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# Community-Based Health Information System Governance Structural Mechanism: Role in Attaining the Alignment and Improvement of Community Health Outcomes

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**Background and purpose** - Health Information System (HIS) governance is necessary for the effective functioning of HIS to improve health outcomes. However, practices associated with the Community-Based Health Information System (CBHIS) governance structural mechanism remain unclear. In addition, there is a paucity of knowledge on the nature of the interrelationships between the CBHIS governance structural mechanism, community health-CBHIS alignment and community health outcomes. The study sought to establish the practices associated with the CBHIS governance structural mechanism and its interrelationships with community health-CBHIS alignment and community health outcomes.

**Methodology** - This study employed a mixed-method research approach, utilising a convergent parallel research design. Two study sites were purposefully chosen from a total of 47 counties. A sample size of 179 respondents participated in the study. The study used Partial Least Squares (PLS) Structural Equation Modelling (SEM) to analyse quantitative research data. Qualitative data were thematically analysed using ATLAS.ti V24.1.0.30612.

**Findings –** The study established and validated eight practices associated with the CBHIS governance structural mechanism, which form part of the CBHIS governance practices necessary for community health-CBHIS alignment to occur. Additionally, the study identified six indicators that measure the community health outcomes construct. Furthermore, the study findings revealed a positive and significant relationship between the CBHIS governance structural mechanism and community health outcomes. In addition, the exogenous construct positively affected the endogenous construct; thus, the study concluded that the model had an overall predictive relevance.

**Practical implications –** The study findings revealed the practices associated with the CBHIS governance structural mechanism necessary for community health-CBHIS alignment to occur. Through the findings, it is suggested that designing and implementing such practices can significantly improve community health outcomes. Health informatics practitioners and policymakers should consider adopting these governance practices to improve health outcomes at the community level.

**Keywords:** Alignment, CBHIS Governance Structural Mechanism, Community Health Outcomes, Health Information Systems.

## 1 Introduction

Health Information Systems (HIS) integrations (also called digital health) are on the rise in different levels of healthcare, including the community healthcare level. Examples of community-level HIS integrations include Integrated Community Health Information System (iCHIS), Electronic Community Health Information System (eCHIS), Mobile-Jamii Afya Link (MJali), Smart Health application, Kobo Collect, DHIS2 Tracker, Totohealth, mDharura, Community-wide Health Information Exchange, among others [1]-[10]. They facilitate community health data collection, analysis and reporting and are generally referred to as Community-Based Health Information Systems (CBHIS).

Effective Health Information System (HIS) governance is essential for ensuring successful integrations and the smooth functioning of HIS systems [11], [12]. HIS governance also improves health outcomes [13],

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[14], [12] and consequently, leads to a properly and fully functioning health system [15], [16], [14]. Studies have shown that companies with a well-functioning IT governance program earn at least 20% more than companies without one, especially if they are pursuing the same strategy [17].

HIS Governance is operationalised via structures, processes, and relational mechanisms, as well as their associated practices [18], [14]. These practices are contextual [19], [20] and are necessary for the health-HIS alignment to occur [21]. Similarly, CBHIS governance is operationalised via the three mechanisms, namely, CBHIS structures, processes and relational mechanisms. Practices associated with these governance mechanisms are necessary for community health-CBHIS alignment, referred to as the alignment, to occur. In addition, CBHIS governance mechanisms determine the realisation of community health outcomes. The focus of this study was on the CBHIS governance structural mechanism and its associated practices.

Existing literature has highlighted certain practices linked to community-level digital health integrations; however, no study to date has comprehensively examined the practices associated with the CBHIS governance structural mechanism. Moreover, the nature of the interrelationship between the CBHIS governance structural mechanism and community health outcomes remains insufficiently understood. While prior research acknowledges the importance of Health Information System (HIS) governance structural mechanisms, it offers a limited in-depth exploration of their operationalisation and impact [22], [23], [12]. Several studies [24], [18], [25] have emphasised the need to investigate both the nature and the how underpinning the interrelationships between community-level HIS governance mechanisms and health outcomes. Addressing this knowledge gap, the present study first sought to identify and validate the practices associated with CBHIS governance structural mechanism, and subsequently to examine the relationships between this mechanism and community health outcomes.

To achieve these objectives, the study employed the HIS governance theory and the Strategic Alignment Model (SAM), focusing on: (1) to identify the practices associated with the CBHIS governance structural mechanism that facilitate community health-CBHIS alignment to occur; and (2) to analyse the interrelationships between the CBHIS governance structural mechanism, alignment, and community health outcomes.

## 2 Literature Review

The healthcare sector in most developing countries is categorised into the national, sub-national and community levels. In Kenya, the healthcare sector is divided into distinctive levels, namely, national referral hospitals, county and sub-county hospitals, primary healthcare facilities and the community healthcare levels. The overall leadership and governance of health lies with the Ministry of Health (MoH). At the sub-national levels, the County Health Management Team (CHMT), the Sub-County Health Management Team (S-CHMT), and the Facility Health Management Team (FHMT) act as the health governance bodies. Community Health Committees (CHCs) act as the leadership and governance body at the community level. The responsibility of each of these bodies is to strengthen health systems. Health Information Systems integration plays a crucial role in this endeavour.

### 2.1 Health Information System (HIS) Governance

IT governance concerns setting up practices associated with structures, processes and relational mechanisms that ensure that the organisation's Information Technology supports and is supported to sustain and extend the organisation's vision, mission, strategies, objectives and goals [26]. In the healthcare sector, governance of HIS ensures health performance and improved health outcomes [13], [27], [28], [11], [14], [29], [12]. It is operationalised through HIS governance structures, processes and relational mechanisms [18]. The next section analyses existing literature on the practices associated with the community-level HIS governance structural mechanism, the HIS outcomes, and the interrelationships between HIS Governance, alignment and health outcomes are discussed.

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## 2.2 Practices Associated with the Community-Level Health Information System Governance Structural Mechanism

The community-level health information system's governance structural mechanism is one of the elements operationalising community-level HIS governance. According to [14], the HIS structural mechanism encompasses committees, teams and bodies whose roles and responsibilities are to make HIS decisions and provide directions. Different digital health integrations in different levels of healthcare have context-specific practices associated with the HIS governance structural mechanism. Practices associated with the hospital-level HIS governance structural mechanism differ from those of community-level HIS. Different studies have examined particular practices associated with the community-level HIS governance structural mechanism.

Notably, a study by [24] observed that Work Improvement Teams (WITs) governance practice improves the quality of services and propels the performance of community health units. According to the study, the outcome of leveraging WITs in the structures of the community health units is improved health of the community members. Similarly, [30] argued that the Quality Improvement Team (QIT), which is a governance body, improved the outcomes of the implemented community health interventions in Benin. The study reported that QITs improved the quality of healthcare as well as increased the performance of CHWs and the utilisation of maternal and child health (MCH) services. Others include the Community-Based Information System (CBIS) steering committee, which is responsible for making timely and well-aligned decisions and ensuring that the CBIS agenda is presented at meetings where policy, programming, and financing decisions are made, both at the national and local government levels [23]. Similarly, community information champions form another governance practice which ensures that community data guides high-level discussions [23]. [25] reiterated the importance of using champions as a health IT governance practice. Feldman et al. argued that the success of the implementation of a health information exchange system in a state-wide relied on the establishment of a project champion with decision-making power. [31] further reiterated that community champions are needed to ensure that policies and plans developed at the national and county levels are implemented with accountability and transparency to achieve the objectives of programs.

Other governance practices for the community-level HIS include the use of Community Health Committees (CHCs). CHC is a community-level body that provides leadership and oversight functions as outlined in the Strategy for Community Health 2014–2019 [32]. Furthermore, the eHealth Technical Working Group [33], the Community Health Digital Team/implementation technical team [33], and the Community Stakeholders Team [33], [34] are also some of the community-level HIS governance practices. Others include the use of neutral conveners as a transparent governance structure [10] and the use of a governing council [2].

It is evident from the existing literature that Work Improvement Teams, Quality Improvement Teams, Community Information Champions, Community Health Committees, eHealth Technical Working Group, Community Health Digital Teams and Community Stakeholders form the practices associated with the different community-level HIS governance structural mechanisms. However, none of the existing studies comprehensively examined these practices in the context of Community-Based Health Information Systems governance. In light of this gap, a pre-study was conducted between January 2024 and March 2024, with the objective of contextualising, testing and refining the design methods and instruments. Table 1 presents practices associated with the community-level HIS governance structural mechanism, as gathered from the literature and the pre-study. The table also presents the sources of these practices.

**Table 1: CBHIS Governance Practices (measurement items) and their sources**

| S.No. | CBHIS Governance Practice | Source |
|---|---|---|
| 1 | Community Health Committees (CHCs) | [32] |
| 2 | eHealth Technical Working Group (TWGs) | [6], [33] |
| 3 | Work/Quality Improvement Teams (WITs) | [24],[30] |
| 4 | eHealth, Technology Support and Information Office | [36], [35], [33] |
| 5 | Community Health Data Review Boards | This study's pre-study. Conducted between January 2024 and March 2024 |
| 6 | Community Health Digital Team | [33] |

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| | | |
|---|---|---|
| 7 | Community information champions | [23], [31], [25] |
| 8 | Community Stakeholders Team | [33], [34], [4] |

### 2.3 Outcomes of Health Information Systems

HIS integration and use have several healthcare benefits. To begin with, CBHIS improves community healthcare coordination. Studies such as [23] opined that improvement in care coordination is one of the HIS benefits. The utilisation of CBHIS facilitates care coordination and management in healthcare cases like Tuberculosis (TB), facilitates ease of tracing drug defaulters such as Comprehensive Care Centre (CCC) patients, provides information on antenatal care (ANC), and provides immunisation coverage data of under-fives [4]. In tandem with these sentiments, [37] observed that the integration of Health IT systems strengthens coordination among all levels of healthcare. Implementation of eCHIS can be observed, for example, in Northwest Ethiopia, where women in the eCHIS intervention group had a higher chance of completing the maternal continuum of care than women in the comparator group [33].

Similarly, CBHISs improve community health data and information quality and make it available. [33] argued that the use of digital devices such as tablets for data processing reduced the number of errors as CHWs conduct their house-to-house registration, thus improving health data quality. The study further reiterated that eCHIS enhanced the quality of community health data. Similarly, [38] reiterated that by introducing HIT in healthcare organisations, the quality of health data and healthcare service delivery improved.

In addition, CBHISs reduce community health operational costs. In support of this argument, [38] pointed out that HITs reduced operational costs and presented an opportunity for further cost savings. Similarly, [36] opined that the use of health IT in beta and alpha healthcare organisations resulted in reduced healthcare organisation costs. However, the reduced costs are more often on the operational expenditure (OPEX) since the capital expenditure CAPEX is usually high [39].

Another outcome of CBHIS implementation and use is an increased efficiency and effectiveness in delivering community health services. Existing studies [38], [40] highlighted that HIT integrations bring benefits such as increased efficiency, improved safety, and patient satisfaction. Similarly, [4], [34] argued that through the utilisation of community health IT interventions, improvements in indicators such as an increase in hospital deliveries, advances in immunisation coverage, efficient distribution of drugs (pain killers, dewormers, multi-vitamins), and distribution of treated bed-nets are some of the reported cases.

Furthermore, the use of CBHISs results in an improvement in community engagement in health. [4] argued that CBHIS provides an avenue where community members engage and deliberate on issues affecting them. According to studies such as [38], [41], [14], [23] health outcomes resulting from HIT initiatives include increased community engagement in health. On the same breadth, a study by [33] on eCHIS implementation in northwest Ethiopia found that eCHIS promotes community engagement in health. Hailemariam et al. [33] observed that through eCHIS, Health Extension Workers (HEWs) promote health information by linking women to health centres and accessing health services.

Moreover, CBHIS promotes accountability and performance management. In support of this finding, [4] opined that Community-Based Information Systems (CBIS) provide information that helps to hold service providers accountable. On the same breadth, a study by [42] pointed out that the Nutritional Information System (NIS) implemented in community health units facilitated accountability. Similarly, [23] opined that HISs help in ensuring accountability in service delivery. According to studies such as [38], [41], [14], [23], HIS initiatives promote accountability. It is evident from the above arguments that several health outcomes result from HIS integrations as indicated in Table 2.

**Table 2: HIS Outcomes (measurement items) and their sources**

| S.No. | Indicator | Source |
|---|---|---|
| 1 | Improved community healthcare coordination | [23], [4], [37], [33] |
| 2 | Improved community health data and information quality and availability. | [33], [38] |
| 3 | Reduced community health operational costs | [38], [36] |
| 4 | Increase in efficiency and effectiveness in delivering community health services | [38], [4], [40], [34] |

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| | | |
|---|---|---|
| 5 | Improvement in community health engagement in health | [4], [38], [41], [14], [23], [33] |
| 6 | Improved accountability and performance management | [4], [42], [23] |

### 2.4 Interrelationships between Health Information System Governance, Alignment and Health Outcomes

A mix of practices associated with IT governance mechanisms is necessary for alignment between business and IT to occur [43]. In the healthcare context, studies such as [36], [44], [38], [35] examined the link between health IT governance and health–IT alignment. Practices associated with the HIS governance mechanisms (structures, processes and relational mechanisms) determine the level of alignment between health and IT. According to [36], the HIS governance structural dimension is apparent in trying to attain IT alignment. In support of this proposition, [45] argued that the involvement of executive teams in IT Governance positively affects alignment. In light of these arguments, this study argues that practices associated with the CBHIS governance structural mechanism form part of the governance practices necessary for the alignment to occur.

Similarly, HIS governance through its mechanisms and associated practices determines the achievement of healthcare goals and objectives [13], [46], [14], [47], [12]. Alignment between health and HIS plays a crucial role in this linkage. [26] argued that alignment is necessary for improved organisational performance. A similar argument can be seen in the healthcare sector, where studies such as [41] have examined the linkage between health-IT alignment and health outcomes. The higher the level of alignment between health and IT, the more benefits it brings to the health sector. Therefore, appropriate governance practices are required to enable alignment to take place. It is evident from the literature that HIS governance practices are necessary for alignment and consequently the realisation of health outcomes. Although the CBHIS governance practices necessary for improving health outcomes are categorised into three governance mechanisms, the focus of this study was the CBHIS governance structural mechanism. The study hypothesised that the CBHIS governance structural mechanism (exogenous construct) is essential for improving community health outcomes (endogenous construct) (Link a), as depicted in the conceptual model in Figure 1. The IT governance theory and the Strategic Alignment Model (SAM) were jointly applied, given that neither framework alone could adequately address the research problem.

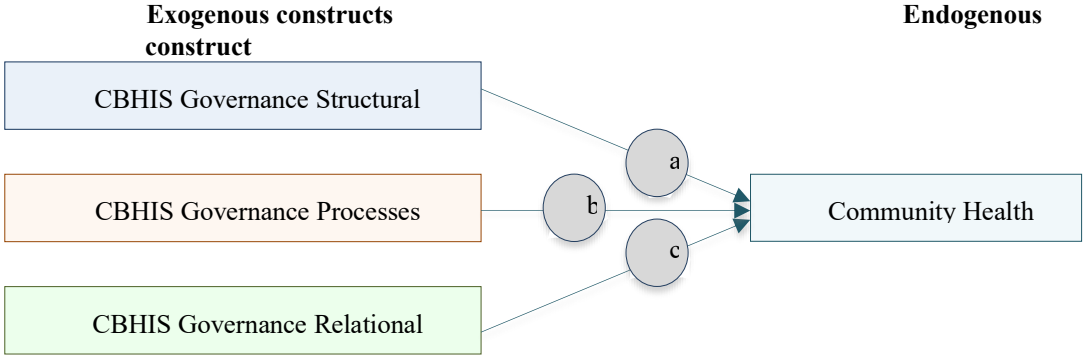


**Figure 1: Conceptual model**

## 3 Research Methodology

### 3.1 Pre-study

Before this study's actual data collection, a pre-study was conducted in Kibra Sub-County in Nairobi County between January and March of 2024. The objective of the pre-study was to refine the questionnaire and identify the research ambiguities. A total of 28 respondents, which included the County Community Health Focal Person (CCHFP), County Health Records & Information Officers (CHRIOs), County Health

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IT officers, the Sub-County Community Health Focal Person (S-CCHFP), Sub-County Health Records & Information Officers (S-CHRIOs) and Community Health Assistants (CHAs), participated in the pre-study exercise.

### 3.2 Data Collection

Guided by a pragmatic worldview, this study employed a mixed-method research approach which utilised a convergent parallel research design. Kisumu City County and Makueni County were purposefully chosen from a total of 47 counties due to their experience in CBHIS implementation and use. The study population consisted of 321 officers drawn from different strata using the CBHISs. The study adopted Yamane's formula of 1967, with a 95% confidence interval and +/- 5% margin of error applied, giving a sample size of 179 respondents. Both probability and non-probability sampling were utilised to pick respondents from the different strata. The distribution of the research population, sampling techniques utilised, and sample sizes are presented in Table 3.

The study utilised a semi-structured questionnaire having the following structured sections. The first section introduced the study, its aim and objectives. The second section comprised consent to take part in the research. Section 3 covered the respondent's general information. Section four consisted of practices associated with the CBHIS governance structural mechanism. This section carried both closed-ended and open-ended questions. The closed-ended questions were presented on a Likert scale of 1 to 5, where 1 represented 'strongly disagree' and 5 represented 'strongly agree'. The open-ended sections presented an opportunity for the respondents to provide additional important information related to the study. Section five covered Community Health Outcomes, where respondents answered six questions presented on a Likert scale of 1 to 5, where 1 represented 'strongly disagree' and 5 represented 'strongly agree'. This section also carried an open-ended section, which allowed respondents an opportunity to provide any additional information about community health outcomes.

Before the data collection exercise, the researchers sought and were issued a research license from NACOSTI (Ref No: 929552). In addition, the researchers also sought clearances from the study sites and were issued with authorisation to conduct research from the two study sites. Ten research assistants (one drawn from each sub-county) were trained and issued with the printed data collection instruments. Data was collected between March and May 2024. Of the 179 administered semi-structured questionnaires, 164 were filled out and returned, representing a response rate of 91.6%.

**Table 3: The distribution of the research population, sampling techniques and sample sizes**

| County | Stratum | Population | Sampling | 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 | 1 | Purposive | 1 |
| | Sub-County Health Records & Information Officers | 7 | Purposive | 7 |
| | County Community Health Focal Person | 1 | Purposive | 1 |
| | Sub-County Community Health Focal Persons | 7 | Purposive | 7 |
| | Community Health Assistants/Officers (CHAs/CHOs) | 198 | Random Sampling | 101 |
| | IT Officers | 7 | Purposive | 7 |
| **Makueni 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 | 3 | Purposive | 1 |
| | IT Directors | 1 | Purposive | 1 |
| | County Health Records & Information Officers | 1 | Purposive | 1 |
| | Sub-County Health Records & Information Officers | 6 | Purposive | 3 |
| | County Community Health Focal Person | 1 | Purposive | 1 |
| | Sub-County Community Health Focal Persons | 6 | Purposive | 3 |

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| | | | | |
|---|---|---|---|---|
| | Health IT officers | 8 | Purposive sampling | 4 |
| | Community Health Assistants/Officers (CHAs/CHOs) | 60 | Random sampling | 30 |
| | **Total** | **321** | | **179** |

### 3.3 Data Analysis

To enable analysis, indicators measuring the CBHIS governance structural mechanism were renamed 'SM1' to 'SM8', while those measuring the community health outcomes were renamed 'CHO1' to 'CHO6'. Coding was done in MS Excel in MS Office Professional Plus 2016. The data was then uploaded to SMART-PLS V 4.1.0.6 for the model construction and assessment. This study employed Partial Least Squares (PLS) Structural Equation Modelling (SEM) to analyse and validate the practices associated with the CBHIS governance structural mechanism and the indicators that measure the community health outcomes. PLS-SEM is appropriate when the goal is to predict variables rather than theory confirmation, which utilises CB-SEM [48]. In addition, the structural equation modelling technique helps to examine the interrelationships between the research constructs. Although research data was collected from 164 respondents drawn from Kisumu and Makueni counties, a bootstrapping technique with 5,000 resamples was used to estimate the significance of the indicator weights. The researchers determined that the instrument was conceptually coherent and that construct validity was sufficient to proceed to the structural tests of the model. In this study, the CBHIS governance structural mechanism was modelled as the formative and the community health outcomes as the reflective model.

Besides the quantitative data collected and analysed, this research also collected qualitative data using open-ended questions. It allowed respondents to express other issues related to the study, but not captured in the quantitative section. It also allowed the respondents to expound on issues they deemed important and necessary for the research, yet not captured. As a result, qualitative data for the CBHIS governance structural mechanism and Community Health Outcomes were captured.

## 4 Research Findings

### 4.1 Identification and Validation of Construct Indicators

The study assessed the reliability and validity of the indicators and constructs following prior studies, as advocated by researchers [49]. To begin with, the loadings of the indicators were examined for their respective latent variable. The higher loadings imply the existence of more shared variance between the construct and its associated item/indicator than error variance. A total of five indicators (SM2, SM4, SM5, CHO1 and CHO5) had their indicator loadings below the threshold of 0.7000. However, these were retained as their low loading (less than 0.7) did not affect the convergent validities, since they were both above 0.5000 (AVE>0.5000). As shown in Table 4, all items loaded heavily and significantly (at $P<0.05$) on their respective constructs. In addition, the t-statistics for the respective indicator weights of both formative and reflective constructs were also positive and significant. The results were indicative of individual item reliability as seen in Table 4.

The researchers assessed the reliability of the scales used by applying Cronbach's alpha and composite reliability (rho_c). Cronbach's alpha is always considered the lower bound, while the composite reliability is considered the upper bound. As suggested by [48], the reliability of constructs falls between Cronbach's alpha and composite reliabilities. As indicated in Table 4, the Cronbach alpha and composite reliability scores for the two constructs were excellent, as they exceeded the minimum threshold level of 0.70 [48], thus indicating the reliability of the indicators used in this study. In addition, the convergent validities for the two constructs were above the minimum threshold of 0.5000 (AVE>0.5000) as shown in Table 4.

Furthermore, the study assessed the discriminant validity of the research constructs using three techniques, namely the Fornell-Lacker Criterion, HTMT and cross-loadings. Research findings demonstrated that the research constructs met the discriminant validity under the Fornell-Lacker Criterion as the construct's correlations were higher than the correlations underneath. Similarly, the use of the Heterotrait-Monotrait Ratio (HTMT) by [50] revealed that the research constructs met the discriminant validity based on the HTMT assessment technique, as its value was less than 0.85, which was within the

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acceptable threshold. Further, although the two techniques (Fornell-Lacker Criterion and HTMT) revealed the non-existence of discriminant validity issues, the researchers examined the cross-loadings table, which confirmed the non-existence of indicators loading significantly to other constructs.

**Table 4: A summary table of indicator loadings, construct's reliability and convergent validity**

| Construct | Indica-tor | Indica tor loading | T statistic | P values | Cronba ch's alpha | Compos ite Reliabilit y | Average Variance Extracted (AVE) |
|---|---|---|---|---|---|---|---|
| **CBHIS Structural Governan ce Mechanis m** | SM1 | 0.720 | 11.738 | 0.000 | 0.891 | 0.913 | 0.571 |
| | SM2 | 0.629 | 12.609 | 0.000 | | | |
| | SM3 | 0.900 | 35.385 | 0.000 | | | |
| | SM4 | 0.645 | 7.87 | 0.000 | | | |
| | SM5 | 0.697 | 13.406 | 0.000 | | | |
| | SM6 | 0.839 | 18.941 | 0.000 | | | |
| | SM7 | 0.774 | 16.517 | 0.000 | | | |
| | SM8 | 0.800 | 15.356 | 0.000 | | | |
| **Communi ty Health Outcomes** | CHO1 | 0.652 | 9.285 | 0.000 | 0.829 | 0.876 | 0.541 |
| | CHO2 | 0.712 | 8.562 | 0.000 | | | |
| | CHO3 | 0.762 | 15.013 | 0.000 | | | |
| | CHO4 | 0.787 | 11.791 | 0.000 | | | |
| | CHO5 | 0.678 | 10.353 | 0.000 | | | |
| | CHO6 | 0.811 | 16.836 | 0.000 | | | |

*SM1 = Community Health Committees; SM2 = eHealth Technical Working Group; SM3 = Work/Quality Improvement Teams (WITs); SM4 = Community Health Digital Team; SM5 = Community Health Data Review Boards; SM6 = Community Stakeholders Team; SM7 = Community information champions/leadership; SM8 = eHealth and information support office; 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.*

The above analyses revealed that all the construct indicators and the constructs themselves met the reliability and validity threshold. Therefore, establishing and validating the practices associated with the CBHIS governance structural mechanism. These practices included the Community Health Committees (CHCs), eHealth Technical Working Groups (TWGs), Quality/Work Improvement Teams (WITs), Community Health Data Review Boards, Community Stakeholders Teams, Community Health Digital Teams, Community Health Information Leadership, and an eHealth and information support office. On the other hand, the community health outcomes resulting from the use of CBHISs were improvement in community healthcare coordination, community health data and information quality and availability, reduction in community health operational costs, efficiency and effectiveness in delivering community health services, improvement in community engagement in health and CBHIS, which promotes accountability and performance management.

### 4.2 Results of testing the structural model

Testing the structural (inner) model was a multi-stage process. To begin with, multicollinearity for the inner model was assessed. The collinearity statistics result for the inner model was 1 (SM -> CHO = 1). This value was less than the threshold of 5, i.e. VIF<5, indicating the nonexistence of collinearity issues.

After establishing the multicollinearity of the inner model, research findings revealed that the beta coefficient (β) for the original sample (O) was 0.507, while that of the sample mean (M) was 0.521 (mean of 5,000 bootstrap samples). This indicated that for every one-unit increase in the CBHIS governance

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structural mechanism, the community health outcomes positively increased by 0.521 units, with the assumption that all other factors were held constant. In addition, the linkage between the CBHIS governance structural mechanism and community health outcomes had a T statistic (t) of 7.159***. The t-statistic showed that the beta coefficient was significantly different from zero, thus greater confidence in the beta coefficient and not due to random chance or random variation. In addition, the positive relationship was highly significant at a P-value (p) of 0.000. A p-value of 0.000 (or < 0.001) indicated a very low probability that the observed beta coefficient was due to random chance, meaning that the beta coefficient was statistically significant. These results suggested a positive and significant relationship between the CBHIS structural mechanism and community health outcomes. Table 5 presents the Path Coefficients for the original sample and the sample mean, Standard deviation (STDEV), T-statistics, and the p-values.

**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 |
|---|---|---|---|---|---|
| **SM -> CHO** | 0.507 | 0.521 | 0.071 | 7.159 | 0.000 |

Besides establishing the relationship between the CBHIS governance structural mechanism and the community health outcomes using the beta coefficients, T statistics and P values, this study further utilised the coefficient of determination (R2) [51] and the predictive relevance (Q2) [52] to assess the predictability of the structural model. To begin with, the coefficient of determination (R2) measures the proportion of variance shown in the endogenous variable as a result of the impact of the exogenous variables. It measured the model's explanatory power [53]. The study findings showed that the variance of the endogenous variable (community health outcomes) was 0.257. This value meant that the CBHIS governance structural mechanism was 25.7% of the variance in community health outcomes. Furthermore, the study utilised predictive relevance (Q2) to establish the predictive relevance of the endogenous construct in the study. Study results revealed that the predictive relevance of the exogenous construct on the endogenous construct was 0.224 or 22.4%. This value was above 0; hence, the study concluded that the model had an overall predictive relevance. Table 6 presents a summary of the coefficient of determination (R2), adjusted R2 and predictive relevance (Q2).

**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 $R^2$ | $Q^2$ |
|---|---|---|---|---|---|---|---|
| **SM** | **CHO** | 0.521 | 7.159*** | 0.000 | 25.7% | 25.2% | 22.4% |

## 4.3 Qualitative data analysis

Besides the quantitative data, qualitative data were collected and analysed using ATLAS.ti software. These are presented in the following section.

### *4.3.1 Practices associated with the CBHIS Governance Structural Mechanism*

Qualitative data analysis revealed the practices associated with the CBHIS governance structural mechanism. Table 7 presents the governance practices and the frequencies at which they occurred in the qualitative data collected and analysed.

**Table 7: Practices associated with the CBHIS governance structural mechanism**

| S.No. | CBHIS Governance Practices associated with the Structural Mechanism | Frequency |
|---|---|---|
| 1 | Community Health Committees (CHC) | 13 |
| 2 | Data Quality Assurance Team | 2 |
| 3 | ICT support office | 2 |
| 4 | Technology support officers | 2 |

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| | | |
|---|---|---|
| 5 | Work improvement teams | 2 |
| 6 | Data Analysts Team | 2 |
| 7 | Quality improvement teams | 2 |
| 8 | Data Review Committee | 1 |
| 9 | Data stakeholders' Office | 1 |
| 10 | Ward-based coordinators champions | 1 |
| 11 | Ward-level Data Review Committee | 1 |
| 12 | Village Data Review Committee | 1 |

Analysis of qualitative data revealed that the data quality assurance team and data analyst team formed the additional governance practices associated with the CBHIS governance structural mechanism. Although qualitative data revealed that the Data Quality Assurance Team and the Data Analyst Team formed the additional practices associated with the CBHIS governance structural mechanism, this study argues that their responsibilities fall broadly within the roles of Quality Improvement Teams and Community Health Digital Teams.

#### *4.3.2 Community Health Outcomes*

Qualitative data analysis revealed several indicators explaining community health outcomes. Table 8 summarises the community health outcomes indicators. In addition, the table presents the frequencies at which they occurred in the qualitative data collected and analysed.

**Table 8: Indicators of community health outcomes**

| S.No. | Community Health Outcomes Indicators | Frequency |
|---|---|---|
| 1 | Improved quality of information | 10 |
| 2 | Timely decision making | 9 |
| 3 | Accountability | 7 |
| 4 | Improved commodity management and supply | 5 |

Analysis of qualitative data revealed the existence of a subtle difference between the qualitatively collected indicators measuring community health outcomes and those covered under the quantitative section.

## 5 Discussion

### 5.1 Practices associated with the CBHIS governance structural mechanism

This study established and validated the following eight practices associated with the CBHIS governance structural mechanism. These were the Community Health Committees (CHCs), eHealth Technical Working Groups (TWGs), Quality/Work Improvement Teams (WITs), Community Health Data Review Boards, Community Stakeholders Teams, Community Health Digital Teams, Community Health Information Leadership and eHealth and Information Support Office. All eight practices associated with the CBHIS governance structural mechanism loaded heavily and significantly on their construct. In addition, the t-statistics for the respective indicator weights were also positive and significant. The following section presents the practices that were associated with the CBHIS governance structural mechanism.

The first is the Community Health Committee (CHC), which served as a community health governance structure composed of 11 to 13 members. These included a Community Health Promoter (CHP), a link facility representative, a Community Health Assistant (CHA), and representatives from groups such as women's groups, the faith community, youth, and people with disabilities. The committee was responsible for various activities, including advocating for community health resources and identifying an annual list of activities. This finding aligns with the roles of CHCs as outlined in the Community Health Strategy 2014–2019 [54], which emphasises their leadership and oversight functions.

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The second governance practice identified was the eHealth Technical Working Group (TWG), which functioned as a collaborative and specialised body within the Community-Based Health Information System (CBHIS) governance framework. The group was responsible for addressing key technical aspects of CBHISs, including system development, implementation, interoperability, standards and protocols, data security and privacy, infrastructure and architecture, integration with broader healthcare systems, as well as providing technical support and consultation. This finding aligns with [6], which emphasised the role of eHealth TWGs in overseeing community health IT operations and facilitating informed decision-making. Similarly, a study by [33] on the implementation of electronic Community Health Information Systems (eCHIS) in northwest Ethiopia found that eCHIS technical working groups were instrumental in discussing and monitoring the progress of eCHIS initiatives.

The third governance practice was the Work/Quality Improvement Team (WIT), which served as a key component of CBHIS governance. The team was responsible for identifying, analysing, implementing, and refining improvements in the processes and workflows of Community Health IT systems. Supporting this finding, previous studies, for example, [24], noted that WITs played a significant role in enhancing the quality of healthcare delivered within both health facilities and surrounding communities. Similarly, [30] found that Quality Improvement Teams (QITs) contributed to improved performance among Community Health Workers (CHWs) and increased utilisation of maternal and child health (MCH) services, thereby strengthening overall community health outcomes.

The fourth governance practice was the Community Health Digital Team (CHDT), a specialised group focused on implementing community Health Information Technology (HIT) solutions and applications, synchronising databases, and aligning workflows to harness digital technologies for improved community health outcomes. This finding aligns with the study by [33], which highlighted the critical role of the eCHIS implementation technical team in supporting the deployment of electronic Community Health Information Systems (eCHIS). While Hailemariam et al. [33] referred to the group as the eCHIS implementation technical team, their responsibilities—encompassing system development, technical support, and implementation—closely mirrored those of the CHDT.

The fifth finding further revealed that the Community Health Data Review Boards (CHDRBs) constituted another key CBHIS governance practice. These boards were responsible for overseeing data collection and utilisation, validating data quality, conducting data analysis, and generating reports to inform decision-making at the community level.

The sixth observed CBHIS governance practice was the Community Health Stakeholders Team, comprising religious leaders, community opinion leaders, Community Health Committees (CHCs), development partners, and administrative representatives such as chiefs and assistant chiefs. This team was responsible for several key functions, including identifying community health needs, prioritising health issues, and advocating for resources. This finding aligns with previous studies, such as [34], [55], which emphasised the importance of political goodwill and support from local government leadership, opinion leaders, faith-based organisations, non-governmental organisations, health facilities, and local administrators in strengthening Community Health Worker (CHW) programs. Similarly, [33] highlighted that the successful implementation of electronic Community Health Information Systems (eCHIS) required the engagement of Kebele leaders, volunteers, women's development armies, and both community and religious leaders.

The seventh identified CBHIS governance practice was the use of Community Digital Health Information Champions or Leaders. These individuals or groups are responsible for promoting access to health information, enhancing digital literacy, and advocating for the use of technology to improve community health and well-being. Supporting this finding, previous studies such as [23] highlighted that community information champions play a critical role in ensuring that community-level data are integrated into high-level planning and decision-making processes.

The final CBHIS governance practice identified was the establishment of an eHealth and Information Support Office. This office provided technical assistance, troubleshooting, and ongoing support to Health Information Technology (HIT) end-users who relied on a range of digital tools and systems. Additionally, it served as a central hub for health information, offering stakeholders access to relevant and up-to-date CBHIS data. This finding is supported by [33], who noted that the presence of a help desk—whether through the Woreda office or the University of Gondar (UoG) support team—significantly facilitated the implementation of eCHIS in Northwest Ethiopia. Similarly, [8] emphasised the importance of localised IT support to address challenges such as equipment malfunction and system failures.

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### 5.2 Interrelationships between CBHIS Governance, alignment and the community health outcomes

Whereas digital health governance determines the realisation of health outcomes, it also dictates the realisation of health-IT alignment. These practices (CBHIS governance structural mechanism) form part of the CBHIS governance practices necessary for community health-CBHIS alignment to occur. In support of this proposition, prior studies such as [36], [38] argued that the HIT governance structural dimension is apparent in attaining IT alignment. Similarly, research by [45] argued that the involvement of governance practices such as executive teams in ITG, positively affects alignment. Therefore, this study concluded that the practices associated with the CBHIS governance structural mechanism form part of the governance practices necessary for community health-CBHIS alignment to occur.

Furthermore, whereas the practices associated with the CBHIS governance structural mechanism form part of the practices necessary for alignment to occur, they also improve community health outcomes. The study findings revealed that the CBHIS governance structural mechanism had a positive and significant relationship with community health outcomes. In addition, the CBHIS structural mechanism explained 0.257 or 25.7% of the variation ($R^2$) in community health outcomes. Similarly, the study findings revealed that the exogenous variable had a predictive relevance (Q2) of 22.4%, thus concluding that the model has predictive relevance.

These study findings are generally in tandem with prior studies such as [13], [14], [56], which suggested that appropriate HIT governance leads to performance and value derivation from HIT integrations. Although there was a scarcity of literature examining community-level HIS governance mechanisms and their effect on community health outcomes, the existing few had established a positive relationship. In particular, a study by [24] examined community work improvement teams in the Kasarani sub-county in Kenya and concluded that WITs propel the performance of community health units and, in particular, improve community-level health service quality. A separate study by [30] examined Benin's Quality Improvement Teams (QITs) and argued that the use of QITs in Benin increased the performance of CHWs and the utilisation of maternal and child health (MCH) services in the municipality of Savè. Furthermore, a study by [6] on East African community digital health and interoperability assessments opined that the eHealth Technical Working Group was responsible for community health IT operations and decision-making to improve community health. Similarly, a study by [33], on eCHIS implementation in Northwest Ethiopia, postulated that eCHIS technical working groups discuss and monitor eCHIS progress and hence improvement in community health.

There was a scarcity of literature that exhaustively examined how the practices associated with community-based HIS affect health outcomes. The few existing studies, such as [24], [33], [30] are supported by the study's findings in the following fronts: from a directional perspective, the nature of the relationships and how they affect health outcomes. Thus, filling the knowledge gap that existed in the literature by identifying the context-specific practices associated with the CBHIS structural mechanism and examining how they relate to community health outcomes.

### 5.3 Study limitations, implications and suggestions for future research

This study utilised data collected from two (2) counties out of forty-seven (47) counties in Kenya. Although this was resolved using the bootstrapping technique, future research may consider expanding the sample size. The following are the implications of this study: it has established context-specific practices associated with the CBHIS governance structural mechanism that may guide health informatics practitioners. Similarly, the result of this study has policy implications as it may inform the development of CBHIS governance policy. In addition, the study contributes to knowledge by filling the gap on the 'how' and the 'nature' of the relationships between the CBHIS governance structural mechanism and community health outcomes. Future studies should be done to examine the practices associated with the other CBHIS governance mechanisms (processes and relational mechanisms) to holistically and comprehensively examine how the CBHIS governance affects community health outcomes. Moreover, such studies can examine how a mix of mature CBHIS governance practices affects both alignment and variance in community health outcomes.

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# 6 Conclusion

This study aimed to establish and validate the practices associated with the CBHIS governance structural mechanism, and consequently, examine how these practices relate to the community health-CBHIS alignment. In addition, the study sought to examine the interrelationships between the CBHIS governance structural mechanism and community health outcomes. The study used survey data gathered from 164 community health officers drawn from two counties in Kenya to establish and validate the practices associated with the CBHIS governance structural mechanism. In addition, the researchers used the data to establish the coefficient of determination and also the predictive relevance.

In summary, the study finding suggests that the practices associated with the CBHIS governance structural mechanism form part of the governance practices necessary for the alignment to occur. In addition, the CBHIS governance structural mechanism has a positive and significant relationship, as well as positively affecting community health outcomes. These findings provide credence to [14] assertion of 'good digital health governance as a prerequisite for realising health system goals, objectives, and outcomes', paving the way to more effective governance of CBHIS to support and improve community health outcomes. This notion is consistent with the arguments of [17], [57], who concluded that effective IT governance is the single most important predictor of IT-generated value.

Further, the results of this study offer several contributions to the HIS literature. This study offers context-specific practices associated with the CBHIS governance structural mechanism. In addition, the findings underscore the importance of practices associated with the CBHIS governance structural mechanism in attaining community health-CBHIS alignment. Furthermore, the contribution of this study is that it establishes the nature of the relationships between the constructs and how they affect each other, demonstrating the importance of CBHIS governance. This contributes to the sparse HIS governance literature and how it translates to health performance and value derivation. Future studies may examine the other CBHIS governance mechanisms (processes and relational mechanisms) and their contribution to improving community health outcomes.

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## Statement of conflict of interest

The authors declare the nonexistence of any conflict of interest.

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## Ethical approval and research license

This study did not require ethical approval since it was not dealing with human data. A research license was issued by NACOSTI (Ref No: 929552). In addition, authority to conduct research was issued by the two counties that participated in this research.

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