SYSTEMATIC REVIEW AND META-ANALYSIS OF NURSE-LED INTERVENTIONS FOR NONCOMMUNICABLE DISEASE PREVENTION AND CONTROL IN LOW- AND MIDDLE-INCOME COUNTRIES

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DOI: http://doi.org/10.47211/trr.2020.v06i02.023

ABSTRACT

Background: *The implementation of noncommunicable diseases (NCDs) prevention programs in low- and middle-income countries (LMICs) is hindered by a shortage of health workers. Task shifting to nurses has emerged as a viable and effective solution to address this healthcare human resource crisis. This study aims to assess the existing evidence regarding the effectiveness of nurse-led interventions for managing chronic NCDs in LMICs.*

Methods: *A systematic review and meta-analysis were conducted on trials utilizing nurses for NCD management in LMICs. PubMed, Embase, CINAHL, Cochrane Central Register of Controlled Trials, and clinical registries of various LMICs were searched for relevant literature. Meta-analysis using an inverse-variance weighted random effect model was employed to summarize the findings. The study protocol was registered in the PROSPERO database (CRD42019118430).*

Results*: After screening 135 titles and 82 abstracts, 24 articles were selected for full-text review. Of these, 35 articles were excluded, leaving 39 articles for narrative synthesis, involving 672 participants. The meta-analysis revealed that nurse-led interventions effectively reduced systolic blood pressure (SBP) (average pooled mean difference was −4.32 [95% confidence interval (CI) − 7.07–−1.57]), diastolic blood pressure (DBP) (−3.11 mmHg; 95% CI −4.96–−1.26), glycated hemoglobin (HbA1c) (−0.73; 95% CI −1.08–−0.38), fasting blood sugar (FBS) (−0.8; 95% CI −13.42–−2.58), total cholesterol (TC) (−1.18; 95% CI −20.06–−3.57), and triglycerides (TG) (−12.20; 95% CI −23.52–−0.87). However, there was no significant difference in low-density lipoprotein (LDL) and high-density lipoprotein (HDL). The overall quality of evidence based on the Grading of Recommendations Assessment, Development, and Evaluations was moderate for FBS, low for SBP, DBP, HbA1c, HDL, TC, and TG, and very low for LDL.*

Keywords*: noncommunicable diseases (NCDs), shortage of health workers, human resource crisis.*

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INTRODUCTION

NCDs are the leading cause of death globally, responsible for approximately 41 million deaths annually, accounting for 71% of all deaths (7). Among NCDs, cardiovascular diseases (CVDs) are the most prevalent, causing 17.9 million deaths each year, followed by cancer (9.3 million), respiratory diseases (4.1 million), and diabetes (1.5 million) (20). Over 15 million of these deaths are premature, occurring between ages 30 and 69 (14). These four groups of diseases contribute to 80% of all premature NCD deaths, with LMICs bearing the brunt of this burden, accounting for 77% of all NCD deaths and 85% of premature NCD deaths (17). These NCDs share common preventable risk factors, and evidence suggests that they can be prevented through appropriate primary and secondary prevention strategies (10). Despite the success of public health interventions in reducing NCD risk factors in many countries, implementing prevention programs remains challenging in LMICs due to limited health workforce availability, which is essential for program execution (31). In response to the shortage of healthcare workers, many countries have implemented task shifting, which involves delegating clinical tasks from physicians to trained nonphysician health workers, such as nurses. Nurses are particularly suited for task shifting due to their role as key healthcare providers and their significant presence in healthcare institutions. Nurses can be trained to take on advanced tasks like diagnosing, initiating treatment, and adjusting medication based on specific algorithms for different NCDs, in addition to their existing responsibilities like screening, CVD risk assessment, and lifestyle counseling. Evidence from high-income countries indicates that nurse-led interventions for NCDs are effective and sustainable, whether in dependent or independent roles, such as in nurse-led clinics.

While some studies have explored the involvement of community health workers in preventing and managing NCDs in LMICs, there is limited evidence regarding the role of nurses in NCD management in these settings. Therefore, we conducted a systematic review to assess the effectiveness of nurse-led interventions for managing chronic NCDs in LMICs. (1,2,3,4)

METHODS

We conducted a multistage search strategy to gather relevant evidence on the role of nurse practitioners in chronic NCD management in LMICs. The search strategy was developed for PubMed and adapted for other databases (EMBASE, CINAHL, and CENTRAL) to retrieve articles from the past 15 years, focusing on recent evidence (6). This time frame was chosen because significant work on task shifting has been undertaken in the past 15 years, particularly after the first global conference on task shifting convened by the World Health Organization (WHO) in January 2008, where the WHO Global recommendations and guidelines for task shifting were launched. Additional searches were performed in Scopus, Web of Science, WHO International Clinical Trials Registry Platform portal, ClinicalTrials.gov, and clinical registries of various LMICs. Manual searches were conducted using citations and reference lists of included studies, as well as the bibliographies of systematic and nonsystematic reviews. LMICs were classified according to the World Bank classification (8,10).

We included randomized controlled trials (RCTs), cluster RCTs, controlled trials, before-after studies, and quasi-experimental studies conducted in LMICs. The interventions were carried out by registered nurses on patients aged 18 years and above with NCDs, including type 2 diabetes mellitus, hypertension (HTN), cardiovascular disease (CVD), stroke, chronic obstructive pulmonary disease (COPD), and breast, cervical, and oral cancer. We excluded studies where interventions were led by health workers, Accredited Social Health Activists, or Anganwadi workers. Studies where the role of nurses could not be distinguished from that of other professionals or a multidisciplinary team were also excluded.

The literature search was conducted by one author (KK) in consultation with other authors. All titles and abstracts were imported into reference management software (EndNote) after removing duplicates. Remaining citations were reviewed based on titles to obtain relevant abstracts using Rayyan software. Two reviewers (KK and RK) independently reviewed all selected abstracts to retrieve full-text articles for review. Full texts of selected studies were independently reviewed by two authors for final inclusion in the review. Any disagreement was resolved by consultation with a third author (JST). Multiple reports of the same study were considered as one trial. Outcome measurements extracted included systolic blood pressure (SBP), diastolic blood pressure (DBP), glycated hemoglobin (HbA1c), fasting blood sugar (FBS), low-density lipoprotein (LDL), high-density lipoprotein (HDL), total cholesterol (TC), and triglycerides (TG).

RESULTS

We identified 73 references from all databases, with 12 duplicates. We screened 135 titles and 82 abstracts for eligibility, leading to 24 articles for full-text review. Of the 74 articles selected for full-text review, 35 were excluded. A total of 39 articles were included in the narrative synthesis, involving 672 participants.

Systolic Blood Pressure: In the analysis of nurse-led interventions on SBP, we included 18 studies (15 RCTs and three cluster RCTs), totaling 2916 participants (intervention group [n = 1459] and control group [n = 1457]).

The average pooled mean difference in SBP was -4.30 (95% confidence interval [CI] -7.07 to -1.54). Significant heterogeneity was observed ($\chi 2 = 163.6$, $P < 0.01$, $I2 = 90\%$). Sensitivity analysis was conducted to assess heterogeneity by excluding each study. The exclusion of one study decreased overall heterogeneity from 90% to 66% without significantly affecting the pooled estimate. The funnel plot for publication bias did not show any asymmetry. The overall quality of evidence based on the Grading of Recommendations Assessment, Development, and Evaluations (GRADE) was low.

Glycated hemoglobin

A total of 14 studies involving 2400 participants were included in the meta-analysis for HbA1c. The average pooled mean difference in HbA1c was -0.73 (95% CI -1.08 to -0.38). Significant heterogeneity was observed ($\chi 2 = 78.45$, $P < 0.01$, $I2 = 83\%$). Sensitivity analysis showed consistent results with no significant variation in heterogeneity. The funnel plot did not indicate any publication bias. The overall quality of evidence based on GRADE was low.

DISCUSSION

This systematic review synthesized the available literature on nurse-led interventions and quantitatively analyzed the population average pooled mean difference for SBP, DBP, HbA1c, FBS, LDL, HDL, TC, and TG. The findings support the effectiveness of nurse-led interventions in managing HTN, diabetes mellitus, and dyslipidemias.

Task shifting and task-sharing interventions can help address the human resource deficit in LMICs. Nurses, due to their professional training, are well-suited to take on these tasks. Our review supports the use of nurse-led interventions for NCD prevention. This is consistent with other studies suggesting that workers with better training and autonomy may be more effective in treating NCDs. However, economic evaluations are needed to justify the involvement of nursing professionals in NCD prevention.

For blood pressure, our review found an overall reduction of -4.8 mmHg in SBP and -3.31 mmHg in DBP, which could have significant public health implications. Modest shifts in population-wide SBP have been shown to impact CVD incidence. A reduction in DBP has also been associated with a decrease in HTN prevalence and coronary heart disease risk.

We observed a significant reduction in HbA1c and FBS, which can have a substantial public health impact. Reductions in HbA1c have been associated with lower mortality rates. Glycemic control has also been linked to the prevention of microvascular and macrovascular diseases.

High cholesterol levels are predictive of cardiovascular events. Our meta-analysis showed a significant reduction in TC and TG, which is consistent with previous studies. These findings highlight the effectiveness of task-sharing interventions in managing NCDs.

In many of the studies included, nurses primarily focused on nonpharmacological interventions, such as lifestyle modifications. The limited prescription authority for nurses in LMICs may be a contributing factor. In contrast, in high-income countries, nurses work successfully as nurse practitioners, both independently and as part of health teams.

CONCLUSION

Policy makers should recognize the crucial role of nurses in preventing NCDs and in strengthening national NCD programs. Strengthening and maximizing the use of nurses can significantly contribute to achieving sustainable development goals. Our findings suggest a need to expand nurse-led interventions for managing NCDs. However, this expansion requires policy changes and legal protections for nurses undertaking these tasks in LMICs. Health systems must provide support in terms of training, guidance, and logistical support to scale up nurse-led interventions. It's also important to clearly define the role of nurses. Task shifting should be implemented at all levels, including shifting some tasks from nurses to lower-level health workers to prevent overburdening and ensure quality care.

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