minimum

threshold of 0.70, as recommended by [34], thereby confirming the reliability of the study indicators. The convergent validities for the two constructs surpassed the minimal criterion of 0.5 (AVE>0.5). Table 4 presents the indicator loadings, construct reliabilities and convergent validity.

Table 4: Indicator loadings, construct's reliabilities, and convergent validity

Construct	Indicator	Indicator loading	T statistic	P values	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)
CBHIS Governance Relational Mechanism	RM1	0.726	11.588	0.000	0.882	0.906	0.521
	RM2	0.514	7.696	0.000			
	RM3	0.744	11.734	0.000			
	RM4	0.682	8.538	0.000			
	RM5	0.686	12.530	0.000			
	RM6	0.717	11.176	0.000			
	RM7	0.768	16.383	0.000			
	RM8	0.804	18.250	0.000			
	RM9	0.809	19.855	0.000			
Community Health Outcomes	CHO1	0.704	15.396	0.000	0.829	0.875	0.539
	CHO2	0.746	13.027	0.000			
	CHO3	0.724	12.598	0.000			
	CHO4	0.821	26.843	0.000			
	CHO5	0.626	8.981	0.000			
	CHO6	0.770	10.470	0.000			

RM1 = CBHIS stakeholders' identification and engagement; RM2 = CBHIS executive's level communication; RM3 = Data review meetings; RM4 = Dialogue days; RM5 = Action days; RM6 = Community Meetings (Barazas); RM7 = Community health digital scorecards; RM8 = Community health chalkboard; RM9 = Information Education Communication (IEC) materials. CHO1 = Improvement in community healthcare coordination; CHO2 = Improvement in community health data and information quality and availability; CHO3 = Reduction in community health operational costs; CHO4 = Efficiency and effectiveness in delivering community health services; CHO5 = Improvement in community engagement in health; CHO6 = Promotes accountability and performance management.

Three techniques are commonly used to assess a construct's discriminant validity: the Fornell-Larcker Criterion, Heterotrait-Monotrait Ratio (HTMT), and cross-loadings. The study findings indicated that all constructs satisfied discriminant validity according to the Fornell-Larcker Criterion, as each construct correlated more strongly with itself than with others. Similarly, the constructs met the HTMT criterion, with values below 0.85, consistent with the threshold recommended by [36]. The cross-loading technique was not applied, as both the Fornell-Larcker Criterion and HTMT results confirmed the absence of discriminant validity issues.

These analyses demonstrated that all constructs and their indicators met the established reliability and validity thresholds, thereby supporting the identification and validation of the practices associated with the CBHIS governance relational mechanism. Building on the validation of the CBHIS governance relational mechanism, the study identified the following key practices: active identification and engagement of CBHIS stakeholders; executive-level communication through emails, formal and informal meetings, and targeted announcements; regular data review meetings; organisation of dialogue days; action days; utilisation of community meetings (barazas); deployment of community health digital scorecards; provision and use of community health 'chalkboards' during dialogue days and community meetings; and the use of Information, Education, and Communication (IEC) materials to disseminate CBHIS-related information.

In addition to the quantitative findings, the qualitative analysis identified two additional practices related to the CBHIS governance relational mechanism. The first involves the use of social media platforms (WhatsApp, Facebook, X) and traditional media (radio and TV) to enhance communication. These channels provide benefits such as real-time updates, targeted messaging, and broader reach, thereby strengthening

the dissemination of community health interventions, including CBHIS initiatives. The study found that multiple WhatsApp groups had been created to facilitate rapid and efficient information sharing among community segments. For instance, Community Health Assistants (CHAs) maintained groups connecting them with their leaders, Sub-County Community Health Focal Persons (S-CCHFPs), Sub-County Health Records and Information Officers (S-CHRIOs), CHRIOs, and CCHFPs. Similarly, S-CCHFPs, S-CHRIOs, CHRIOs, and CCHFPs had their own groups, while CHAs also used WhatsApp groups to interact directly with Community Health Promoters (CHPs), reflecting a structured, multi-tiered communication network. Highlighting the central role of these platforms in routine CBHIS communication, one respondent remarked:

“We mainly communicate through our Work-related WhatsApp group formed by our CHA.”
(Respondent 10)

Facebook pages and other social media groups were actively used to communicate and share health-related information. Dedicated pages and groups disseminated interventions, updates, resources, and success stories, for instance, a community health page posting daily health tips and upcoming events. Targeted advertisements were also used to reach specific demographics, such as promoting household registrations within communities. Similarly, X (formerly Twitter) facilitated regular updates and posts on health interventions, events, and tips. Respondents noted:

“Communication also happens through social platforms, e.g., WhatsApp, Facebook sharing, and Twitter.” (Respondent 1, Respondent 5), and *“Communication also happens by sending SMS, using radio and television.”* (Respondent 31)

Other innovative channels included the use of tikTok, skits, poems and dance performances, highlighting the diverse methods used to engage communities and disseminate CBHIS information effectively. A respondent noted:

“TikTok, skits, poems, and dance performances, as well as billboards along highways and roads.” (Respondent 89)

Radio and television stations were also important channels for communicating CBHIS interventions and progress within communities. Radio programs and talk shows provided a platform for health experts to discuss topics such as maternal and child health, engage with listeners, and respond to queries - for example, through weekly radio segments on maternal and child health. Similarly, TV stations, such as Ramogi TV, were utilised to discuss community health interventions and run educational campaigns offering in-depth information on specific programs. Leveraging social media, radio, and TV enabled more effective dissemination of CBHIS information, contributing to improved community health outcomes. One respondent noted:

“Sometimes, local radio stations are used to pass critical information to county officials. They also inform community members about ongoing activities, facilitating CHPs, CHAs, and county officials in delivering services smoothly.” (Respondent 65)

Analysis of qualitative data further revealed that community health conferences represent a highly effective communication and governance practice within the CBHIS relational mechanism. These conferences provide a structured and formal setting for knowledge exchange, collaboration, and stakeholder engagement across multiple levels. The study found that conferences serve as platforms for sharing community health interventions through expert presentations, workshops, training sessions, case studies, and success stories. They also facilitate resource sharing, capture community voices, and promote interactive discussions. Respondents consistently noted that the conferences organised offered valuable opportunities to learn from diverse experiences and replicate successful practices. Table 5 summarises the practices associated with the CBHIS governance relational mechanism.

Table 4. Practices associated with the CBHIS governance relational mechanism

S.No.	CBHIS governance practices
1	CBHIS stakeholders' identification and engagement
2	CBHIS executive's level of communication
3	Data review meetings
4	Dialogue days
5	Action days
6	Community meetings (Barazas)
7	Community Health Digital Scorecard
8	Community 'chalkboard'
9	Information Education Communication (IEC)
10	Social media platforms, radio and TV stations, SMSs and phone calls
11	Conferences

Consequently, the governance of CBHIS contributed to several positive community health outcomes, including improved healthcare coordination, enhanced quality and availability of community health data, reduced operational costs, increased efficiency and effectiveness in service delivery, greater community engagement in health initiatives, and strengthened accountability and performance oversight.

4.2 Results of testing the structural model

The structural model was evaluated in multiple stages, beginning with an assessment of multicollinearity in the inner model. The collinearity statistics indicated a variance inflation factor (VIF) of 1 for the path from the relational mechanism to community health outcomes ($RM \rightarrow CHO$), well below the commonly accepted threshold of 5. This result confirms the absence of collinearity issues in the model.

Following the identification of multicollinearity of the inner model, the research results indicated that the beta coefficient (β) for the original sample (O) was 0.629, whereas the sample mean (M) was 0.642. This suggested that a one-unit increase in the CBHIS governance relational mechanism correlated with a positive increase of 0.629 units in community health outcomes, assuming all other factors remained constant. The relationship was characterised by a T statistic (t) of 9.600***. The t-statistic demonstrated that the beta coefficient was statistically distinct from zero, hence, enhancing confidence in its validity and suggesting that it was not attributable to arbitrary occurrence or fluctuation. The beneficial correlation was statistically significant, with a P-value of 0.000. A p-value of 0.000 (or < 0.001) signified a minimal likelihood that the measured beta coefficient rose from an arbitrary occurrence, indicating that the beta coefficient was statistically significant. The results indicated a significant positive relationship between the CBHIS governance relational mechanism and community health outcomes. Table 6 presents the structural model results.

Table 5. Path Coefficients - Mean, STDEV, T Values, p values

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
RM $\rightarrow$ CHO	0.629	0.642	0.066	9.600	0.000

The study additionally employed the coefficient of determination (R^2) [37] and the predictive relevance (Q^2) [38]. They were used to evaluate the structural model's predictability. The coefficient of determination (R^2) quantifies the ratio of variation in the endogenous construct attributable to the influence of the exogenous factors. It assesses the model's explanatory capability [39]. The research findings indicated that the CBHIS governance relational mechanism accounted for 39.6% of the variance in community health outcomes. Moreover, the research employed predictive relevance (Q^2) to ascertain the predictive significance of the endogenous construct. The findings indicated that the predictive significance stood at 0.360, or 36.0%. This value exceeded 0; therefore, the study deduced that the model possessed a significant degree of predictive relevance. Table 7 provides a concise overview of the coefficient of determination (R^2), adjusted R^2 , and predictive relevance (Q^2).

Table 6. A summary table of all the techniques utilised to assess the structural model

Predictor(s)	Outcome	Beta values	T statistics	P-values	R ²	Adjusted R ²	Q ²
RM	CHO	0.629	9.600***	0.000	39.6%	39.2%	36.0%

5 Discussion

5.1 Practices associated with the CBHIS Governance Relational Mechanism

This research established the following governance practices associated with the CBHIS governance relational mechanism.

First, CBHIS stakeholders' identification and engagement involves recognising and including all parties who are either influencing or being influenced by the CBHIS initiative. According to this research, digital health stakeholders included the national and county government, development partners such as AMFREF Health Africa, Living Goods, community health workers, community members, digital health information systems developers, church and associated health facilities, and the administrative wing, which included both the Chiefs and Assistant Chiefs. This finding was in tandem with the arguments of previous studies such as [5], [6], [10], [22], [24], who opined that the healthcare sector had many actors that went beyond the healthcare organisation. As argued by [24] and [40], all these stakeholders need to be identified and engaged to foster involvement and collaboration amongst crucial digital health implementers. As such, the success of health interventions such as HISs significantly relies on the identification and participation of all stakeholders involved in health [12], [20], [41]. It is evident from the above arguments that stakeholder identification and engagement play a vital role, and hence, there is a need to identify them exhaustively when addressing the governance of CBHISs.

The CBHIS executive level of communication formed another CBHIS governance practice, which created an environment where the county executives communicated with their subordinates. This approach was utilised to convey vital messages, decisions, and other relevant information to CBHIS stakeholders at county, sub-county, ward and community health unit levels. Research findings revealed that the county executives utilised different approaches, such as e-mails, internal memos, as well as formal and informal meetings. This finding supported the arguments of previous studies such as [15], [17] who postulated that executive-level enterprise-wide communications and organisational top-level announcements, such as sending and receiving timely and accurate e-mails, constituted crucial communication approaches for the success of health information exchange (HIE).

Data review meetings formed another practice related to the CBHIS governance relational mechanism. It is a structured gathering where CHWs gathered to analyse, discuss, and interpret community health data related to a specific project or program. The purpose of such meetings was to evaluate the performance of CHWs, recognise trends in disease outbreaks, and utilise data to inform decisions that enhanced outcomes. In addition, such meetings were employed to develop community health targets, promote accountability and facilitate open communication and collaboration amongst the CHWs. The research findings revealed that CHWs frequently utilised data review meetings to deliberate on CBHIS data and information. This finding supported the arguments raised by previous studies, such as [25].

Dialogue days formed another practice associated with the CBHIS governance relational mechanism. According to the research findings, dialogue days happened every quarter of the year. This allowed CHWs, community members and community health stakeholders to discuss community health issues arising from community health data. Community health performance, community health scorecards, and performance of CBHIS were some of the issues of concern during the dialogue days. According to the research findings, such platforms allowed for exchanging community health views, ideas, and opinions to achieve a common plan and set of actions. This research finding agreed with arguments of [20], who pointed out that the success of CHW programs using the WBOTs strategy relied partly on community dialogues involving different stakeholders.

Action days, also referred to as community health outreach events, was another noted practice associated with the CBHIS governance relational mechanism. These events entailed activities and services, including health education workshops, information booths, and community resources aimed at promoting health and well-being within the community. The study findings revealed that the CBHIS decisions, activities and processes were communicated during the community health outreach events.

Conducting community meetings (barazas) was a practice that was used to achieve the CBHIS governance relational mechanism. According to this research, community meetings provided an avenue for engaging with the community. It allowed members to discuss important community issues such as the CBHIS implementation and use. The Chief or the Assistant Chiefs always lead such gatherings. Such forums reflected the importance of communal decision-making and community cohesion. This finding supported those of previous studies [20], [24], [25] who pointed out the importance of community meetings commonly known as barazas.

A community health digital scorecard was also a practice that was also used to achieve CBHIS governance relational mechanism. This was utilised to assess and measure the progress of digital health integrations. It contained a set of Key Performance Indicators (KPIs) that helped to evaluate how well a community was leveraging CBHISs to support healthcare, improve health outcomes, and enhance overall quality of life. According to the research, the scorecard also helped in identifying and communicating areas for improvement, as well as tracking progress over time. Through the scorecard, community leaders, healthcare organisations, public health agencies, and policymakers would gauge the effectiveness of CBHIS initiatives and make data-driven decisions to enhance well-being of the communities.

Community 'chalkboard' was identified as another CBHIS governance practice in place. It was either through a physical or digital space where community members would share information, messages, and announcements using chalk or digital writing tools. It served as a platform for communication, creativity, and community engagement. In the case of a physical community chalkboard, mainly a blackboard or whiteboard placed in a public area, passersby were encouraged to write messages, share announcements, express creativity, or convey information relevant to the community. An online platform such as social media was used in the case of digital community chalkboards. This finding is in agreement with those of a study conducted by [26], which pointed out that the community 'chalkboard' can be applied as a communication model that carries the community health agenda and guides community dialogue and discussions.

The use of Information Education Communication (IEC) materials formed another practice related to the CBHIS governance relational mechanism. Such materials were used to inform and educate community members about specific community health interventions and programs such as CBHISs. This was conducted with a view of promoting behavioural change through communication. Among other interventions, IEC materials were utilised in community-based projects such as eCHIS to disseminate crucial information, raise awareness, and encourage positive behaviours. In addition, IEC materials could be used to create changes in attitude, provide skills and knowledge and mobilise communities. Some of the methods and tools used included printed materials, audio-visual media, interactive methods, and digital media, among others.

Social media platforms, radio and TV programs were also utilised to communicate CBHIS issues. Research findings revealed that social media platforms (WhatsApp, Facebook, and X) and radio and TV stations were utilised to enhance communication of community health interventions such as CBHIS initiatives. These mediums offered benefits such as broad reach, real-time updates, and targeted messaging, which could improve community engagement, awareness, and participation in health programs. The findings of this research are in agreement with the results of a study by [28], who observed that the creation of communication channels, such as the use of the Telegram social media channel, facilitates communication with eCHIS implementers.

The utilisation of conferences also serve as a channel or platform to communicate community health interventions. Conferences provide a structured and formal environment for exchanging knowledge, fostering collaboration, and engaging stakeholders at various levels. Expert presentations, workshops and training, case studies and success stories, stakeholder engagement, resource sharing, community voice, and interactive sessions are some of the ways that can be applied in conferences for community health interventions.

5.2 Interrelationships between the CBHIS Governance Relational Mechanism, Alignment and the Community Health Outcomes

The practices associated with the CBHIS governance relational mechanism constitute a critical component of the governance practices necessary for achieving alignment. Consistent with this view, prior studies [15], [17], [33] highlight the relational mechanism as pivotal in attaining alignment. [15] further emphasise that,

even when appropriate structures and processes are in place, the relational mechanisms of HIT governance remain essential for achieving and sustaining alignment.

The study findings demonstrated a significant and positive relationship between the CBHIS governance relational mechanism and community health outcomes, with the relational mechanism explaining 39.6% of the variance ($R^2 = 0.396$) and exhibiting predictive relevance ($Q^2 = 0.360$), confirming the model's robustness. These results indicate that effective relational governance practices contribute substantially to enhancing community health outcomes.

This aligns with prior research emphasising the critical role of stakeholder identification and engagement in community health initiatives. For instance, [24] highlighted that recognising key community health stakeholders is fundamental for CHWs to create meaningful impact, while [20] observed that successful CHW programmes depend on including diverse actors within the community health ecosystem. Similarly, [12] and [41] underscored that the active participation of all relevant stakeholders is crucial for the effectiveness of health interventions, including HIS implementations.

The findings also underscore the importance of structured communication in supporting HIS success. Disseminating IT policies, guidelines, and procedures facilitates organisational adoption and maximises the value of HIS investments [42]. Executive-level communications and top-level organisational announcements further strengthen alignment, coordination, and value realisation [17]. Together, these insights suggest that stakeholder engagement and effective communication, which form the core elements of the CBHIS governance relational mechanism, are central drivers of improved community health outcomes.

Moreover, structured community dialogues were identified as an essential practice for translating governance mechanisms into tangible outcomes. [20] emphasised the role of dialogue in the success of the WBOTs strategy, while [26] observed that engaging communities through dialogue can lead to measurable improvements in health outcomes. Complementary tools such as community "chalkboards" further support these interactions by guiding discussions and fostering collective engagement in health promotion [26]. These findings reinforce the view that the implementation of relational governance practices is critical for deriving value from health information system (HIS) investments [17], and align with broader evidence that effective digital health governance is fundamental to achieving health system goals and outcomes [5], [11], [43].

5.3 Limitations of the Study

Several limitations should be considered when interpreting the findings of this study. First, the use of purposive sampling may have introduced sampling bias, since participants were intentionally selected based on characteristics relevant to the research objectives. As a result, the sample may not fully represent the broader population, thereby limiting the generalisability of the findings beyond the study context. Additionally, the sampling approach may have restricted the diversity of perspectives captured, which could have influenced the range of responses obtained.

Despite these limitations, purposive sampling was considered appropriate for the exploratory nature of the study because it facilitated the inclusion of participants with relevant knowledge and experience regarding CBHIS governance practices. Future studies could strengthen the robustness and generalisability of the findings by employing probability-based sampling techniques and larger, more diverse samples across different community health settings.

6 Conclusion and Practical Implications

This study identified several relational governance practices associated with the Community-Based Health Information System (CBHIS) that appear to support alignment between CBHIS implementation and community health processes. Specifically, practices such as stakeholder identification and engagement, data review meetings, dialogue days, community health chalkboards, and the use of Information, Education, and Communication (IEC) materials emerged as important relational mechanisms within the studied contexts. The findings suggest that these governance practices may contribute to improved community health outcomes by enhancing collaboration, stakeholder engagement, communication, and information sharing within community health systems.

These findings provide important practical implications for health informatics practitioners, policymakers, and community health stakeholders by highlighting relational governance practices that may strengthen the effectiveness of CBHIS implementation and support community health system performance. However, the findings should be interpreted with caution in light of the study limitations outlined earlier. As such, the study offers preliminary rather than conclusive evidence regarding the role of relational governance mechanisms in CBHIS implementation.

To strengthen the empirical validation and generalisability of these findings, future research should test and apply the proposed tool and governance practices across additional contexts using more representative sampling approaches, including randomly selected communities. Such studies would provide more robust evidence regarding the applicability, scalability, and effectiveness of relational governance mechanisms in improving community health outcomes and overall community health system performance.

7 Recommendations

This study identified context-specific practices associated with the CBHIS governance relational mechanism, offering practical guidance for health informatics practitioners and policymakers. The findings underscore the importance of investing in relational approaches such as CBHIS community meetings (barazas), dialogue days, community health digital scorecards, and Information Education Communication (IEC) materials to strengthen governance and enhance community health outcomes.

For policy formulation, the results highlight the need to integrate these practices into CBHIS governance frameworks to support alignment and system effectiveness. Future research should explore practices linked to the processes governance mechanism to assess their influence on community health outcomes. Additionally, subsequent studies could investigate the combined effects of practices across CBHIS governance mechanisms on alignment and the variance in community health outcomes.

Declarations

Ethics approval

Ethical approval was unnecessary for this research since it did not include direct human data.

Research permit and consent to participate

The National Commission for Science, Technology and Innovation (NACOSTI) issued a research license (Ref. No: 929552) to carry out this research. The study's authorisation was secured from county administrations and all participating sub-counties. All research participants provided informed consent. Respondents were allocated numerical identifiers ranging from 1 to 164 to safeguard personal identity. All procedures were conducted following applicable norms and legislation.

Consent for publication

Not applicable.

Availability of data and materials

All relevant data are included in the manuscript. The data supporting these findings can be obtained from the corresponding author upon request.

Competing interests

The authors wish to affirm that they hold no financial or non-financial competing interests.

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Authors' contributions

HC: Conceptualised the study, carried out literature review, analysed the data, composed the text, and revised the manuscript; TW: Conceptualised the study, revised and sanctioned the manuscript, and provided oversight during the research process; DO: Conceptualised the study, revised the manuscript, endorsed its final version, and provided guidance throughout the research. All authors reviewed the manuscript.

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