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Determinants and Outcomes of Non-Communicable Diseases Screening and Linkage to Care among Community Health Volunteers in Nyeri County, Kenya

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Abstract

Purpose: Non-communicable diseases (NCDs), especially hypertension, diabetes mellitus and cancers, are a growing public health concern in Kenya, contributing significantly to morbidity and premature mortality. In response, Kenya has strengthened community-based health strategies, with Community Health Volunteers (CHVs) now known as Community Health Promoters (CHPs) playing a key role in early detection, health promotion, and linkage to care. The study aims to explore determinants and outcomes of NCD screening and linkage to care among CHVs in Nyeri County.

Methodology: A quasi-experimental study was conducted that utilized a mixed-method approach among CHVs in intervention and control groups across 10 community units in Nyeri County. Data on CHV sociodemographic characteristics, training, supervision, incentives, availability of screening tools, and community engagement were collected. NCDs outcomes included screening coverage, identification of hypertension and diabetes, and linkage to care. Logistic regression was used to identify determinants of CHV effectiveness.

Findings: Enhanced training, regular supervision, and access to screening tools were significantly associated with higher screening rates (AOR = 2.8, 95% CI: 1.9–4.1). CHVs in the intervention group screened 78% of eligible community members, compared with 52% in the control group ($p < 0.001$). Linkage to care was significantly higher in the intervention group (65% vs. 38%; $p<0.01$), and was positively influenced by follow-up mechanisms and community awareness. Notably, CHV experience (>2 years) and the presence of supportive community structures also predicted better performance.

Unique Contribution to Theory, Practice and Policy: Enhanced CHV programs significantly improve NCD screening and linkage outcomes. Strengthening CHV training, supervision, resource provision, and community engagement is vital for sustainable NCD control in Kenya and similar low-resource settings.

Keywords: *Non-communicable Diseases, Community Health Volunteers, Screening, Linkage to Care, Determinants, Kenya*

JEL Codes: *I10, I11, I12, I15, I18, O15, O55, D91*

INTRODUCTION

Non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, and cancers, account for over 70% of global deaths, disproportionately affecting populations in low- and middle-income countries. Nearly three-quarters of NCD-related deaths occur in these settings, where health systems often face resource constraints and limited capacity for early diagnosis and long-term management (World Health Organization [WHO], 2023).

In Kenya, NCDs contribute substantially to the national disease burden, with rising prevalence observed in both urban and rural populations due to rapid urbanization, changing dietary patterns, physical inactivity, and increased life expectancy (MoH- Kenya, 2020). The dual burden of communicable and non-communicable diseases further strains the healthcare system, necessitating integrated and community-centred approaches to care.

Primary healthcare systems play a critical role in addressing NCDs through early detection, prevention, and timely linkage to care. Community Health Volunteers (CHVs), as part of Kenya's community health strategy under the Ministry of Health, Kenya, are strategically positioned to bridge the gap between households and formal health services. They facilitate household-level screening, health education, referral, and follow-up, particularly in underserved communities (Ochieng *et al*., 2018).

In Nyeri County, CHVs have been actively deployed to support NCD screening initiatives; however, their effectiveness is influenced by a range of factors, including level of training, availability of screening tools, supervision, motivation, and community trust (Abuya *et al*., 2021; Mugambi *et al*., 2023).

Evidence suggests that while structured training and supportive supervision can significantly enhance CHV capacity and performance, challenges such as inadequate resources, high workload, and limited incentives persist (Riang'a *et al*., 2024). This study, therefore, evaluates the determinants influencing CHV performance and examines the outcomes of NCD screening and linkage to care, to inform strategies to strengthen community-based NCD interventions.

Problem Statement

Non-communicable diseases (NCDs) are a leading cause of morbidity and mortality in Kenya, with an increasing burden driven by demographic and lifestyle changes. Despite the adoption of community-based strategies to enhance early detection and linkage to care, gaps remain in the effectiveness of these interventions at the primary healthcare level.

Community Health Volunteers (CHVs) play a central role in bridging communities and health facilities; however, their performance in NCD programs is inconsistent and influenced by factors such as inadequate training, limited resources, and low motivation (World Health Organization [WHO], 2023; Ministry of Health, Kenya, 2020).

In Nyeri County, although CHVs are actively involved in NCD screening and referral, there is limited evidence on the determinants influencing their performance and the extent to which their efforts translate into improved linkage to care (Ochieng et al., 2018; Abuya et al., 2021). This gap in knowledge limits the ability to optimize community-based NCD interventions. Therefore, this study sought to assess the factors affecting CHV performance and evaluate the outcomes of NCD screening and linkage to care in order to inform strategies for strengthening primary healthcare systems (Mugambi *et al.,* 2023; Riang'a *et al.,* 2024).

Although non-communicable diseases (NCDs) are a growing public health challenge throughout Kenya, Nyeri County represents a particularly important setting for piloting

community-based NCD screening and linkage interventions. The county is undergoing a significant demographic and epidemiological transition characterized by an ageing population and an increasing burden of chronic diseases. According to the 2019 Kenya Population and Housing Census, Nyeri has one of the highest proportions of older persons in Kenya, with an old-age dependency ratio of 12.8%, nearly twice the national average of 6.9%, and the highest life expectancy in the country. These demographic characteristics place a substantial proportion of the population at increased risk of NCDs such as hypertension, diabetes, cardiovascular diseases, and cancer.

Evidence further indicates that Nyeri bears a disproportionately high burden of NCDs compared to many other counties. Studies conducted at Nyeri County Referral Hospital report that over 50% of hospital admissions and more than 55% of hospital deaths are attributable to NCDs. Furthermore, Nyeri has been reported to have one of the highest prevalences of diabetes mellitus in Kenya, with estimates ranging from 6.4% to 12.6%, considerably higher than national estimates. Hypertension prevalence has also been reported at approximately 23%, with recent surveys indicating persistently high levels of both hypertension and diabetes across the county.

Despite a relatively well-established health infrastructure, challenges remain in early detection, community-level screening, referral completion, and long-term management of chronic conditions. Consequently, Nyeri County provides an ideal environment for evaluating the effectiveness of Community Health Volunteers (CHVs) in strengthening NCD screening, referral pathways, and linkage to care. The lessons generated from this pilot are likely to be relevant to other Kenyan counties experiencing similar demographic ageing and increasing NCD burdens.

Theoretical Framework

This study was guided by the Andersen Behavioural Model of Health Services Use, a widely applied framework for understanding factors that influence health service utilization. The model posits that an individual's use of health services is determined by the interaction of **predisposing factors**, **enabling factors**, and **need factors**, all of which operate within the broader health system context.

Predisposing factors refer to individual and community characteristics that influence the likelihood of using health services before the onset of illness. These include demographic variables such as age and education, as well as knowledge, attitudes, and health beliefs. In the context of this study, predisposing factors are reflected in community awareness of non-communicable diseases (NCDs), trust in Community Health Volunteers (CHVs), and health-seeking behaviours that influence willingness to participate in screening activities.

Enabling factors represent the logistical and system-level conditions that facilitate or hinder access to health services. These include the availability and accessibility of health facilities, affordability of services, health system resources, and the presence of trained health workers. In this study, enabling factors are operationalized through CHV-related system supports such as training, supportive supervision, availability of screening tools (blood pressure machines and glucometers), referral mechanisms, transport costs, waiting time at health facilities, and availability of essential medicines. These factors are particularly critical in explaining variations in both screening uptake and successful linkage to care.

Need factors refer to the perceived or evaluated health status that motivates individuals to seek care. In this study, need is represented by CHV-identified risk status for NCDs such as

hypertension and diabetes, as well as the clinical urgency generated through community-based screening activities. The identification of at-risk individuals by CHVs creates a demand for further diagnostic confirmation and continuity of care at health facilities.

The Andersen Model is particularly appropriate for this study because it provides a comprehensive explanation of both **service utilization (screening)** and **continuity of care (linkage to treatment)**. It also helps to interpret the observed disparity between high screening rates and relatively lower linkage to care by highlighting the influence of enabling health system barriers such as transport costs, long waiting times, and facility-level constraints.

By applying this framework, the study situates CHV performance within a broader health systems and behavioural context, demonstrating that improvements in NCD outcomes depend not only on individual-level factors but also on the strength of enabling health system structures. This theoretical grounding supports the evaluation of enhanced CHV interventions as a mechanism for improving equitable access to NCD services in resource-limited settings such as Nyeri County, Kenya.

METHODOLOGY

Study Design and Setting

This study used a quasi-experimental design with a mixed-methods approach to evaluate the effectiveness of an enhanced Community Health Volunteer (CHV) model in improving screening and linkage to care for non-communicable diseases (NCDs) in Nyeri County. The design involved intervention and control community units, enabling comparison of outcomes before and after implementation without random assignment.

Nyeri County has an established Community Health Strategy with approximately 2,510 CHVs linked to functional Community Health Units (CHUs) across all sub-counties. The sampling frame included all active and registered CHVs within selected intervention and control sub-counties. A total of 300 CHVs (150 intervention and 150 control) were selected using stratified random sampling to ensure representation across geographic areas and CHUs. This sample, representing about 12% of the county CHV workforce, was considered adequate to detect meaningful differences in NCD screening, referral, and linkage-to-care outcomes while minimizing selection bias and enhancing representativeness.

Community units were purposively assigned to intervention and control arms based on comparability in population size, geographic distribution, and baseline service indicators. The intervention group received an enhanced CHV package comprising structured NCD training, provision of screening tools (blood pressure monitors and glucometers), and strengthened supportive supervision. The control group continued routine implementation under the standard Community Health Strategy. Baseline and endline data were collected to assess changes in CHV performance, screening coverage, and linkage to care.

Quantitative data were obtained through structured questionnaires, CHV registers, and health facility records. Qualitative data were collected using key informant interviews and focus group discussions with CHVs, supervisors, and community members to explore contextual factors influencing implementation. Integration of quantitative and qualitative findings enabled triangulation, strengthening validity and providing both outcome measurement and contextual understanding of CHV-led NCD service delivery in Nyeri County.

Data Analysis

Descriptive statistics summarized CHV characteristics. Bivariate and multivariate logistic regression analyses identified determinants of screening and linkage outcomes. Statistical significance was set at $p<0.05$. Qualitative data were transcribed verbatim and analyzed thematically to complement quantitative findings. Ethical approval was obtained, and informed consent was secured from all participants.

RESULTS

Socio-demographic Characteristics of CHVs

The study included CHVs from both intervention and control community units, with the majority being female (68%), reflecting the gendered nature of community health service delivery. The mean age was 42 years (± SD), indicating a relatively mature and experienced workforce.

Most CHVs had attained at least secondary-level education, consistent with national community health guidelines, and a significant proportion had over 2 years of experience. This level of experience suggests familiarity with community engagement and health promotion activities, which may influence performance outcomes as shown in the table one below;

Table 1: Socio-demographic Characteristics of Community Health Volunteers (CHVs)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male		32%
	Female		68%
Age (Mean ± SD)		42 ±	—
Education Level	Primary		
	Secondary		Majority
Experience	<2 years		
	≥2 years		Majority

Determinants of NCD Screening

Several key determinants significantly influenced the effectiveness of CHVs in conducting NCD screening. CHVs who received enhanced training demonstrated higher competency in identifying at-risk individuals and conducting screenings compared to those in the control group. Training improved both technical knowledge and confidence in using screening tools.

Supportive supervision emerged as a critical factor, with CHVs receiving regular supervisory visits showing improved adherence to screening protocols and better reporting practices. The availability of functional screening tools, such as blood pressure machines and glucometers, was strongly associated with higher screening rates, highlighting the importance of resources in community-based interventions.

Motivational factors, including both financial and non-financial incentives, also played a significant role. CHVs who reported higher levels of motivation were more actively engaged in household visits and screening activities, suggesting that performance is closely linked to perceived recognition and support, as shown in Table 2 below.

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Table 2: Association between Program Factors and NCD Screening Performance among CHVs

Variable	Category	Screening (%)	p-value
Training	Enhanced	Higher	<0.05
	Standard	Lower	
Supervision	Regular	Higher	<0.05
	Irregular	Lower	
Tools	Available	Higher	<0.05
	Not available	Lower	
Incentives	Present	Higher	<0.05
	Absent	Lower	

Further, a logistic regression analysis was carried out and shows that CHVs with training were 2.5 times more likely to conduct screening, and the availability of tools had the strongest effect (AOR =3.2)

Table 3: Multivariate Logistic Regression Analysis for Determinants of NCD Screening

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Training	2.5	(1.5 – 4.2)	<0.001
Supervision	1.9	(1.2 – 3.1)	0.006
Tools	3.2	(1.8 – 5.6)	<0.001
Incentives	1.7	(1.1 – 2.8)	0.02

Determinants of Linkage to Care

Effective linkage to care was influenced by both system-level and community-level factors. The presence of structured referral systems, including standardised referral forms and clear communication channels between CHVs and health facilities, significantly improved referral completion rates.

Active follow-up mechanisms, such as home visits and phone call reminders, enhanced continuity of care and ensured that referred clients accessed health services. Additionally, community awareness and trust in CHVs were crucial in facilitating acceptance of referrals. Communities that demonstrated higher levels of trust were more likely to comply with screening outcomes and seek further care, as shown in Table 4 below;

Table 4: Multivariate Analysis of Factors Influencing Linkage to Care

Variable	AOR	95% CI	p-value
Referral System	2.8	(1.6 – 4.9)	<0.001
Follow-up Mechanism	2.3	(1.4 – 3.8)	0.002
Community Trust	1.9	(1.1 – 3.2)	0.01

Outcomes

The intervention demonstrated a statistically significant improvement in both screening and linkage to care outcomes. The screening rate in the intervention group was 78%, compared to 52% in the control group, indicating a substantial increase attributable to the enhanced CHV model. Similarly, linkage to care was higher in the intervention group (65%) compared to the control group (38%).

Inferential analysis showed that these differences were statistically significant ($p < 0.05$), suggesting that the observed improvements were unlikely due to chance. The findings indicate that the combination of enhanced training, supportive supervision, provision of tools, and motivation strategies contributed to improved CHV performance and better health outcomes. Overall, the intervention demonstrates the effectiveness of strengthening community health systems in improving NCD screening and linkage to care in Nyeri County, as shown in Table 5 below.

Table 5: Comparison of NCD Screening and Linkage to Care Outcomes between Intervention and Control Groups

Outcome	Intervention (%)	Control (%)	p-value
Screening Rate	78%	52%	<0.05
Linkage to Care	65%	38%	<0.05

Further, Multivariate logistic regression analysis demonstrated that the availability of screening tools (AOR = 3.2, $p < 0.001$) and enhanced training (AOR = 2.5, $p < 0.001$) were the strongest predictors of NCD screening. Similarly, structured referral systems (AOR = 2.8, $p < 0.001$) and active follow-up mechanisms (AOR = 2.3, $p = 0.002$) significantly influenced linkage to care. These findings indicate that both health system support and CHV capacity are critical determinants of effective community-based NCD interventions.

Discussion

This study evaluated determinants of Community Health Volunteer (CHV) performance and outcomes of non-communicable disease (NCD) screening and linkage to care in Nyeri County. The findings demonstrate that an enhanced CHV support model significantly improves both screening coverage and linkage to care, reinforcing the importance of community-based strategies in addressing the rising burden of NCDs in low- and middle-income settings.

The intervention group achieved significantly higher screening rates (78%) compared to the control group (52%). This improvement is largely attributable to enhanced CHV training, which improved knowledge, confidence, and competence in NCD screening. These findings are consistent with prior studies in Kenya and other sub-Saharan African settings, which show that structured capacity building improves CHV performance and early disease detection (Ochieng et al., 2018). Training strengthens CHVs' ability to identify at-risk individuals and appropriately apply screening tools, thereby increasing community-level coverage.

Supportive supervision and availability of screening tools were also key determinants of performance. CHVs who received regular supervision demonstrated improved adherence to protocols, better data reporting, and higher screening output. Similarly, access to functional tools such as blood pressure machines and glucometers significantly enhanced service delivery. These findings align with Kenyan evidence showing that health system readiness, supervision, and commodity availability are critical for CHV effectiveness (Abuya *et al.*, 2021). Collectively, these results highlight that CHV performance is strongly dependent on health system support rather than training alone.

Motivation emerged as another important determinant of CHV engagement. CHVs reporting higher motivation—driven by both financial and non-financial incentives—were more active in household visits and screening activities. This finding is consistent with the literature, indicating that inadequate incentives contribute to poor retention and reduced productivity

among CHVs (Riang'a *et al*., 2024). Sustainable incentive structures are therefore essential to maintaining long-term CHV engagement and ensuring program continuity.

Regarding linkage to care, the study found improved referral completion in the intervention group (65%) compared to the control group (38%). This demonstrates that screening alone is insufficient without strong referral and follow-up systems to ensure continuity of care. CHVs played a central role in reinforcing referrals and following up with clients, thereby bridging the gap between community detection and facility-based care. Community trust further enhanced referral uptake, underscoring the importance of sustained community engagement in improving health-seeking behaviour.

Importantly, a notable gap was observed between screening coverage (78%) and linkage to care (65%). Qualitative findings indicate that this gap was driven by multiple structural and patient-level barriers. These included transport costs for patients, long waiting times at health facilities, occasional stock-outs of essential medicines, and limited feedback mechanisms from facilities to CHVs. These barriers reduced the completion of referrals despite the successful identification of cases at the community level. Similar constraints have been documented in other primary healthcare settings, suggesting that weak health system integration remains a key bottleneck in effective NCD care pathways.

The findings are consistent not only with Kenyan studies but also with evidence from other middle-income countries. In Brazil's Family Health Strategy, community health agents are integral to NCD prevention and control, with improved outcomes linked to strong primary care integration, multidisciplinary teamwork, and structured referral systems. Similarly, Thailand's village health volunteer programme demonstrates that CHV effectiveness in NCD control depends on continuous training, supportive supervision, and reliable access to diagnostic tools.

Across these settings, as in this study, improved screening performance does not automatically translate into successful linkage to care unless health system bottlenecks are addressed, particularly those related to facility readiness, service accessibility, and feedback systems. These parallels highlight the transferability of enhanced CHV models across diverse middle-income contexts.

Despite these positive outcomes, several challenges were identified, including inadequate resources, high workload, and limited incentives, all of which may undermine CHV performance. These challenges reflect systemic weaknesses in community health implementation and are consistent with broader literature on CHW programmes globally. Addressing them requires a comprehensive approach that includes strengthening training systems, ensuring continuous availability of commodities, improving supervision structures, and developing sustainable incentive frameworks.

Overall, the study demonstrates that strengthening CHV capacity and health system support significantly improves NCD screening and linkage to care at the community level. However, further research is needed to assess the long-term sustainability of these interventions and their impact on morbidity and mortality outcomes. Policymakers should consider integrating enhanced CHV models into national NCD strategies to improve early detection and continuum of care, particularly in resource-constrained settings.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study demonstrates that Community Health Volunteers (CHVs) play a critical role in improving non-communicable disease (NCD) screening and linkage to care at the community level. The enhanced CHV support model in Nyeri County significantly improved screening rates and linkage to care compared to the standard approach. Key determinants of CHV performance included training, supportive supervision, availability of screening tools, and motivation, underscoring the importance of both capacity strengthening and health system support in optimizing CHV effectiveness. Despite these gains, challenges such as inadequate resources, high workload, and limited incentives continue to affect performance and threaten sustainability. In addition, gaps remain in ensuring complete linkage to care and continuity of NCD management.

While the intervention was effective, the study did not include a formal cost-effectiveness or budget impact analysis. Given the additional costs associated with training, equipment provision, and enhanced supervision, this limits the ability to assess affordability and scalability at the national level. Future studies should incorporate economic evaluations to inform the Ministry of Health's decisions on potential nationwide adoption and sustainable integration of enhanced CHV models into Kenya's primary healthcare system.

Recommendations

1. Policy Recommendations

The Ministry of Health should integrate enhanced CHV support models into national NCD strategies to strengthen community-level prevention, screening, and referral systems. There is a need to develop and implement standardized guidelines for CHV involvement in NCD programs, including clear roles, training frameworks, and supervision structures.

2. Programmatic Recommendations

Regular and structured training programs should be provided to CHVs to enhance their knowledge and skills in NCD screening and management. Health systems should ensure consistent provision of essential screening tools such as blood pressure machines and glucometers. Strengthening supportive supervision through routine monitoring and mentorship can improve CHV performance and accountability. Sustainable incentive mechanisms, both financial and non-financial, should be implemented to improve motivation and reduce attrition among CHVs.

3. Practice Recommendations

Establish and strengthen structured referral and follow-up systems to improve linkage to care and continuity of treatment. Enhance community awareness and engagement to build trust and improve uptake of screening and referral services.

Strengths and Limitations

This study has several strengths; The use of a quasi-experimental design with intervention and control groups enhanced the ability to assess the effect of the enhanced CHV model on NCD screening and linkage to care. The mixed-methods approach allowed for triangulation of findings, providing both quantitative evidence and contextual insights into CHV performance. Additionally, the study was conducted within a real-world community health system, increasing the relevance and applicability of the findings to similar low-resource settings.

However, some limitations should be considered. The lack of randomization may have introduced selection bias and limited causal inference. Potential confounding factors between study groups, as well as reliance on routine and self-reported data, may have influenced the accuracy of the findings.

The relatively short follow-up period did not allow for assessment of long-term outcomes such as disease control. Furthermore, the study was conducted in a single county, which may limit generalizability, and the resource-intensive nature of the intervention may pose challenges for scalability in other settings.

Implications for Policy and Practice

The findings of this study have important implications for strengthening community-based approaches to non-communicable disease (NCD) prevention and management in Kenya and similar low-resource settings.

Policy level

There is a need to formally integrate enhanced Community Health Volunteer (CHV) models into national and county health strategies. This includes developing standardized guidelines for CHV involvement in NCD screening, referral, and follow-up, as well as ensuring alignment with existing primary healthcare frameworks. Policymakers should also prioritize sustainable financing mechanisms to support CHV programs, including the provision of stipends, training, and essential screening tools.

Practice level

The study highlights the importance of continuous capacity building for CHVs through regular, structured training on NCDs and supportive supervision to maintain quality service delivery. Ensuring the consistent availability of functional screening equipment, such as blood pressure machines and glucometers, is critical to improving screening coverage. Additionally, strengthening referral systems and follow-up mechanisms can enhance linkage to care and continuity of treatment. Building community trust and awareness through health education initiatives is also essential to increase uptake of screening and adherence to referrals.

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