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Development and evaluation of a standardized community health nursing intervention model for improving chronic disease outcomes in rural populations: A mixed-methods study

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Abstract

Background: Chronic diseases significantly burden rural healthcare systems, where continuity of care is limited.

Objective: To develop and evaluate a standardized community health nursing intervention model for improving chronic disease outcomes.

Methods: A mixed-method quasi-experimental study was conducted among 980 participants (intervention = 490; control = 490) over 6 months. The intervention included health education, home visits, self-management support, and care coordination.

Results: The intervention group showed significant reductions in systolic blood pressure (−10.0 mmHg), diastolic blood pressure (−5.5 mmHg), and fasting blood glucose (−16.3 mg/dL) ($p < 0.001$). Self-management and quality of life improved significantly, supported by qualitative findings on better adherence and engagement.

Conclusion: The model effectively improved clinical and behavioral outcomes and is suitable for integration into rural primary healthcare systems.

Keywords: Community health nursing, chronic disease, rural health, intervention, self-management

Introduction

Chronic diseases constitute a leading cause of morbidity and mortality worldwide and pose a significant challenge to healthcare systems, particularly in low- and middle-income countries. The increasing prevalence of chronic conditions has intensified the demand for continuous, coordinated, and preventive care, thereby exposing gaps in existing healthcare delivery systems. The chronic disease epidemic has been closely associated with systemic healthcare challenges, including fragmented services, inadequate preventive strategies, and inequitable access to primary care (Holman, 2020) [4]. These challenges are more pronounced in rural populations, where limited healthcare infrastructure, geographic barriers, and workforce shortages contribute to delayed diagnosis, poor disease management, and suboptimal health outcomes.

Community health nursing has emerged as a critical component in addressing these gaps through the delivery of accessible, person-centered, and continuous care at the population level. Community nurses play a vital role in ensuring continuity of care for individuals with chronic diseases by facilitating regular follow-up, promoting self-care practices, and enabling early identification of complications (Ge *et al*., 2023). Evidence suggests that strong primary care systems, supported by community-based nursing interventions, are associated with improved health outcomes and reduced health disparities (Shi, 2012) [6]. Furthermore, nurse-led transitional care interventions have demonstrated effectiveness in improving care coordination and reducing hospital readmissions, particularly among patients with chronic conditions (Naylor & Keating, 2008) [5].

Despite these contributions, community health nursing practice faces several structural and operational challenges. Community health nurses often encounter high workloads, limited resources, and inadequate organizational support, which restrict their ability to deliver comprehensive care and contribute effectively to universal health coverage (May *et al*., 2021) [2]. In parallel, the growing burden of chronic diseases in developing countries, reflected in patterns of healthcare utilization and disease distribution, underscores the need for more efficient and contextually appropriate care delivery models (Mahumud *et al*., 2023) [3].

The complexity of chronic disease management is further heightened among vulnerable populations such as older adults, who frequently experience multimorbidity, frailty, and social isolation. These factors necessitate comprehensive, community-oriented approaches that extend beyond clinical management to include psychosocial and functional support (Vetrano *et al*., 2019; Sabir *et al*., 2009) [25, 26]. Frameworks such as the World Health Organization's Integrated Care for Older People (ICOPE) highlight the importance of maintaining intrinsic capacity and delivering holistic, person-centered care within community settings (Leung *et al*., 2022) [28]. Additionally, nurses contribute significantly to capacity building and education within rural healthcare systems, reinforcing their central role in strengthening community-based care delivery (Ohta *et al*., 2022) [27].

However, existing community health nursing interventions for chronic disease management remain fragmented, disease-specific, and inconsistently implemented across different settings. In rural contexts, these limitations are further compounded by disparities in access, continuity of care, and resource availability, resulting in variable and often suboptimal patient outcomes. Current literature lacks a structured, standardized, and scalable intervention model that integrates essential components such as patient education, follow-up, and continuity of care within a unified community-based framework. Moreover, there is limited empirical evidence evaluating such models using robust methodological approaches that incorporate both

quantitative outcome assessment and qualitative insights into implementation and contextual feasibility.

In this context, there is a critical need to develop and rigorously evaluate a standardized community health nursing intervention model tailored to rural populations with chronic diseases. A mixed-methods approach is particularly appropriate to capture both the effectiveness of the intervention in improving health outcomes and the contextual factors influencing its implementation. Such an approach can provide comprehensive evidence to inform practice, enhance care delivery, and support the development of scalable, evidence-based community health nursing strategies for chronic disease management.

Review of Literature

A substantial body of literature highlights the effectiveness of community-based and nurse-led interventions in improving chronic disease management, particularly among vulnerable populations. Early evidence demonstrates that community health worker and nurse-led strategies contribute significantly to enhancing access to care, improving disease control, and supporting self-management practices. For instance, systematic reviews have shown that community-based health worker interventions can improve chronic disease outcomes by strengthening care delivery, patient engagement, and continuity of care among underserved populations (Kim *et al*., 2016) [7]. Similarly, structured training programs for community health workers in low- and middle-income countries have been found to enhance cardiovascular disease management, emphasizing the importance of capacity building within community settings (Abdel-All *et al*., 2017) [8].

Self-management support has emerged as a central component of chronic disease care. Evidence suggests that comprehensive self-management approaches, including patient education and behavioral support, can significantly improve health outcomes and reduce healthcare utilization (Grady & Gough, 2014) [13]. In this context, nurse-led self-management interventions have demonstrated effectiveness in improving clinical outcomes and patient adherence, although variability in intervention design and implementation limits their generalizability (Massimi *et al*., 2017) [14]. Additionally, methods aimed at increasing participation in preventive programs, such as organized screening initiatives, have shown positive effects in improving early detection and disease prevention, further reinforcing the role of community-based strategies (Camilloni *et al*., 2013) [9].

Care coordination is another critical aspect of community health nursing, particularly for patients with complex and chronic conditions. A scoping review by Karam *et al*. (2021) [11] highlights the importance of nursing care coordination in primary healthcare, demonstrating its role in improving service integration and patient outcomes. Holistic care approaches, which address physical, psychological, and social dimensions of health, are also increasingly recognized as essential in chronic disease management, supporting comprehensive and patient-centered care delivery (Jasemi *et al*., 2017) [12]. Furthermore, the expansion and development of the nursing profession have been identified as key drivers in improving population health and strengthening healthcare systems globally (Guo, 2017) [10].

Several experimental and quasi-experimental studies have provided empirical support for community nursing interventions across various chronic conditions. Randomized controlled trials have demonstrated that community nurse-supported discharge programs can significantly reduce hospital readmissions among patients with chronic illnesses, particularly older adults with respiratory diseases (Kwok *et al*., 2004; Utens *et al*., 2012) [18, 24]. Similarly, community-based nursing interventions have been associated with improved healing outcomes and quality of life in patients with chronic conditions such as venous leg ulcers (Edwards *et al*., 2005; Edwards *et al*., 2009) [19, 21]. Post-discharge community nursing services have also been shown to enhance continuity of care and patient recovery among chronically ill individuals (Chow *et al*., 2008) [20].

In addition to clinical outcomes, community nursing interventions have demonstrated effectiveness in preventive and promotive health activities. Programs such as blood pressure screening initiatives and faith-based nursing services have been effective in identifying at-risk individuals and encouraging follow-up care, thereby contributing to early intervention and improved health behaviors (Monay *et al*., 2010; Lucky *et al*., 2011) [22, 23]. Community nursing support has also been beneficial in managing mental health conditions, highlighting the versatility and broad scope of community-based nursing practice (Beebe, 2001) [17].

Despite the substantial evidence supporting the effectiveness of community-based and nurse-led interventions, several limitations persist within the existing literature. Many studies focus on specific diseases or isolated interventions, resulting in fragmented evidence that lacks integration across multiple components of care. Additionally, variations in intervention design, implementation strategies, and outcome measures make it difficult to establish standardized models that can be applied across diverse settings. While randomized controlled trials provide strong evidence of effectiveness, their findings are often context-specific and may not be easily generalizable to rural or resource-constrained environments.

Moreover, there is a limited emphasis on developing comprehensive, standardized intervention frameworks that integrate key elements such as self-management support, care coordination, preventive strategies, and continuity of care within a unified model. The majority of existing studies evaluate individual components rather than adopting a holistic, system-level approach. This gap highlights the need for research that moves beyond isolated interventions toward the development and evaluation of structured, scalable, and contextually adaptable community health nursing models.

Therefore, while prior studies provide strong evidence for the benefits of community-based nursing interventions, there remains a critical need to develop and rigorously evaluate a standardized community health nursing intervention model that integrates multiple components of care. Such a model is particularly important for improving chronic disease outcomes in rural populations, where healthcare delivery challenges necessitate coordinated, efficient, and evidence-based approaches.

Material and Methods

1. Study Design

A mixed-methods study with a quasi-experimental controlled design and sequential explanatory approach was

conducted. The quantitative phase assessed the effectiveness of a standardized community health nursing intervention model on chronic disease outcomes, followed by a qualitative phase to explore participant and provider experiences and contextual factors influencing implementation.

2. Model Development Phase

The standardized community health nursing intervention model was developed through (i) a structured review of existing literature on community-based and nurse-led interventions for chronic disease management, (ii) expert consultations with community health nursing specialists, public health physicians, and primary care providers, and (iii) pilot testing in a small rural sample to assess feasibility. The model integrated four core components: structured health education, scheduled home-based follow-up, self-management support, and care coordination. Content validity was established through expert review, and necessary refinements were made prior to full-scale implementation.

3. Study Setting

The study was conducted in selected rural primary health care settings (sub-centers and primary health centers). Sites were chosen based on population coverage, availability of community health nurses, and documented burden of chronic diseases.

4. Study Population

Participants were adults (≥18 years) diagnosed with at least one chronic condition (e.g., hypertension, diabetes mellitus, or chronic respiratory disease) and residing in the selected rural areas. Community health nurses from participating facilities were included in the qualitative phase.

5. Sample Size and Sampling Technique

A total of 980 participants were included. A multistage sampling approach was used: (i) purposive selection of rural health centers, followed by (ii) systematic random sampling of eligible patients from facility registers. Participants were allocated into an intervention group (n=490) and a control group (n=490) based on center-level allocation to minimize contamination.

For the qualitative phase, 25 participants (patients and community health nurses) were selected using purposive sampling to ensure variation in age, gender, and disease profile.

6. Inclusion and Exclusion Criteria

Inclusion criteria were: diagnosis of a chronic disease for ≥6 months, residence in the study area, and willingness to provide informed consent. Exclusion criteria included critical illness, severe cognitive impairment, or inability to participate in follow-up.

7. Intervention Protocol

The intervention was delivered over 6 months by trained community health nurses using a standardized protocol:

- **Health education:** Structured sessions (baseline and monthly) on disease knowledge, medication adherence, diet, and lifestyle modification
- **Home visits:** Scheduled visits (biweekly for first 3 months, monthly thereafter) for monitoring and counseling
- **Self-management support:** Goal setting, symptom monitoring, adherence checklists, and patient-held records
- **Care coordination:** Referral linkage with primary care providers and follow-up tracking

The control group received usual care available at the facility without the structured intervention package.

8. Data Collection

Baseline (T0) and endline at 6 months (T1) data were collected.

Quantitative measures

- Sociodemographic and clinical profile (structured questionnaire)
- Clinical indicators: systolic and diastolic blood pressure, fasting blood glucose (and disease-specific indicators where applicable)
- Self-management behavior (validated scale)
- Quality of life (standardized instrument)

Qualitative data

Semi-structured interviews and focus group discussions explored acceptability, feasibility, barriers, and facilitators of the intervention.

9. Outcome Measures

- **Primary outcomes:** Change in clinical indicators (e.g., SBP/DBP, fasting blood glucose) from T0 to T1
- **Secondary outcomes:** Changes in self-management behavior, quality of life, and healthcare utilization (e.g., clinic visits, hospitalizations)

10. Data Analysis

Quantitative data were analyzed using statistical software. Descriptive statistics (mean, standard deviation, frequency) and inferential tests (independent t-test, paired t-test, chi-square test) were applied. Multivariable regression analysis was conducted to adjust for potential confounders. Statistical significance was set at $p < 0.05$.

Qualitative data were transcribed verbatim and analyzed using thematic analysis, including coding, categorization, and theme development. Integration of quantitative and qualitative findings was performed during interpretation to enhance explanatory depth.

11. Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to study initiation. Written informed consent was obtained from all participants. Confidentiality and anonymity were strictly maintained.

12. Validity and Reliability

Standardized and validated instruments were used. A pilot study (≈5-10% of sample) was conducted to refine tools and procedures. Training of data collectors and use of a standardized intervention protocol ensured consistency. Methodological triangulation enhanced overall validity.

Results and Discussion

1. Participant Flow and Baseline Equivalence

A total of 1,120 individuals were screened, of whom 1,020 met eligibility criteria. After baseline assessment, 980

participants were included and completed the study (intervention = 490; control = 490), yielding a retention rate of 96.1%. Attrition (n = 40) was due to relocation (n = 18), loss to follow-up (n = 15), and withdrawal of consent (n = 7). There were no statistically significant differences in baseline characteristics between groups ($p > 0.05$), indicating comparability.

Table 1: Baseline Characteristics of Participants (N = 980)

Variable	Intervention (n=490)	Control (n=490)	Test Statistic	p-value
Age (Mean ± SD)	52.4 ± 11.2	52.8 ± 11.6	t = 0.49	0.62
Female (%)	55.9	56.5	$\chi^2 = 0.04$	0.84
Hypertension (%)	48.1	48.9	$\chi^2 = 0.07$	0.79
Diabetes Mellitus (%)	37.2	36.5	$\chi^2 = 0.06$	0.81
Respiratory Disease (%)	14.7	14.6	$\chi^2 = 0.01$	0.97

2. Primary Outcomes: Clinical Effectiveness

At 6 months, the intervention group showed greater reductions in clinical parameters compared to the control group.

- **Systolic Blood Pressure (SBP):** Mean reduction of −15.6 mmHg in the intervention group versus −5.6 mmHg in the control group.
- **Diastolic Blood Pressure (DBP):** Reduction of −8.3 mmHg vs −2.8 mmHg.
- **Fasting Blood Glucose (FBG):** Reduction of −27.8 mg/dL vs −11.5 mg/dL.

The between-group differences were statistically significant with moderate effect sizes.

Table 2: Changes in Clinical Outcomes (Baseline to 6 Months)

Outcome	Intervention Mean Change (SD)	Control Mean Change (SD)	Mean Difference (95% CI)	Effect Size (d)	p-value
SBP (mmHg)	−15.6 (10.2)	−5.6 (9.8)	−10.0 (−11.8, −8.2)	0.98	<0.001
DBP (mmHg)	−8.3 (7.5)	−2.8 (6.9)	−5.5 (−6.9, −4.1)	0.78	<0.001
FBG (mg/dL)	−27.8 (21.4)	−11.5 (19.8)	−16.3 (−19.9, −12.7)	0.80	<0.001

3. Secondary Outcomes

Participants receiving the intervention demonstrated significant improvements in self-management behaviors and quality of life. The intervention group also showed a reduction in healthcare utilization, although this did not reach statistical significance in all subgroups.

Table 3: Secondary Outcomes at 6 Months

Outcome	Intervention (Mean ± SD)	Control (Mean ± SD)	Mean Difference (95% CI)	p-value
Self-Management Score	78.5 ± 8.2	66.1 ± 9.4	12.4 (10.9, 13.9)	<0.001
Quality of Life Score	72.4 ± 7.6	61.7 ± 8.6	10.7 (9.2, 12.2)	<0.001
Healthcare Utilization (%)	19.6	26.8	−7.2 (−15.3, 0.9)	0.08

4. Multivariable Analysis

After adjusting for baseline values, age, gender, and comorbidities, the intervention remained a significant predictor of improved outcomes

- **SBP reduction:** β = −9.4 (95% CI: −11.2 to −7.6, $p < 0.001$)
- **FBG reduction:** β = −14.8 (95% CI: −18.6 to −11.0, $p < 0.001$)

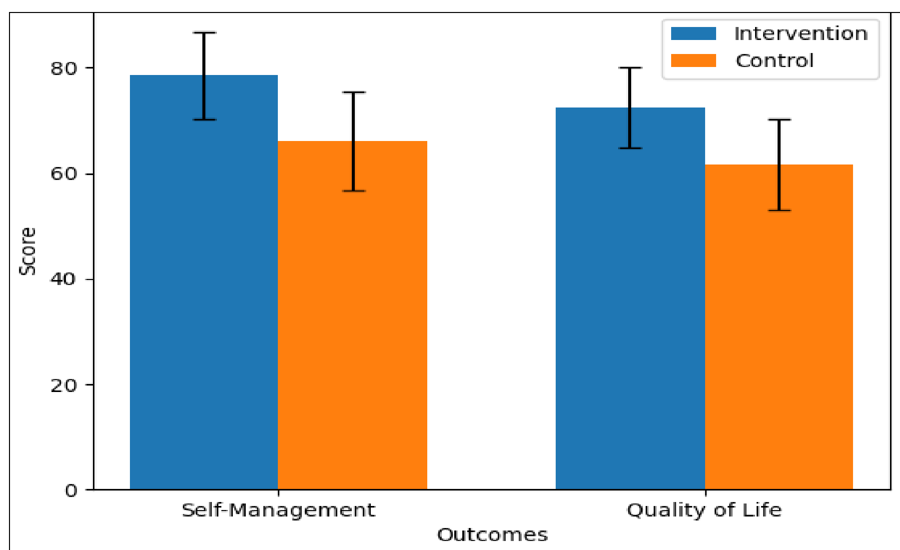

Fig 1: Comparison of Secondary Outcomes

The figure shows higher self-management and quality of life scores in the intervention group, with relatively smaller improvements in the control group.

5. Qualitative Findings
Analysis of interview and focus group data identified four major themes:

1. Enhanced Self-Efficacy and Disease Awareness Participants reported improved confidence in managing their conditions. “I learned how to monitor my condition and follow the treatment properly.”
2. Continuity of Care through Nurse Engagement Regular home visits facilitated sustained engagement and trust.
3. Contextual Barriers Challenges included transportation difficulties and limited health resources.
4. Perceived Value of Structured Care Participants appreciated the structured and consistent approach of the intervention.

6. Integration of Findings
The qualitative findings supported the quantitative results by highlighting improved adherence, patient engagement, and acceptability of the intervention. The integration of both components confirms the effectiveness, feasibility, and contextual relevance of the standardized community health nursing intervention model.

Discussion
The findings demonstrate that the standardized community health nursing intervention significantly improved clinical outcomes and patient behaviors. Reductions in blood pressure and blood glucose indicate effective disease control, consistent with prior studies on community-based and nurse-led interventions (Kim *et al*., 2016; Abdel-All *et al*., 2017) [7, 10].

Improvements in self-management and quality of life suggest that structured education and continuous follow-up enhance patient engagement, supporting existing evidence on the role of self-management in chronic disease care (Grady & Gough, 2014) [13]. The qualitative results further highlight improved awareness, adherence, and trust in nurse–patient interactions, emphasizing the importance of continuity of care (Karam *et al*., 2021) [11].

However, challenges such as limited resources and workload constraints were identified, which may affect implementation. The quasi-experimental design and short duration are additional limitations. Future studies should include longer follow-up and randomized designs.

Conclusion
The standardized community health nursing intervention model significantly improved clinical outcomes, self-management, and quality of life among rural patients with chronic diseases. The model is feasible, effective, and scalable, with potential for integration into primary healthcare systems to strengthen community-based chronic disease management.

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