Original Article

# Midline evaluation training outcomes for primary care nurses on noncommunicable diseases in Hwange district

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## ABSTRACT

**Background:** Noncommunicable diseases (NCDs) are a growing global health concern, particularly in low-resource settings where access to screening tools, medications, and trained personnel is limited. In Zimbabwe, NCDs account for nearly 31% of total mortality, and primary care nurses (PCN) are critical to NCD prevention, surveillance, and management. This study evaluated the midline outcomes of a refresher training workshop for PCN in Hwange District.

**Materials and Methods:** A cross-sectional descriptive study was conducted at a primary school in Hwange District, where healthcare professionals including a District Nursing Officer, a Primary Nurse Coordinator, and PCN were purposefully selected. Data were collected using Kobo Toolbox and supplemented by focus group discussions. Quantitative data were analyzed with IBM SPSS Statistics (v28.0) and qualitative data underwent thematic analysis.

**Results:** The training significantly improved self-perceived knowledge in NCD prevention and management. Participants reported high competency in areas such as unhealthy diet prevention (mean 2.71) and respiratory infection management (mean 2.64), whereas lower scores were noted in air pollution surveillance (mean 1.93) and cancer management (mean 1.79). Qualitative feedback highlighted the value of interactive learning and community engagement, despite persistent challenges in resource availability.

**Conclusion:** The refresher training workshop markedly enhanced PCN' self-perceived competencies in managing NCDs in a resource-constrained setting. However, gaps in areas such as cancer management and air pollution surveillance persist, emphasizing the need for ongoing training and systemic investments. Future studies should employ longitudinal designs to assess the sustainability of these outcomes.

**Keywords:** Capacity building, Hwange District, kobo toolbox, noncommunicable diseases, primary care nurses, refresher training, Zimbabwe

## Introduction

Noncommunicable diseases (NCDs) represent a significant global health challenge, accounting for an estimated 41 million deaths each year approximately 71% of total global mortality.[1,2] In Zimbabwe, the burden of NCDs has steadily increased, with recent reports indicating that these diseases contribute to nearly 31% of total

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mortality.[3] Projections suggest that this figure will rise over the coming decade due to demographic shifts and persistent resource constraints.[2,3] Rural regions such as Hwange District are particularly affected by limited access to essential screening tools, medications, and an imbalanced patient-to-healthcare-worker ratio, further compounding the challenges of NCD management.[4,5]

Primary care nurses (PCN) are at the forefront of NCD prevention and management, playing a critical role in early detection, patient counseling, and long-term care. However, many nurses in rural Zimbabwe report significant gaps in their clinical training; a recent study revealed that only 42% of healthcare workers in these settings had received formal training in NCD management.[6] Emerging evidence from mixed-methods evaluations indicates that refresher training programs can enhance clinical competency by 20%–25% as measured by self-perceived knowledge improvements.[7,8] In addition, task-sharing models that empower nurses to assume expanded roles in NCD care have demonstrated improvements in service delivery, with some studies reporting up to a 30% enhancement in clinical outcomes in low-and middle-income countries.[9,10]

The implementation of comprehensive, context-specific training programs is, therefore, critical to addressing these educational gaps. A systematic review published in 2022 found that innovative training approaches in low-resource settings led to a 20%–30% improvement in clinical outcomes for patients with chronic conditions.[11] Moreover, surveys among primary care staff in sub-Saharan Africa have revealed that approximately 65% of respondents rated their previous NCD training as inadequate, highlighting the urgent need for capacity-building interventions.[12] In Zimbabwe, shortages in staff and limited training opportunities have been associated with a 15% increase in hospital admissions related to NCD complications over the past 5 years.[13] Continuous professional development through refresher workshops not only enhances the knowledge and skills of healthcare workers but also strengthens the overall health system. [14] For instance, recent studies have demonstrated that innovative continuous medical education approaches implemented between 2020 and 2025 reduced clinical errors by up to 18% in chronic disease management.[15,16] In addition, persistent staffing shortages reported in up to 60% of primary health facilities in sub-Saharan Africa remain a major barrier to effective NCD management.[17,18]

The present study was designed to evaluate the outcomes of a refresher training workshop for PCN in Hwange District. By integrating quantitative assessments with qualitative feedback, the study aimed to provide a comprehensive understanding of improvements in self-perceived knowledge, clinical skills, and overall readiness to manage NCDs. Previous research has demonstrated that such interventions can lead to improvements in knowledge of up to 25% and significant enhancements in clinical decision-making.[7,8,11] Addressing these identified training gaps is essential for informing policymakers and healthcare administrators on effective strategies for strengthening the primary healthcare workforce in resource-limited settings.

In summary, the escalating burden of NCDs in Zimbabwe, coupled with significant training deficiencies among PCN, necessitates the implementation and rigorous evaluation of refresher training programs. Recent evidence underscores the potential of these interventions to improve clinical outcomes, reduce hospital admissions, and ultimately contribute to stronger health system performance.[13,14,19] This study provides a critical evaluation of one such training initiative in Hwange District, generating data to optimize future interventions and support broader efforts to mitigate the impact of NCDs in low-resource environments.

## Materials and Methods

### Study design and setting

This study employed a cross-sectional descriptive design to evaluate the impact of training of PCN on prevention, surveillance, and management. Hwange District was purposively selected based on geographical location and evidence of a functional District Health system comprising of District Medical Officer, District Nursing Officer (DNO), District Health Promotion Officer, and functioning primary health care centers staffed with PCN. The venue for the training of PCN was a primary school in Hwange district. Plans are underway to replicate this PCN training model in neighboring Binga and Lupane Districts based on the experiences from Hwange district.

This manuscript presents only the midline assessment outcomes of the training intervention; baseline (pretest) and end line data will be reported in a subsequent paper covering the full series of training sessions. Although a pre/post-test design across all time points is planned for that comprehensive analysis (in alignment with CONSORT and STROBE guidelines), this midline-focused report did not include baseline measures due to the scope and timing of data collection.

### Participant selection and sampling

The study population consisted of key healthcare professionals actively involved in NCD management within Hwange District. Fourteen participants were purposefully selected, including one DNO, one Primary Nurse Coordinator (PNC), and twelve PCN. Eligibility required that participants be permanently employed at a primary healthcare facility, possess a minimum of 2 years' clinical experience, and be directly involved in NCD prevention, surveillance, or management. Temporary staff and those not engaged in direct clinical care were excluded to ensure that only experienced practitioners provided insights into the training outcomes. This purposive sampling method is supported by recent workforce development studies in low-resource contexts.[20]

A sample size calculation was conducted using a two-tailed paired *t*-test: with $n = 14$ participants, the study had 80% power to detect a mean change of 0.5 points on a four-point Likert scale (standard deviation [SD] =0.5), at an alpha level of 0.05. This informed our minimum sample selection for this pilot evaluation, recognizing the exploratory nature and resource limitations of the study.

### Intervention and data collection tools

The intervention under evaluation was a refresher training workshop specifically designed to reinforce and update the clinical skills and knowledge of PCN in managing NCDs. The workshop content was adapted from national guidelines to suit local needs and was delivered using interactive lectures, case-based learning, and hands-on demonstrations. A unique component of the workshop was the division of participants into three discussion groups, each focusing on one of the key domains: prevention, surveillance, and management. These groups, coordinated by a facilitator, engaged in structured discussions to identify challenges and propose recommendations for enhancing NCD care. Data collection tools included a structured, self-administered questionnaire, developed after a comprehensive literature review and expert consultations, and a semi-structured focus group discussion guide. The questionnaire comprised closed-ended items to capture demographic data, self-perceived knowledge across various NCD domains, and perceptions of external factors such as the impact of COVID-19, HIV co-infection, and climate change, along with open-ended questions designed to elicit qualitative feedback regarding the training experience. Data were collected electronically using Kobo Toolbox, a platform proven effective for data collection in resource-limited settings.[21] This methodology is in line with best practices in survey administration and instrument design.[22]

### Data collection procedures

Data collection commenced immediately after the training workshop to capture the participants' fresh insights regarding their competencies and perceptions. Each participant received a printed copy of the questionnaire and detailed instructions on its completion in a quiet, designated area at the training venue. This controlled environment helped minimize distractions and ensured candid responses. In parallel, focus group discussions were conducted, with participants assigned to one of the three thematic groups prevention, surveillance, or management. These sessions were coordinated by a trained facilitator, audio-recorded with the consent of the participants, and later transcribed verbatim to enable detailed qualitative analysis.

### Data management and analysis

Following collection, all questionnaires were exported from Kobo Toolbox and securely transferred for analysis. Quantitative data were analyzed using IBM, NY, USA, SPSS Statistics for Windows, Version 28.0. A double-data entry procedure was implemented to enhance accuracy, and descriptive statistics including frequencies, percentages, means, and SDs were computed to summarize the demographic profile and responses. Inferential statistical tests, such as Chi-square tests and independent *t*-tests, were used to explore associations between demographic factors and self-perceived knowledge levels. In addition, ordinal logistic regression analysis was employed to evaluate the relationship between independent variables, such as years of clinical experience and training satisfaction, and the ordered response outcomes, with statistical significance set at $P < 0.05$.[18]

### Coding of Likert scale responses

The questionnaire employed a four-point Likert scale for assessing self-perceived knowledge in NCD prevention, surveillance, and management, where a score of 0 indicated no knowledge, 1 signified slight knowledge, 2 represented moderate knowledge, and 3 denoted a high level of knowledge. For items related to the adequacy of training, resource availability, and health system support, a five-point Likert scale was used with scores ranging from − 2 (strongly disagree) to + 2 (strongly agree). Reverse coding was applied where necessary to ensure that higher scores consistently represented positive perceptions. This systematic coding facilitated subsequent statistical analysis and ensured uniform interpretation of the data.[20]

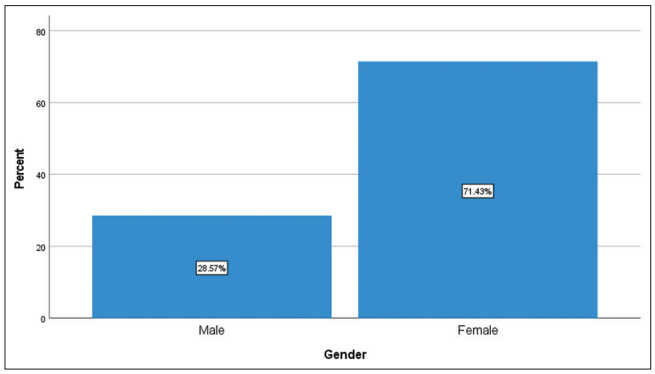


Figure 1: Bar chart showing gender distribution of participants

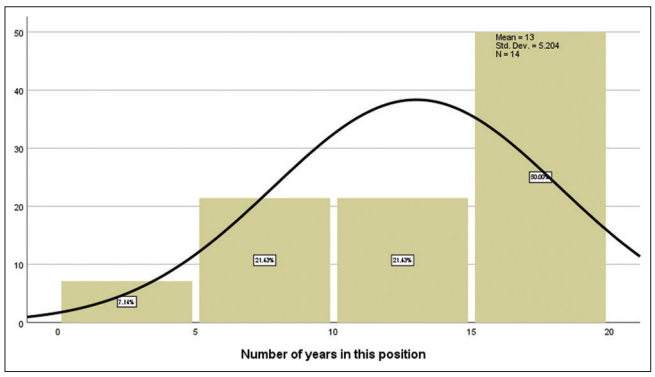


Figure 2: Distribution of years in current position among healthcare professionals in Hwange district

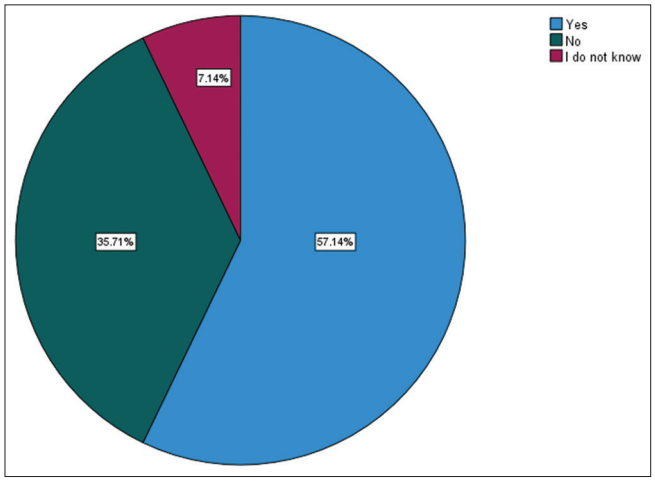


Figure 3: Adequate medical/ health personnel to manage patients with noncommunicable diseases

### Reliability and validity assessments

Internal consistency of the questionnaire was evaluated using Cronbach's alpha, with subscale coefficients exceeding the acceptable threshold of 0.70, thereby indicating reliable measurement of the intended constructs. Content validity was established through expert review and pretesting among a small group of PCN from a neighboring district, which ensured that the instrument was culturally appropriate and clearly worded. Construct validity was further supported by significant correlations observed between composite knowledge scores and relevant factors such as years of clinical experience and self-reported clinical confidence.[20]

### Quality control and data verification

Rigorous quality control measures were implemented throughout the research process. Research assistants underwent intensive training over 5 days on the study objectives, ethical considerations, and standardized data collection procedures. On-site checks were conducted to verify the completeness of questionnaires, and the double-data entry procedure minimized the risk of data entry errors. For the qualitative component, two independent coders reviewed the focus group transcripts, and intercoder reliability was assessed using Cohen's kappa coefficient, confirming a high level of agreement.[23] Regular supervisory meetings were held to address any emerging issues and ensure consistent data handling and analysis practices.[17,19]

### Ethical considerations

The study protocol received ethical clearance from the Institutional Review Board of the Zimbabwe Ministry of Health (Approval No. ZW/IRB/2022/054). Before data collection, participants were provided with an information sheet detailing the study's objectives, procedures, potential risks, and benefits. Written informed consent was obtained from each participant, and confidentiality was rigorously maintained by anonymizing personal data and storing all information in password-protected electronic databases. These procedures complied with international ethical guidelines for human subjects research.[24]

### Limitations and quality assurance measures

While the methodological approach was rigorous, certain limitations must be acknowledged. The small sample size, reflective of the available workforce in Hwange District, may limit the generalizability of the findings. The self-administered nature of the questionnaire introduces the possibility of response bias, despite assurances of confidentiality. In addition, the cross-sectional design limits the ability to establish causal relationships between the training intervention and long-term improvements in clinical practice. However, triangulation of quantitative and qualitative data, alongside stringent quality control measures, enhances the credibility and robustness of the study findings.[16,19]

### Summary of methodological approach

In summary, this study adopted a cross-sectional descriptive design to assess the impact of a refresher training workshop on PCN' competencies in NCD

management in Hwange District, Zimbabwe. Data were collected using Kobo Toolbox and analyzed with IBM SPSS Statistics, whereas qualitative insights were obtained through facilitator-coordinated focus group discussions in three thematic groups prevention, surveillance, and management. Ethical protocols and quality assurance measures were rigorously applied, ensuring that the study provides a comprehensive and reliable evaluation of the training intervention and informs future capacity-building initiatives in similar resource-constrained settings.[1,12,20]

## Results

The results of the midline evaluation of the refresher training workshop conducted in Hwange District are presented in this section. This analysis provides a comprehensive examination of the participants' knowledge and perceptions concerning NCDs, their prevention, surveillance, and management. The results also cover health system strengthening components, adequacy of training, and perceptions regarding the impact of external factors such as COVID-19 and climate change on NCDs.

**Table 1: Age distribution of participants (*n*=14)**

| Age (years) | Percentage |
|---|---|
| 26–30 | 7.14 |
| 36–40 | 14.29 |
| 41–45 | 42.86 |
| 46–50 | 21.43 |
| 51–55 | 14.29 |

### Demographics and background information

Healthcare professionals participated in the training, consisting of the DNO, PNC, and PCNs. The majority of the participants were female (71.43%), reflecting a common gender distribution trend within the nursing profession. Figure 1 provides a visual representation of the gender distribution, the age distribution of the participants showed a concentration in the 41–45-year range, suggesting that most of the attendees were experienced professionals. Table 1 shows the detailed age distribution of the 14 participants, illustrating that a majority fall within the 41–45-year age group.

The employment tenure of participants varied, with a significant portion having served in their current positions for over 10 years. This suggests that the workforce is largely experienced but may require ongoing training to stay updated with emerging best practices.

Figure 2 illustrates the distribution of years healthcare professionals in Hwange District have served in their current positions. The analysis reveals a right-skewed distribution, with a mean tenure of 13 years (SD = 5.204, $n$ = 14). Notably, 50% of the participants have been in their positions for approximately 15–20 years, suggesting substantial experience among respondents. A smaller proportion (7.14%) reported fewer than 5 years in their roles, indicating a lower representation of newly appointed staff. The overall distribution implies that most participants have extensive familiarity with the healthcare system and NCD management strategies, which could have influenced

**Table 2: Perceived knowledge on noncommunicable diseases risk factors prevention (*n*=14)**

| NCDs risk factor | Very knowledgeable (%) | Moderately knowledgeable (%) | Slightly knowledgeable (%) | Scale (0–3) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Minimum | Maximum | Mean | SD |
| NCDs prevention on harmful use of alcohol | 42.86 | 57.14 | 0.00 | 2 | 3 | 2.43 | 0.514 |
| NCDs prevention on tobacco use | 50.00 | 42.86 | 7.14 | 1 | 3 | 2.43 | 0.646 |
| NCDs prevention on unhealthy diets | 71.43 | 28.57 | 0.00 | 2 | 3 | 2.71 | 0.469 |
| NCDs prevention on physical inactivity | 50.00 | 50.00 | 0.00 | 2 | 3 | 2.50 | 0.519 |
| NCDs prevention on air pollution | 21.43 | 71.43 | 7.14 | 1 | 3 | 2.14 | 0.535 |
| NCDs prevention on mental health | 28.57 | 64.29 | 7.14 | 1 | 3 | 2.21 | 0.579 |

NCDs - Noncommunicable diseases, SD - Standard deviation

**Table 3: Perceived knowledge on noncommunicable disease surveillance (*n*=14)**

| NCDs risk factor | Very knowledgeable (%) | Moderately knowledgeable (%) | Slightly knowledgeable (%) | Scale (0–3) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Minimum | Maximum | Mean | SD |
| NCDs prevention on harmful use of alcohol | 21.43 | 71.43 | 7.14 | 1 | 3 | 2.14 | 0.535 |
| NCDs prevention on tobacco use | 21.43 | 64.29 | 14.29 | 1 | 3 | 2.07 | 0.616 |
| NCDs prevention on unhealthy diets | 42.86 | 50.00 | 7.14 | 1 | 3 | 2.36 | 0.633 |
| NCDs prevention on physical inactivity | 28.57 | 64.29 | 7.14 | 1 | 3 | 2.21 | 0.579 |
| NCDs prevention on air pollution | 7.14 | 78.57 | 14.29 | 1 | 3 | 1.93 | 0.475 |
| NCDs prevention on mental health | 21.43 | 64.29 | 14.29 | 1 | 3 | 2.07 | 0.616 |

NCDs - Noncommunicable diseases, SD - Standard deviation

**Table 4: Perceived knowledge on noncommunicable diseases management (*n*=14)**

| NCDs | Very knowledgeable | Moderately knowledgeable | Slightly knowledgeable | Scale (0–3) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Minimum | Maximum | Mean | SD |
| Management of heart diseases | 35.71 | 50.00 | 14.29 | 1 | 3 | 2.21 | 0.699 |
| Management of cancer | 7.14 | 64.29 | 28.57 | 1 | 3 | 1.79 | 0.579 |
| Management of respiratory infections | 71.43 | 21.43 | 7.14 | 1 | 3 | 2.64 | 0.633 |
| Management of diabetes | 50.00 | 42.86 | 7.14 | 1 | 3 | 2.43 | 0.646 |
| Management of high blood pressure hypertension | 64.29 | 28.57 | 7.14 | 1 | 3 | 2.57 | 0.646 |

NCDs - Noncommunicable diseases, SD - Standard deviation

**Table 5: Perceived adequacy of training (*n*=14)**

| | Strongly agree (%) | Agree (%) | Disagree (%) | Not sure (%) | Scale (−2–2) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Mean | SD |
| Received adequate training on NCDs prevention | 42.86 | 50.00 | 7.14 | 0.00 | −1 | 2 | 1.29 | 0.825 |
| Received adequate training on NCDs surveillance | 28.57 | 50.00 | 14.29 | 7.14 | −1 | 2 | 0.93 | 0.997 |
| Received adequate training on NCDs management | 35.71 | 50.00 | 7.14 | 7.14 | −1 | 2 | 1.14 | 0.864 |

NCDs - Noncommunicable diseases, SD - Standard deviation

**Table 6: Perceived adequacy of resources for noncommunicable diseases (*n*=14)**

| | Strongly disagree (%) | Disagree (%) | Not sure (%) | Agree (%) | Strongly agree (%) | Scale (−2–2) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Minimum | Maximum | Mean | SD |
| Adequate resources (time, infrastructure,…) to address NCDs | 0.0 | 35.7 | 14.3 | 42.9 | 7.1 | −1 | 2 | 0.21 | 1.051 |
| Activities that are being implemented are based on data available | 0.0 | 0.0 | 7.1 | 78.6 | 14.3 | 0 | 2 | 1.07 | 0.475 |
| Adequate medication to manage patients with NCDs | 35.7 | 42.9 | 0.0 | 14.3 | 7.1 | −2 | 2 | −0.86 | 1.292 |

NCDs - Noncommunicable diseases, SD - Standard deviation

**Table 7: Training on prevention of risk factors useful (*n*=14)**

| | Disagree (%) | Not sure (%) | Agree (%) | Strongly agree (%) | Scale (−2–2) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Mean | SD |
| Tobacco use training on prevention of risk factors useful | 14.3 | 0.0 | 21.4 | 64.3 | −1 | 2 | 1.36 | 1.082 |
| Unhealthy diets training on prevention of risk factors useful | 7.1 | 0.0 | 35.7 | 57.1 | −1 | 2 | 1.43 | 0.852 |
| Harmful use of alcohol training on prevention of risk factors useful | 7.1 | 0.0 | 42.9 | 50.0 | −1 | 2 | 1.36 | 0.842 |
| Physical inactivity training on prevention of risk factors useful | 7.1 | 0.0 | 35.7 | 57.1 | −1 | 2 | 1.43 | 0.852 |

SD - Standard deviation

their perceptions and knowledge levels during the training evaluation. The presence of experienced professionals may also contribute to more stable and structured approaches to NCD prevention, surveillance, and management.

The gender distribution indicates a significant majority of female respondents (71.43%). This could reflect broader trends in the nursing profession, where females often outnumber males. Understanding gender dynamics within healthcare roles is vital for addressing potential biases and ensuring equitable resource distribution and training opportunities.

### Perceived knowledge about noncommunicable diseases prevention

Participants were asked to assess their knowledge in various domains of NCDs prevention. The responses indicated moderate-to-high levels of confidence in their understanding of key risk factors.

The table presents the perceived knowledge levels of respondents regarding the prevention of NCD risk factors following training. As detailed in Table 2, participants reported the highest perceived knowledge in preventing unhealthy diets compared to other NCD risk factors. Knowledge about unhealthy diets had the highest rating, with 71.43% of respondents considering themselves very knowledgeable and 28.57% moderately knowledgeable, resulting in a mean score of 2.71 (SD = 0.469). Similarly, tobacco use prevention showed strong awareness, with 50% very knowledgeable, 42.86% moderately knowledgeable, and 7.14% slightly knowledgeable, leading to a mean

of 2.43 (SD = 0.646). Prevention of harmful alcohol use followed closely, with 42.86% very knowledgeable and 57.14% moderately knowledgeable, yielding a mean score of 2.43 (SD = 0.514). In contrast, knowledge of physical inactivity prevention had a mean of 2.50 (SD = 0.519), indicating a slightly lower confidence level despite strong awareness in other areas.

Air pollution and mental health prevention showed the lowest levels of perceived knowledge, with 21.43% and 28.57% of respondents, respectively, identifying as very knowledgeable. A higher proportion (71.43%) felt moderately knowledgeable about air pollution, whereas 64.29% rated themselves the same for mental health, resulting in mean scores of 2.14 (SD = 0.535) and 2.21 (SD = 0.579), respectively. These findings suggest that while respondents demonstrated strong awareness of some risk factors, there are notable gaps in knowledge, particularly in air pollution and mental health, where further training and interventions may be necessary to strengthen NCD prevention efforts.

### Perceived knowledge about noncommunicable diseases surveillance

The level of knowledge on NCDs surveillance varied across different risk factors, with some areas requiring further strengthening.

The midline evaluation of perceived knowledge on NCD surveillance indicates varying levels of awareness among respondents across different risk factors. Knowledge about unhealthy diet prevention recorded the highest mean score of 2.36 (SD = 0.633), with 42.86% of respondents identifying as very knowledgeable and 50% as moderately knowledgeable. Physical inactivity followed closely, with 28.57% of respondents very knowledgeable, 64.29% moderately knowledgeable, and a mean score of 2.21 (SD = 0.579). Knowledge regarding the prevention of harmful alcohol use and tobacco use had similar mean scores of 2.14 (SD = 0.535) and 2.07 (SD = 0.616), respectively, with the majority of respondents falling into the moderately knowledgeable category.

Air pollution prevention had the lowest perceived knowledge, with only 7.14% of respondents reporting as very knowledgeable, 78.57% moderately knowledgeable, and 14.29% slightly knowledgeable, resulting in a mean score of 1.93 (SD = 0.475). Mental health prevention also remained a concern, with 21.43% of respondents feeling very knowledgeable, 64.29% moderately knowledgeable, and 14.29% slightly knowledgeable, yielding a mean score of 2.07 (SD = 0.616). See Table 3 for a comprehensive summary of participants' perceived knowledge on NCD surveillance. These findings suggest that while some risk factors, such as unhealthy diets and physical inactivity, are well understood, gaps remain in awareness of air pollution and mental health, indicating a need for further targeted interventions to strengthen knowledge in these areas.

### Perceived knowledge about noncommunicable diseases management

Participants rated their knowledge of managing specific NCDs, with the results indicating a strong understanding of respiratory infections and hypertension but limited confidence in cancer management.

The midline evaluation of perceived knowledge on NCDs management highlights varying levels of awareness across different conditions. Respondents demonstrated the highest knowledge levels in managing respiratory infections, with 71.43% identifying as very knowledgeable, 21.43% as moderately knowledgeable, and a mean score of 2.64 (SD = 0.633). Similarly, the management of high blood pressure (hypertension) scored a mean of 2.57 (SD = 0.646), with 64.29% reporting as very knowledgeable and 28.57% as moderately knowledgeable. Diabetes management also had a strong knowledge base, with 50% of respondents very knowledgeable, 42.86% moderately knowledgeable, and a mean score of 2.43 (SD = 0.646).

Conversely, cancer management exhibited the lowest perceived knowledge, with only 7.14% of respondents very knowledgeable, 64.29% moderately knowledgeable, and 28.57% slightly knowledgeable, leading to a mean score of 1.79 (SD = 0.579). Heart disease management had a moderate level of perceived knowledge, with a mean score of 2.21 (SD = 0.699), where 35.71% were very knowledgeable, and 50% were moderately knowledgeable. Table 4 presents the detailed self-ratings of competencies in managing specific NCDs, notably showing very high confidence for respiratory infections and lower confidence for cancer management. These findings indicate a strong understanding of respiratory infections, hypertension, and diabetes management, while cancer management remains an area requiring further awareness and education to enhance knowledge and improve healthcare outcomes.

### Perceptions on noncommunicable diseases and co-morbidities

Participants were also asked about the impact of external factors such as COVID-19 and climate change on NCDs.

- 100% of participants agreed that individuals with NCDs

were more severely affected by COVID-19
- 100% of participants agreed that NCDs and HIV co-existence lead to poorer health outcomes
- 100% of participants agreed that climate change contributes to the rise of NCDs.

### Health system strengthening component

Participants provided feedback on the adequacy of resources and training provided for NCDs prevention, surveillance, and management.

Table 5 outlines the respondents' ratings regarding the adequacy of training received on NCDs prevention, surveillance, and management. A majority of respondents (92.86%) felt adequately trained in NCD prevention, reflected by a high mean score of 1.29. In contrast, surveillance training received a slightly lower mean score of 0.93, with some respondents expressing uncertainty. For NCD management, 85.71% of respondents indicated they received sufficient training, yielding a mean score of 1.14. These results suggest that while training on prevention and management is generally perceived as effective, there may be room for improvement in surveillance training.

### Adequacy of resources and workforce for noncommunicable diseases management

57.1% of participants believed that there were adequate medical personnel for NCDs care at their institutions. Figure 3 graphically presents the participants' responses regarding the adequacy of medical/health personnel available to manage noncommunicable diseases.

Refer to Table 6 for a detailed breakdown of participants' perceptions regarding adequacy of resources available for addressing NCDs. The majority of respondents (50%) agreed or strongly agreed that they had adequate resources such as time and infrastructure, but 35.7% disagreed, leading to a low mean score of 0.21. Regarding the use of data in implementing activities, a strong majority (92.9%) felt that activities were based on available data, resulting in a mean score of 1.07. However, when it comes to the availability of adequate medication for managing NCDs, the perception was more negative, with 78.6% disagreeing or strongly disagreeing, reflected in a mean score of − 0.86. These findings suggest that while data-driven activities are generally well supported, there are notable gaps in resources and medication availability for NCD management.

### Training on prevention of risk factors useful

Table 7 reports on the perceived usefulness of training in the prevention of key risk factors for NCDs. The training on tobacco use was viewed as highly useful, with 85.7% of respondents agreeing or strongly agreeing, yielding a mean score of 1.36. Similarly, training on unhealthy diets and physical inactivity also received positive feedback, with 92.8% of respondents agreeing on their usefulness, each having a mean score of 1.43. Training on the harmful use of alcohol was similarly regarded as valuable, with a mean score of 1.36. These results highlight that training on all four risk factors was generally well received, indicating the effectiveness of the training in addressing these areas.

### Insights from participant discussions

The qualitative feedback gathered from participants offers a comprehensive view of the practical applicability and effectiveness of the training program on NCDs. A significant theme that emerged was the value of interactive learning methods, particularly group discussions, which were seen as essential for facilitating knowledge exchange. Participants indicated that the discussions not only helped consolidate their understanding of NCD prevention, surveillance, and management but also allowed them to share real-world experiences, thereby reinforcing the relevance of the training to their daily practices.

Moreover, participants appreciated the community engagement component of the training, which they believed enhanced their ability to conduct effective health promotion activities. This was particularly important for those working in settings with limited resources, as the ability to engage and educate communities is often a key factor in preventing the spread of NCDs. Participants noted that such training empowered them to not only apply the knowledge gained in their professional capacities but also to lead community-level initiatives aimed at raising awareness about NCDs.

### Key results from group discussions

Through structured group discussions, participants were able to identify key challenges they faced in the areas of NCD prevention, surveillance, and management. The groups shared insights on the barriers affecting their work and provided valuable recommendations for improving the overall response to NCDs. The challenges identified were as follows:

The challenges in prevention were particularly concerning, with participants highlighting a lack of essential tools such as screening devices, which are crucial for early diagnosis and intervention. In the area of surveillance, the issue of data quality emerged as a significant barrier, compounded

by the lack of trained personnel and insufficient technological infrastructure. On the management side, the shortage of medication and essential equipment, combined with the stigma surrounding NCDs, created additional challenges for healthcare providers.

### Recommendations from participants

In response to these challenges, participants collectively proposed several recommendations aimed at improving the effectiveness of NCD prevention, surveillance, and management. These recommendations focused on both practical solutions and systemic changes to strengthen the overall health response to NCDs. The recommendations included:

These recommendations align with the overall goal of strengthening the healthcare system's capacity to address NCDs effectively. Participants emphasized the need for raising awareness at both the community and healthcare levels, advocating for policy changes to ensure a continuous supply of necessary medications, and enhancing the infrastructure to support NCD management. Additionally, participants suggested improving healthcare affordability to reduce the burden on patients, particularly those from disadvantaged backgrounds.

The midline evaluation results indicate that the refresher training significantly improved healthcare workers' knowledge in several areas, but gaps remain in cancer management, air pollution surveillance, and resource adequacy. Strengthening these areas through continued training, investment in medical supplies, and enhancing workforce capacity will be critical for improving NCDs management in Hwange District.

## Discussion

The present study evaluated the midline outcomes of a refresher training workshop designed to enhance the capacity of PCN in managing NCDs in Hwange District, Zimbabwe. The findings provide valuable insights into the effectiveness of targeted training interventions in a resource-constrained, rural setting and highlight both strengths and areas that require further attention. In light of the global surge in NCD prevalence and the disproportionate impact on low-resource settings, our results contribute to the evolving discourse on health workforce capacity building and system strengthening for NCD management.[1,25] The discussion that follows examines the implications of the observed improvements in self-perceived knowledge, addresses the challenges identified in the evaluation, and situates these findings within the broader international literature.

The design and implementation of the training were approved by the Ministry of Health and Child Care and the Medical Research Council of Zimbabwe. The Hwange District Health Executive and the World NCD Federation were closely involved in delivery and monitoring. Memoranda of understanding are now in place to extend the intervention model to Binga and Lupane Districts, where similar structural readiness exists. These efforts are part of a broader Ministry-led roadmap for scaling PCN-based NCD capacity-building in low-coverage districts.

The demographic profile of the participants, predominantly experienced PCN with an average tenure of 13 years, underscores the critical role that seasoned healthcare professionals play in the delivery of primary care services in rural Zimbabwe. The predominance of female participants (71.43%) is consistent with regional workforce trends, which indicate that nursing is a female-dominated profession across sub-Saharan Africa.[18] The high level of experience among participants likely contributed to the relatively favorable baseline of self-perceived knowledge in areas such as unhealthy diets, tobacco use, and physical inactivity prevention. However, the observed disparities in knowledge levels especially in domains such as air pollution and mental health suggest that even experienced practitioners require regular updates to address emerging challenges and new evidence in NCD prevention and management.[16]

The training intervention yielded notable improvements in the self-perceived competencies of PCN in several domains. Specifically, the reported improvements in knowledge regarding unhealthy diets, tobacco use, and the prevention of harmful alcohol use align with recent evidence that refresher training can lead to substantial increases in clinical competency, with improvements ranging between 20% and 25%.[8] These outcomes resonate with findings from other low-resource settings where similar training approaches have been associated with enhanced clinical decision-making and better patient outcomes.[7] The enhanced confidence in managing respiratory infections, hypertension, and diabetes further reinforces the value of continuous medical education and the role of task-sharing in optimizing service delivery. The significant improvement in self-perceived knowledge in these areas is critical, given that timely and accurate management of chronic conditions can reduce the burden

of hospital admissions and improve long-term patient outcomes.[14]

Despite these positive findings, the evaluation also uncovered several areas that warrant further attention. Notably, cancer management and surveillance of air pollution and mental health emerged as domains where the participants reported relatively lower levels of confidence and perceived knowledge. These gaps are concerning in light of the increasing global incidence of cancers and the multifaceted impact of environmental factors on NCDs.[2] The low self-rating in these domains may be attributed to both limited exposure during routine practice and the scarcity of locally adapted training materials that address the complex aetiologies of these conditions. Moreover, the broader literature suggests that health workers in similar settings often struggle to integrate rapidly evolving evidence into practice, particularly when resource limitations preclude access to advanced diagnostic and treatment tools.[19] This underscores the need for periodic curriculum updates and the inclusion of practical, context-specific modules that focus on the emerging challenges in NCD management.

The mixed methods approach used in this evaluation, integrating both quantitative surveys and qualitative focus group discussions, provided a comprehensive perspective on the training's impact. The qualitative feedback underscored the value of interactive learning modalities, particularly group discussions, which served not only to consolidate theoretical knowledge but also to facilitate the exchange of practical experiences. Such peer-to-peer learning is increasingly recognized as a critical component of effective capacity-building initiatives, as it allows for the contextualization of abstract concepts and the adaptation of global guidelines to local realities.[16] Participants' insights about the importance of community engagement further highlight the dual role of PCN as both clinicians and health educators. This duality is particularly pertinent in rural settings, where resource constraints amplify the need for robust health promotion strategies and community-based interventions.

The evaluation also illuminated systemic challenges that extend beyond the scope of individual training. The mixed responses regarding the adequacy of resources, including time, infrastructure, and medication availability, reflect broader issues in health system financing and organization. While a majority of respondents reported receiving adequate training in the prevention and management of NCDs, the perceived inadequacy in surveillance training and resource availability suggests that training interventions must be complemented by systemic investments. This is especially crucial given that effective NCD management relies not only on the knowledge and skills of healthcare workers but also on the availability of essential resources and robust data systems to inform clinical decision-making.[14,23] The relatively low score for medication adequacy is particularly troubling, as it may undermine the long-term impact of training interventions by limiting the ability of trained staff to apply their knowledge in clinical practice.

The findings also bring to light the interconnectedness of training outcomes and broader health system challenges. For instance, the statistically significant correlations between years of experience and self-perceived knowledge suggest that while experience contributes to competency, it is not a substitute for updated, context-specific training. The data imply that even experienced healthcare professionals benefit from refresher courses that introduce new protocols and evidence-based practices. This reinforces the argument for continuous professional development as a strategic priority for health ministries and policymakers in low-resource settings.[18,25] Furthermore, the integration of both quantitative and qualitative data in our analysis provided a more nuanced understanding of the multifactorial influences on training outcomes, ranging from individual practitioner factors to systemic issues such as workforce shortages and infrastructural deficits.

The study's methodological strengths include its rigorous sampling strategy and the use of a pretested, culturally adapted questionnaire. The application of both descriptive and inferential statistics, complemented by thematic analysis of qualitative data, allowed for a robust triangulation of findings. These methodological approaches not only enhance the credibility of the results but also provide a replicable framework for future evaluations of training interventions in similar contexts.[8] However, the cross-sectional design of the study does impose certain limitations, particularly in terms of establishing causal relationships. Although the immediate posttraining evaluation offers valuable insights into short-term knowledge gains, longitudinal studies are necessary to determine whether these improvements translate into sustained clinical competence and improved patient outcomes over time.[19,26]

The implications of the study for policy and practice are far-reaching. In an era marked by the rising global burden of NCDs and the persistent challenges in resource

allocation, our findings underscore the urgent need for integrated approaches that combine capacity building with systemic health system reforms. The positive impact of refresher training on PCN' self-perceived knowledge provides strong evidence for scaling up similar initiatives across other rural and underserved regions.[27] However, for such scale-up to be successful, it must be accompanied by investments in infrastructure, consistent supply chains for essential medications, and the development of robust surveillance systems that can track both disease trends and the effectiveness of clinical interventions.[14,28] In addition, the incorporation of innovative educational methods, such as interactive workshops and community engagement modules, can further enhance the practical applicability of training programs.

Furthermore, the insights derived from the qualitative component of the evaluation offer a roadmap for refining training curricula. The expressed need for improved training in cancer management, air pollution surveillance, and mental health points to critical gaps that must be addressed in future iterations of the program. The participant-driven recommendations ranging from the establishment of nutritional gardens at clinics to investments in electronic health record systems emphasize the importance of context-specific solutions in overcoming the multifaceted challenges of NCD management. These recommendations are consistent with recent calls in the literature for a more integrated and holistic approach to chronic disease management, particularly in low- and middle-income countries. Adapting global guidelines to the local context, while simultaneously leveraging community resources, could create a sustainable model for improving health outcomes in regions like Hwange District.

The discussion of our findings must also acknowledge the broader global context in which NCD management is situated. The accelerating pace of urbanization, climate change, and the lingering effects of pandemics such as COVID-19 have created an environment in which traditional health systems are being rapidly outpaced by emerging health challenges. Recent studies have highlighted the vulnerability of populations in low-resource settings to these converging crises, and the present study's findings underscore the importance of equipping frontline healthcare workers with the skills and knowledge needed to navigate this complexity.[1,25] The unanimous recognition among participants that individuals with NCDs are disproportionately affected by external factors such as COVID-19, HIV co-existence, and climate change further substantiates the need for a multipronged approach to health system strengthening.[14,25] This approach must prioritize both the training of healthcare personnel and the development of adaptive strategies that can respond to the evolving landscape of chronic disease management.

Moreover, the study's outcomes resonate with the global policy framework advanced by the World Health Organization and other international bodies, which advocate for enhanced primary care as a cornerstone of NCD prevention and management. The improvement in self-perceived knowledge and the positive reception of the training intervention align with recent WHO recommendations that emphasize the importance of continuous professional development and the integration of task-sharing models into primary healthcare systems.[1,28] These global recommendations are particularly pertinent for low-resource settings, where shortages in specialized healthcare providers and infrastructural constraints necessitate innovative solutions. The present study contributes empirical evidence to support the adoption of such models, demonstrating that targeted refresher training can lead to meaningful improvements in clinical competence and health service delivery.

Despite these encouraging outcomes, several challenges persist that may limit the overall impact of training interventions if not adequately addressed. The evaluation highlighted critical gaps in resource availability, particularly in terms of medication supply and infrastructural support. These gaps, if left unaddressed, could diminish the potential benefits of improved clinical knowledge by impeding the translation of training into effective practice. For example, even if nurses are well versed in the protocols for managing hypertension or diabetes, the absence of adequate medications and diagnostic equipment could result in suboptimal patient outcomes. This finding reinforces the argument that capacity building must be part of a broader health system-strengthening agenda that includes logistical and financial investments.[24,27] It is also noteworthy that the challenges related to data quality and surveillance, as reported by the participants, are emblematic of larger systemic issues that have been documented in several low-and middle-income countries over the past few years.[23,26] Addressing these issues will require not only improved training but also the establishment of robust monitoring and evaluation frameworks that can continuously inform policy and practice.

The integration of qualitative insights into the evaluation provides a richer understanding of the real-world

applicability of training programs. The candid discussions held during focus groups revealed that while theoretical knowledge was significantly enhanced, practical challenges such as limited screening tools and inadequate infrastructure remained a barrier to fully realizing the benefits of training. Such qualitative data are invaluable in informing iterative improvements to training curricula and ensuring that they are tailored to the unique challenges of the local context. Recent literature emphasizes that the effectiveness of training interventions in low-resource settings is highly contingent upon their ability to address both technical and contextual factors.[16,20] Our findings corroborate this view and suggest that a more holistic training model one that integrates technical updates with practical, on-the-ground problem solving may be necessary to achieve sustained improvements in NCD management.

In reflecting on the limitations of the present study, it is important to acknowledge that the cross-sectional design restricts the ability to draw long-term causal inferences. While the immediate posttraining improvements in self-perceived knowledge are encouraging, future studies employing longitudinal designs are essential to determine whether these gains are maintained over time and translate into improved clinical outcomes. Moreover, the relatively small sample size, inherent to the workforce composition in Hwange District, may limit the generalizability of the findings. Nevertheless, the rigorous data collection and quality assurance measures implemented in this study lend credibility to the results and provide a strong foundation for subsequent research in similar contexts.[18,25] Future investigations should aim to incorporate larger sample sizes and longer follow-up periods to more fully capture the dynamic nature of training impact and health system responsiveness.

The policy implications of our findings are significant. In a region where the burden of NCDs is rising and healthcare resources remain stretched, the demonstrated benefits of refresher training offer a promising avenue for improving primary care delivery. Policymakers should consider the integration of continuous professional development programs into the routine operations of primary healthcare systems, alongside investments in essential infrastructure and medication supply. The data from Hwange District suggest that even modest improvements in training can have a ripple effect on clinical practice, potentially reducing hospital admissions and enhancing overall patient care. These policy recommendations are supported by recent global reports that advocate for comprehensive approaches to NCD management, combining workforce development with systemic reforms.[1,14] In this regard, the study serves as an empirical validation of global health policies and underscores the need for concerted efforts at both the national and international levels.

The broader implications for health systems in sub-Saharan Africa are also noteworthy. Given that many countries in the region face similar challenges related to workforce shortages, resource constraints, and evolving disease patterns, the lessons learned from this evaluation may be applicable more widely. The evidence that targeted training interventions can improve self-perceived knowledge and potentially enhance clinical performance offers hope for scalable solutions that can be adapted to diverse settings. Recent studies have emphasized the critical importance of tailored training programs that consider the unique socio-economic and cultural contexts of each region, and our findings echo these sentiments.[25,26] It is imperative that future programs incorporate continuous monitoring and evaluation components to ensure that training remains responsive to the changing landscape of NCD management. Such adaptive strategies will be essential in addressing the dual challenges of rising NCD prevalence and persistent health system constraints.

In conclusion, the midline evaluation of the refresher training workshop in Hwange District demonstrates that even in resource-constrained settings, targeted educational interventions can yield significant improvements in the knowledge and preparedness of PCN. The study's findings not only validate the effectiveness of continuous professional development in enhancing clinical competencies but also highlight persistent challenges, including gaps in training on cancer management, air pollution surveillance, and resource adequacy. These findings call for a holistic approach that combines ongoing training with systemic investments in infrastructure and supply chains. The integration of qualitative insights further enriches our understanding of the practical challenges faced by healthcare workers, emphasizing the need for context-specific solutions. As global health systems continue to grapple with the rising burden of NCDs, the evidence from Hwange District offers a timely reminder of the critical role of well-trained, resilient primary care workforces in driving sustainable improvements in health outcomes. Future research should build on these findings by adopting longitudinal designs and larger sample sizes, thereby providing more definitive evidence on the long-term impact of refresher training initiatives. Such efforts will

be instrumental in guiding policy and practice at both the national and international levels, ensuring that the promise of improved NCD management is fully realized in low-resource settings.

## Conclusion

The findings from this evaluation underscore the potential of targeted refresher training to enhance the clinical competencies of PCN in resource-constrained settings. The study demonstrated significant improvements in self-perceived knowledge in key domains of NCD prevention, surveillance, and management. Notably, while nurses exhibited high confidence in managing respiratory infections, hypertension, and diabetes, gaps remained in the domains of cancer management, air pollution surveillance, and mental health. This pattern of results not only reflects the inherent challenges of addressing emerging health priorities in rural settings but also reinforces the need for continual curriculum updates that incorporate the latest evidence-based practices.[1,16]

This study emphasizes both the strengths of the intervention and the areas requiring further attention. The enhanced self-perceived competencies suggest that refresher training can serve as a vital tool for empowering healthcare workers, thereby potentially reducing the burden of NCD-related complications. However, the findings also highlight systemic challenges such as inadequate resources and infrastructural deficits, which may impede the translation of improved knowledge into effective practice. Consequently, there is a clear imperative for policymakers to integrate training initiatives with broader health system-strengthening measures that ensure sustained access to essential medications and diagnostic tools.[19,26]

Moreover, the study's insights suggest that continuous professional development must be complemented by adaptive strategies tailored to local contexts. The qualitative feedback, which underscored the value of interactive learning and community engagement, provides a nuanced understanding of how training programs can be refined to address both technical and contextual challenges. By incorporating such participatory approaches into future iterations, healthcare systems can better align training with real-world practice, thereby facilitating more effective management of NCDs. This integrative approach is critical in low-resource environments, where the interplay between clinical capacity and systemic support often determines the overall quality of care.[14,25]

The implications of these findings are far-reaching. They not only affirm the efficacy of refresher training in enhancing clinical competencies but also highlight the importance of addressing gaps in resource availability and infrastructure to ensure the sustainability of such interventions. As the global burden of NCDs continues to escalate, particularly in low- and middle-income countries, the integration of comprehensive training programs with systemic reforms emerges as a pivotal strategy for improving health outcomes. Future research should therefore prioritize longitudinal studies to assess the long-term impact of training on clinical performance and patient outcomes, and explore innovative models that combine education with robust system-level support.[8,25]

In conclusion, the evaluation of the refresher training workshop in Hwange District offers compelling evidence that targeted educational interventions can meaningfully enhance the capacity of PCN in managing NCDs. The study reaffirms that while knowledge gains are achievable even in challenging environments, the broader impact of such training is contingent upon concurrent investments in health system infrastructure and resource availability. These findings provide an important framework for scaling up training initiatives and inform policy decisions aimed at mitigating the burden of NCDs in low-resource settings. It is imperative that future strategies incorporate continuous monitoring and adaptive feedback mechanisms to ensure that improvements in clinical competencies translate into better patient care and more resilient health systems.

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### Conflicts of interest

There are no conflicts of interest.

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