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# Health and Nutrition Literacy among Community Health Workers in Rural and Urban Tanzania: A Comparative Study

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**Abstract**

**Introduction:** Community health workers (CHWs) are vital in primary health care delivery, especially in low and middle-income countries (LMICs). However, the quality of their services is often questioned due to their limited training compared to professional healthcare providers. Despite evidence of CHWs' contributions to health and nutrition in Tanzania, the country continues to face high levels of malnutrition and preventive diseases. This underscores the need to evaluate CHWs' literacy in health and nutrition to enhance their role in promoting these areas. This paper aimed to assess health and nutrition literacy among Community Health Workers (CHWs) in rural and urban Tanzania while exploring factors influencing these literacy levels.

**Materials and Methods:** This cross-sectional study, conducted in Pwani and Dar es Salaam, Tanzania, involved 194 CHWs, who were obtained using Yamane's formula for sample size determination. Data was collected via face-to-face interviews using the adapted European Health Literacy Questionnaire (HLS-EU-Q47) for health literacy and the Short Food Literacy Questionnaire (SFLQ) for nutrition literacy. Pearson correlation analysed the association between nutrition literacy (NL) and health literacy (HL), while multinomial logistic regression identified factors influencing HL and NL among CHWs.

**Results:** Our study found limited health literacy among CHWs to be higher in rural areas (24.5%) than in urban areas (17.6%), while health literacy rates were higher in urban (31.9%) compared to rural (22.9%). Regression analysis showed limited health literacy was significantly associated with age (P = 0.048, OR = 1.041, 95% CI), area of residence (P = 0.002, OR = 0.318, 95% CI) and supervision frequency (P = 0.01, OR = 5.266, 95% CI). Limited nutrition literacy was significantly associated with weekly time spent on CHW activities (P = 0.006, OR = 0.183, 95% CI), age (P = 0.013, OR = 1.050, 95% CI) and area of residence (P = 0.008, OR = 0.387, 95% CI). The correlation between health literacy and nutrition literacy had a Pearson coefficient of 0.517 (P = 0.000).

**Conclusion:** Our study shows a higher prevalence of limited health and nutrition literacy among rural CHWs than urban ones, with area of residence being the most decisive associated factor. The area of residence is the strongest associated factor for NL and HL. Policymakers can use the identified factors in areas with similar social demographic characteristics to improve community-based health intervention that will, in turn, improve the health and nutrition outcomes of the community.

**Keywords:** Community Health Workers; Health Literacy; Nutrition Literacy; Rural-Urban Disparities; Tanzania

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**Introduction**

Community health workers (CHWs) play a critical role in primary health care delivery, particularly in low and middle-income countries (LMICs) (Perry et al., 2014). CHWs are increasingly integral to many health systems and programs, delivering a wide range of essential health and nutrition interventions and bridging the gap between communities and formal health services (Hill et al., 2014). Their roles encompass preventive, promotive, and curative services, significantly impacting maternal and child health, infectious diseases, and chronic conditions (Darzi & Evans, 2016).

The World Health Organization (WHO) has forecasted a global shortage of 18 million health workers by 2030, emphasizing the urgent need to address this deficit to achieve universal health coverage and the Sustainable Development Goals (Darzi & Evans, 2016). One viable solution to mitigate this shortfall is the strategic recruitment, training, and deployment of CHWs, particularly in LMICs where health workforce shortages are most acute (Perry et al., 2014). This approach helps alleviate the workforce gap and empowers communities by improving access to health services, enhancing health literacy, and promoting better health outcomes (Lewin et al., 2010; Coughlin et al., 2020).

CHWs have demonstrated effectiveness in various health interventions, including immunization programs, maternal and child health initiatives, and the management of chronic diseases such as HIV/AIDS and tuberculosis. Their community-based approach allows for culturally appropriate health education and the promotion of healthy behaviours, which are critical in addressing the social determinants of health (Hill et al., 2014).

The CHWs are paraprofessionals or lay workers to whom simple medical procedures can be 'task shifted' from higher level medical providers such as nurses and doctors (Ballard & Montgomery, 2017); they work within their community in health and nutrition promotion, prevention, and delivery roles (O'Donovan et al., 2018; Olaniran et al., 2019). CHWs were widely promoted to provide primary healthcare in resource-poor settings as early as the 1978 Alma-Ata Declaration (World Health Organization, 1978). In this context, Tanzania has emerged as a pioneer among African nations in establishing a comprehensive primary healthcare strategy to improve healthcare access. Central to this strategy are CHWs, individuals embedded within communities and entrusted with the responsibility of bridging the gap between communities and healthcare resources (Mutafungwa et al., 2019).

Health and Nutrition are closely associated (Brandhorst & Longo, 2019; Ross et al., 2020). According to the World Health Organisation (WHO) (2020), health depends upon nutrition since good health requires proper nutrition. There is an inextricable link between health and literacy, particularly health literacy (Muhanga & Malungo, 2017; Muhanga, 2021). Health literacy (HL) and nutrition literacy (NL), have been recognized as a fundamental public health objective that encompasses the cognitive and social capacities that shape an individual's motivation and ability to acquire, comprehend, and utilize information in ways that promote and sustain good health (Taylor et al., 2019). The ongoing debates about the definitions of NL and HL have emerged with a consensus, highlighting the interconnectedness of these concepts and giving rise to the notion of nutrition literacy as a distinct subset of health literacy (Velardo, 2015). HL has been conceptualized as a risk factor for good health, with various examinations of the relationship between levels of health literacy and a range of health conditions revealing that low levels of HL are associated with poor health outcomes (Muscat et al., 2021; Muhanga & Malungo., 2018).

The world faces a triple burden of malnutrition, including under-nutrition, over-nutrition and micronutrient deficiencies, especially in low- and middle-income countries (LMICs) (Prentice, 2023). The 2022 Tanzania Demographic and Health Survey (TDHS) report reveals a sobering picture

of childhood malnutrition in Tanzania. The report indicates that the prevalence of chronic undernutrition (stunting) stands at a concerning 30%. In comparison, acute malnutrition (wasting) affects 3% of the child population, overweight affects 4% of the child population, and underweight remains a significant issue, impacting 12% of children (MoH Tanzania, 2023).

Notably, there has been a rapid decline in prevalence among children under five; stunting has decreased steadily from 48% in the 1999 TDHS to 30% in the 2022 TDHS-MIS (MoH Tanzania, 2023). However, it is crucial to recognize that despite these commendable improvements, Tanzania continues to grapple with persistently high levels of undernutrition, with still a concerning 30% acute malnutrition rate in the country (MoH Tanzania, 2023; Khamis et al., 2020). One of the critical causes of nutritional problems is limited access to health services, including limited nutritional and health knowledge, which causes problems such as malnutrition and various non-communicable diseases (Ahmadzadeh et al., 2019).

Long distances involved in reaching healthcare facilities and the shortage of qualified healthcare providers in many rural areas in Tanzania have compelled rural residents to seek health information from community health workers and other informal sources, including traditional birth attendants and their immediate family members (Kassim & Katunzi-Mollel, 2017; Mwangakala, 2016). Financial hardship, social exclusion and limited health literacy have compelled the urban poor to turn towards the primary healthcare system CHWs are part of in search of health services (Angeles et al., 2019; Ludwick et al., 2020).

In this context, CHWs are trusted and vital mediators between the formal healthcare system and the community (Jumanne et al., 2021). These CHWs serve as catalysts for change in key health and nutrition strategies, such as engaging with households during the pivotal first 1000 days of a child's life to advocate and implement key nutrition-specific and nutrition-sensitive interventions, thereby playing a pivotal role in reducing stunting (Mutafungwa et al., 2019).

However, the quality of services this cadre of health workers provides has been questioned; unlike professional healthcare providers, community health workers receive less training on various health issues (Kassim & Katunzi-Mollel, 2017). In countries such as Iran, significant results in the society's health status are attributed to the high effectiveness of CHW performance (Zalani et al., 2021); although studies in the country document the contribution of CHW in realms of health and nutrition, Tanzania still struggles with high levels of malnutrition and preventive diseases necessitating a need to assess the capabilities of CHW's in integration in promotion of health and nutrition particularly on their literacy levels in realms of health and nutrition. HL and NL are important personal skills that enable people to control the determinants of health (Ahmadi & Karamitanha., 2023).

This paper aimed to assess health and nutrition literacy among Community Health Workers (CHWs) in rural and urban Tanzania while exploring factors influencing these literacy levels. CHWs play a crucial role in primary health care in LMICs, serving as intermediaries between formal health systems and communities. Their responsibilities span maternal and child health, infectious disease management, and chronic disease prevention. Therefore, enhancing CHWs' health and nutrition literacy was vital for effective health education, promoting healthy behaviours, and improving community health.

## Materials and Methods

### Theoretical Framework

This research will be based on the Socio-Cognitive Theory (SCT), which has been used to guide behaviour change interventions. SCT has been used to understand the influence of social determinants of health and a person's past experiences on behaviour change (Stajkovic & Sergent,

2020). SCT is perceived to apply to HL as it explains clearly the interaction between individuals and the environment (Mshingo et al., 2023).

**Study Sample**

This cross-sectional study was conducted in Pwani and Dar es Salaam in Tanzania. Among the regions of Tanzania, Dar es Salaam is the biggest city and is home to more than five million people (URT, 2021). This number accounts for more than 10% of the total population of Tanzania; health services in Dar es Salaam depend mainly on private rather than public health services. For example, only 19% (111 out of 572) of health facilities account for public health service provision (URT, 2021). Although health facilities are easily accessible, the health system is heavily private-oriented.

Thus, less resilient social classes cannot access quality care due to financial insufficiency (Oh et al., 2023), making community health-based programs, of which CHWs are part, vital for the less resilient social classes to create equity. Ilala district is one of the five districts of Dar es Salaam. According to the United Republic of Tanzania (2021), most of the areas are considered slums with dense populations, and poor residents face financial constraints in accessing health services. Mkuranga district in Pwani was the rural setting for this study since it has similar climatic and environmental conditions to achieve comparability. The sample population for this study was 188 CHWs as per calculation from Yamane's sample size determination formula.

$$n = \frac{N}{1 + N(e \times e)}$$

$$n = \frac{354}{1 + 354(0.05 \times 0.05)}$$

n = 187.798 ≈ 188.

The sample size was split evenly between the selected study areas, with 94 CHWs from each area.

**Measurement of Health and Nutrition Literacy.**

In this study, the European Health Literacy Questionnaire HLS-EU-Q47, which consists of 47 questions, was adapted to measure health literacy. The methodological aspect of the Short Food Literacy Questionnaire (SFLQ) used in a Swiss validation study (Krause et al., 2018) was adopted to measure nutrition literacy in this study. Answers were scored on a four-point Likert scale from very easy to very difficult on each tool used for each item.

To categorize the health and nutrition literacy levels of the CHWs, an index was calculated using IBM SPSS version 20 for HL and NL separately using the following formula as per recommendations from a health literacy study (Pelikan et al., 2019):

$$Index = (mean(per\ item) - 1) \times \frac{50}{3}$$

Health and nutrition literacy were individually categorized into four levels using the index calculated. An index score from 0 to 25 is termed as "inadequate", a score above 25 to 33 as "problematic", an index score greater than 33 to 42 as "sufficient", and an index score greater than 42 as "excellent" (Krause et al., 2018). To identify the vulnerable individuals in the study population, inadequate and problematic categories were combined as one level termed "limited" health or nutrition literacy, encompassing the index scores from 0 to 33.

**Factors Influencing Health and Nutrition Literacy among CHWs**

A multinomial logistic regression was used to identify factors influencing HL and NL among CHWs. Factors included in the model were Age in years, Number of dependents, Sex, Area of Residence,

*Tanzania Journal of Health Research*
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Education Level, Supervision Frequency and Average weekly time spent on CHW activities. The equation used in the study:

Outcome variable: $HL$ or $NL$

$$\log\left(\frac{P(HL_i=k)}{P(HL_i=K)}\right) = \beta_0^{HL} + \beta_1^{HL}\cdot \text{Age}_i + \beta_2^{HL}\cdot \text{Number of dependents}_i + \beta_3^{HL}\cdot \text{Sex}_i + \beta_4^{HL}\cdot \text{Area of Residence}_i + \beta_5^{HL}\cdot \text{Education Level}_i + \beta_6^{HL}\cdot \text{Supervision Frequency}_i + \beta_7^{HL}\cdot \text{Average weekly time}_i$$

$$\log\left(\frac{P(NL_i=k)}{P(NL_i=K)}\right) = \beta_0^{NL} + \beta_1^{NL}\cdot \text{Age}_i + \beta_2^{NL}\cdot \text{Number of dependents}_i + \beta_3^{NL}\cdot \text{Sex}_i + \beta_4^{NL}\cdot \text{Area of Residence}_i + \beta_5^{NL}\cdot \text{Education Level}_i + \beta_6^{NL}\cdot \text{Supervision Frequency}_i + \beta_7^{NL}\cdot \text{Average weekly time}_i$$

where:

- $HL_i$ and $NL_i$ represent the health literacy and nutrition literacy outcomes for CHW $i$,
- $P(HL_i = k)$ and $P(NL_i = k)$ denote the probability of CHW $i$ having health literacy or nutrition literacy level $k$,
- $P(HL_i = K)$ and $P(NL_i = K)$ represent the baseline probabilities (reference category),
- $\beta$ coefficients ($\beta_0^{HL}, \beta_1^{HL}, \ldots, \beta_7^{HL}$ for health literacy and $\beta_0^{NL}, \beta_1^{NL}, \ldots, \beta_7^{NL}$ for nutrition literacy) represent the effects of each predictor variable on the log odds of the outcome.

## Results

### Socio-demographic characteristics of the respondents

This comparative study on health and nutrition literacy among community health workers in rural and urban found that 50% of respondents live in each area (Table ), with a slightly higher proportion of females in rural areas. Among females, 54.4% were located in rural areas, whereas 45.6% were in urban areas. Conversely, among males, 46.8% resided in rural areas, while 53.2% lived in urban areas. The study found that 42% of respondents were female, and 58% were male. In rural areas, 47.9% were female and 52.1% were male, whereas in urban areas, 38.3% were female, and 61.7% were male (Table 1).

Regarding marital status, 71.3% of respondents were married, while divorced, separated, and cohabitating individuals comprised less than 10% of the total respondents (Table 1). Regarding length of residency, 83.5% had lived in their current location for 16 years or more, with only 3.2% having lived there for 0 to 5 years. Education levels varied significantly, with 71.8% of respondents having completed only primary education, 23.9% completing secondary education, and 3.7% possessing college or higher education credentials (Table 1).

The most common household size among the study population is 4 to 6 members, comprising 41.5% of respondents. Households with less than four members comprise 43.6% of respondents, while those with more than 6 comprise 14.9%. Most (60.6%) of the households do not have children under 5 years old. Among those with children under 5 years, the majority (33.5%) have one child, while very few (1.6%) have three or more children in this age group. Results further indicate

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the income of these households, with three-quarters (75%) of the study population earning less than TSh 250,000 monthly. A quarter (25%) earn between TSh 250,000 and TSh 500,000 (Table 1).

**Table 1:** Table showing socio-demographic information of study population (n= 188)

| | | Area of Residence | | |
|---|---|---|---|---|
| | | **Rural** | **Urban** | **Total** |
| **Sex** | Female | 43(22.9%) | 36(19.1%) | 79(42%) |
| | Male | 51(27.1%) | 58(30.9%) | 109(58%) |
| **Marital Status** | Married | 77(41%) | 57(30.3%) | 134(71.3%) |
| | Divorced | 6(3.2%) | 3(1.6%) | 9(4.8%) |
| | Separated | 5(2.7%) | 12(6.4%) | 17(9%) |
| | Cohabitation | 2(1.1%) | 8(4.3%) | 10(5.3%) |
| | Single | 3(1.6%) | 14(7.4%) | 17(9%) |
| | Widowed | 1(0.5%) | 0(0%) | 1(0.5%) |
| **Years as a Resident** | 0 to 5 years | 5(2.7%) | 1(0.5%) | 6(3.2%) |
| | 6 to 15 years | 6(3.2%) | 19(10.1%) | 25(13.3%) |
| | 16 or more years | 83(44.1%) | 74(39.4%) | 157(83.5%) |
| **Education Level** | Primary level | 74(39.2%) | 61(32.4%) | 135(71.8%) |
| | Secondary level | 20(10.6%) | 25(13.3%) | 45(23.9%) |
| | College or Higher | 0(0%) | 7(3.7%) | 7(3.7%) |
| | No education/Primary school dropout | 0(0%) | 1(0.5%) | 1(0.5%) |
| **Number of Household members** | Less than 4 members | 25(13.3%) | 57(30.3%) | 82(43.6%) |
| | 4 to 6 members | 46(24.5%) | 32(17%) | 78(41.5%) |
| | More than 6 members | 23(12.2%) | 5(2.7%) | 28(14.9%) |
| **Household income** | Less than TSh 250,000 | 91(48.4%) | 50(26.6%) | 141(75%) |
| | 250,000 to 500,000 TSh | 3(1.6%) | 44(23.4%) | 47(25%) |
| | More than 500,000 TSh | 0(0%) | 0(0%) | 0(0%) |
| **Number of children under 5 years** | None | 56(29.8%) | 58(30.9%) | 114(60.6%) |
| | 1 child | 34(18.1%) | 29(15.4%) | 63(33.5%) |
| | 2 children | 2(1.1%) | 6(3.2%) | 8(4.3%) |
| | 3 or more children | 2(1.1) | 1(0.5) | 3(1.6%) |
| **Total** | | **94(50%)** | **94(50%)** | **188(100%)** |

**Health Literacy and Nutrition Literacy Categories**

The results in Table 2 on health and nutrition literacy among CHWs in rural and urban revealed varying levels of HL and NL across different areas of residence. In rural areas, 24.5% of CHWs had limited health literacy, compared to 17.6% in urban areas, making up 42% and 33% of the total CHWs, respectively. Sufficient health literacy was reported among 22.9% of rural and 31.9% of urban areas, totalling 54.8%. Excellent health literacy was found among 2.7% in rural and 0.5% in urban areas, making up 3.2%.

Regarding nutrition literacy, 27.1% of CHWs in rural areas had limited nutrition literacy, while 21.3% in urban areas accounted for 48.4% of the total (Table 2). Sufficient nutrition literacy was

*Tanzania Journal of Health Research*
**Volume 25: Issue 1, January 2025** https://dx.doi.org/10.4314/thrb.v26i1.8

reported among 19.7% of rural and 27.1% of urban areas, totalling 46.8%. Excellent nutrition literacy was found among 3.2% rural and 1.6% urban areas, making up 4.8% (Table 2).

**Table 2:** Health and Nutrition Literacy rates among CHWs in Rural and Urban areas (n= 188)

| | | Area of Residence | | |
|---|---|---|---|---|
| | | **Rural** | **Urban** | **Total** |
| **Health Literacy Categories** | Limited HL | 46(24.5%) | 33(17.6%) | 79(42%) |
| | Sufficient HL | 43(22.9%) | 60(31.9%) | 103(54.8%) |
| | Excellent HL | 5(2.7%) | 1(0.5%) | 6(3.2%) |
| **Nutrition Literacy Categories** | Limited NL | 51(27.1%) | 40(21.3%) | 91(48.4%) |
| | Sufficient NL | 37(19.7%) | 51(27.1%) | 88(46.8%) |
| | Excellent NL | 3.2%(6) | 3(1.6%) | 9(4.8%) |

Furthermore, the study findings, as shown in Table 3, indicate a significant relationship between Community Health Workers' (CHWs) health literacy (HL) levels and their area of residence. The cross-tabulation reveals that in urban areas, 33 CHWs had limited HL, 60 had sufficient HL, and 1 had excellent HL. In rural areas, 46 CHWs had limited HL, 43 had sufficient HL, and 5 had excellent HL. The Pearson Chi-square test yielded a value of 7.612 with 2 degrees of freedom and a p-value of 0.022, indicating a statistically significant association between HL levels and area of residence (Table 3).

**Table 3:** A cross-tabulation between Area of residence and HL categories of CHWs (n= 188)

| | | HL Categories | | |
|---|---|---|---|---|
| | | Limited HL | Sufficient HL | Excellent HL |
| Residence | Urban | 33 | 60 | 1 |
| | Rural | 46 | 43 | 5 |
| Total | | 79 | 103 | 6 |

Pearson Chi Square Value = 7.612 (df = 2, P value = 0.022).

These results suggest that CHWs in urban areas are more likely to have sufficient or excellent HL than those in rural areas. The significant association found (p = 0.022) underscores that this disparity is not due to random variation but likely reflects fundamental differences in health literacy between urban and rural CHWs. Factors contributing to these differences could include better access to educational resources, health information, and training opportunities in urban settings than in rural ones (Lehman & Sanders, 2007). This disparity may affect the effectiveness of CHWs in performing their roles, particularly in delivering health education and promoting healthy behaviours in their communities.

The study investigated the relationship between CHWs' nutrition literacy (NL) and their area of residence. Table 4 presents the cross-tabulation results, showing that 40 CHWs had limited NL in urban areas, 51 had sufficient NL, and 3 had excellent NL. In rural areas, 51 CHWs had limited NL, 37 had sufficient NL, and 6 had excellent NL. The Pearson Chi-square test produced a value of 4.577

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with 2 degrees of freedom and a p-value of 0.102, suggesting no statistically significant association between NL levels and area of residence (Table 4).

**Table 4:** A cross-tabulation between Area of residence and NL categories of CHWs (n= 188)

| | | NL Categories | | |
|---|---|---|---|---|
| | | Limited NL | Sufficient NL | Excellent NL |
| Residence | Urban | 40 | 51 | 3 |
| | Rural | 51 | 37 | 6 |
| Total | | 91 | 88 | 9 |

Pearson Chi Square Value = 4.577 (df = 2, P value = 0.102)

The study explored the relationship between health literacy (HL) and nutrition literacy (NL) among CHWs in rural and urban Tanzania. Table 5 shows a statistically significant positive correlation, with a Pearson coefficient of 0.517 and a p-value of 0.000. This suggests that higher HL is associated with higher NL among CHWs.

The positive correlation underscores the interconnectedness of these literacies, highlighting the potential for integrated programs to improve both. HL and NL require similar cognitive skills, such as effectively comprehending and using information. CHWs with higher HL are likely better at processing health-related and nutritional information, leading to improved overall health knowledge and nutrition literacy.

**Table 5:** The correlation between health and nutrition literacy (n= 188)

**Correlations**

| | | **NL** |
|---|---|---|
| **HL** | Pearson Correlation | 0.517** |
| | Sig. (2-tailed) | 0.000 |

**. Correlation is significant at the 0.01 level (2-tailed).

*Tanzania Journal of Health Research*
**Volume 25: Issue 1, January 2025** https://dx.doi.org/10.4314/thrb.v26i1.8

**Table 6:** Factors Influencing Health Literacy among CHWs (n= 188)

| HL Categories | B | Wald | Sig. | Exp(B) | 95% CI for Exp(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| **Excellent Health Literacy Vs Limited Health Literacy** | | | | | | |
| Intercept | -3.489 | 2.302 | .129 | | | |
| Age in years | 0.054 | 0.915 | 0.339 | 1.055 | 0.945 | 1.179 |
| Number of dependents | -0.166 | 0.340 | 0.560 | 0.847 | 0.484 | 1.482 |
| Sex=Female | -0.639 | 0.433 | 0.511 | 0.528 | 0.079 | 3.538 |
| Sex=Male | 0[b] | . | . | . | . | . |
| Area of Residence=Rural area | 1.225 | 1.108 | 0.292 | 3.406 | .348 | 33.345 |
| Area of Residence=Urban area | 0[b] | . | . | . | . | . |
| Education Level=Primary level or Primary school dropout | -1.825 | 2.397 | 0.122 | 0.161 | 0.016 | 1.625 |
| Education Level=Secondary level or higher | 0[b] | . | . | . | . | . |
| Supervision Frequency =Monthly | -0.862 | 0.400 | 0.527 | 0.422 | 0.029 | 6.112 |
| Supervision Frequency =Quarterly | 0.239 | 0.032 | 0.858 | 1.270 | 0.094 | 17.205 |
| Supervision Frequency =Weekly | 0[b] | . | . | . | . | . |
| **Sufficient Health Literacy vs. Limited Health Literacy** | | | | | | |
| Intercept | -1.464 | 2.270 | 0.132 | | | |
| Age in years | 0.040 | 3.917 | 0.048 | 1.041 | 1.000 | 1.084 |
| Number of dependents | 0.105 | 1.050 | 0.305 | 1.111 | 0.908 | 1.359 |
| Sex=Female | -0.421 | 1.443 | 0.230 | 0.656 | 0.330 | 1.305 |
| Sex=Male | 0[b] | . | . | . | . | . |
| Area of Residence=Rural area | -1.146 | 9.583 | 0.002 | 0.318 | 0.154 | 0.657 |
| Area of Residence=Urban area | 0[b] | . | . | . | . | . |
| Education Level=Primary level or Primary school dropout | -0.604 | 2.131 | 0.144 | 0.547 | 0.243 | 1.230 |
| Education Level=Secondary level or higher | 0[b] | . | . | . | . | . |
| Supervision Frequency =Monthly | 0.359 | 0.322 | 0.570 | 1.432 | 0.414 | 4.951 |
| Supervision Frequency =Quarterly | 1.661 | 6.678 | 0.010 | 5.266 | 1.494 | 18.567 |
| Supervision Frequency =Weekly | 0[b] | . | . | . | . | . |

a. The reference category is: Limited Health Literacy.
b. This parameter is set to zero because it is redundant.

The multinomial logistic regression model was employed to examine the relationship between various predictors and health literacy levels, categorized as "Sufficient Health Literacy," "Excellent Health Literacy," and "Limited Health Literacy." "Limited Health Literacy" served as the reference category. The analysis yielded the following insights:

**Excellent Health Literacy vs. Limited Health Literacy**

**Age in years:** Age is not a significant predictor (p = 0.339). The odds ratio (OR) of 1.054 suggests that individuals have 1.055 times higher odds of having excellent health literacy than limited health literacy for each additional year of age. However, this effect is not statistically significant (Table 6).

**Number of dependents:** The number of dependents is not a significant predictor (P = 0.56). The OR of 0.847 suggests that having more dependents slightly decreases the odds of having excellent health literacy, but this effect is not statistically significant (Table 6).
**Sex** (reference category -Female): Sex is not a significant predictor (P = 0.511). The OR suggests females are 0.528 less likely to have excellent health literacy than males, but this effect is not statistically significant (Table 6).
**Area of Residence** (reference category: Rural area): Area of residence is not a significant predictor (P = 0.292). The OR suggests that those in rural areas are 3.406 more likely to have excellent health literacy than those in urban areas, implying that urban residents are less likely to have excellent health literacy. However, this effect is not statistically significant (Table 6).
**Education Level** (reference category: Primary level or Primary school dropout): Education level is not a significant predictor (P = 0.122). The OR suggests that those with primary education are 0.161 less likely to have excellent health literacy than those with higher education, but this effect is not statistically significant (Table 6).
**Supervision Frequency** (reference categories: Monthly and Quarterly)**:** The frequency of supervision is not a significant predictor for either monthly (P = 0.527) or quarterly (P = 0.858) intervals. The OR of 0.422 for monthly supervision and 1.270 for quarterly supervision suggests that Monthly supervision (monthly) decreases the odds of having excellent health literacy, and quarterly supervision increases the odds of having excellent health literacy compared to weekly supervision. However, these effects are not statistically significant (Table 6).

**Limited Health Literacy vs. Sufficient Health Literacy**
**Age in years:** Age is a significant predictor (P = 0.048). The OR of 1.041 suggests that For each additional year of age, individuals have 1.041 times higher odds of having sufficient health literacy than limited health literacy, indicating younger individuals are more likely to have limited health literacy (Table 6).
**Number of dependents:** The number of dependents is not a significant predictor (P = 0.305). The OR of 1.111 suggests that for each additional dependent, individuals have 1.111 times higher odds of having sufficient health literacy than limited health literacy, but this effect is not statistically significant (Table 6).
**Sex** (reference category -Female): Sex is not a significant predictor (P = 0.23). The OR of 0.656 suggests females are more likely to have limited health literacy than males, but this effect is not statistically significant (Table 6).
**Area of Residence** (reference category: Rural area): Area of residence is a significant predictor (P = 0.002). The OR suggests that those in rural areas are 0.318 more likely to have limited health literacy than those in urban areas, implying that urban residents are less likely to have limited health literacy. This effect is significant (Table 6).
**Education Level** (reference category: Secondary level or higher): Education level (Primary) is not a significant predictor (P = 0.144). The OR suggests that those with primary education are 0.547 less likely to have sufficient health literacy than those with higher education, but this effect is not statistically significant (Table 6).
**Supervision Frequency** (reference categories: Monthly and Quarterly)**:** Monthly supervision is insignificant (P = 0.570). The OR suggests that those supervised monthly are 1.432 times more likely to have excellent health literacy than those supervised weekly, implying that weekly supervision increases the likelihood of limited health literacy (Table 6).

Quarterly supervision is significant (P = 0.01). The OR suggests that those supervised quarterly are 5.266 more likely to have excellent health literacy than those supervised weekly, indicating that weekly supervision increases the likelihood of limited health literacy (Table 6).

**Sufficient Nutrition Literacy vs. limited Nutrition Literacy**

**Age:** For each additional year, the odds of having sufficient nutrition literacy (compared to limited nutrition literacy) increase by a factor of 1.050. This means that each additional year increases the odds of having sufficient nutrition literacy, and this result is statistically significant (P = 0.013) (Table 7).

**Area of Residence** (Reference category = Rural Areas): Living in a rural area is associated with lower odds of having sufficient nutrition literacy than living in an urban area. This result is statistically significant (P = 0.008). The OR indicates that CHWs in rural areas are 0.387 times less likely to have sufficient nutrition literacy compared to those in urban areas (Table 7).

**Average weekly time spent on CHW activities** (Reference categories = I day in the week; 2 days in the week): Spending 1 day per week on CHW activities is associated with lower odds of having sufficient nutrition literacy than spending 3 days or more per week. The odds are reduced by a factor of 0.183. This result is statistically significant (P= 0.006), indicating that individuals who spend 1 day per week on CHW activities have 0.183 times the odds of having sufficient nutrition literacy compared to those who spend 3 days or more per week. Spending 2 days per week on CHW activities is associated with lower odds of having sufficient nutrition literacy than spending 3 days or more per week. The odds are reduced by a factor of 0.207. This result is statistically significant (P= 0.011), indicating that individuals who spend 2 days per week on CHW activities have 0.207 times the odds of having sufficient nutrition literacy compared to those who spend 3 days or more per week (Table 7). In summary, spending more time on CHW activities is associated with higher odds of having sufficient nutrition literacy.

**Table 7**: Factors Influencing Nutrition Literacy among CHWs (n= 188)

| **NL Categories** | | | | | **95% CI for Exp(B)** | |
|---|---|---|---|---|---|---|
| | **B** | **Wald** | **Sig.** | **Exp(B)** | **Lower Bound** | **Upper Bound** |
| **Excellent Nutrition Literacy Vs Limited Nutrition Literacy** | | | | | | |
| Intercept | -0.114 | 0.003 | 0.956 | | | |
| Age in years | -0.033 | 0.443 | 0.506 | 0.968 | 0.879 | 1.066 |
| Number of dependents | 0.205 | 1.119 | 0.290 | 1.228 | 0.839 | 1.796 |
| Sex=Female | -0.628 | 0.592 | 0.442 | 0.534 | 0.108 | 2.642 |
| Sex=Male | 0[b] | . | . | . | . | . |
| Area of Residence=Rural area | 0.065 | 0.006 | 0.939 | 1.067 | 0.203 | 5.627 |
| Area of Residence=Urban area | 0[b] | . | . | . | . | . |
| Education Level=Primary level or Primary school dropout | -0.304 | 0.113 | 0.736 | 0.738 | 0.125 | 4.339 |
| Education Level=Secondary level or higher | 0[b] | . | . | . | . | . |
| Supervision Frequency =Monthly | -0.917 | 0.358 | 0.550 | 0.400 | 0.020 | 8.069 |
| Supervision Frequency =Quarterly | 0.988 | 0.612 | 0.434 | 2.685 | 0.226 | 31.916 |
| Supervision Frequency =Weekly | 0[b] | . | . | . | . | . |
| Average weekly time spent on CHW activities =1 day in the week | -1.747 | 2.332 | 0.127 | 0.174 | 0.018 | 1.641 |
| Average weekly time spent on CHW activities =2 days in the week | -1.920 | 2.738 | 0.098 | 0.147 | 0.015 | 1.425 |
| Average weekly time spent on CHW activities =3 days or more in a week | 0[b] | . | . | . | . | . |
| **Sufficient Nutrition Literacy vs. limited Nutrition Literacy** | | | | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Intercept | -0.722 | 0.469 | 0.493 | | | |
| Age in years | 0.049 | 6.182 | 0.013 | 1.050 | 1.010 | 1.092 |
| Number of dependents | -0.072 | 0.526 | 0.468 | 0.931 | 0.767 | 1.130 |
| Sex=Female | -0.183 | 0.285 | 0.593 | 0.833 | 0.425 | 1.630 |
| Sex=Male | 0[b] | . | . | . | . | . |
| Area of Residence=Rural area | -0.948 | 6.966 | 0.008 | 0.387 | 0.192 | 0.783 |
| Area of Residence=Urban area | 0[b] | . | . | . | . | . |
| Education Level=Primary level or Primary school dropout | -0.448 | 1.332 | 0.249 | 0.639 | 0.299 | 1.367 |
| Education Level=Secondary level or higher | 0[b] | . | . | . | . | . |
| Supervision Frequency =Monthly | 1.300 | 3.356 | 0.067 | 3.669 | 0.913 | 14.745 |
| Supervision Frequency =Quarterly | 1.295 | 3.296 | 0.069 | 3.650 | 0.902 | 14.773 |
| Supervision Frequency =Weekly | 0[b] | . | . | . | . | . |
| Average weekly time spent on CHW activities =1 day in the week | -1.699 | 7.467 | 0.006 | 0.183 | 0.054 | 0.618 |
| Average weekly time spent on CHW activities =2 days in the week | -1.574 | 6.393 | 0.011 | 0.207 | 0.061 | 0.702 |
| Average weekly time spent on CHW activities =3 days or more in a week | 0[b] | . | . | . | . | . |

a. The reference category is: Limited Nutrition Literacy.
b. This parameter is set to zero because it is redundant.

## Discussion

CHWs bridge gaps in healthcare that lead to health disparities and help people navigate disconnected healthcare systems that marginalize vulnerable populations (Wagner, 2020). CHWs serve as frontline public health workers who are trusted members of and/or closely understand the community served. Since CHWs are from the communities they serve, they can act as a bridge between community members and health/social services while providing culturally competent health education, counselling, and support. CHWs, therefore, represent a key piece of the National efforts to Improve Health Literacy and Health Outcomes.

To promote health literacy in the community and improve their health, it is necessary for service providers such as CHWs to acquire skills related to health literacy and to implement strategies including evaluation of health literacy and appropriate interventions (Mor-Anavy et al., 2021; Nutbeam & Lloyd, 2021). In a study done by Mor-Anavy et al. (2021), significant positive associations were found ($p < 0.05$) between the level of health literacy, the attitudes toward health literacy promotion, and the degree to which special communication techniques were used when treating patients and members of the community with low health literacy among healthcare workers. Our study focused on community health workers HL and NL and the determinants that influence them.

The demographic profile of CHWs, including their marital status, long-term residency, and primary-level education, has significant implications for their health and nutrition literacy and, thus, their ability to effectively engage with communities and deliver health interventions. Such demographic characteristics can influence CHWs' health and nutrition literacy, affecting their ability to effectively engage with communities and deliver health interventions (Njororai et al., 2021). Understanding these demographics is crucial for tailoring training programs and interventions to enhance CHWs' capacities in health literacy and community health promotion.

The study indicates significant differences in the sex of Community Health Workers (CHWs) between rural and urban Tanzania, which may impact health and nutrition literacy levels and health outcomes (Rafiq et al., 2019). These differences are influenced by broader societal and cultural factors, including gender roles in health care (Aljassim & Ostini, 2020). Understanding these demographics is crucial for designing targeted interventions to address health disparities and

enhance health literacy among CHWs in both settings (Rafiq et al., 2019). However, it is important to note that rurality alone does not explain rural-urban health literacy differences, and sociodemographic factors have been seen to play a significant role (Aljassim & Ostini, 2020); the role of these factors will be expanded in the factors influencing HL and NL below.

The household composition and economic conditions of CHWs can significantly impact their health and nutrition literacy and ability to carry out their roles effectively. Lack of financial incentives and compensation may influence CHWs' workload and priorities in delivering health interventions (Gadsen et al., 2021). Moreover, most (75%) of CHWs earning below TSh 250,000 per month underscore socioeconomic challenges that may affect their access to resources and ongoing training opportunities. This is because comparable studies in other low-resource settings have also identified household demographics and income levels as critical determinants of health worker effectiveness and community engagement (Hill et al., 2014). The impact of household composition on health worker performance and service delivery has been documented, emphasizing the need for supportive policies and resources to enhance CHWs' capacities in diverse community settings (Aljassim & Ostini, 2020).

**Health and Nutrition Literacy among CHWs in Urban and Rural Areas**

The study shows a higher prevalence of limited health literacy in rural areas (24.5%) compared to urban areas (17.6%) among CHWs. At the same time, urban areas tend to have higher health literacy rates (31.9%) compared to rural areas (22.9%). These findings concur with a systematic literature review study by Aljassim and Ostini (2020) that included 19 studies. Aljassim and Ostini indicated higher health literacy rates among urban populations than rural ones. These differences are more likely in developing countries like the study area for this study.

Similar patterns of urban-rural disparities in health literacy have been documented in other studies. For example, Speirs et al. (2012) noted that poor nutrition behaviours were more common among individuals with limited health literacy, often concentrated in rural areas. These findings are consistent with the present study, highlighting health literacy gaps between urban and rural settings. However, our findings contradict a study by Haeger et al. (2023) that indicated higher literacy rates among rural populations rather than urban ones. Nutrition literacy rates among the CHWs follow the same trend as HL, with higher nutrition literacy among urban CHWs rather than rural CHWs.

Efforts to address these disparities are critical. Interventions to improve health literacy have shown promise in enhancing diet quality and reducing disease risk (Kang et al., 2022). Such interventions should be tailored to address the unique challenges faced by rural CHWs, potentially involving enhanced training programs, better access to health information, and community-specific health education strategies (Musoke et al., 2021).

While the results indicate some variation in NL categories between urban and rural CHWs, the differences are not statistically significant. This finding implies that NL among CHWs is relatively similar across urban and rural settings, unlike the health literacy (HL) results. The lack of significant disparity in NL could be attributed to similar levels of access to nutrition information and education in both settings. It may reflect uniformity in the training programs provided to CHWs regardless of their location.

This finding is essential as it highlights that factors other than geographic location might be more critical in influencing NL among CHWs. Factors such as individual education levels, personal interest in nutrition, and specific job-related experiences may significantly impact NL more than merely the area of residence.

Other studies have shown varying results regarding the influence of geographic location on health-related literacy. For instance, research by Aljassim and Ostini (2020) found notable urban-

rural disparities in health literacy associated with poor health behaviours. However, similar to our study in nutrition literacy, some research indicates minimal differences across geographic locations. Speirs et al. (2012) found that while general health literacy showed geographic variation, specific domains like nutrition literacy could be more uniformly distributed if access to relevant information and education were standardized.

**Relationship between Health and Nutrition Literacy**

In investigating the relationship between health and nutrition literacy among CHWs, our study employed a Pearson correlation test, which yielded a modest positive correlation between HL and NL, which is significant at the 0.1% level ($r$ = 0.517, P = 0.000, 95% CI). This indicates that as CHWs' HL increases, NL among CHWs also increases. Findings from this study concur with a study done by Altun *et al.* (2022), whose findings also show a positive correlation between HL and NL, albeit the correlation was low. The study findings also align with existing literature emphasizing the importance of comprehensive literacy in health outcomes. For example, Sorensen et al. (2012) discussed the multifaceted nature of health literacy and its crucial role in enabling individuals to navigate the health system effectively, which can include nutritional aspects. Similarly, Velardo (2015) highlighted that nutrition literacy is an extension of health literacy, as it involves specific skills related to understanding dietary information and making informed food choices.

**Factors Influencing Health and Nutrition Literacy among CHWs**

It is well-established that there is a strong and consistent relationship between literacy and health outcomes (Nutbeam & Lloyd, 2021). However, the relationship between health literacy and the social determinant of health is less studied and poorly understood. Studies have shown health literacy to be associated with other socio-determinants of health, including education, income levels, area-based measures of social disadvantage and access to health care that are key to the success of disease prevention and control efforts aimed at reducing health disparities (Simmons et al., 2017; Coughlin et al., 2020).

Our study employed a multinomial logistic regression to investigate which factors influence health and nutrition literacy among CHWs. The regression showed limited health literacy among this cadre of health workers to be significantly associated with age (OR 1.041, CI 95% 1.000-1.084, P= 0.048), area of residence (OR 0.318, CI 95% 0.154-0.657, P= 0.002) and supervision frequency (OR 5.266, CI 95% 1.494-18.567, P= 0.01). Also, the regression showed limited NL to be significantly associated with average weekly time spent on CHW activities (OR 0.183, CI 95% 0.054-0.618, P= 0.006), area of residence (OR 0.387, CI 95% 0.192-0.783, P= 0.008) and age (OR 1.050, CI 95% 1.010-1.092, P= 0.013). Age has been associated with higher health literacy in various studies (Fry et al., 2024; Cutilli, 2007; Eronen et al., 2019); with increasing age among the population, health literacy increases. This is the case for our study. Contrary to our findings, there are studies (Van Hoa et al., 2020; Vogt et al., 2018) that also associate age with lower health literacy, particularly for older adults (>65 years).

In our study, the most closely associated factor with literacy, be it health or nutrition literacy, is an area of residence, with rural CHWs the more disadvantaged population group with higher odds of having limited health and nutrition literacy. As explained above, our findings concur with a systematic literature review study done by Aljassim and Ostini, 2020 which included 19 studies for the review which indicated higher health literacy rates among urban populations rather than rural ones, and these differences are more likely in developing countries like the study area for our study. However, our studies' findings contradict a study by Haeger et al., 2023 that indicated higher literacy rates among rural populations rather than urban ones.

Findings from our study concur with the SCT. Socio-determinants and personal past experiences of health have been seen to influence the population's literacy. In this study, the socio-determinants of health and personal past experiences with significant association with HL or NL were age, area of residence, supervision frequency, and average time spent on CHW activities.
With a general 42 per cent limited HL rate and a 48 per cent limited NL rate among this cadre of health workers, the situation needs to be examined more closely, and interventions designed to improve the technical capacity of CHWs at the frontline of community-based health interventions. Rural areas are more disadvantaged than urban areas and more dependent on community-based interventions, so priority should be given to improving the capacity of community health workers.

## Conclusions

Our study reveals a high prevalence of limited health literacy (HL) and nutrition literacy (NL) among Community Health Workers (CHWs) in rural areas compared to their urban counterparts. This disparity highlights rural CHWs' significant challenges in acquiring and utilizing health and nutrition information effectively.

The findings also demonstrate a modest positive correlation between HL and NL, with a Pearson correlation coefficient of 0.517. This suggests that improvements in NL likely accompany improvements in HL. The logistic regression analysis further identified key factors influencing HL and NL, with area of residence and age significantly associated with both. Area of residence emerged as the most substantial factor, indicating that CHWs in rural areas are disadvantaged considerably.
Additionally, the analysis highlighted that the average weekly time spent on CHW activities significantly influences NL, while supervision frequency is a crucial factor for HL. These insights suggest that targeted interventions focusing on these factors could enhance the effectiveness of CHWs in rural areas.

Policymakers and intervention implementers can leverage these findings to design and implement community-based health interventions tailored to the socio-demographic characteristics of CHWs. By addressing the specific needs and challenges of rural CHWs, such interventions can improve health and nutrition outcomes within their communities.

## Declarations

### Ethics approval and consent to participate

A research permit was obtained from the Sokoine University of Agriculture. After being given information on the study, the participants were required to sign the consent form or apply a thumbprint (in ink), marking their consent to participate in the study. Respondents were made aware of their freedom to not participate in the study or withdraw from it without negative consequences. Ethical clearance was obtained from the Tanzania National Institute for Medical Research (NIMR/HQ/R.8a/Vol.IX/4562).

### Consent for publication

Not applicable

### Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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**Authors' contributions**

All authors participated in drafting and substantively revising the proposal for this study. All authors designed the questionnaire employed in the field. BM analysed and interpreted data collected from the community health workers. MM supervised the field enumerators to ensure data quality. EN and MM reviewed this paper and provided comments on areas for improvement. All authors read and approved the final manuscript.

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