



The Effect of a Diabetes Nursing Practitioners in Community Health Settings on Patient Outcomes and Cost Savings: Rapid Review

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ABSTRACT

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Background: Community healthcare settings play a critical role in diabetes management, particularly in regions with high prevalence, such as Israel. While nurse practitioners (NPs) or diabetes nurse specialists have demonstrated cost-effectiveness and positive outcomes in hospitals and primary care, their impact in community settings remains underexplored. This review examines the potential of diabetes-focused NPs/diabetes nurse specialists to improve patient outcomes and reduce costs in community healthcare contexts.

Methods: Four sources of information were searched, namely Web of Science, PubMed, ScienceDirect, and Google Scholar. Primary studies conducted in community healthcare settings within the past 10 years (2014-2024) using a sample of diabetes mellitus patients cared by NPs or diabetes nurse specialists met the eligibility criteria. The quality of the studies was assessed using the Newcastle-Ottawa Scale (NOS).

Results: Initially, 278 studies were identified, and upon screening them against the eligibility criteria, six of them were found to be eligible for review. All were cohort studies using varied research approaches, predominantly comparative analysis, pre-post designs, and observation. Three of the studies were of high quality, two of moderate quality, and one of low quality. It was found that NPs or diabetes nurse specialists have the potential to improve clinical patient outcomes. They are also likely to save the healthcare system costs because they provide the same quality of care and achieve comparable clinical patient outcomes as physicians and physician assistants yet, in jurisdictions like the United States, their compensation is generally lowered than that of physicians.

Conclusion: Policymakers should work on the increased deployment of NPs or diabetes nurse specialists to community healthcare settings after assessing cost-effectiveness in their jurisdictions.

KEYWORDS:

Healthcare, Diabetes, Physicians

INTRODUCTION

In countries like Israel and the United States, community healthcare settings (CHS) play a pivotal role in improving the quality of diabetes management, especially in rural areas (Calderon-Margalit et al., 2018; Dugani et al., 2021). There is a high prevalence of diabetes in Israel, especially among minority communities and children

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(Loewenberg Weisband et al., 2020; Treister-Goltzman & Peleg, 2023; Zucker et al., 2016). Although diabetes rates have remained relatively stable over the last few years, the Israeli Ministry of Health reported that, among people aged between 20 and 79 years, the prevalence was 9.7% in 2019, which is higher than the European average of 6.3% (Ministry of Health, 2021). Through community health initiatives, community health workers can help in identifying barriers to care as they provide education, coaching and other support (e.g., mentoring staff and students), especially to minorities who are disproportionately affected by diabetes (McDowell & Boyd, 2018; Vaughan, 2024). Previous studies have shown that community health (CH) interventions for diabetes prevention and management are generally cost-effective (Jacob et al., 2019).

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Nurse practitioners (NPs) and diabetes nurse specialists are increasingly working with people with diabetes in community healthcare settings (Trout et al., 2019). However, little is known about their effect on cost-savings and effectiveness in improving diabetes patient outcomes in CHS. Studies conducted in hospitals and primary care settings have consistently demonstrated that NPs have a positive impact on patient outcomes and cost-effectiveness (Donald et al., 2014; Htay & Whitehead, 2021). This cost-effectiveness is mainly because NPs provide the same quality of care as physicians but at a cheaper cost as also reflected in their lower compensation compared to physicians (American Association of Nurse Practitioners, 2013; Laurant et al., 2018). Based on these prior findings, it can also be hypothesized that NPs for diabetes care in community settings can significantly improve patient outcomes and offer greater cost savings.

This review aims to explore the effect of diabetes NPs on patient outcomes and cost savings.

METHODS

This review was conducted in accordance with the updated PRISMA guidelines (Page et al., 2021).

Eligibility Criteria

Apart from case reports and secondary studies like systematic reviews, studies of various research designs were eligible, including conference abstracts if they reported the findings of an eligible primary study. The studies must focus on the effect of diabetes NPs or nurse specialists in community or primary care settings on either patient outcomes or cost savings/cost effectiveness. Studies were considered eligible if the population of interest were diabetes mellitus patients, the healthcare setting is in the community, the intervention is diabetes diagnosis and treatment offered by NPs, and reports patient outcomes or cost-effectiveness. Studies were excluded if they were published before 2014, written in a non-English language, and full text are unavailable.

Search Strategy

The sources of information searched included Web of Science, PubMed, ScienceDirect, and Google Scholar. On PubMed, MeSH terms were used besides regular search terms to improve search precision. The following are the search terms that were used: “Diabetes” AND (“Nursing Practitioner” OR “Nurse Specialist” OR “Advanced Practice Nurse”) AND (“Community Health” OR “Primary Care” OR “Public Health” OR “Outpatient” OR “Rural Health” OR “Community-Based”) AND (“Patient Outcome*” OR “Cost-effective*”). The syntax of this search string was tailored for each source of information’s native architecture (See Appendix A for PubMed and ScienceDirect search strategies).

Study Selection

The study selection process was carried out by one reviewer. The risk of bias arising from a single reviewer was mitigated by carrying out the process in two stages. In the first stage, eligible studies were screened using the defined eligibility criteria. The second stage was confirmatory in that it was aimed at identifying and rectifying any errors and omissions in the first stage.

Data Extraction

The following data items were extracted from the eligible studies: authors, year of publication, country, study design, study aim and objectives, study setting, outcomes assessed (patient outcomes and cost-effectiveness), sample size, participant characteristics, the role of the diabetes NPs or nurse specialists, and key findings. The study extraction process was conducted by one reviewer (the author) in two stages to mitigate errors and omissions, whereby the first stage was the actual process, and the second stage was a confirmatory one.

Risk of Bias Assessment

Since all the studies retrieved were cohort studies (non-randomized), their quality or risk of bias was assessed using the Newcastle-Ottawa Scale (NOS) (Wells et al., 2009). The scale has three main components, namely Selection (maximum of four stars), Comparability (maximum of two stars), and Outcome (maximum of three stars). In this review, the quality of a study was converted into a percentage form. For example, if a study scored 9 out of 9 stars, its quality was rated as 100%. A follow-up of six months was considered long enough to demonstrate the effect of diabetes specialist nurses/APNs/NPs.

Synthesis Methods

Since studies focused on different outcomes and utilized heterogenous study designs, a narrative synthesis was deemed the most appropriate (Lisy & Porritt, 2016; Popay et al., 2006). Findings between studies were compared to identify meaningful patterns, which, in turn, helped in the derivation of themes that addressed the review’s aim.

RESULTS

Study Selection

Initially, a total of 278 records were identified from the four sources of information, namely 161 on PubMed, 100 on Google Scholar, 10 on Web of Science, and 7 on ScienceDirect. After removing 18 duplicated records, the remaining 260 records were subjected to title and abstract screening. As a result, 229 records were ineligible. The remaining 31 records were sought for retrieval, whereby 2 could not be found online. The rest 29 records were screened for eligibility using their full texts. Of these, 15 were excluded for a wrong intervention. For example, Garg et al. (2017) conducted a study that investigated the effect of a follow up conducted by NPs after discharge of elective

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surgery patients diagnosed with diabetes. Although they focused on relevant outcomes like glycemic control and follow up of patients in the community, the NPs were hospital-based rather than community-based. Also, a randomized controlled trial (RCT) nearly met the eligibility criteria but did not distinguish findings for interventions undertaken by an NP and a physician, making it hard to understand the true effect of an NP (Berry et al., 2016). Another set of six records were excluded because they

addressed a study aim that did not align with the aim of this review. For example, Riordan et al. (2017) focused on NPs' roles, links with other professionals, and barriers instead of their impact on patient outcomes and cost-effectiveness. Finally, two studies were excluded because they used wrong participants, that is, diabetes insipidus patients instead of diabetes mellitus patients. Figure 1 below summarizes this study selection process.

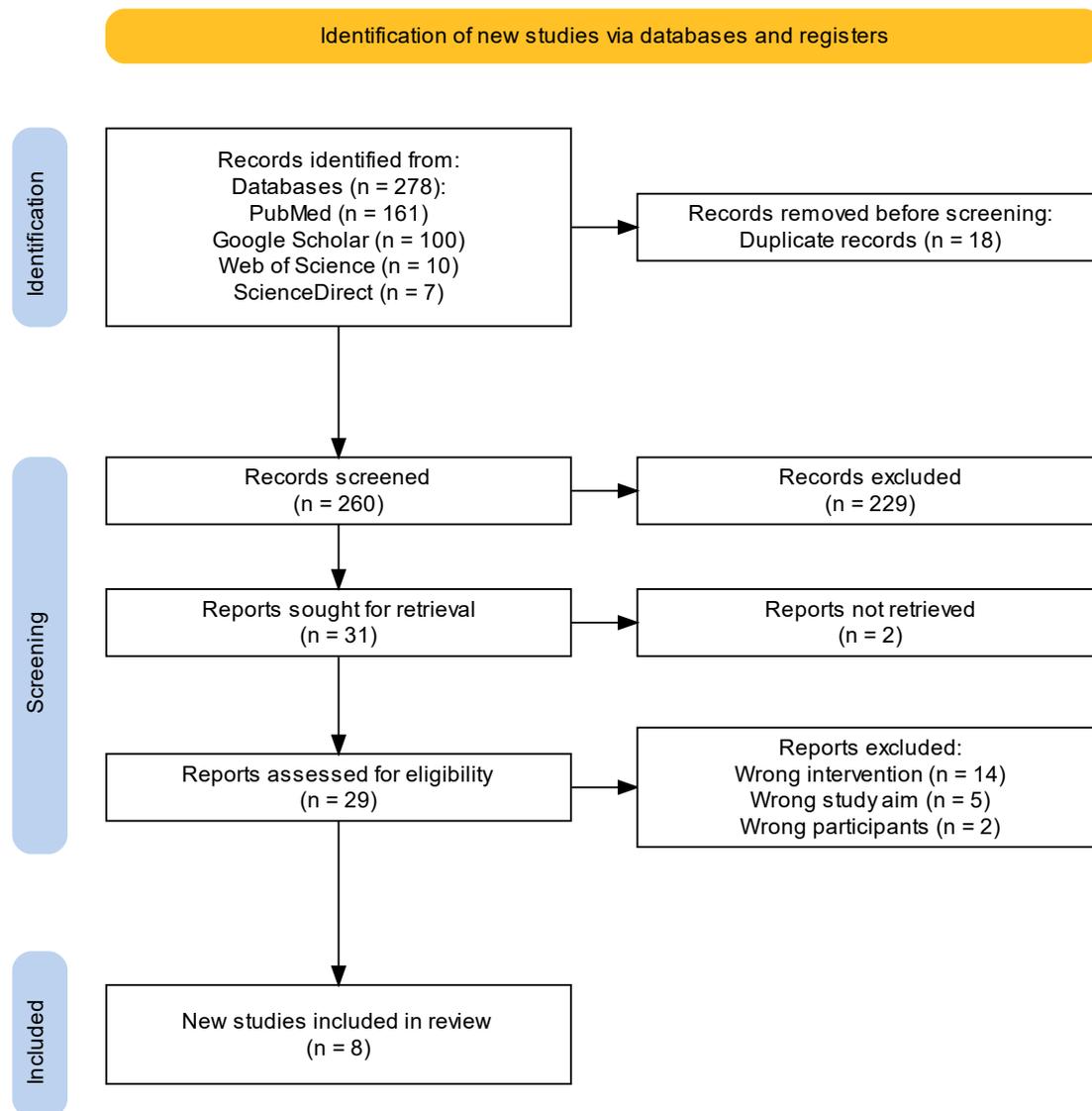


Figure 1: PRISMA flowchart summarizing the study selection process (Haddaway et al., 2022)

Study Characteristics

The studies utilized a total sample of 380,007 diabetic patients. Three studies were conducted in the United States, one in Israel, one in the United Kingdom, and one in Spain. All were cohort studies with varied research approaches, including comparative, pre-post, and observational approaches. Two studies compared the effect of a diabetes specialist nurse/APN with that of another healthcare professional, mainly physicians and physician assistants (Jackson et al., 2018; Marin et al., 2018). One study

compared the effect of a diabetes nurse specialist alone versus combined management with a diabetologist in Israel (Gadot & Azuri, 2023). Two studies used a pre-post design to track improvements over time (Cabr  Font et al., 2021; Waizinger, 2020), whereas one study was purely observational over an extended period of 17 years. All the studies focused on diabetes clinical and patient outcomes, and none of them reported cost-effectiveness-related outcomes. Table 1 summarizes the study characteristics and the results of individual studies.

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Table 1: Study Characteristics and Findings of Individual Studies

Authors, Year, Country	Study Aims/Objectives	Design,	Outcomes Assessed	Participant Characteristics (Sample Size)	Key Findings
Waizinger (2020), United States	Quality improvement study with pre-post design; aimed to improve metabolic control in diabetic patients through an enhanced intervention with graduates of an advanced diabetes course supervised by a diabetes nurse specialist.		Metabolic control outcomes (HbA1c)	19 GADC nurses working in 18 community clinics, covering 7,800 patients with diabetes in total.	Metabolic control improvement: total from 77.9% to 86% (+8%) and Arab sector from 68.9% to 79% (+10.1%); HbA1c reduction in those with levels above 9%: -2.3% overall, -3.3% in Arab sector.
Marin et al. (2018), United States	Retrospective comparative study; assess differences in HbA1c between primary care physicians and primary care-based advanced practice nurse (APN)		Changes in HbA1c over time (6, 12, and 24 months)	Age 18-85, diagnosed with type 2 diabetes for at least 2 months, 2+ healthcare provider visits during the study period, at least 2 HbA1c levels; 269 diabetic patients (93 treated by ANP and 176 by physician)	At 6 and 12 months, no significant differences in HbA1c between APN and physician treated patients, but at 24 months, APN-treated patients showed a trend of greater HbA1c reduction compared to physician-treated patients (mean difference -0.26, p=0.097).
Riordan et al. (2018), United Kingdom	Retrospective observational study; to assess the effectiveness of a structured, primary care-managed diabetes program in improving the quality of care over a span of 17 years		Proportions achieving HbA1c ≤58 mmol/mol, blood pressure ≤140/80 mmHg, and cholesterol <5.0 mmol/l.	>18 years patients diagnosed with diabetes (n=3,196)	Patients referred to diabetes nurse specialists were more likely to have poor glycemic control than those not referred.
Jackson et al. (2018), United States	Cohort study; to examine differences in intermediate diabetic patient outcomes between physicians, NPs, and physician assistants.		HbA1c; systolic blood pressure; low-density lipoprotein cholesterol (LDL-C)	Adult diabetic patients being treated pharmaceutically (n=368,481)	No clinically significant variations were observed in the outcomes between the three primary care providers.
Cabré Font et al. (2021), Spain	Longitudinal cohort study with a pre-post design; To evaluate outcomes of a therapeutic education program for insulin-treated T2D patients in primary care.		Clinical outcomes (HbA1c, hypoglycemia), educational outcomes (skills, lifestyle, adherence), and patient satisfaction (quality of life).	Adult diabetic patients with suboptimal metabolic control or repeated hypoglycemia (n=161)	After 6 months, there were significant improvements in HbA1c reduction, hypoglycemia episodes, learning skills, lifestyle, adherence to care, and patient satisfaction. 98% of participants considered the DSN's role essential in the program.
Gadot and Azuri (2023), Israel	Retrospective comparative study; to assess diabetes outcomes in the community by comparing management solely by a diabetes-clinic specialist nurse to combined		HbA1c levels, LDL, TG, and blood pressure	Adult diabetic patients with poor control of HbA1c levels (above 9%) (n=100)	The study found significant HbA1c reduction in both nurse-only and nurse-diabetologist groups, with no significant differences in clinical outcomes, including

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Authors, Year, Country	Study Aims/Objectives	Design	Outcomes Assessed	Participant Characteristics (Sample Size)	Key Findings
	management with a diabetologist.	with a			LDL, triglycerides (TG), or blood pressure, after follow-ups.

Quality Assessment Findings

Three studies were of high quality (overall quality of 90% and above), two of moderate quality (75%-89%), and

one of low quality (74% and below). Table 2 below summarizes the quality findings for each study.

Table 2: Quality Assessment Findings

Study	Selection	Comparability	Outcome	Overall Quality
Waizinger (2020)	***	**	*	66.67%
Marin et al. (2018)	****	**	***	100%
Riordan et al. (2018)	***	**	***	88.87%
Jackson et al. (2018)	****	**	***	100%
Cabré Font et al. (2021)	***	*	***	87.5%
Gadot and Azuri (2023)	****	**	***	100%

Synthesis Findings

Diabetes Specialist Nurses Can Improve Diabetes Outcomes

Studies that used a pre-post design found that after the introduction of diabetes nurse specialists or APNs in community or primary healthcare settings, various diabetes outcomes, such as metabolic control (HbA1c), educational outcomes like skills, lifestyle, and adherence, as well as patient satisfaction (quality of life) improved significantly (Cabré Font et al., 2021; Waizinger, 2020). Diabetes nurse specialists or APNs were involved in the implementation of interventions targeted at improving these outcomes. Waizinger (2020) focused on a quality improvement intervention that involved the deployment of nurse graduates of an advanced diabetes course that was supervised by an APN. On the other hand, Cabré Font et al. (2021) evaluated the effectiveness of a therapeutic educational intervention for insulin-treated type 2 diabetes patients. Therefore, their findings do not assess the direct impact of APNs or diabetes nurse specialists in routine care as they were involved in the implementation of targeted programs. Another study found that over a follow up period of 17 years in retrospectively obtained data, patients who were referred to a diabetes nurse specialist had poorer glycemic control than those not referred (Riordan et al., 2018). Even so, the fact that the patients were not randomized between the two groups, the risk of bias is likely to be high in that only complex cases were being referred to the specialist. Therefore, the best approach to understanding the true effect of diabetes nurse specialists and NPs in community and primary care is by exploring how they compare with other professionals, such as physicians.

Diabetes Nurse Specialists Provide the Same Quality of Care as Other Providers

Three studies implied that diabetes nurse specialists and APNs provide the same level of care as other providers like physicians, assistant physicians, and diabetologists (Gadot & Azuri, 2023; Jackson et al., 2018; Marin et al., 2018). Marin et al. (2018) retrospectively followed up 269 patients, whom they divided into two groups, namely primary care-based APN and primary care physician. At 6 months and 12 months follow ups, no differences in HbA1c levels were observed between the two groups, but there was a trend of more improvements in the APN group compared to the physician group at the 24-month mark. Even so, in the entire follow up period, no significant differences in outcomes were observed between the two groups. Also, focusing on various outcomes, among them Hb1Ac, blood pressure, and LDL, Jackson et al. (2018) found no significant differences between physicians, nurse practitioners, and assistant physicians among adult patients being treated pharmaceutically. Reinforcing further this observation is the finding by Gadot and Azuri (2023) that a diabetes nurse specialist versus combined care by diabetes nurse specialist and diabetologist did not yield any significant differences in various clinical outcomes, namely HbA1c levels, LDL, TG, and blood pressure after follow-ups ranging between 150 and 165 days.

DISCUSSION

The findings of this review revealed that the deployment of diabetes nurse specialists/APNs/NPs to community settings is likely to improve various clinical patient outcomes, such as glycemic control, blood pressure, triglycerides, and cholesterol (Cabré Font et al., 2021; Riordan et al., 2018; Waizinger, 2020). However, two of these studies were of moderate quality and one of low quality,

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which calls for the need to be cautious when translating this finding into policy or practice. Regardless, the findings are consistent with hospital-based studies that have shown that diabetes nurse specialists/APNs/NPs can significantly improve outcomes when involved in the treatment and management of patients diagnosed with diabetes (Donald et al., 2014; Htay & Whitehead, 2021). High quality studies in community settings can provide more precise estimations of the effect of specialists/APNs/NPs on clinical patient outcomes.

Further, the findings of this study indirectly implied that the deployment of diabetes nurse specialists/APNs/NPs to community healthcare settings could be cost-effective and hence able to save significant healthcare costs. For example, three studies, all high quality as cohort studies revealed that the quality of care provided by specialists/APNs/NPs does not differ from the quality of care provided by other primary care providers like physicians, assistant physicians, and diabetologists (Gadot & Azuri, 2023; Jackson et al., 2018; Marin et al., 2018). Their findings are also consistent with other previous studies conducted in hospital settings that have demonstrated that specialists/APNs/NPs provide the same quality of care as other healthcare professionals (Kuo et al., 2015; Shozuhara & Suzuki, 2024). Although the cost of care between NPs and physicians may be comparable (Shozuhara & Suzuki, 2024), the fact that NPs/APNs/nurse specialists get lower compensation compared to physicians means they save costs for the healthcare system (American Association of Nurse Practitioners, 2013; Laurant et al., 2018). Therefore, it can confidently be concluded that, if in a jurisdiction it is established that NPs or diabetes nurse specialists can provide care at a lower cost compared to physicians, they can be deployed to community healthcare as they can significantly improve patient outcomes and satisfaction.

More future, high-quality studies utilizing experimental approaches, like randomized controlled trials and longer follow up periods of up to 5-10 years are required to assess the accurate effect of NPs or diabetes nurse specialists on clinical patient outcomes. Also, future studies should employ explicit cost-effectiveness assessment methodologies to provide precise estimates of how much costs are saved when NPs or diabetes nurse specialists are deployed to community healthcare settings. Such knowledge can guide better decision making in policy formulation and practice.

CONCLUSION

In conclusion, this review has demonstrated that the deployment of NPs or diabetes nurse specialists to community healthcare settings can potentially save costs without compromising the quality of care. However, more future studies utilizing more robust methodologies can be used to determine the true effect of NPs or diabetes nurse specialists on patient clinical outcomes and cost-savings.

Additionally, since regulation landscapes for NPs and diabetes nurse specialists differ from country to country, more studies in each jurisdiction should be conducted. For instance, in the United States, NPs have lower compensation than physicians, the source of their cost-effectiveness, a condition that may not be true in all jurisdictions.

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APPENDICES

Appendix A

Web of Science (Search Date: 02/11/2024; Date Range Applied: 2014-2024)

Search Round	Search String	Results
#1	TS=(Diabetes)	410,880
#2	TS=("Nursing Practitioner" OR "Nurse Specialist" OR "Advanced Practice Nurse")	1,482
#3	TS=("Community Health" OR "Primary Care" OR "Public Health" OR "Outpatient" OR "Rural Health" OR "Community Based")	489,484
#4	#1 AND #2	40
#5	#3 AND #4	10

PubMed (Search Date: 05/11/2024; Date Range Applied: 2014-2024)

Search Round	Search String	Results
#1	"Diabetes Mellitus"[Mesh] OR "Diabetes"[Tiab]	396,183
#2	"Advanced Practice Nursing"[Mesh] OR "Advanced Practice Nurs*"[Tiab] OR "Nurs* Practitioner*"[Tiab] OR "Nurse Specialist*"[Tiab]	10,435
#3	#1 AND #2	359
#4	"Community Health Services"[Mesh] OR "Community Health Nursing"[Mesh] OR "Community Health Centers"[Mesh] OR "Community Health"[Tiab] OR "Primary Care" OR "Primary Health Care"[Mesh] OR "Primary Care Nursing"[Mesh] OR "Nurses, Public Health"[Mesh] OR "Rural Health Services"[Mesh] OR "Rural Health"[Tiab] OR "Community-Based"[Tiab]	324,310
#5	#3 AND #4	161