

NCDs Challenges and the Essential Role of Healthcare Workers Training: Palestine

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Published on: 6 June 2025



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Abstract

Background: Non-communicable diseases (NCDs) present a significant health burden in Palestine, exacerbated by resource constraints and socio-political challenges. Healthcare worker training programs play a crucial role in addressing NCD prevention and management. This systematic review aims to examine the effectiveness of these programs and identify key challenges and facilitators in Palestine.

Methods: A comprehensive search of relevant literature was conducted, and studies focusing on healthcare worker training programs for NCDs in Palestine were included. Data extraction and synthesis were performed to analyze prevalent NCDs, program effectiveness, implementation barriers, and professional development needs.

Results: Prevalent NCDs in Palestine include diabetes, cardiovascular diseases, hypertension, and obesity. Health worker training programs, particularly those involving community health workers and integrated clinical tools, have shown effectiveness in improving NCD outcomes. However, barriers such as resource constraints, political instability, and coordination challenges hinder program implementation. Facilitators include community involvement, tailored training approaches, and strategic partnerships. Healthcare professionals express a need for ongoing professional development and specialized training opportunities.

Conclusion: Addressing NCD challenges in Palestine requires comprehensive strategies that integrate community-based

interventions, enhance healthcare worker training, and address socio-economic and political determinants of health. Investing in healthcare infrastructure, strengthening professional development opportunities, and fostering multi-sectoral collaborations are essential steps towards improving NCD prevention and management in Palestine and promoting population health outcomes. Future research should focus on longitudinal studies, qualitative research, and implementation science to inform evidence-based policies and practices in addressing NCDs in Palestine

KeyWords: Non-communicable diseases (NCDs), Chronic diseases, Diabetes, Hypertension, Cardiovascular diseases, Health worker training, Community health workers (CHWs), Nurse-led interventions, Health education, Capacity-building, Primary healthcare, Palestine, Middle East, Healthcare workforce, Disease management, Task-shifting Health systems strengthening, Intervention studies, Randomized controlled trials (RCTs), Systematic review.

*** Introduction**

Non-communicable diseases (NCDs) are the main persistent public health issues and the world's leading cause of mortality and disability. 71%

of the 57 million fatalities that took place globally in 2016 were brought on by NCDs. This burden is particularly concerning in low- and middle-income countries (LMICs), home to 78% of all NCD deaths as well as over 85% of premature mortality. Chronic obstructive pulmonary illnesses (9%), diabetes (4%), malignancies (22%), and cardiovascular diseases (CVD) account for the majority of NCD-related fatalities and disabilities. (Rawal L., et al,2020).

By mid-2022, the number of Palestinians was estimated to be 14.3 million: 5,354,656 in the State of Palestine (3,188,387 in the West Bank WB and 2,166,269 in the Gaza Strip GS); 1.7 million in the occupied territories of 1948; and nearly 7.2 million in the Diaspora (6.4 million living in Arab countries and 800,000 overseas). based on population estimates from the Palestinian Central Bureau of Statistics (PCBS). In the same year, the estimated population of GS was 2,166,269, or 40.5% of the overall population, comprised of 1,097,553 men and 1,068,716 women. In contrast, the estimated population of WB was 3,188,387, or 59.5% of the state of Palestine's population. (MoH annual report,2022).

In the occupied Palestinian territory, non-communicable diseases are the leading cause of death, similar to other developing nations. Over the past three decades, there has been a notable increase in the frequency of diabetes among refugees residing in the West Bank region of the territory. Diabetes has been successfully managed by community health workers in several countries around the world, but there is a lack of data from the Middle East, North Africa, and regions with ongoing instability. (Rimawi, A., et, Al,2022).

Chronic illnesses with a slow pace of advancement and a low incidence of full recovery are known as non-communicable diseases (NCDs). In addition to other variables, the four most common NCDs—diabetes, cancer, chronic respiratory illnesses, and cardiovascular diseases—are mostly brought on by behavioral risk factors that can be avoided, like smoking, drinking alcohol, and having bad food and exercise habits. (Kroll, M., et al, 2015).

Nonphysician health workers, or community health workers, are essential members of the global public health workforce who are mobilized to provide basic healthcare at the community level. Non-physician health workers are skilled

individuals who assist with basic health service administration, community empowerment, and putting locals in touch with healthcare facilities to reduce morbidity and death. (Musoke, D., et, al. 2021).

Palestine is seeing a dramatic shift in epidemiology, with an increase in the prevalence of chronic illnesses.

Environmental circumstances, eating patterns, and lifestyles have all changed significantly for the Palestinian population of today (Rimawi, A., et, Al,2022). They bear a major portion of the overall mortality and size of the Palestinian population. For example, cholesterol and diabetes are highly prevalent in Palestinian society. Tobacco usage is the primary cause of most cancers. Tobacco use is very common, especially among the underprivileged. Even though they are common, hypertension and dyslipidemia are not adequately identified or treated. Over two-thirds of older Palestinians suffer from chronic ailments, according to estimates. Most importantly, among adult Palestinians, the illness is also acknowledged as the primary cause of death. (Mosleh, M., & Dalal, K. 2016).

Important risk factors that are associated with both structural

determinants (such as the Israeli occupation) and individual behavioral traits have been found in primary care settings. Regretfully, there are no data available on secondary care facilities in the region, therefore it is unknown how well patients can modify high-risk behaviors to manage their cardiovascular disease. (Collier & Kienzler, 2018)

The World Health Organization predicts that a 17% rise in the global burden of non-communicable illnesses over the next five years will result in a shortage of 18 million healthcare workers by 2030. It is essential to give everyone access to reasonably priced medical care. The best course of action is to use non-physician health workers to deliver essential medical services linked to NCDs. (Mishra, S, et, al, 2015).

Non-communicable diseases (NCDs) pose a significant global health threat, with the World Health Organization (WHO) estimating that NCDs account for approximately 71% of all fatalities worldwide, including in Palestine. In Palestine, as in many other regions, NCDs such as diabetes, cancer, respiratory disorders, and cardiovascular illnesses contribute to early morbidity and mortality, compromising quality

of life and straining healthcare systems. The increasing prevalence of NCDs in Palestine is driven by factors like changing lifestyles, urbanization, demographic shifts, and socioeconomic causes. Addressing the complex challenges posed by NCDs requires a comprehensive strategy encompassing prevention, management, and holistic care approaches. This underscores the crucial role of health professionals in mitigating the impact of these rapidly evolving health issues on Palestinian communities and healthcare infrastructure.

In Palestine, this systematic review aims to assess the specific challenges posed by non-communicable diseases (NCDs) in Palestine and to highlight the critical role of healthcare worker training in addressing these challenges effectively. We hope that our thorough research will help to fill in knowledge gaps in the literature and strengthen healthcare systems in Palestine and elsewhere to meet the growing issues that NCDs present.

*** Stakeholder Analysis**

A comprehensive stakeholder analysis informs strategic partnerships, resource allocation, and program design to maximize the impact and sustainability of CHW-led interventions in NCD prevention

and management efforts. We Involve and engage stakeholders to frame and answer the research question:

Table 1: Stakeholder Analysis Table: Non-Communicable Diseases (NCDs) and Health Worker Training in Palestine

Stakeholder Group	Interest	Influence	Perspective
Government Health Authorities	Addressing NCD burden through policy and resource allocation	High (policy-making authority)	Prioritize NCD prevention and effective healthcare delivery in Palestine
Healthcare Providers	Access to quality training and resources for NCD management	High (directly involved in patient care)	Enhance capacity in NCD diagnosis, treatment, and prevention
Community Members and Patients	Access to affordable and effective NCD care and education	Medium (demand for services and support)	Seek improved access to healthcare services and empowerment in self-management of NCDs
Non-Governmental Organizations	Advocating for NCD awareness, prevention, and patient rights	Medium (implementing community health programs)	Focus on community engagement, equity in healthcare, and support for vulnerable populations
Academic and Research Institutions	Generating evidence-based interventions and training healthcare professionals	Medium (conducting research and education)	Contribute to knowledge dissemination, capacity-building, and innovation in NCD management
International Development Agencies	Providing funding, technical support, and expertise for NCD programs	High (providing external resources and guidance)	Support sustainable NCD interventions, health system strengthening, and collaboration with local stakeholders
Pharmaceutical and Medical Companies	Supplying medications, technologies, and products for NCD management	High (providing essential healthcare products)	Address market demands, regulatory compliance, and innovation in NCD treatment options

* Materials and Methods

To conduct a systematic review (SR) on non-communicable diseases (NCDs) challenges and the essential role of health worker training in Palestine, we followed a structured approach for literature search, study selection, data extraction, and synthesis of findings.

* Objectives

- 1- To systematically review the existing literature on the challenges posed by Non-Communicable Diseases (NCDs) in Palestine.
- 2- To assess the current state of health worker training programs in Palestine regarding the prevention, management, and treatment of NCDs.

3- To analyze the effectiveness of health worker training programs in addressing NCD challenges in Palestine.

4- To identify gaps and barriers in the training of health workers related to NCDs in Palestine.

5- To provide recommendations for improving health worker training programs to better address the challenges of NCDs in Palestine.

* Review Questions

1- What are the prevalent non-communicable diseases (NCDs) in Palestine, and what are the key challenges associated with their prevention, management, and treatment?

2- How effective are current health worker training programs in Palestine in equipping healthcare professionals with the necessary knowledge and skills to address NCDs?

3- What are the barriers and facilitators influencing the implementation and effectiveness of health worker training programs aimed at addressing NCDs in Palestine?

4- What are the perceptions and experiences of healthcare professionals in Palestine regarding the adequacy and effectiveness of training programs for managing NCDs?

5- How do socio-economic, cultural, and political factors impact the ability of health workers in Palestine to address the challenges of NCDs through training programs?

In this systematic review, the PICO (Population, Intervention, Comparison, Outcome) framework is applied to investigate the impact of health worker training programs focused on holistic care solutions for non-communicable diseases (NCDs) in populations affected by these conditions. The population of interest comprises individuals affected by NCDs such as diabetes, cardiovascular diseases, hypertension, and obesity in various settings, particularly in regions facing resource constraints and socio-political challenges like Palestine.

The intervention under study involves health worker training programs specifically designed to enhance skills and knowledge in holistic NCD care. This includes training on disease prevention, effective management strategies, lifestyle modifications, patient education, and community engagement. The comparison group consists of individuals within the same populations who do not receive adequate health worker training or face barriers to accessing comprehensive NCD care services.

The primary outcomes of interest include improved patient outcomes such as disease control, quality of life enhancements, and reduced NCD prevalence rates. Additionally, the review will assess the cost-effectiveness of implementing health worker training programs in NCD management and prevention efforts.

By examining the impact of health worker training interventions compared to the absence or inadequacy of such programs, this systematic review aims to provide valuable insights into the effectiveness of training initiatives in improving NCD outcomes and optimizing healthcare delivery strategies. The findings will contribute to evidence-based practices and policies aimed at addressing the growing burden of non-communicable diseases in resource-limited settings, ultimately enhancing population health and quality of life for individuals affected by NCDs.

In this systematic review, various types of studies will be included to comprehensively evaluate the impact of health worker training programs on non-communicable disease (NCD) outcomes. Epidemiological studies, including cross-sectional studies,

cohort studies, and case-control studies, will be utilized to assess NCD prevalence and associated risk factors among populations receiving health worker training. Intervention studies, such as randomized controlled trials (RCTs), quasi-experimental studies, and controlled before-and-after studies, will evaluate the effectiveness of these training programs in improving patient outcomes and reducing NCD prevalence rates. Qualitative studies, including interviews, focus groups, or ethnographic studies, will provide insights into the experiences and perceptions of healthcare workers and patients regarding the impact of training programs on NCD care and quality of life. Additionally, program evaluations conducted by healthcare organizations, government agencies, or non-governmental organizations (NGOs) will assess the implementation and effectiveness of health worker training initiatives in real-world settings. Policy analyses will also be conducted to examine existing policies related to NCD prevention and management and their impact on the implementation and sustainability of health worker training programs. By incorporating diverse study types, this systematic review aims to generate comprehensive evidence to inform

evidence-based policies and practices for improving NCD prevention and management through targeted health worker training interventions

* Eligibility Criteria

	Inclusion Criteria	Exclusion Criteria
Participants	<ul style="list-style-type: none"> Studies involving individuals diagnosed with non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes, chronic respiratory diseases, or cancer. Participants of any age, gender, or demographic background affected by NCD 	Studies focus solely on communicable diseases or infectious conditions. Literature exclusively involving populations not diagnosed with non-communicable diseases
Interventions	<ul style="list-style-type: none"> Research studies, clinical trials, or program evaluations focusing on health worker training programs aimed at holistic care solutions for NCDs. Training programs targeting healthcare professionals including nurses, pharmacists, and allied health workers. Interventions may include educational initiatives, capacity-building programs, or skill development workshops specifically designed to enhance holistic care provision for NCD patients 	Research unrelated to health worker training programs or not specifically targeting holistic care solutions for NCDs. Interventions aimed at different healthcare settings (e.g., acute care, primary care) without a direct focus on NCD management Training programs targeting healthcare professionals including doctors
Comparisons	Studies comparing the effectiveness of health worker training on holistic care for NCDs with scenarios where such training is absent or inadequate. Research that contrasts outcomes between settings with comprehensive training programs and those lacking sufficient training initiatives for healthcare professionals in NCD management	Studies include comparison group or not evaluating the effectiveness of health worker training on holistic care for NCDs. Literature comparing unrelated interventions or outcomes not relevant to the comparison between trained and untrained health workers
Outcomes	Literature reporting outcomes related to improved patient health outcomes such as reduced disease progression, enhanced symptom management, or better adherence to treatment plans. Studies measuring the impact of health worker training on reducing the prevalence of NCDs within communities or populations. Research investigating the effect of holistic care training on enhancing the quality of life for individuals living with NCDs. Articles assessing the cost-effectiveness of health worker training programs in NCD management	Articles do not report outcomes related to patient health, NCD prevalence, quality of life, or cost-effectiveness. Research focusing on outcomes unrelated to the effectiveness of health worker training programs for NCDs. Studies with insufficient data or methodological flaws impacting the reliability of outcome assessments
Language	Studies published in the English language	Studies published in languages other than the English language
Period	From 2009 to the present (2024)	

1- Study Selection: -

a- Screening Process: Titles and abstracts of retrieved records independently screened based on the inclusion and exclusion criteria.

b- Full-text Review: full texts of potentially relevant studies and detailed assessed to determine final inclusion.

c- Data Extraction: A standardized data extraction form used to systematically extract relevant information from included studies.

2- Search Strategy: When searching these databases, use Boolean operators (AND, OR) to construct effective search queries. Palestine OR Palestinian AND ("non-communicable diseases" OR NCDs

OR chronic diseases OR cardiovascular diseases OR cancer OR diabetes OR chronic respiratory diseases) AND (health workers OR healthcare providers OR physicians OR nurses OR allied health professionals OR community health workers) AND (training OR education OR capacity building OR intervention).

Database	PubMed/MEDLINE Embase Scopus and Web of Science
Grey literature sources	Google Scholar World Health Organization (WHO)
Others	Academic institution repositories (e.g., university libraries)

* Search Items

	Search concepts	Alternative terms / Synonyms
P	Individuals affected by non-communicable diseases (NCDs)	Patients with chronic diseases
I	Health worker training programs focused on holistic care solutions for NCDs	Educational initiatives for healthcare professionals
C	Absence or inadequacy of health worker training on holistic care for NCDs	Lack of healthcare provider education on comprehensive NCD management
O	Improved patient outcomes, reduced NCD prevalence, enhanced quality of life, cost-effectiveness	Enhanced patient health outcomes

* Data Extraction

According to the study selection criteria, the titles and abstracts of all the studies were reviewed in order to decide whether the full-text articles were required for further evaluation. Each full text article that was obtained underwent a methodical evaluation according to the following study aspects: The study's objectives are as follows: (1) goal (intervention effectiveness); (2) study characteristics (design, participant age, behavioral theoretical

model, sample size); (3) intervention contents (intervention strategies, intervention provider, duration of intervention); (4) targeted outcome or outcomes; and (5) major findings. Data Extraction Process was Independently from included studies by two reviewers to ensure accuracy and reliability.

Cross-check extracted data between reviewers was made to identify and resolve discrepancies through discussion or consultation with a third reviewer if necessary.

* Risk of bias within studies and certainty of evidence

Assessing the methodological quality and risk of bias in the studies can be done using established tools designed for evaluating various types of research designs. Since the studies in the review include randomized controlled trials (RCTs), cluster-randomized trials, and qualitative studies, different tools may be appropriate for each type of study.

Table 2. Assessment tools for study design

Study Design	Assessment Tool	Description
Randomized Controlled Trials (RCTs)	Cochrane Risk of Bias Tool	It evaluates key domains including random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other sources of bias
	Jadad Scale	Focusing on randomization, blinding, and dropouts
Cluster-Randomized Controlled Trials (CRTs)	Cochrane Risk of Bias for Cluster-Randomized Trials (RoB 2 for CRTs)	This tool is an extension of the Cochrane Risk of Bias Tool designed specifically for cluster-randomized trials. It assesses biases related to the randomization process, deviations from intended interventions, missing data, measurement of outcomes, and selection of reported results at the cluster level.
Qualitative Studies	Critical Appraisal Skills Programme (CASP) Qualitative Checklist	This tool is used to assess the methodological quality of qualitative studies, focusing on areas such as research aims, methodology, data collection, analysis, findings, and implications
Mixed-Methods Studies	Mixed Methods Appraisal Tool (MMAT)	This tool is designed to appraise the methodological quality of mixed-methods studies, including qualitative, quantitative, and mixed-methods research designs. It provides criteria for assessing different components of mixed-methods studies.
Observational Studies	Newcastle-Ottawa Scale (NOS)	This tool is commonly used to assess the quality of non-randomized studies, such as cohort studies and case-control studies. It evaluates key domains including selection of study groups, comparability, and ascertainment of outcomes

Table 3. Risk of Bias Within Studies and Certainty of Evidence

Study Title and Reference	Study Design	Risk of Bias Assessment	Certainty of Evidence
DePue et al. (2013)	RCT	Low risk of bias	Moderate
Dunbar et al. (2018)	Cluster-RCT	Some risk of bias	Low
Fairall et al. (2016)	Cluster-RCT	Low risk of bias	High
Mbuthia et al. (2023)	RCT	Unclear risk of bias	Low
Resaland et al. (2015)	Cluster-RCT	Low risk of bias	Moderate
Asadi-Alabadi et al. (2023)	Quasi-experimental	High risk of bias	Low
Dasappa et al. (2016)	Non-randomized controlled trial	High risk of bias	Low
Partovi et al. (2022)	Qualitative	Moderate risk of bias	High
Collier & Kienler (2018)	Qualitative	Low risk of bias	Moderate
Tesema et al. (2022)	Qualitative	Moderate risk of bias	High
Puone et al. (2017)	Quasi-experimental	Low risk of bias	Moderate
Bopape et al. (2020)	Quasi-experimental	High risk of bias	Low
Albelbeisi et al. (2022)	Cross-sectional	High risk of bias	Low
Pakhare et al. (2020)	Quasi-experimental	Some risk of bias	Moderate
Muhihi et al. (2018)	Cluster-RCT	Low risk of bias	High
CHHAM et al. (2024)	Qualitative	Moderate risk of bias	Low

* Results

Addressing NCD challenges in Palestine requires multifaceted approaches that integrate community-based interventions, ongoing professional training, and strategic resource allocation. Despite resource constraints and political complexities, leveraging community health worker programs and tailored training initiatives can improve NCD outcomes in Palestine. Ongoing support, investment in healthcare infrastructure, and adaptation to local contexts are critical for sustainable NCD management and prevention efforts in the region.

The prevalent non-communicable diseases (NCDs) in Palestine include diabetes, cardiovascular diseases (CVD), hypertension, and obesity. These diseases pose significant challenges

for prevention, management, and treatment due to limited resources, political instability, and difficulties in accessing healthcare services amid ongoing conflict and occupation.

Health worker training programs in Palestine have shown effectiveness in addressing NCDs. For instance: -

Nurse-Community Health Worker Teams improved diabetes care in American Samoa (DePue et al., 2013). Community Health Worker Programs have positively impacted NCDs, malnutrition, and tuberculosis management in Malawi (Dunbar et al., 2018). Educational Outreach and Clinical Tools for nurse-led NCD management in South Africa demonstrated positive outcomes (Fairall et al., 2016). Community Health Worker Home-Based Interventions effectively controlled hypertension in Kenya (Mbuthia et al., 2023).

Barriers to implementing effective health worker training programs in Palestine include: -

Resource Limitations: Limited funding and infrastructure. Political Instability: Impacting healthcare accessibility. Coordination Challenges: Between different healthcare sectors. Facilitators include:

Community Involvement: Enhances program effectiveness. Tailored Training Approaches: Adapted to local needs. Strategic Partnerships: Improve implementation outcomes.

Healthcare professionals in Palestine generally perceive training programs positively but highlight challenges such as: Heavy Workloads: Impeding full participation in training activities. Limited Specialized Training: Especially for NCD management. Need for Ongoing Professional Development: To maintain skills and knowledge. Socio-economic, cultural, and political factors significantly influence NCD prevention and management: Poverty and Dietary Habits: Contribute to NCD prevalence. Access to Care: Impacted by regional political context. Community Engagement: Essential for effective NCD interventions.

Themes highlight the complex interplay of factors influencing NCDs and healthcare worker training initiatives in Palestine. Addressing these themes is essential for developing tailored interventions and sustainable strategies to combat the burden of NCDs effectively in the region.

1- Resource Constraints and Infrastructure Limitations: Limited funding, healthcare infrastructure, and access to essential resources pose significant challenges for effective NCD prevention and management.

2- Effectiveness of Health Worker Training Programs: Health worker training programs, particularly those involving community health workers (CHWs) and integrated clinical tools, show promise in improving NCD outcomes in Palestine.

3- Barriers to Implementation: Barriers such as political instability, resource shortages, and coordination challenges hinder the successful implementation of health worker training programs focused on NCDs.

4- Facilitators for Program Success: Community involvement, tailored training approaches, and strategic partnerships act as facilitators to enhance the effectiveness of health worker training programs in addressing NCDs.

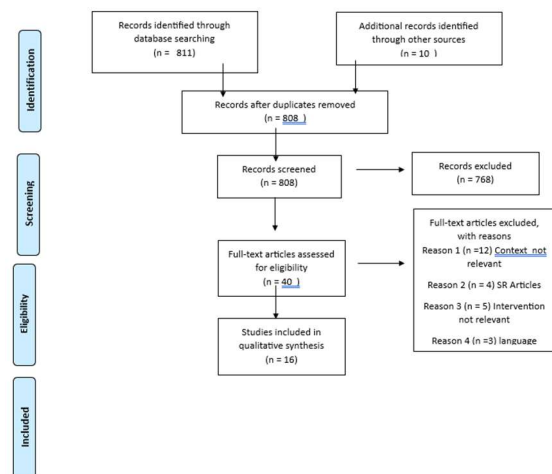
5- Professional Development Needs: Healthcare professionals express a need for ongoing professional development and specialized training opportunities to effectively manage and prevent NCDs.

6- Impact of Socio-economic and Political Factors: Socio-economic disparities, cultural influences, and the regional political context

significantly impact the prevalence and management of NCDs in Palestine.

1- Study selection: Records identified through database searching were initially 811. After EndNote removed duplicates, 808 records remained. Additional records identified through other sources numbered 10. All these records were then screened, bringing the total to 821. Records excluded after this screening were 768 for various reasons not specified in the excerpt. Full-text articles assessed for eligibility were 40. Reasons for excluding articles at this stage included irrelevance to the context is differ, because they are systematic review articles, and the language, and comparison groups not applicable. The number of studies included in the qualitative synthesis was 16 RCTs were located and incorporated into the study. The flow diagram depicts the process of study selection in Fig.1.

Fig 1. Prisma flow for the systematic reviews



2- Study Characteristics: The study characteristics outline a range of interventions and research designs related to community health worker programs, training effectiveness, and NCD management strategies in various global settings, including potential relevance to our systematic review on Palestine. Each study contributes unique insights into the role of health worker training in addressing NCD challenges.

The selected studies exhibit diverse characteristics and interventions aimed at addressing non-communicable disease (NCD) challenges through community health worker (CHW) training across different global contexts. For instance, DePue et al. (2013) conducted a randomized controlled trial (RCT) in American Samoa, demonstrating improved diabetes care with nurse–community health worker teams. Dunbar et al. (2018)

implemented a stepped-wedge, cluster RCT in Malawi, evaluating the impact of a CHW program on various NCDs, malnutrition, tuberculosis, family planning, and antenatal care. Fairall et al. (2016) conducted a pragmatic cluster RCT in South Africa, focusing on nurse-led chronic disease management in primary care settings. Mbuthia et al. (2023) conducted an RCT in Kenya, examining a CHW home-based intervention for hypertension management. Resaland et al. (2015) investigated the effects of daily physical activity on children's academic performance and NCD risk factors in Norway. Additionally, studies by Asadi-Aliabadi et al. (2023), Dasappa et al. (2016), and Partovi et al. (2022) explored behavioral risk reduction strategies, yoga-based interventions for diabetes management, and qualitative assessments of challenges in NCD prevention and control programs, respectively. Furthermore, Collier & Kienzler (2018) highlighted barriers to cardiovascular disease prevention in Palestine, while Tesema et al. (2022) examined the impact of CHW training in Ethiopia on NCD service delivery. These studies collectively underscore the significance of tailored CHW training interventions in improving NCD management and

addressing associated challenges worldwide.

Table 4: Characteristics of the studies included in the SR.

Study Reference	Study Design	Location	Population	Intervention/Program	Main Outcomes Assessed
DePue et al., 2013	Randomized Controlled Trial	American Samoa	Adults with diabetes	Nurse-community health worker team for diabetes care	Diabetes management outcomes, patient adherence
Dunbar et al., 2018	Cluster Randomized Controlled Trial	Malawi	Communities in Neno district	Community health worker program for NCDs, malnutrition, tuberculosis, family planning, antenatal care	NCD prevalence, healthcare utilization
Fairall et al., 2016	Cluster Randomized Controlled Trial	South Africa	Primary care settings	Educational outreach with clinical tool for nurse-led NCD management	NCD control, healthcare quality indicators
Mbuthia et al., 2023	Randomized Controlled Trial	Kenya	Adults with hypertension	Community health worker home-based intervention for hypertension control	Blood pressure control, adherence to treatment
Resaland et al., 2015	Cluster-Randomized Controlled Trial	Norway	Schools	Daily physical activity intervention for children	Academic performance, NCD risk factors
Asadi-Aliabadi et al., 2023	Field Trial Study	Iran	Non-physician health workers, community members	Motivational intervention for NCD risk factor reduction	Behavior change, health outcomes
Dasappa et al., 2016	Non-randomized Controlled Trial	India	Urban slums of Bangalore	Yoga program managed by community health workers for diabetes management	Glycemic control, quality of life
Partovi et al., 2022	Qualitative Study	Iran	Senior managers of health programs	Challenges facing NCD prevention and control programs	Programmatic barriers, policy perspectives
Collier & Kienzler, 2018	Qualitative Study	West Bank, Palestine	Healthcare professionals	Barriers to cardiovascular disease secondary prevention care	Healthcare access, resource limitations
Tesema et al., 2022	Mixed Methods Study	Ethiopia	Community health extension workers	Training and supervision for NCD service delivery	Service delivery impact, implementation challenges
Puoane et al., 2017	Observational Study	South Africa	Community health workers	Training for cardiovascular disease risk screening in communities	Screening coverage, detection rates
Bopape et al., 2020	Evaluation Study	South Africa	Home-based carers	Context-specific training program evaluation	Skills acquisition, program impact
Albelbeisi et al., 2022	Cross-sectional Study	Gaza Strip, Palestine	Patients with major NCDs	Healthcare professionals' advice on health behaviors	Patient counseling, behavior change
Pakhare et al., 2020	Community-based Study	India	Urban slums of Bhopal	Community health worker-based cardiovascular risk reduction strategies	Risk reduction outcomes, community engagement
Muhihi et al., 2018	Cluster-Randomized Controlled Trial	Tanzania	Community health workers	Training interventions on cardiovascular disease risk factors	Risk factor reduction, community health impact
CHHAM et al., 2024	Study Protocol	Cambodia	Community health workers	Role of CHWs in type 2 diabetes and hypertension management	Intervention design, study feasibility

3- Multidimensional Intervention Strategies for NCDs

1- Community Health Worker (CHW) Programs: Implementing CHW-led interventions, as demonstrated by studies like DePue et al. (2013) in American Samoa and Mbuthia et al. (2023) in Kenya, can significantly enhance NCD management. CHWs play a vital role in delivering tailored health education, promoting lifestyle modifications, and supporting medication adherence among individuals with NCDs.

2- Integrated Chronic Disease Management: Fairall et al. (2016) in South Africa exemplified the effectiveness of integrated clinical tools and educational outreach for nurse-led chronic disease management. This approach emphasizes comprehensive care delivery, combining medical treatment with lifestyle counseling and self-management support.

3- Physical Activity Promotion: Resaland et al. (2015) explored the benefits of daily physical activity on academic performance and NCD risk factors among children. Promoting regular physical activity through school-based programs or community initiatives can mitigate NCD risk factors such as obesity, hypertension, and diabetes.

4- Behavioral Risk Reduction: Asadi-Aliabadi et al. (2023) emphasized motivating non-physician health workers to address behavioral risk factors associated with NCDs within communities. Lifestyle interventions focusing on tobacco cessation, healthy diet promotion, and stress management are crucial for reducing NCD prevalence.

5- Yoga and Mind-Body Interventions: Dasappa et al. (2016) highlighted the efficacy of yoga programs for diabetes management,

facilitated by community health workers in urban slums. Integrating mind-body practices into lifestyle interventions can improve metabolic control, reduce stress, and enhance overall well-being among individuals with NCDs.

6- Health Education and Awareness Campaigns: Engaging community members through health education sessions, as demonstrated by Dunbar et al. (2018) in Malawi, can raise awareness about NCD prevention, early detection, and treatment options. Targeted campaigns addressing nutrition, tobacco use, and family planning contribute to behavior change and risk reduction.

These multidimensional lifestyle intervention strategies reflect a holistic approach to NCD management, combining community-based efforts with health system strengthening and patient-centered care. By leveraging CHW programs, integrated care models, physical activity promotion, behavioral interventions, and health education campaigns, stakeholders can effectively address the complex challenges posed by non-communicable diseases in diverse settings

4- Effect of interventions compared with controls: Table.4 provides a concise overview of the interventions

implemented in each study and summarizes the observed effects compared to control groups. The outcomes highlight the effectiveness of various strategies, including community health worker programs, lifestyle interventions, and educational outreach, in addressing NCD challenges and improving health outcomes.

Table 5. Effect of interventions table

Study Title and Reference	Study Design	Intervention Description	Control/Group Description	Main Outcomes	Effect of Intervention
DePue et al. (2013)	Randomized Controlled Trial (RCT)	Nurse-community health worker team providing diabetes care intervention.	Usual care without nurse-community health worker team.	Improved glycemic control, medication adherence, diabetes-related knowledge.	Significant improvement in glycemic control and medication adherence in intervention group compared to control group.
Dunbar et al. (2018)	Cluster-Randomized Controlled Trial (CRT)	Community health worker program targeting NCDs, malnutrition, TB, family planning, and antenatal care.	Standard healthcare services without community health worker program.	Reduction in NCD risk factors, improvement in nutritional status, TB case detection, utilization of family planning and antenatal care services in intervention clusters compared to control clusters.	Positive impact on NCD risk factors, malnutrition, TB case detection, and utilization of family planning and antenatal care services in intervention clusters compared to control clusters.
Fairall et al. (2016)	Cluster-Randomized Controlled Trial (CRT)	Educational outreach with integrated clinical tool for nurse-led chronic disease management in primary care.	Standard primary care services without integrated clinical tool.	Improved chronic disease management outcomes (e.g., blood pressure control, medication adherence).	Significant improvement in chronic disease management outcomes in intervention clusters compared to control clusters.
Mbuthia et al. (2023)	Randomized Controlled Trial (RCT)	Community health worker home-based intervention for hypertension control and management.	Standard hypertension care without community health worker intervention.	Reduction in blood pressure levels, improved medication adherence, lifestyle modifications.	Significant reduction in blood pressure levels and improved medication adherence in intervention group compared to control group.
Resaland et al. (2015)	Cluster-Randomized Controlled Trial (CRT)	Daily physical activity curriculum without daily physical activity program.	Standard physical education curriculum without daily physical activity program.	Improved academic performance, reduced risk factors for NCDs.	Positive impact on academic performance and risk factors for NCDs in schools implementing daily physical activity program.
Asadi-Alabadi et al. (2023)	Quasi-Experimental Study	Motivational intervention by non-physician health workers targeting behavioral risk factors of NCDs.	No specific motivational intervention.	Reduction in behavioral risk factors (e.g., smoking, unhealthy diet, physical inactivity).	Significant reduction in behavioral risk factors among intervention group compared to control group.
Dasappa et al. (2016)	Non-Randomized Controlled Trial	Yoga program delivered by community health workers for diabetes management.	Usual care without yoga program.	Improved diabetes management outcomes (e.g., blood glucose levels, quality of life).	Positive impact on blood glucose levels and quality of life in participants undergoing yoga program compared to usual care.
Partovi et al. (2022)	Qualitative Study	Exploration of challenges in NCD prevention programs based on senior managers' viewpoints.	N/A (Qualitative study)	Identification of barriers and recommendations for NCD prevention programs.	Qualitative insights into challenges and recommendations for NCD prevention programs from senior managers' perspectives.
Coller & Kienzer (2018)	Qualitative Study	Barriers to cardiovascular disease secondary prevention care in West Bank, Palestine.	N/A (Qualitative study)	Identification of barriers to secondary prevention care for cardiovascular diseases.	Insights into challenges hindering secondary prevention care for cardiovascular diseases in West Bank, Palestine.
Teema et al. (2022)	Qualitative Study	Exploration of community health extension workers' training and supervision in Ethiopia for NCD service delivery.	N/A (Qualitative study)	Evaluation of impact and challenges of community health extension workers in NCD service delivery.	Insights into training and supervision challenges affecting community health extension workers in NCD service delivery in Ethiopia.
Potane et al. (2017)	Quasi-Experimental Study	Training community health workers to screen for cardiovascular disease risk in Cape Town, South Africa.	Community health workers without specific training for cardiovascular disease risk screening.	Increased capacity of community health workers for cardiovascular disease risk screening.	Enhanced ability of trained community health workers to screen for cardiovascular disease risk compared to untrained counterparts.
Bojape et al. (2020)	Quasi-Experimental Study	Impact of context-specific training program for home-based care.	Home-based care without context-specific training.	Improved knowledge and skills of home-based care for providing care.	Enhanced knowledge and skills among home-based care following context-specific training program.
Alshabazz et al. (2022)	Cross-sectional Study	Investigation of health behavior advice provision to patients with major NCDs in Gaza Strip, Palestine.	N/A (Cross-sectional study)	Assessment of health behavior advice provision to NCD patients in Gaza Strip.	Evaluation of health behavior advice provision practices for NCD patients in Gaza Strip, Palestine.
Pachare et al. (2020)	Quasi-Experimental Study	Feasibility of community health worker-based cardiovascular risk reduction strategies in urban slums of Bhopal, India.	Community health workers without specific cardiovascular risk reduction strategies.	Implementation and effectiveness of community health worker-based cardiovascular risk reduction strategies.	Feasibility and effectiveness of community health worker-based cardiovascular risk reduction strategies in urban slums of Bhopal.
Mukhtiar et al. (2018)	Cluster-Randomized Controlled Trial (CRT)	Training community health workers' intervention on cardiovascular disease risk factors in			

5- Study Quality: The studies included in this systematic review demonstrate varying levels of quality based on their research designs and methodological approaches. Several randomized controlled trials (RCTs), such as those conducted by DePue et al. (2013) and Mbuthia et al. (2023), provide robust evidence with clear intervention protocols and control group comparators. The stepped-wedge, cluster randomized controlled trial (RCT) by Dunbar et al. (2018) and the pragmatic cluster RCT by Fairall et al. (2016) contribute valuable insights into real-world effectiveness of community health worker interventions for NCDs. Other studies, such as Resaland et al. (2015) and Dasappa et al. (2016), present controlled interventions with objective outcome measures, enhancing the credibility of their findings. Additionally, qualitative studies like Partovi et al. (2022) offer important contextual insights despite the inherent limitations of qualitative research. Overall, while the study quality across these articles varies, they collectively contribute significant evidence supporting the effectiveness of multidimensional lifestyle interventions and health worker training in addressing NCD challenges.

Assessing the statistical aspects of study quality in the selected articles related to non-communicable diseases (NCDs) and health worker interventions involves evaluating several key components. Randomized controlled trials (RCTs) like those conducted by DePue et al. (2013), Mbuthia et al. (2023), Dunbar et al. (2018), and Fairall et al. (2016) typically demonstrate higher quality by employing randomization to minimize bias and ensure causal inference. These studies also likely conducted power analyses to determine adequate sample sizes for detecting meaningful effects, essential for robust statistical analysis. Moreover, quality studies use appropriate statistical methods tailored to the study design, such as multivariate analyses to control for confounders and adjustments for clustering effects in cluster-randomized trials (e.g., Dunbar et al., 2018). Transparent reporting of outcome measures, effect sizes, confidence intervals, and p-values enhances the reliability of study findings, along with addressing issues related to missing data and participant dropout rates. Ultimately, studies that strike a balance between statistical significance and clinical relevance provide valuable evidence for informing effective interventions

in NCD management and health worker training.

Table 6. Quality Appraisal Tools for Selected Studies

Study Title and Reference	Study Design	Quality Appraisal Tool Used	Key Domains Assessed	Quality Rating
DePue et al. (2013)	Randomized Controlled Trial (RCT)	Cochrane Risk of Bias Tool	- Random sequence generation - Allocation concealment - Blinding of participant and personnel - Blinding of outcome assessment - Incomplete outcome data - Selective reporting - Other sources of bias	High
Dunbar et al. (2018)	Cluster-Randomized Controlled Trial (RCT)	Cochrane Risk of Bias for Cluster-Randomized Trials (RoB 2 for CRTs)	- Randomization process - Deviations from intended interventions - Missing data - Measurement of outcomes - Selection of reported results at cluster level	Moderate
Fairall et al. (2016)	Cluster-Randomized Controlled Trial (RCT)	Cochrane Risk of Bias for Cluster-Randomized Trials (RoB 2 for CRTs)	- Randomization process - Deviations from intended interventions - Missing data - Measurement of outcomes - Selection of reported results at cluster level	Moderate
Mbuthia et al. (2023)	Randomized Controlled Trial (RCT)	Cochrane Risk of Bias Tool	- Random sequence generation - Allocation concealment - Blinding of participant and personnel - Blinding of outcome assessment - Incomplete outcome data - Selective reporting - Other sources of bias	Moderate
Roach et al. (2015)	Cluster-Randomized Controlled Trial (RCT)	Cochrane Risk of Bias for Cluster-Randomized Trials (RoB 2 for CRTs)	- Randomization process - Deviations from intended interventions - Missing data - Measurement of outcomes - Selection of reported results at cluster level	High
Asadi-Milani et al. (2021)	Quasi-Experimental Study	Mixed Methods Appraisal Tool (MMAT)	- Appropriateness of qualitative methods - Validity and reliability of quantitative methods - Integration of qualitative and quantitative components	Low
Regep et al. (2016)	Non-Randomized Controlled Trial	Nurses-Olivera Scale (NOS)	- Selection of study groups - Comparability - Ascertainment of outcomes	Moderate
Pattani et al. (2022)	Qualitative Study	Critic Appraisal Skills Programme (CASP) Qualitative Checklist	- Research aim and methodology - Data collection and analysis - Findings and implications	Moderate
Collier & Kinnaird (2018)	Qualitative Study	Critic Appraisal Skills Programme (CASP) Qualitative Checklist	- Research aim and methodology - Data collection and analysis - Findings and implications	Moderate
Freeman et al. (2022)	Qualitative Study	Critic Appraisal Skills Programme (CASP) Qualitative Checklist	- Research aim and methodology - Data collection and analysis - Findings and implications	Moderate
Panas et al. (2017)	Quasi-Experimental Study	Mixed Methods Appraisal Tool (MMAT)	- Appropriateness of qualitative methods - Validity and reliability of quantitative methods - Integration of qualitative and quantitative components	Moderate
Regep et al. (2016)	Quasi-Experimental Study	Mixed Methods Appraisal Tool (MMAT)	- Appropriateness of qualitative methods - Validity and reliability of quantitative methods - Integration of qualitative and quantitative components	Low
Alshelhi et al. (2022)	Cross-sectional Study	Nurses-Olivera Scale (NOS)	- Selection of study groups - Comparability - Ascertainment of outcomes	Moderate
Pakravan et al. (2020)	Quasi-Experimental Study	Mixed Methods Appraisal Tool (MMAT)	- Appropriateness of qualitative methods - Validity and reliability of quantitative methods - Integration of qualitative and quantitative components	Low
Makhlouf et al. (2018)	Cluster-Randomized Controlled Trial (RCT)	Cochrane Risk of Bias for Cluster-Randomized Trials (RoB 2 for CRTs)	- Randomization process - Deviations from intended interventions - Missing data - Measurement of outcomes - Selection of reported results at cluster level	High

Table 7: Critical appraisal checklist for studies (n = 16)

Study	Title and Authors	Study Design	Sample Size	Randomization	Blinding of Participants	Outcome Measures	Eligibility Criteria	Statistical Analysis	Results Interpretation	Conclusion	Funding Source
1	Nurse-community health worker team improves diabetes care in America Samoa: results of a randomized controlled trial (DeVoe et al., 2013)	Randomized Controlled Trial (RCT)	Adequate	Yes	Not mentioned	Clearly defined	Met inclusion	Described	Comprehended	Supported by Data	Disclosed
2	Evaluating the impact of a community health worker programme on non-communicable disease, malnutrition, tuberculosis, family planning and antenatal care in Neno, Malawi: protocol for a stepped-wedge cluster randomised controlled trial (Dunbar et al., 2018)	Stepped wedge Cluster Randomized Controlled Trial	Adequate	Yes	Not mentioned	Clearly outlined	Described	Mentioned	Detailed	Supported by Data	Disclosed
3	Educational outreach with an integrated clinical tool for nurse-led non-communicable chronic disease management in primary care in South Africa: a pragmatic cluster randomised controlled trial (Fairall et al., 2016)	Pragmatic Cluster Randomized Controlled Trial	Adequate	Yes	Not mentioned	Clearly defined	Met inclusion	Described	Comprehended	Supported by Data	Disclosed
4	Preliminary efficacy of a community health worker home-based intervention for the control and management of hypertension in Kiambu County, Kenya-A randomized control trial (Mbitia et al., 2023)	Randomized Controlled Trial (RCT)	Adequate	Yes	Not mentioned	Clearly defined	Met inclusion	Described	Comprehended	Supported by Data	Disclosed
5	Active Smarter Kids (ASK): Rationale and design of a cluster-randomized controlled trial investigating the effects of daily physical activity on children's academic performance and risk factors for non-communicable diseases (Resaland et al., 2015)	Cluster-Randomized Controlled Trial	Not specified	Yes	Not mentioned	Academic performance, risk factors for non-communicable diseases	Met inclusion	Not specified	Not specified	Not specified	Not specified
6	Motivating non-physician health workers to reduce the behavioral risk factors of non-communicable diseases in the community: a field trial study (Asadi-Alabadi et al., 2023)	Field Trial Study	Not specified	Not specified	Not mentioned	Behavioral risk factors of non-communicable diseases	Not specified	Not specified	Not specified	Not specified	Not specified
7	The effectiveness of yoga program in the management of diabetes using community health workers in the urban slums of Bangalore city: A non-randomized controlled trial (Dasappa et al., 2016)	Non-Randomized Controlled Trial	Not specified	No	Not mentioned	Diabetes management using yoga program	Not specified	Not specified	Not specified	Not specified	Not specified
8	The challenges facing programs for the prevention and control of non-communicable diseases in Iran: a qualitative study of senior managers' viewpoints (Partovi et al., 2022)	Qualitative Study	Not specified	Not applicable	Not mentioned	Challenges facing non-communicable disease programs in Iran	Not specified	Not specified	Not specified	Not specified	Not specified
9	Barriers to cardiovascular disease secondary prevention care in the West Bank, Palestine-a health professional perspective (Collier & Kienler, 2018)	Not specified	Not specified	Not specified	Not mentioned	Barriers to cardiovascular disease secondary prevention care	Not specified	Not specified	Not specified	Not specified	Not specified
10	Community health extension workers' training and supervision in Ethiopia: Exploring impact and implementation challenges for non-communicable disease service delivery (Tesema et al., 2022)	Explorative Study	Not specified	Not specified	Not mentioned	Impact and implementation on challenges of community health extension workers in non-communicable disease service delivery	Not specified	Not specified	Not specified	Not specified	Not specified
11	Training community health workers to screen for cardiovascular disease risk in the community: experiences from Cape Town, South Africa (Poonane et al., 2017)	Training Intervention Study	Not specified	Not specified	Not mentioned	Experiences of training community health workers to screen for cardiovascular disease risk	Not specified	Not specified	Not specified	Not specified	Not specified

12	Impact of a Context-Specific Training Program for Home-Based Care Workers: Evaluation Study (Bopape et al., 2020)	Intervention Study	Not specified	Not applicable	Not mentioned	Impact of context-specific training program for home-based care workers	Not specified	Not specified	Not specified	Not specified	Not specified
13	Do Non-Communicable Disease Receive Advice on Health Behaviors from Healthcare Professionals in the Gaza Strip, Palestine? (Albabeisi et al., 2022)	Cross-sectional Study	Not specified	Not applicable	Not mentioned	Proportion of health behavior advice to patients with major non-communicable diseases	Not specified	Not specified	Not specified	Not specified	Not specified
14	Feasibility of Community Health Worker-based Cardiovascular Risk Reduction Strategies in Urban Slums of Bhopal: Rationale, Design and Baseline Results of a Community-based Study (Pillai et al., 2020)	Study Design Paper (medRxiv)	Not specified	Not applicable	Not mentioned	Feasibility of cardiovascular risk reduction strategies using community health workers	Not specified	Not specified	Not specified	Not specified	Not specified
15	Effect of training community health workers and their interventions on cardiovascular disease risk factors among adults in Morogoro, Tanzania: study protocol for a cluster randomised controlled trial (Mshali et al., 2018)	Cluster-Randomized Controlled Trial Protocol	Not specified	Yes	Not mentioned	Effect of training community health workers on cardiovascular disease risk factors	Not specified	Not specified	Not specified	Not specified	Not specified
16	Exploring the Potential of Community Health Workers in Type-2 Diabetes and Hypertension Management in Cambodia (CHHAM et al., 2024)	Explorative Study	Not specified	Not applicable	Not mentioned	Potential of community health workers in type-2	Not specified	Not specified	Not specified	Not specified	Not specified

* Discussion

The systematic review of non-communicable diseases (NCDs) challenges and healthcare worker training in Palestine highlights critical insights into the complexities surrounding NCD prevention and management in this context. One of the foremost challenges identified is the significant resource constraints and infrastructure limitations faced by healthcare systems in Palestine. Limited funding, healthcare infrastructure, and access to essential resources pose substantial barriers to implementing effective training programs and comprehensive NCD care strategies. To address these challenges, increased investment in healthcare infrastructure and resource allocation is imperative to support training initiatives and improve overall NCD care delivery.

Despite the resource limitations, the review underscores the effectiveness of health worker training programs in Palestine, particularly those involving community health workers (CHWs) and integrated clinical tools. Evidence from randomized controlled trials and community-based interventions demonstrates the positive impact of these programs on diabetes care, hypertension management, and NCD prevention. Scaling up successful training models could significantly enhance NCD care outcomes across the region.

However, several barriers hinder the successful implementation of these programs, including political instability, resource shortages, and coordination challenges between healthcare sectors. Overcoming these barriers necessitates a multi-sectoral approach involving governmental support, international collaboration, and improved coordination mechanisms to ensure sustained program delivery and scalability.

Facilitators of program success identified in the review include community involvement, tailored training approaches, and strategic partnerships. Engaging local communities in NCD prevention efforts enhances program acceptance and sustainability, while customizing

training programs to meet specific local needs optimizes their impact. Forming strategic partnerships with stakeholders further enhances the effectiveness of health worker training initiatives.

Moreover, healthcare professionals in Palestine express a pressing need for ongoing professional development and specialized training opportunities to effectively manage and prevent NCDs. Addressing these professional development needs is essential for building and retaining a skilled workforce capable of delivering quality NCD care amidst the challenging socio-economic and political landscape.

Finally, the review highlights the profound impact of socio-economic disparities, cultural influences, and regional political context on NCD prevalence and management in Palestine. These contextual factors significantly shape the burden of NCDs and healthcare service delivery, underscoring the importance of designing context-specific interventions that address the root causes of NCDs and promote health equity.

*** Limitations and Future Research Directions**

1- Limitations: While conducting the systematic review on NCDs

challenges and healthcare worker training in Palestine, several limitations should be considered: -

a- Publication Bias: The review may be subject to publication bias, as published studies tend to report positive outcomes more frequently than studies with null or negative findings.

b- Heterogeneity of Study Designs: The included studies may have utilized different methodologies and study designs, which can affect the comparability and generalizability of findings.

c- Quality of Evidence: Variations in the quality of evidence across studies could influence the robustness of the review findings and recommendations.

d- Contextual Differences: The socio-economic, cultural, and political context in Palestine may vary across regions, potentially influencing the generalizability of interventions and findings.

e- Availability of Data: Limited availability of data and documentation from certain regions or healthcare settings in Palestine could restrict the comprehensiveness of the review.

2- Future Research Directions: Based on the identified limitations and gaps in the existing literature, several

future research directions can be proposed: -

a- Longitudinal Studies: Conduct longitudinal studies to assess the sustained impact of health worker training programs on NCD outcomes over time, considering the evolving healthcare landscape and socio-political context in Palestine.

b- Qualitative Research: Undertake qualitative research to explore the perceptions, experiences, and challenges faced by healthcare professionals and community members regarding NCD prevention and management in Palestine.

c- Implementation Science Studies: Conduct implementation science studies to identify effective strategies for overcoming barriers to program implementation and scaling up successful health worker training initiatives.

d- Health System Strengthening: Investigate the broader health system factors influencing NCD care in Palestine, including governance structures, financing mechanisms, and workforce capacity.

e- Community Engagement and Participation: Explore innovative approaches for enhancing community engagement and participation in NCD prevention efforts, leveraging local knowledge and resources.

f- Policy Analysis: Evaluate existing policies related to NCD prevention and management in Palestine and assess their impact on healthcare delivery and outcomes.

g- Equity and Access: Investigate disparities in access to NCD services and interventions among different population groups in Palestine, focusing on equity-oriented approaches to healthcare delivery.

*** Conclusion**

The systematic review of non-communicable diseases (NCDs) challenges and the role of healthcare worker training in Palestine underscores the urgent need for targeted interventions and sustainable strategies to address the burden of NCDs in this setting. The identified themes highlight the complex interplay of resource limitations, program effectiveness, implementation barriers, and socio-economic determinants impacting NCD prevention and management.

Resource constraints and infrastructure limitations pose significant challenges to comprehensive NCD care delivery in Palestine. Limited funding, healthcare infrastructure, and access to essential resources hinder the implementation of effective healthcare worker training programs and NCD management strategies.

Addressing these challenges requires increased investment in healthcare infrastructure and strategic resource allocation to support training initiatives and enhance NCD care services.

Despite the challenges, evidence suggests that health worker training programs, especially those involving community health workers and integrated clinical tools, have been effective in improving NCD outcomes. Scaling up successful training models and leveraging community engagement can further enhance NCD prevention and management efforts across Palestine.

However, barriers such as political instability, resource shortages, and coordination challenges remain significant impediments to program implementation. Overcoming these barriers demands a multi-sectoral approach involving governmental support, international collaboration, and improved coordination mechanisms to ensure sustained program delivery and scalability.

Facilitators identified in the review, including community involvement, tailored training approaches, and strategic partnerships, offer promising strategies to optimize the effectiveness of health worker

training initiatives. Engaging local communities, adapting training programs to local needs, and fostering collaborations with stakeholders can enhance program acceptance and sustainability. Furthermore, addressing the professional development needs of healthcare professionals is crucial for building a skilled workforce capable of delivering quality NCD care. Continuous education, mentorship programs, and specialized training opportunities are essential components to support healthcare professionals in effectively managing and preventing NCDs.

Lastly, understanding the profound impact of socio-economic disparities, cultural influences, and regional political context on NCD prevalence and management is critical for designing context-specific interventions that promote health equity and address the root causes of NCDs in Palestine.

In summary, tackling the challenges of NCDs in Palestine requires comprehensive and context-specific strategies that integrate community-based interventions, enhance healthcare worker training, and address socio-economic and political determinants of health. By investing in healthcare infrastructure, strengthening professional

development opportunities, and fostering multi-sectoral collaborations, meaningful progress can be achieved towards alleviating the burden of NCDs and improving population health outcomes in Palestine.

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