ORIGINAL ARTICLE

The Impact of Nurse Educator-Led Clinic (NELC) on HbA1c and Clinical Variables among Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: Numerous studies comparing the effectiveness of discipline-based education have yet to demonstrate significant differences in the quality of services provided by various healthcare professions. Therefore, this study aimed to evaluate patient outcomes related to HbA1c and other clinical variables among patients with Type 2 Diabetes Mellitus (T2DM) in a community health clinic setting. **Method:** This study involved 200 patients with T2DM who attended the Nurse Educator-Led Clinic (NELC) from January 2023 to December 2023 at a primary care health clinic in Selangor, Malaysia. A pre-and post-intervention assessment was conducted over six months, with HbA1c as the primary outcome. Secondary outcomes included fasting blood glucose (FBG), body mass index (BMI), systolic and diastolic blood pressure, waist circumference (WC), and hip circumference (HC). **Results:** The findings demonstrated a reduction in the mean HbA1c level from 9.80% to 7.68%, FBG from 8.61 mmol/L to 7.7 mmol/L, systolic blood pressure from 141.55 mmHg to 136.36 mmHg, and diastolic blood pressure from 79.88 mmHg to 76.60 mmHg. A significant correlation was observed between pre- and post-intervention means for the clinical variables (HbA1c, FBG, systolic BP, diastolic BP, WC, and HC), with p-values <0.05. **Conclusion:** In this study, the single-centre NELC demonstrated sustained improvements in clinical outcomes, particularly in achieving glycemic control within 24 weeks. The findings support the implementation of programs emphasizing collaborative education and management. Further research with multicentre involvement and longer follow-up durations is recommended to evaluate whether NELC interventions consistently deliver sustained benefits in clinical patient outcomes.
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Keywords: Nurse Educator, Haemoglobin, Diabetes Mellitus, Lead clinic

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INTRODUCTION

Diabetes prevalence is rising rapidly worldwide. The International Diabetes Federation (IDF) reported 463 million cases in 2018, projected to increase to 700 million by 2045 (1). According to the International Diabetes Federation, in 2018, Malaysia had the highest prevalence of diabetes in the Western Pacific region compared to neighbouring countries such as Thailand (8%), Indonesia (6.2%), the Philippines (6.1%), and Singapore (12.8%) (2). Statistics from the Malaysian National Health and Morbidity Survey (2015) show that the prevalence of diabetes increased from 11.6% in 2006 to 17.5% in 2015 (3).

Intense efforts are needed to achieve good glycemic control and delay the onset of diabetes complications. Evidence suggests diabetes self-management education can improve short-term glucose control and reduce diabetes complications (4). Multiple healthcare professionals, including nurses, pharmacists, and dietitians, play a crucial role in providing education on diabetes self-management. However, research comparing the effectiveness of discipline-specific education has yet to identify significant differences in the quality of services provided by various healthcare professions (5). Among healthcare professionals, nurses represent the largest and most dependable group. Acting as the link between theory and practice, nurses are uniquely positioned to promote positive changes

and transform healthcare delivery (6). Practice nurses, in particular, are well-suited to provide monitoring, personalized feedback, and education on critical self-management topics (7).

In Malaysia's Ministry of Health, diabetes educator nurses are required to complete specific training, such as the Advanced Diploma in Diabetes Care (ADDC), before qualifying as diabetes educators. This program equips nurses with the knowledge and skills needed to manage and care for patients with diabetes effectively. In Malaysia, diabetes nurse educators are integral members of a dedicated healthcare team, providing holistic care to patients with Type 2 Diabetes Mellitus (T2DM), particularly by empowering patients in their self-care management (8). The role of the diabetes educator includes improving the quality of patient education by assessing patients' knowledge and needs, enhancing their understanding of diabetes management, and addressing potential problems and barriers in managing their condition (9).Despite increasing interest, there is limited evidence supporting the clinical efficacy of nurse-led diabetes self-management interventions in improving glucose control, particularly in Malaysia. This study aims to evaluate patient outcomes from the Nurse Educator-Led Clinic (NELC) for T2DM patients in a community health clinic setting.

METHODS

Research Setting

This study was conducted in an urban area at the centre of a primary healthcare clinic in Selangor, Malaysia. This setting was selected due to its accessibility for respondents, particularly those affected by COVID-19, and its status as one of the clinics with the highest number of active T2DM patients in Selangor, serving 3,412 patients. Additionally, the clinic is well-established with a Diabetes Resources Centre (DRC) and has been led by a diabetes nurse educator since 2016. The DRC offers various services, including counselling, foot care assessment and examination, insulin injection competency training, behaviour modification programs, awareness campaigns, and guidance to support patients in diabetes self-care management.

Overview of NELC

Diabetes nurse educators provide services to patients through the NELC program. The program emphasizes five key elements tailored to support T2DM patients. Additionally, patients' sociodemographic data, medical profiles, care plans, and interventions are systematically recorded in the clinic's Electronic Medical Record (EMR). **Figure 1** illustrates the components of the NELC program.

Educational Elements in NELC

The NELC program incorporates eleven key educational elements: an introduction to diabetes, medication and glycemic target control, insulin assessment and competency, lipodystrophy assessment, recognition and management of hypoglycemia and hyperglycaemia symptoms, dietary guidance, exercise planning, self-monitoring of blood sugar, insulin initiation, insulin adjustment and titration.

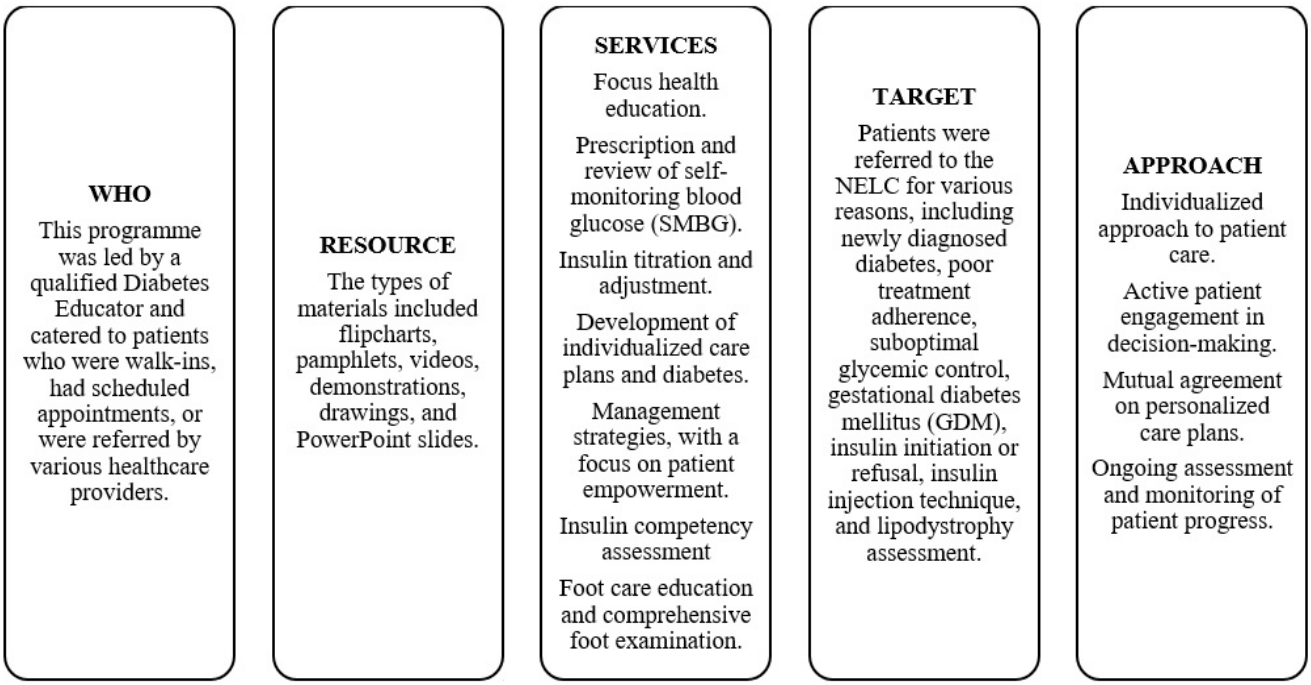

Fig. 1: Overview of the NELC

Study Design and Sampling

This retrospective study included 200 T2DM patients who attended the Nurse Educator-Led Clinic (NELC) from January 2023 to December 2023. The study involved a pre-and post-intervention assessment, focusing on patients' medical profiles over six months. Key variables assessed included HbA1c, fasting blood glucose (FBG), body mass index (BMI), systolic and diastolic blood pressure, waist circumference (WC), and hip circumference (HC).

Inclusion and Exclusion Criteria

Participants were eligible for the study if they were Malaysian adults aged ≥18 years, clinically diagnosed with T2DM for at least six months, and had complete medical records, including HbA1c, fasting blood glucose (FBG), body mass index (BMI), systolic and diastolic blood pressure, waist circumference (WC), and hip circumference (HC). Additionally, they must have been seen by a diabetes nurse educator at the Diabetes Resources Centre between January 2023 and December 2023.

Exclusion criteria included individuals with a history of psychiatric disorders, Type 1 Diabetes Mellitus (T1DM), Gestational Diabetes Mellitus (GDM), or pre-diabetes.

Study Flow

Data collection commenced after obtaining ethical approval. The researcher extracted the medical profiles of patients who attended the NELC program using the clinic's electronic medical record system. Participants meeting the inclusion criteria were identified, and the final list of respondents was confirmed prior to data analysis.

Statistical Analysis

All data were analyzed using SPSS software (version 26). Statistical significance was set at an alpha level 0.05 with two-tailed p values. Results were expressed as mean ± SD or n (%). The Chi-square or Fisher's exact test was used for categorical variables to assess associations between variables.

Ethical Considerations

The Medical Research and Ethics Committee (MREC) granted ethical approval, with the research identification number NMRR ID-22-01586-ITN. As this retrospective study only used existing medical records, patient consent and information sheets were not required.

RESULT

Demographic and Clinical Characteristics of Respondents

Table I presents the demographic and clinical characteristics of the respondents. A total of 200 T2DM patients participated in this study, with 59.5% being female. Most respondents (77.5%) were known cases of diabetes, while 22.5% were newly diagnosed. The average age of respondents ranged between 41 and 50 years (46.5%). Most respondents were on a combination of insulin and oral glycemic-lowering medications (73.0%). The duration of diabetes among respondents was predominantly less than five years (72.0%), followed by six to nine years (24.5%), and more than ten years (3.5%).

Table I: Demographic and Clinical Characteristics of Respondents (n=200)

Variables	Frequency(n)	Percentage (%)
Age (years) Mean: 46.49 (SD: 10.01)		
21 -30 years old	25	12.5
31- 40 year	51	25.5
41 -50 years	93	46.5
51- 60 years	31	15.5
Gender		
Female	119	59.5
Male	81	40.5
Type of cases		
Known case	45	22.5
Newly Diagnose	155	77.5
Type of medication		
Oral glycemia-lowering drugs (OGLD) only	54	27.0
OGLD & Insulin	146	73.0
Duration of diabetes (years) Mean: 4.53(SD: 4.01)		
<5 years	144	72.0
6-9 years	49	24.5
>10 years	7	3.5

Education Elements in NELC

Most respondents received health education on key topics such as an introduction to diabetes, diet, and exercise (100%). Psychological support and motivation were provided to 89.5% of respondents, while education on recognizing and managing hypoglycemia and hyperglycaemia symptoms was also given to 89.5%. Other education topics included medication and glycemic target control (76.0%), insulin assessment and competency (75.5%), lipodystrophy assessment (61.0%), and self-monitoring of blood sugar (61.0%). However, only 12.5% of respondents received education on insulin initiation, and 24.5% on insulin adjustment and titration.

HbA1c Baseline and After 24 Weeks of Intervention

Table II displays the glycated haemoglobin (HbA1c) levels at baseline and after 24 weeks of NELC intervention. HbA1c levels were categorized based on the Canadian Diabetes Association (2013) targets: controlled (<7.0% or <53 mmol/mol), moderately controlled (7.0%–8.5% or 53 mmol/mol–69.5 mmol/mol), and uncontrolled (>8.5% or >69.5 mmol/mol). At baseline, the majority of respondents had uncontrolled HbA1c levels (83.5%), followed by moderately controlled (13.5%) and controlled levels (2.0%). After 24 weeks of NELC interventions, the highest proportion of respondents achieved controlled HbA1c levels (39.0%), followed by uncontrolled (33.0%) and moderately controlled levels (28.0%).

Comparison of Medical Profile Characteristics at Baseline and 24 Weeks of NELC Interventions

Table III compares the medical profile characteristics of respondents at baseline and after 24 weeks of NELC

interventions. The mean HbA1c decreased from 9.80% at baseline to 7.68% following the intervention. At baseline, most respondents were classified as obese (37.0%), overweight (34.0%), normal weight (28.5%), or underweight (0.5%). After 24 weeks, the majority fell into the overweight BMI category (38.5%).

The comparison of all medical profile variables shows significant improvements. Fasting blood glucose (FBG) levels decreased from 8.61 ± 7.7 mmol/L to 7.79 ± 3.4 mmol/L. Systolic blood pressure improved from 141.55 ± 10.4 mmHg to 137.36 ± 10.4 mmHg, and diastolic blood pressure decreased from 79.88 ± 7.0 mmHg to 78.60 ± 8.13 mmHg. Hip circumference reduced from 104.20 ± 11.4 cm to 103.47 ± 11.3 cm, and waist circumference decreased from 98.22 ± 14.5 cm to 96.59 ± 11.3 cm. The results indicate a significant correlation between pre- and post-intervention means for the medical profile variables (HbA1c, FBG, systolic BP, diastolic BP, WC, and HC), with $p < 0.05$.

Table II: Glycated hemoglobin (HbA1c) baseline and after 24 weeks of interventions

Variables	Baseline		24 weeks post NELC Intervention	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
HbA1c Categories				
<7.0%	4	2.0	78	39.0
7.0%–8.5%	27	13.5	56	28.0
>8.5%	167	83.5	66	33.0

Table III: Comparison of medical profile characteristics at baseline and 24 weeks of NELC interventions.

Variables	Baseline		24 weeks post NELC Intervention		P- Value
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	
HbA1c Categories (%)[ab]	9.80 ±1.9		7.68±1.7		* 0.008
<7.0%	4	2.0	78	39.0	
7.0%–8.5%	27	13.5	56	28.0	
>8.5%	167	83.5	66	33.0	
Body Mass Index (kg/m)[b]	28.85±5.7		25.77 ±4.7		*0.07
<18.5 (Underweight)	1	0.5	1	0.5	
18.5 to 24.9 (Normal Weight)	57	28.5	74	37.0	
25.0 to 29.9(Overweight)	68	34.0	77	38.5	
>30 (Obesity)	74	37.0	48	24.0	
Fasting Blood Glucose (FBG)[a]	8.61±7.7		7.79±3.4		*0.01
Systolic Blood Pressure (mmHg)[a]	141.55±10.4		137.36±10.4		
Diastolic Blood Pressure (mmHg)[a]	79.88±7.0		78.60±8.13		*<0.001
Hip Circumference (cm)[a]	104.20±11.4		103.47±11.3		
Waist Circumference (cm)[a]	98.22±14.5		96.59±11.3		

*paired t-test * Sig. (2-tailed), Note [a] Mean ±standard deviation, [b] Frequency, and percentage*

Self-Monitoring of Blood Glucose (SMBG) and Insulin Titration Guided by a Diabetes Educator

Table IV provides descriptive results of SMBG and insulin titration practices. Among the respondents, 43.5% performed SMBG while using both oral glycemic-lowering drugs (OGLD) and insulin, 17.5% performed SMBG with OGLD only, and 39.0% did not perform SMBG. Of the 200 respondents, only 49 (24.5%) received guidance on insulin titration from a diabetes educator.

Table IV: Self-monitoring blood glucose (SMBG) and insulin titration guided by a diabetes Educator (n=200)

Variables	Frequency (n)	Percentage (%)
Self-monitoring blood glucose (SMBG)		
Not performed	78	39.0
Performed (Oral glucose-lowering drugs only)	35	17.5
Performed (OGLD and Insulin)	87	43.5
Insulin titration		
Yes	49	24.5
No	151	75.5

Comparison of HbA1c Levels before and After Intensive Insulin Titration Guided by a Diabetes Educator

Table V compares HbA1c levels before and after receiving intensive insulin titration guided by a diabetes educator. At baseline, most respondents had uncontrolled HbA1c (77.5%), followed by moderately controlled (20.4%) and controlled HbA1c (0.2%). After intensive insulin titration, the proportion of respondents with controlled HbA1c increased to 38.7%, while those with moderately controlled HbA1c rose to 32.6%, and uncontrolled HbA1c decreased to 28.6%.

Table V: The comparison of HbA1c before and after receiving the intensive insulin titration guided by a diabetes educator (n=49)

Variables	Baseline		24 weeks post NELC Intervention	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
HbA1c Categories				
<7.0% (controlled)	1	0.2	19	38.7
7.0%–8.5% (moderate)	10	20.4	16	32.6
>8.5%(uncontrolled)	38	77.5	14	28.6

Note: The intensive insulin titration = (Insulin adjustment and non-pharmacological management)

DISCUSSION

This recent study of nurse-led education program would effectively improve clinical outcomes. Participants who underwent the NELC program demonstrated significant improvements in HbA1c, blood pressure, body mass index, and waist and hip circumference. These improvements were sustained over a 24-week follow-up period. Furthermore, no adverse effects were noted in patients' electronic medical records due to the NELC intervention. Additionally, no participants were hospitalized or experienced fatalities related to hypoglycemia. Parallel with previous study which demonstrated that nurse-led education programs could achieve significant reductions in HbA1c levels over six months (10–13). Several factors contribute to these reductions by promoting behavior changes, such as improving adherence to treatment, dietary habits, and physical activity, all of which support better glycemic control(14). One of the central mechanisms by which the NELC impacts HbA1c levels is through structured diabetes education. By providing patients with in-depth knowledge about the pathophysiology of diabetes, glycemic targets, and the role of medication adherence, which NELC empowers individuals to take ownership of their condition. Additionally, the guidance provided by nurse educators in interpreting SMBG results and adjusting insulin dosages safely ensured that glycemic

control was achieved without increasing the risk of hypoglycemia. This individualized approach to SMBG supports optimal glycemic management, which is critical for reducing HbA1c levels(14). These findings suggest strong patient acceptance of the intervention. In addition, our findings align closely with global and regional literature on nurse-led interventions, particularly regarding reductions in HbA1c levels. Globally, structured education programs, consistently report HbA1c reductions of 0.8–1.2% over six months, driven by education on glycemic targets, medication adherence, and lifestyle changes(15). Regionally, studies in Southeast Asia, highlight culturally tailored interventions achieving similar reductions (0.6–1.0%) through family involvement and addressing barriers like dietary misconceptions(16). The NELC intervention in our study mirrors these outcomes, demonstrating significant HbA1c reductions by emphasizing structured education, self-monitoring of blood glucose (SMBG), and improving adherence to healthier behaviors. Previous studies have primarily focused on the effects of drug treatment on glycemic control. In contrast, we utilized the NELC intervention to empower individuals in managing their care. Many anti-diabetic medications have specific side effects, prompting researchers to explore alternative approaches to improving diabetes management. This study indicates that improvements in Body Mass Index (BMI), blood pressure, and waist-to-hip ratio which are integral to comprehensive diabetes care (17). Elevated BMI is associated with increased risks of heart disease, high blood pressure, type 2 diabetes, and certain cancers. Our study's findings align with existing research demonstrating that lifestyle interventions can lead to significant improvements by impact of lifestyle changes (18). Providing patient knowledge and needs, able to improve their understanding of diabetes management, and addressing barriers to effective self-management, ultimately reducing the risk of hospital admissions due to diabetes complication(19). However, multicentre studies with larger sample sizes are required to substantiate our results further. Since this retrospective study relies on secondary data, objectivity could be limited. Therefore, a randomized controlled trial should be conducted to validate these preliminary findings and comprehensively test the effectiveness of the NELC program.

In Malaysia, where physician contact time is limited due to the high prevalence of diabetes, nurse educators provide critical support by dedicating time to engage with patients and their families to discuss and plan treatments recommended by physicians. Furthermore, nurses themselves benefit from the implementation of nurse-led clinics, gaining increased knowledge, confidence, and preparedness, which contribute to improved patient outcomes (20). Our study contributes significantly to the understanding of diabetes management in resource-limited healthcare settings by demonstrating the effectiveness of nurse-led interventions. Specifically, our findings highlight that structured diabetes self-management education programs, facilitated by nurses, can lead to significant improvements in patients' self-management behaviors, empowerment, and activation levels (21).

Future Directions

We acknowledge several limitations of this study. Participants were observed over a relatively short period of six months, which may not fully capture the long-term impact of the self-management intervention. Longer follow-up durations are necessary to evaluate the sustained effects of the NELC program. Additionally, the study's retrospective design, relying on secondary data, may have introduced biases. This study also emphasizes the role of self-monitoring blood glucose (SMBG) in empowering patients to adjust their insulin doses effectively. However, this study shows the low rate of patients receiving insulin titration guidance, which was partly due to the unavailability of glucometer machines at home, financial constraints, and patients' readiness to undergo insulin adjustment. Research suggests that insulin adjustment is critical for achieving optimal dosing and improved glycemic control (22). Unfortunately, the cost of glucometers and testing strips remains a barrier for many T2DM patients, limiting widespread adoption (23). Future research should address these challenges by incorporating strategies to improve access to glucometers and financial support for T2DM patients. Employing prospective or randomized study designs will further enhance the rigor and reliability of findings regarding the effectiveness of the NELC program.

CONCLUSION

Improving diabetes outcomes enhances quality of life and reduces healthcare costs by lowering complications and hospitalisations. Implementing nurse-led education programs into clinical practice can significantly improve patient outcomes, quality of care, and nursing performance. Integrating the NELC model into national healthcare policies, particularly within the framework of Malaysia's National Strategic Plan for Non-Communicable Diseases, could address significant gaps in diabetes management. The model aligns with global recommendations for task-shifting by empowering nurses to assume extended roles in patient education and self-management support. Scaling the NELC model through primary healthcare settings and training programs for nurses offers a cost-effective and sustainable approach to improving clinical outcomes while reducing healthcare disparities, particularly in rural areas. Additionally, the NELC framework promotes professional development for nurses and empower multidisciplinary collaboration, thereby strengthening the healthcare workforce. Its adaptability and emphasis on patient-centered, non-pharmacological care make the NELC model a scalable and impactful solution for addressing the growing burden of diabetes, both

nationally and in other resource-constrained regions globally. In this study, the single-centre Nurse Educator-Led Clinic (NELC) demonstrated persistent clinical benefits in achieving HbA1c within 24 weeks. These findings support the implementation of a curriculum that fosters collaborative learning and understanding. However, further research with an extended multicentre cohort design and longer follow-up periods is necessary to confirm whether the NELC intervention consistently provides sustained clinical benefits for patients.

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REFERENCES

1. Ganasegeran K, Hor CP, Jamil MFA, Loh HC, Noor JM, Hamid NA, et al. A systematic review of the economic burden of type 2 diabetes in Malaysia. Int J Environ Res Public Health. 2020;17(16):1–23.
2. International Diabetes Federation. IDF Diabetes Atlas 9th Edition. 2019.
3. National Health and Morbidity Survey. Non-Communicable Diseases, Risk Factors & Other Health Problems Ministry of Health Malaysia. Inst Public Heal [Internet]. 2015;(Vol.II).Availablefrom: https://www.moh.gov.my/moh/resources/nhmsreport2015vol2.pdf
4. Lai YC, Chen YS, Jiang Y Der, Wang CS, Wang IC, Huang HF, et al. Diabetes self-management education on the sustainability of metabolic control in type 2 diabetes patients: Diabetes share care program in Taiwan. J Formos Med Assoc [Internet]. 2024;123(2):283–92. Available from: https://doi.org/10.1016/j.jfma.2023.09.010
5. Haas L, Maryniuk M, Beck J, Cox CE, Duker P, Edwards L, et al. National standards for diabetes self-management education and support. Diabetes Care. 2018;37 Suppl 1(January):1630–7.
6. World Health Organization. Investing in education, jobs and leadership NURSING. Who[Internet].2020;144.Availablefrom: https://www.who.int/publications/i/item/9789240003279
7. Otter CEM, Keers JC, Reker C, Smit J, Schoonhoven L, de Man-van Ginkel JM. How nurses support self-management of hospitalized patients through verbal communication: a qualitative study. BMC Nurs [Internet]. 2022;21(1):1–11. Available from: https://doi.org/10.1186/s12912-022-01099-3
8. Zakariah N, Chandran A. Role of Nurses in Diabetes Care and an Update on Key Findings of the National Diabetes Registry Report 2013-2019. 2020;(December).
9. Rodriguez K, Ryan D, Dickinson JK, Phan V. Improving Quality Outcomes: The Value of Diabetes Care and Education Specialists. Clin Diabetes. 2022;40(3):356–65.
10. Goswami S, Eckert L, Sturgill M, Ramos R, Bridgeman MB. Patient education on self-administration of insulin via pen: An interprofessional team-based educational initiative. J Interprofessional Educ Pract. 2023;32(June):100663.
11. Dallosso H, Khunti K, Gray LJ, Hulley K, Ghaly M, Patel N, et al. Implementation of a diabetes prevention programme in a multi-ethnic community in primary care in England: An evaluation using constructs from the RE-AIM Framework. Prim Care Diabetes. 2023;(April):11–5.
12. Tamiru S, Dugassa M, Amsalu B, Bidira K, Bacha L, Tsegaye D. Effects of Nurse-Led diabetes Self-Management education on Self-Care knowledge and Self-Care behavior among adult patients with type 2 diabetes mellitus attending diabetes follow up clinic: A Quasi-Experimental study design. Int J Africa Nurs Sci. 2023;18(August 2022).
13. Oluchina S. The effectiveness of an education intervention based on self-care model on diabetes self-management behaviors and glycemic control. Int J Africa Nurs Sci. 2022;17(May).
14. Care D, Suppl SS. 5. Facilitating Behavior Change and Well-being to Improve Health Outcomes: Standards of Medical Care in Diabetes—2022. Diabetes Care. 2022;45(January):S60–82.
15. Yu X, Chau JPC, Huo L, Li X, Wang D, Wu H, et al. The effects of a nurse-led integrative medicine-based structured education program on self-management behaviors among individuals with newly diagnosed type 2 diabetes: a randomized controlled trial. BMC Nurs [Internet]. 2022;21(1):1–17. Available from: https://doi.org/10.1186/s12912-022-00970-7
16. Bhurji N, Javer J, Gasevic D, Khan NA. BMJ open improving management of type 2 diabetes in South Asian patients: A systematic review of intervention studies. BMJ Open. 2019;6(4).
17. Elsayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. 8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes—2023. Diabetes Care. 2023;46(January):S128–39.
18. Unick JL, Beavers D, Jakicic JM, Kitabchi AE, Knowler WC, Wadden TA, et al. Effectiveness of lifestyle interventions for individuals with severe obesity and type 2 diabetes: Results from the look AHEAD trial. Diabetes Care. 2020;34(10):2152–7.
19. Elsayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. 16. Diabetes Care in the Hospital: Standards of Care in Diabetes—2023. Diabetes Care. 2023;46(January):S267–78.
20. Mat Isa R, Chong MC, Lee WL, Mohamed Iqbal TB, Jamaludin S@ TS, Saiful Suhardi MI. Nurse-Led Interventions for Diabetes Education: A Literature Review. Int J Care Sch. 2023;6(3):90–100.

21. Husin M, Rou X, Miin S, Mei Y, Lim F, Hung S, et al. Primary Care Diabetes The Effectiveness of Enhanced Primary Healthcare (EnPHC) interventions on Type 2 diabetes management in Malaysia : Difference-in-differences (DID) analysis. Prim Care Diabetes [Internet]. 2023;17(3):260–6. Available from: https://doi.org/10.1016/j.pcd.2023.03.003
22. Holmes-Truscott E, Browne JL, Speight J. The impact of insulin therapy and attitudes towards insulin intensification among adults with type 2 diabetes: A qualitative study. J Diabetes Complications [Internet]. 2020;30(6):1151–7. Available from: http://dx.doi.org/10.1016/j.jdiacomp.2016.03.027
23. Kerr D, Duncan I, Repetto E, Maroun R, Wu A, Perkins C, et al. Cost Analysis of Self-Monitoring Blood Glucose in Nonintensively Managed Type 2 Diabetes. Am J Manag Care. 2023;29(12):670–5.