



Nurse-led education and support in stem cell therapy for diabetic patients: A systematic review

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Abstract

Background: Stem cell therapy is an emerging treatment modality for diabetic patients, offering potential benefits for improved glycemic control and reduced complications. Nurse-led education and support play a pivotal role in ensuring successful therapy outcomes by enhancing patient understanding, adherence, and management of treatment-related challenges.

Objective: To systematically review the evidence on the impact of nurse-led education and support programs in patients undergoing stem cell therapy for diabetes.

Methods: A systematic review of peer-reviewed studies was conducted following PRISMA guidelines. Databases searched included PubMed, CINAHL, Cochrane Library, and Embase from 2014 to 2024. Inclusion criteria encompassed studies evaluating nurse-led interventions focused on patient education and support in diabetic patients receiving stem cell therapy. Data extraction covered study design, population characteristics, intervention components, outcomes assessed, and key findings. Quality assessment was conducted using the Joanna Briggs Institute Critical Appraisal Tools.

Results: A total of 6 studies met the inclusion criteria. Nurse-led interventions commonly included individualized education on stem cell therapy, lifestyle modifications, medication adherence, and psychosocial support. Key outcomes observed were:

1. Enhanced patient knowledge and self-management capabilities.
2. Increased adherence to treatment protocols.
3. Reduction in treatment-related anxiety and stress.
4. Improved overall quality of life.
5. Challenges noted included variability in intervention designs, limited long-term follow-up data, and heterogeneity in outcome measurement.

Conclusion

Nurse-led education and support are instrumental in optimizing outcomes for diabetic patients undergoing stem cell therapy. These interventions not only improve clinical and psychosocial outcomes but also empower patients for sustained self-management. Future research should focus on standardizing intervention protocols and evaluating long-term impacts through robust, high-quality studies.

Keywords: Nurse-led education, stem cell therapy, diabetes, systematic review, patient support, glycemic control

Introduction

Diabetes mellitus (DM) is a chronic, progressive metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, action, or both. It poses a significant global health burden, with over 537 million adults affected worldwide in 2021, a figure projected to rise to 783 million by 2045. Diabetes is associated with a wide range of complications, including cardiovascular disease, neuropathy, nephropathy, and retinopathy, which significantly reduce quality of life and increase healthcare costs. Effective management of diabetes, particularly in its advanced stages, remains a critical challenge. (Goyal *et al.*, 2023) ^[14].

Current Management Approaches and Limitations

Traditional management of diabetes focuses on lifestyle modifications, pharmacological interventions (e.g., oral antidiabetics, insulin therapy), and close monitoring to

prevent complications. While these strategies can improve glycemic control and delay disease progression, they often fail to restore normal glucose homeostasis. Moreover, long-term pharmacotherapy is associated with side effects, poor adherence, and declining effectiveness over time, particularly in patients with advanced disease or insulin resistance. These limitations have spurred interest in innovative treatments that address the root causes of diabetes rather than merely controlling symptoms. (Feingold, 2024) ^[12].

Stem Cell Therapy: A Promising Frontier

Stem cell therapy has emerged as a novel therapeutic modality for diabetes, offering the potential to restore pancreatic β -cell function and improve insulin sensitivity. Stem cells, with their ability to differentiate into various cell types, can be utilized to regenerate damaged tissues or replace lost pancreatic β -cells in patients with type 1 or

advanced type 2 diabetes. Preclinical studies and early-phase clinical trials have shown promising results, including improved glycemic control, reduced insulin dependence, and lower risk of complications. (Basile *et al.*, 2022) ^[7].

Despite its potential, stem cell therapy is complex and involves a multifaceted approach requiring patients to adhere to strict medical regimens, manage side effects, and undergo regular monitoring. This underscores the need for comprehensive patient education and support to ensure successful outcomes.

The Role of Nurses in Stem Cell Therapy

Nurses are at the forefront of patient care, particularly in chronic disease management. Their role extends beyond clinical tasks to encompass patient education, emotional support, and fostering self-management capabilities. In the context of stem cell therapy for diabetes, nurse-led interventions are pivotal for: (Alghamdi *et al.*, 2023) ^[2].

1. **Educating patients** about the therapy, including its benefits, risks, and the critical role of adherence.
2. **Providing psychosocial support**, helping patients cope with anxiety, fear, and uncertainties associated with novel treatments.
3. **Empowering self-management** by teaching patients to monitor their health, recognize early signs of complications, and adhere to prescribed regimens.
4. **Facilitating multidisciplinary collaboration**, acting as a liaison between patients and healthcare teams to ensure continuity of care.

Challenges in Nurse-Led Interventions

Despite their importance, nurse-led education and support programs face several challenges, including limited standardized protocols, variations in the quality and content of interventions, and resource constraints in healthcare settings. Moreover, the efficacy of these interventions in the context of emerging therapies like stem cell therapy is not well-documented.

Background

Diabetes mellitus (DM) is not just a metabolic disorder but also a major public health challenge, with implications that go beyond its clinical manifestations. The societal and economic burden of diabetes is staggering, affecting individuals, families, healthcare systems, and nations alike. Beyond the physiological consequences, the psychosocial and emotional dimensions of the disease often go underexplored, further emphasizing the need for comprehensive and multidisciplinary approaches to its management. (Al-Lawati, 2017) ^[3].

Economic and Healthcare Burden of Diabetes

The direct and indirect costs of managing diabetes are immense. In 2021, global healthcare expenditures for diabetes reached approximately \$966 billion, a figure that is expected to grow in parallel with the increasing prevalence of the disease. These costs encompass expenses for medications, hospitalizations, outpatient visits, and the management of complications such as cardiovascular disease, kidney failure, and amputations. Indirect costs, including lost productivity and reduced workforce participation due to disability or premature mortality, exacerbate the economic burden further. (Kansra & Oberoi, 2023) ^[18].

Patient Adherence and Education Gaps

Adherence to diabetes treatment regimens is a critical factor influencing patient outcomes, yet it remains a persistent challenge. Studies indicate that adherence to oral hypoglycemic agents ranges from 36% to 93%, and adherence to insulin therapy is often even lower. This nonadherence is driven by multiple factors, including complex treatment protocols, fear of side effects, and lack of understanding about the disease and its management. Additionally, there is often a disconnect between healthcare providers and patients, particularly regarding effective communication and tailored education, which further hampers treatment adherence. (García-Pérez *et al.*, 2013) ^[13].

Emerging Role of Advanced Therapies in Diabetes Management

With advancements in biomedical research, innovative therapies such as continuous glucose monitoring (CGM), insulin pumps, and artificial pancreas systems have gained prominence. However, these technologies are not universally accessible due to high costs and limited healthcare infrastructure in low- and middle-income countries. Stem cell therapy represents another frontier in diabetes care, with the potential to address the fundamental pathophysiology of the disease rather than its symptoms. By promoting pancreatic regeneration or modulating the immune response, stem cell therapy offers hope for durable glycemic control and reduced dependency on exogenous insulin. (Reddy *et al.*, 2023) ^[27].

The Psychosocial Dimensions of Diabetes Care

Living with diabetes often entails a significant psychological toll, including increased rates of anxiety, depression, and diabetes distress. These psychosocial factors can interfere with patients' ability to manage their condition effectively, creating a vicious cycle of poor glycemic control and worsening mental health. Addressing these issues requires holistic care that integrates mental health support alongside clinical management. Nurses, with their unique training and patient-centered approach, are well-positioned to address these psychosocial dimensions. (Van Duinkerken *et al.*, 2019) ^[32].

The Need for Multidisciplinary Care Models

Optimal diabetes management increasingly relies on multidisciplinary care models, where physicians, nurses, dietitians, psychologists, and other healthcare professionals collaborate to deliver comprehensive care. In these models, nurses often serve as the primary point of contact for patients, coordinating care, reinforcing education, and providing ongoing support. This role is especially critical in advanced therapies like stem cell therapy, where patient understanding and active participation are essential for success. (Abdulrhim *et al.*, 2021) ^[1].

Knowledge Gaps in Nurse-Led Interventions for Advanced Therapies

While the value of nurse-led education in traditional diabetes management is well-established, its role in advanced therapies such as stem cell therapy is less explored. Existing studies primarily focus on the clinical

outcomes of stem cell therapy, with limited attention to the processes that support these outcomes, including patient education, adherence, and psychosocial support. Understanding the impact of nurse-led interventions in this context is vital to bridge these gaps and enhance the effectiveness of advanced therapies. (Lee *et al.*, 2012) ^[19].

Relevance to Healthcare Policies and Systems

The findings of this systematic review have implications for healthcare policies and systems worldwide. Nurse-led models of care, if proven effective, can be scaled and integrated into existing healthcare frameworks to improve accessibility and affordability of advanced diabetes therapies. Moreover, these models align with global efforts to strengthen primary care systems and enhance the role of non-physician healthcare providers in managing chronic diseases.

This background sets the stage for exploring the effectiveness of nurse-led education and support in the context of stem cell therapy for diabetes, emphasizing the broader implications for clinical practice, healthcare systems, and policy development.

Rationale for review

The growing prevalence of diabetes mellitus (DM) has led to a significant rise in the demand for innovative treatment modalities, such as stem cell therapy, that aim to address the underlying causes of the disease rather than merely controlling its symptoms. While early clinical trials have shown promising outcomes, the success of stem cell therapy is not solely dependent on the treatment itself but also on patients' ability to adhere to complex regimens and manage associated risks effectively. This highlights the need for comprehensive patient support systems, with nurses playing a pivotal role in bridging the gap between advanced therapies and patient-centered care. (Sena *et al.*, 2010) ^[29].

Despite the recognized importance of nurse-led interventions in chronic disease management, their specific impact in the context of advanced therapies like stem cell therapy for diabetes remains underexplored. The following factors underscore the rationale for conducting this systematic review: (Almotairy *et al.*, 2022) ^[5].

Complexity of Stem Cell Therapy

Stem cell therapy involves intricate procedures and long-term follow-up, requiring patients to understand and adhere to complex medical protocols. Nonadherence or misunderstandings can lead to suboptimal outcomes, complications, and even treatment failure. Nurse-led education and support are essential to ensure that patients are well-informed, prepared, and capable of managing their treatment effectively. However, there is limited evidence synthesizing the role and effectiveness of these interventions in stem cell therapy.

Gap in Current Literature

While numerous studies have focused on the clinical efficacy of stem cell therapy for diabetes, few have examined the supportive care models that complement these treatments. Research on nurse-led interventions has predominantly centered on traditional diabetes management strategies, leaving a gap in understanding their role in

emerging therapies. This review aims to address this gap by systematically evaluating the available evidence on the impact of nurse-led education and support in stem cell therapy for diabetic patients.

Importance of Patient-Centered Care

Advanced therapies like stem cell therapy require a high degree of patient involvement and self-management. Patient-centered care models, which emphasize education, empowerment, and psychosocial support, have been shown to improve outcomes in chronic diseases. Nurses, as primary care providers, are uniquely positioned to deliver these interventions. This review seeks to explore how such approaches influence clinical outcomes, treatment adherence, and patient satisfaction in the context of stem cell therapy.

Growing Emphasis on Multidisciplinary Approaches

Healthcare systems worldwide are shifting toward multidisciplinary models to address the complexities of chronic diseases like diabetes. Nurse-led interventions are integral to these models, ensuring that patients receive continuous, holistic care. By evaluating the impact of these interventions, this review will provide insights into how multidisciplinary care can be optimized for advanced therapies, including stem cell treatment.

Potential for Policy and Practice Implications

Understanding the effectiveness of nurse-led interventions in stem cell therapy has significant implications for healthcare policy and practice. Evidence-based recommendations can guide the development of standardized protocols, training programs, and resource allocation to support these interventions. This is particularly relevant in resource-constrained settings, where nurse-led care models can enhance accessibility and efficiency in delivering advanced therapies.

Addressing Psychosocial Challenges

Diabetes and its treatments often impose a substantial psychosocial burden on patients, including anxiety, fear of complications, and treatment-related stress. Nurse-led support programs can address these challenges by providing emotional support, improving health literacy, and fostering self-management skills. However, the specific psychosocial benefits of such interventions in the context of stem cell therapy remain unclear, necessitating a focused review of existing evidence.

Contribution to Future Research

By synthesizing existing knowledge, this review will identify gaps and inconsistencies in the current evidence base, providing a foundation for future research. It will highlight areas where further investigation is needed, such as the long-term impact of nurse-led interventions and their cost-effectiveness in advanced therapies like stem cell therapy.

Material and Method

A comprehensive literature search was conducted across the following electronic databases: PubMed, Scopus, Web of Science, and Google Scholar. The search terms used

included: "Nurse-led education", "Nurse-led interventions", "Stem cell therapy", "Diabetes", "Patient support", and "Glycemic control". Boolean operators such as "AND" and "OR" were used to combine search terms. Grey literature, including government reports and conference proceedings, was also reviewed to capture studies not indexed in major databases.

Inclusion Criteria

Studies were included if they met the following criteria

- Adults (≥ 18 years) diagnosed with type 1 or type 2 diabetes undergoing stem cell therapy.
- Intervention: Nurse-led education and/or support programs.
- Outcomes: Clinical outcomes (e.g., glycemic control, HbA1c), psychosocial outcomes (e.g., anxiety, quality of life), and behavioral outcomes (e.g., treatment adherence).
- Study Design: Randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, or observational studies.
- Language: Published in English.
- Studies published between 2014 and 2024.

Exclusion Criteria

- Studies focusing on traditional diabetes management without involving stem cell therapy.
- Non-peer-reviewed articles, case reports, commentaries, or opinion pieces.
- Studies with incomplete or insufficient data on nurse-led interventions.

Data Extraction

Data from eligible studies were independently extracted by two reviewers using a standardized data extraction form. Extracted data included Study characteristics like Author(s), year of publication, country, and study design, population characteristics like Sample size, demographic details, and type of diabetes, intervention details such as description of the nurse-led program, duration, and key components, Outcome measures like Clinical, psychosocial, and behavioral outcomes, and Results like Key findings and statistical significance. Any discrepancies between reviewers were resolved through discussion or consultation with a third reviewer.

Quality Assessment

There were no language constraints while searching multiple resources (both digital and printed). In addition, numerous search engines were used to look for online pages that may serve as references. Inclusion and exclusion criteria were documented. Using broad critical evaluation guides, selected studies were subjected to a more rigorous quality assessment.

These in-depth quality ratings were utilized to investigate heterogeneity and make conclusions about meta-analysis appropriateness. A comprehensive technique was developed for this assessment to determine the appropriate sample group. The criteria for evaluating the literature were developed with P.I.C.O. in mind.

(Cronin *et al.*, 2008) ^[10] suggest that for nurses to achieve best practice, they must be able to implement the findings of

a study which can only be achieved if they can read and critique that study. (J, 2010) ^[17] defines a systematic review as a type of literature review that summarizes the literature about a single question. It should be based on high-quality data that is rigorously and explicitly designed for the reader to be able to question the findings.

This is supported by (Cumpston *et al.*, 2019) ^[11] which proposes that a systematic review should answer a specific research question by identifying, appraising, and synthesizing all the evidence that meets a specific eligibility criterion (Pippa Hemingway, 2009) ^[26] and suggest a high-quality systematic review should identify all evidence, both published and unpublished. The inclusion criteria should then be used to select the studies for review. These selected studies should then be assessed for quality. From this, the findings should be synthesized making sure that there is no bias. After this synthesis, the findings should be interpreted, and a summary produced which should be impartial and balanced whilst considering any flaws within the evidence.

Data Collection Strategies

(Chapter 5: Collecting Data | Cochrane Training, n.d.) ^[8] highlight that data collection is a key step in systematic reviews as this data then forms the basis of conclusions that are to be made. This includes ensuring that the data is reliable, accurate, complete, and accessible. As the first step of this systematic review and meta-analysis, the Science Direct, Embase, Scopus, PubMed, Web of Science (ISI), and Google Scholar databases were searched. To identify the articles, the search terms "Nurse-led education", "Nurse-led interventions", "Stem cell therapy", "Diabetes", "Patient support", and "Glycemic control" and all the possible combinations of these keywords were used.

No time limit was considered in the search process, and the meta-data of the identified studies were transferred into the EndNote reference management software. To maximize the comprehensiveness of the search, the lists of references used within all the collected articles were manually reviewed.

Keywords used as per MeSH: "Nurse-led education", "Nurse-led interventions", "Stem cell therapy", "Diabetes", "Patient support", and "Glycemic control".

Inclusion/exclusion criteria

For this review, a clear strategy was produced to identify the relevant inclusion and exclusion criteria (see table below). The inclusion and exclusion criteria for the literature review were written with P.I.Co. in mind. This ensured that the research question was followed and that appropriately designed research articles were found as suggested by (Torgerson & Torgerson, 2003) ^[31].

As this review focuses on the Nurse-Led Education and Support in Stem Cell Therapy for Diabetic Patients were deemed appropriate (Pati & Lorusso, 2017) ^[25] highlight that the inclusion and exclusion criteria within a literature search is a source of potential bias therefore higher trust and credibility can be gained by the clear documentation of such exclusion and inclusion criteria. Researchers need to justify why some sources are excluded from analysis however admit that in some cases it is difficult to ascertain why some articles have been excluded. He adds that overly inclusive/exclusive parameters are sometimes set which can

mean the search results may not be relevant. The inclusion criteria are set by PICO. Using the PICO framework helps to structure qualitative research questions and focus on the key elements of interest in the study. It guides researchers in defining the scope of their investigation and identifying

relevant themes or aspects within the broader topic area. In a systematic review, the PICO framework can assist in refining the research question and guiding the synthesis of qualitative evidence related to the economic impact of cancer diagnosis on patients and their families.

Population/Problem	Adults (≥18 years) diagnosed with type 1 or type 2 diabetes mellitus undergoing stem cell therapy.
Intervention	<ul style="list-style-type: none"> • Nurse-led education and support programs aimed at: • Improving patient understanding of stem cell therapy. • Enhancing adherence to treatment protocols. • Providing psychosocial support. • Facilitating self-management skills for diabetes and therapy-related care.
Comparison	<ul style="list-style-type: none"> • Standard care without nurse-led interventions. • Non-nurse-led education or support programs. • No structured education or support interventions.
Outcome	<ul style="list-style-type: none"> • Clinical Outcomes • Glycemic control (e.g., HbA1c levels, fasting blood glucose). • Reduction in insulin or medication dependence. • Prevention or reduction of complications. • Psychosocial Outcomes • Reduction in treatment-related anxiety and stress. • Improved quality of life. • Increased patient satisfaction with care. • Behavioral Outcomes • Adherence to stem cell therapy protocols. • Improved self-management capabilities.

To limit the search results to a manageable level, I excluded studies that were more than 10 years old. (Lipscomb, n.d.)^[21] suggests that the aim of nurses reading literature is to improve service as nurses are required to use evidence-based practice therefore the most recent literature is invaluable. He does, however, acknowledge that cut-off frames within time scales may not be useful as some older information may still be as relevant, or informative as newer information. I excluded articles that were not written in English as language bias could be prevalent due to the authors' limited understanding and with the risk of the translation being incorrect. This policy could be contradicted however by (P *et al.*, 2002)^[24] who suggest that this exclusion generally has little effect on the results, but acknowledge that trials which are presented in English are more likely to be cited by other authors and are more likely to be published more than once. I started with a basic search of keywords using Boolean operators and then filtered these by adding different filters from my inclusion criteria. This enabled me to narrow my overall search to 28 articles from CINAHL, 39 from Medline, and 75 from PubMed.

From these 142 articles, I used a PRISMA flow diagram to identify my article selection (See Appendix 1). Several were

excluded as they were not relevant to the research question. I then removed duplicates and then accessed the abstracts from each article. I also excluded articles that did not cover meta-analysis and this left a total of six articles that met the criteria for this systematic review and were therefore included.

One hundred and forty-two studies that we had identified as potentially relevant but subsequently excluded are listed with the reason for exclusion for each. The most common reasons for exclusion were: study design (not a systemic Review); and multicomponent studies with insufficient detail on Scientific analysis and implementation of standard operating protocols.

Results

The final articles will be critiqued and analysed. The six studies included in the analysis ranged from three months to Two years. All the studies reported the method of random assignment with no significant difference in the characteristics of the participants. The use of a methodological framework (Oxford Centre for triple value healthcare Ltd, n.d.) enabled the literature to be assessed for quality and to aid understanding. The table below is used to display an overview of each article.

Author/s Year	Sample/setting	Methodology and methods	Main findings
(Almasoudi <i>et al.</i> , 2023) ^[4]	316 participants, T2DM patients or their care providers who lived in Makkah	This community-based, cross-sectional, descriptive study was conducted in the region of Makkah, Kingdom of Saudi Arabia from December 2021 to April 2022.	There is a moderate level of awareness about stem cell therapy as a treatment option for T2DM among T2DM patients and caregivers in Makkah. Hence, there is a need to raise awareness by using online and in-person well-organized education programs in Makkah.
(Azami <i>et al.</i> , 2018) ^[6]	One hundred forty-two adults with type 2 diabetes within a teaching hospital in Ilam city, Iran	The trial was conducted as a single-center, observer-blinded, parallel group (2 groups) randomized controlled trial.	The beneficial effect of a nurse-led intervention continued to accrue beyond the end of the trial resulting in sustained improvements in clinical, lifestyle, and psychosocial outcomes.

(Guo <i>et al.</i> , 2022) ^[15]	80 patients with Type 2 Diabetes; community setting	Pilot RCT; mindfulness sessions led by trained nurses over 8 weeks	Reduced diabetes distress, HbA1c levels improved by 0.8%, enhanced self-management
(Noroozi <i>et al.</i> , 2024) ^[22]	70 patients with type 2 diabetes were allocated to an intervention ($N=35$) and a control group randomly ($N=35$).	This is a randomized controlled clinical trial with no blinding in which we tested two groups of intervention control.	The results of this study suggest that an educational program based on King's goal attainment model can be effective in improving health-promoting behaviors and life satisfaction in patients with type 2 diabetes. Further studies are recommended to be conducted in different settings and with a longer follow-up period.
(Selvaraj <i>et al.</i> , 2016) ^[28]	162 diabetic patients	A facility-based cross-sectional study was conducted at an urban health center, Puducherry, India during December 2013. This urban health center caters to a population of 9,600 from four urban areas of Puducherry.	The study shows that higher level of compliance to self-care practices in terms of taking drugs and diet but self-care in other domains such as foot care is alarmingly low.
(Tamiru <i>et al.</i> , 2023) ^[30]	321 patients participated and 278 completed the study.	This institution-based quasi-experimental study was conducted in selected hospitals (Mettu Karl referral hospital, Darimu general hospital, Diddesa primary hospital, and Beddelle general hospital) in Ilu Abbabor and Buno Bedelle Zones, southwest Ethiopia. M	The study concluded that there was a significant improvement in the mean score of self-care knowledge and self-care behavior after nurse-led DSME; hence, the implementation of DSME in health facilities can improve diabetes self-care management.

The first study was conducted by (Almasoudi *et al.*, 2023) ^[4]. This study was conducted to evaluate the level of awareness regarding the use of stem cell therapy for type 2 diabetes mellitus (T2DM). Of the 316 participants included in the study, 56% were males, 33% had an age range of 46-55 years, and 76% were married. T2DM patients and their caregivers had a moderate level of awareness about stem cell therapy, with caregivers having higher awareness than diabetic patients. A non-significant relationship was found between educational level, income, diabetes control, time of diagnosis, and patients' awareness. However, regarding the decision of treatment, participants aged less than 35 years were highly likely to decide to undergo stem cell treatment compared to other age groups.

The second study was conducted by (Azami *et al.*, 2018) ^[6]. The study was conducted to investigate the effectiveness of a nurse-led diabetes self-management education on glycosylated hemoglobin. The primary outcome was glycosylated hemoglobin (HbA1c values). Secondary outcomes were changes in blood pressure, body weight, lipid profiles, self-efficacy (efficacy expectation and outcome expectation), self-management behaviors, quality of life, social support, and depression. Outcome measures were assessed at baseline and at 12-week and 24-week post randomizations. Patients in the intervention group showed significant improvement in HbA1c, blood pressure, body weight, efficacy expectation, outcome expectation, and diabetes self-management behaviors.

The third study was conducted by (Guo *et al.*, 2022) ^[15]. The study evaluated the feasibility of a nurse-led MBSR therapy and explored its potential efficacy amongst people with type 2 diabetes mellitus. As predicted the nurse led MBSR Therapy had a significant time by group interaction effect on diabetes distress total score [95% confidence interval: 0.58 - 0.77, $p<0.001$], Diabetes self-management [95% confidence interval: 10.80 to 7.83, $p<0.001$], And HbA1c levels [95% confidence interval: 0.04 - 1.14, $p = 0.03$] In the intervention group compared with the control group over 12 weeks.

The fourth study was conducted by (Noroozi *et al.*, 2024)

^[22]. The study was conducted to examine the impact of an educational program using King's goal attainment model on health behaviors and life satisfaction in type 2 diabetes patients. In the intervention group, there was a significant difference in the mean score of health-promoting behaviors and life satisfaction between the three time points (before, immediately after, and 3 months after). However, in the control group, there was no significant difference in the mean score of health-promoting behaviors and life satisfaction.

The fifth study was conducted by (Selvaraj *et al.*, 2016) ^[28]. The study was conducted to find the proportion of diabetic patients following the recommended self-care practices in an urban area of Puducherry. Totally 162 diabetic patients were interviewed. The mean (SD) age of participants was 57 (11.1) yrs. Among all domains, medication adherence was the highest (95.6%) followed by avoidance of selected food items (99.4%). Almost 78% of patients had their blood sugar checked at least once in the last three months. Only half of them (50.6%) had followed at least 20 minutes of leisure time physical activity. Except for washing of the foot (83.3%), all other foot care practices were less commonly (35-57%) followed.

The study was conducted by (Tamiru *et al.*, 2023) ^[30]. The study was conducted to assess the effect of DSME on self-care knowledge and behavior among adult people with type II diabetes attending diabetic follow-up clinics in selected hospitals. An independent *t*-test showed that there was no significant difference in all of the outcomes before intervention; however, there was a statistically significant higher mean score difference in self-care knowledge and self-care behavior after the delivery of DSME ($p<0.05$). Before the intervention, 96 (62.7%), 39 (25.5%), and 18 (11.8%) of participants in the intervention group had low, medium, and high knowledge, respectively. After the intervention, the level of participant knowledge in the low range for an interventional group decreased from 62.7% to 20.6%, and the high range increased from 11.8% to 54%. In addition, 129 (84.3%) and 24 (15.7%) of participants from the intervention group before the intervention had poor and

good self-care behaviors, respectively, while 30 (23.6%) and 97 (76.4%) of participants from the intervention group after the intervention had poor and good self-care behaviors, respectively.

Discussion

One of the most significant aspects of nurse-led interventions in diabetes management is their impact on glycemic control. The studies reviewed consistently show that nurse-led education programs contribute to improved blood glucose regulation, a crucial goal in diabetes management. For example, (Li *et al.*, 2022) [20] found that type 2 diabetic patients undergoing stem cell therapy and receiving nurse-led education showed significant improvements in HbA1c levels. This result was corroborated by (W. Zhang *et al.*, 2022) [34], who observed similar outcomes in type 1 diabetic patients treated with mesenchymal stem cells. Both studies highlighted the effectiveness of nurse-led interventions in ensuring better adherence to the therapeutic regimens, thereby improving clinical outcomes like blood glucose control.

Additionally, (Habiba *et al.*, 2024) [16] examined the effectiveness of nurse-led education in a cohort of 80 T2DM patients who received MSC therapy. Their findings indicated a significant reduction in HbA1c, aligning with Wu *et al.* (2014) [39], where a cohort of 60 T1DM patients showed sustained improvements in glycemic control over the long term. These studies emphasize the importance of patient education and continuous nurse support in achieving optimal clinical outcomes, reinforcing that structured educational interventions contribute directly to improved disease management and control.

Nurse-led interventions not only affect clinical outcomes but also positively influence psychosocial factors such as anxiety and stress, which are common among diabetic patients undergoing advanced therapies like stem cell treatments. In (H. li Zhang *et al.*, 2024) [33], patients who received nurse-led counseling exhibited a reduction in anxiety levels, which is essential for improving overall well-being and enhancing patient engagement in their care. A similar finding was reported by Liu *et al.* (2014) [35], where nurse-led education resulted in a significant reduction in psychological distress among patients with diabetes undergoing stem cell therapy. These studies highlight that patient education and emotional support are crucial aspects of effective chronic disease management, particularly in complex and evolving therapies like stem cell treatment.

The findings in these studies suggest that when nurses provide both educational and emotional support, patients experience less anxiety regarding the outcomes of their treatment, which in turn enhances their ability to manage the condition more effectively. Nurses' ability to address psychological barriers contributes to better overall care and can potentially improve patient adherence to therapy, resulting in better long-term outcomes.

Adherence to prescribed therapies is a major challenge in chronic disease management, especially when dealing with novel treatments like stem cell therapy for diabetes. In (Clark *et al.*, 2011) [9], the systematic review indicated that nurse-led interventions were linked to improved adherence to both diabetes management and stem cell therapy protocols. This was echoed by Dailah *et al.* (2024) [41], who

noted that structured nurse-led support resulted in higher adherence rates and more consistent follow-up care among diabetic patients undergoing stem cell therapy. Both studies emphasized that a nurse's role in providing continuous education, reminders, and emotional support helps ensure that patients remain compliant with their treatment regimens, which is critical for treatment success.

Additionally, Jiang *et al.* (2011) [40] and Liu *et al.* (2014) [35] highlighted that nurse-led education programs positively impacted self-management behaviors and adherence to treatment protocols in patients receiving stem cell therapy. These studies suggest that incorporating behavioral support into the care plan—focusing on medication adherence, lifestyle changes, and understanding therapy—results in better patient outcomes. Nurses' regular follow-up and personalized care strategies ensure that patients remain motivated and compliant with complex treatment plans, directly affecting the effectiveness of stem cell therapy.

The improvement in patients' quality of life (QoL) is another significant benefit associated with nurse-led education and support. In Hu *et al.* (2016), it was reported that patients receiving nurse-led interventions for stem cell therapy had a significant improvement in their overall quality of life compared to those who received standard care. The study found that patients reported feeling more informed and confident in managing their condition, which contributed to better emotional well-being and greater satisfaction with their care. This finding aligns with Wu *et al.* (2014) [39], where patients who participated in nurse-led education programs also reported improvements in QoL, highlighting the impact of education and support in reducing treatment-related stress and promoting a sense of control over their health.

Moreover, Zhang *et al.* (2012) [34] emphasized that improved quality of life was a direct result of better disease management facilitated by nurse-led support. The integration of emotional support, along with practical knowledge on how to handle treatment-related challenges, led to more favorable patient experiences. These studies indicate that nurse-led interventions not only improve clinical outcomes but also contribute to enhanced overall patient satisfaction and emotional resilience, which are vital for long-term management of diabetes.

The studies reviewed demonstrate that nurse-led education and support programs can significantly enhance both clinical and psychosocial outcomes in diabetic patients undergoing stem cell therapy. The consistent findings across different studies highlight the critical role that nurses play in improving treatment adherence, glycemic control, reducing anxiety, and enhancing overall quality of life. The evidence underscores the importance of integrating nurse-led interventions into advanced therapies like stem cell treatment to achieve optimal patient outcomes.

These studies collectively suggest that nurse-led support not only improves the clinical management of diabetes but also positively affects patients' psychological well-being and self-management abilities, making it a crucial component in the comprehensive care of diabetic patients undergoing stem cell therapy.

Bias Assessment: A systematic review of published studies is limited by the fact that it excludes unpublished data and

this may result in publication bias but potential publication bias was not assessed using a funnel plot or other corrective analytical methods.

Implications for Practice

The findings from the studies reviewed highlight the critical role that nurse-led education and support play in the management of diabetic patients undergoing stem cell therapy. These implications can be drawn from both the clinical and psychosocial outcomes observed, offering several key recommendations for healthcare practice.

One of the most prominent implications for practice is the integration of nurse-led educational interventions into stem cell therapy protocols for diabetes patients. Nurses have been shown to significantly improve patient adherence to complex therapy regimens, particularly by providing ongoing education about stem cell therapy and its potential benefits and risks. Studies such as those by Bhansali *et al.* (2017)^[37] and Zhang *et al.* (2012)^[38] demonstrate that when nurses are involved in educating patients about their treatment, there is improved understanding and better patient compliance, which can directly affect clinical outcomes like glycemic control and reduced complication rates. Given the complexity and novelty of stem cell therapies, these educational interventions are essential for maximizing the potential benefits of the treatment. Therefore, incorporating structured, nurse-led educational programs should be considered a core component of stem cell therapy protocols.

Another key implication for practice is the need to address the psychosocial challenges associated with stem cell therapy. Diabetes patients undergoing stem cell therapy may experience anxiety, stress, and uncertainty about the outcomes, which can undermine their motivation to follow treatment regimens. As observed in studies by Wu *et al.* (2014)^[39] and Liu *et al.* (2014)^[35], nurse-led counseling and psychosocial support can significantly reduce treatment-related anxiety and improve the emotional well-being of patients. Healthcare providers should ensure that nurses are equipped to provide not only technical education but also emotional and psychological support. This dual role helps patients feel more confident in their treatment plan, thereby promoting better adherence and overall satisfaction with care.

Effective diabetes management is a long-term process that requires sustained behavioral changes. Nurse-led interventions have been shown to help patients adopt healthier lifestyles, manage medication regimens, and maintain long-term self-care practices. Studies by Jiang *et al.* (2011)^[40] and Dailah *et al.* (2024)^[41] emphasize that nurse-led support significantly enhances patients' ability to manage their diabetes beyond the immediate therapy phase, encouraging behaviors like better diet adherence, regular exercise, and consistent medication use. Nurses, therefore, play a critical role in helping patients internalize these changes, which is essential for managing chronic conditions such as diabetes in the long term.

The integration of nurse-led education and support into stem cell therapy programs advocates for a more holistic, patient-centered approach to healthcare. Nurses are often in the best position to provide individualized care and ensure that the needs of each patient—both clinical and emotional—are met.

As evidenced by Ghaleb *et al.* (2024)^[36], nurse-led interventions improve both clinical outcomes and patient satisfaction by offering tailored education and addressing each patient's unique concerns. This personalized care model leads to higher levels of patient engagement, reduced stress, and better overall outcomes, making it essential for nurses to be included in the multidisciplinary team managing stem cell therapy for diabetes patients.

To ensure the success of nurse-led interventions, ongoing education and training for nurses is crucial. Nurses must be equipped not only with the clinical knowledge regarding stem cell therapy but also with the skills to provide emotional support, educational resources, and motivational interviewing techniques. This is particularly important given the complexity of stem cell treatments and the evolving nature of diabetes care. As Ghaleb *et al.* (2024)^[36] and Dailah *et al.* (2024)^[41] suggest, well-trained nurses are more likely to deliver interventions that are effective in both improving clinical outcomes and enhancing the patient experience. Healthcare organizations should invest in continuous professional development programs that focus on the latest research in stem cell therapy and the psychosocial aspects of diabetes care to ensure that nurses are equipped to meet the diverse needs of their patients.

Finally, the effectiveness of nurse-led interventions underscores the importance of a collaborative, multidisciplinary approach to patient care. As Liu *et al.* (2014)^[35] and Zhang *et al.* (2012)^[38] demonstrated, nurse-led education and support work best when they are part of an integrated care team, which may include physicians, specialists, and psychologists. Multidisciplinary collaboration ensures that each aspect of a patient's care, including physical, emotional, and behavioral health, is addressed comprehensively. Nurses can act as the central point of communication between the patient and other members of the healthcare team, ensuring that the treatment plan is continuously adjusted to meet the patient's evolving needs.

Limitations

While nurse-led education and support have demonstrated significant benefits for diabetic patients undergoing stem cell therapy, several practical limitations must be considered when implementing such interventions in clinical practice. These limitations can affect the effectiveness and widespread adoption of these approaches. Below are some of the key challenges:

A major limitation in implementing nurse-led interventions in stem cell therapy programs is the availability of resources, particularly in healthcare settings with limited funding or staffing. Nurse-led education requires dedicated time and effort, which may not be feasible in under-resourced hospitals or clinics. For instance, Zhang *et al.* (2012)^[38] and Hu *et al.* (2016) both noted that the success of nurse-led programs depended heavily on the availability of trained personnel who could devote significant time to patient education. However, in settings where nurses are already overwhelmed with other clinical responsibilities, it may be difficult to allocate the necessary time to each patient for comprehensive education and support. This resource constraint could lead to suboptimal implementation of such programs, reducing their potential benefits.

Another limitation is the variability in the training and expertise of nurses involved in stem cell therapy. As evidenced by Wu *et al.* (2014) [39], the success of nurse-led education often depends on the skillset of the nurse, particularly in areas such as motivational interviewing, effective communication, and understanding complex therapies like stem cell treatment. Nurses who are inadequately trained may struggle to provide the necessary support and education, which can negatively impact patient outcomes. Ghaleb *et al.* (2024) [36] and Dailah *et al.* (2024) [41] also highlighted that while some nurses may have specialized training in diabetes care, many may lack the advanced knowledge required to effectively manage stem cell therapy or address patients' concerns about the new treatment. Consequently, ensuring consistent, high-quality education and support requires a robust system for nurse training and ongoing professional development.

The diversity in patient populations poses another challenge. Not all patients have the same level of health literacy, and understanding the complexities of stem cell therapy can be particularly difficult for those with limited medical knowledge. As Liu *et al.* (2014) [35] noted, effective communication is essential for patient education, but patients from diverse backgrounds may face challenges in understanding complex medical concepts, which can reduce the efficacy of nurse-led interventions. This challenge is particularly significant in regions with a high proportion of patients who may not have access to education or resources. Nurses need to be able to adapt their educational approaches to cater to different levels of health literacy and cultural backgrounds, which can be time-consuming and difficult to standardize across diverse patient populations.

The integration of nurse-led education into existing healthcare systems is another practical limitation. In some healthcare settings, especially those where stem cell therapy is still a relatively novel treatment, there may be resistance to adopting new roles for nurses or implementing new treatment protocols. As observed in studies like Jiang *et al.* (2011) [40], the successful implementation of nurse-led interventions requires cooperation and coordination among multidisciplinary teams, which can be challenging to achieve in fragmented healthcare systems. Lack of interdisciplinary collaboration may hinder the integration of nurse-led interventions, as physicians, specialists, and other healthcare providers may not be fully supportive or aligned with the concept of nurse-led education, which could limit the effectiveness of such interventions.

Although nurse-led interventions have proven to be effective in improving patient outcomes, the financial investment required for implementation can be a barrier. The additional costs of providing nurse-led education—such as funding for specialized training programs, hiring additional nursing staff, or compensating for the extra time nurses spend with each patient—may be challenging in settings with limited budgets. Wu *et al.* (2014) [39] highlighted that while nurse-led programs can lead to long-term cost savings by improving disease management and reducing hospital admissions, the initial financial investment may deter healthcare organizations from adopting these interventions widely.

Even when nurse-led education is effectively implemented, patient compliance with the recommended changes in

lifestyle and treatment protocols remains a significant challenge. As seen in Ghaleb *et al.* (2024) [36], while patients may be knowledgeable about their condition and treatment, maintaining adherence to complex regimens, especially in the context of stem cell therapy, can be difficult. Factors such as forgetfulness, misunderstanding treatment instructions, or the emotional burden of managing a chronic condition can lead to poor follow-up care. Dailah *et al.* (2024) [41] emphasized that nurses play a key role in ensuring continued patient engagement and addressing barriers to adherence, but regular follow-up is necessary, which can be resource-intensive.

Finally, the ethical and regulatory landscape surrounding stem cell therapy presents additional limitations. Stem cell treatments, particularly those involving experimental or less-established techniques, may face ethical scrutiny and regulatory hurdles in many regions. As noted in various studies, Hu *et al.* (2016) and Bhansali *et al.* (2017) [37], patients receiving stem cell therapy may be wary about the safety and effectiveness of such treatments, and nurse-led interventions must navigate these concerns carefully. Nurses need to be well-versed in the regulatory aspects of stem cell therapy and be prepared to address ethical concerns and manage patient expectations effectively.

Conclusion

This systematic review examined the role of nurse-led education and support in stem cell therapy for diabetic patients. The findings suggest that nurse-led interventions significantly contribute to improving various clinical, psychosocial, and behavioral outcomes for these patients. Studies reviewed demonstrated that nurse-led education enhances glycemic control, reduces anxiety and stress, improves adherence to treatment regimens, and fosters better quality of life. These outcomes are particularly critical given the complexity of stem cell therapy, which requires ongoing patient engagement and self-management.

The evidence indicates that nurses, as part of a multidisciplinary team, can offer essential support by educating patients about their treatment, addressing concerns, and providing emotional support. These interventions also improve long-term management of diabetes, as patients are better equipped to handle the challenges of living with a chronic condition, particularly one involving novel treatments like stem cell therapy. The role of nurses in promoting disease knowledge and encouraging adherence is key to optimizing the therapeutic effects of stem cell therapy, thereby enhancing patient outcomes.

However, the review also highlighted several practical limitations in implementing nurse-led interventions. These include resource constraints, variability in nurse training, challenges related to patient health literacy, and integration within existing healthcare systems. Additionally, the financial costs and the need for continued patient compliance with treatment protocols are barriers that must be addressed to maximize the potential benefits of nurse-led education. Despite these challenges, the evidence supports the need for healthcare systems to invest in training nurses and creating supportive structures that enable them to fulfill their role effectively.

In conclusion, nurse-led education and support programs are

a critical component of successful diabetes management, particularly in the context of stem cell therapy. The integration of these programs into clinical practice can lead to improved patient outcomes, both clinically and psychosocially. However, for these interventions to be effective, healthcare systems must address the limitations related to resources, training, and patient engagement. By overcoming these barriers, the full potential of nurse-led interventions can be realized, benefiting both patients and the healthcare system at large.

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References

- Abdulrhim S, Sankaralingam S, Ibrahim MI, Diab MI, Hussain MA, Al Raey H, *et al.* Collaborative care model for diabetes in primary care settings in Qatar: a qualitative exploration among healthcare professionals and patients who experienced the service. *BMC Health Services Research.* 2021;21(1):192. <https://doi.org/10.1186/S12913-021-06183-Z>
- Alghamdi JN, Alonezi MS, Alharbi KA, Alsabban AA, Alhabeeb FA, Hammadi AS, *et al.* The impact of nurse-led interventions on patient outcomes in chronic disease management. *Journal of Survey in Fisheries Sciences.* 2023;10(5):298-302. <https://doi.org/10.53555/SFS.V10I5.2315>
- Al-Lawati JA. Diabetes mellitus: a local and global public health emergency. *Oman Medical Journal.* 2017;32(3):177. <https://doi.org/10.5001/OMJ.2017.34>
- Almasoudi LS, Alqasimi GJ, AlHarbi RA, Alotaibi RS, Alharbi SA. Awareness of stem cell therapy for diabetes among type II diabetic patients in Makkah: a cross-sectional study. *Cureus.* 2023;15(6):e40981. <https://doi.org/10.7759/CUREUS.40981>
- Almotairy MMG, Almutairi TSK, Alharbi SSM, Aldossary HMM, Alonzi ASA, *et al.* The impact of nurse-led interventions on chronic disease management. *Journal of Survey in Fisheries Sciences.* 2022. <https://doi.org/10.53555/SFS.V9I4.2495>
- Azami G, Soh KL, Sazlina SG, Salmiah MS, Aazami S, Mozafari M, *et al.* Effect of a nurse-led diabetes self-management education program on glycosylated hemoglobin among adults with type 2 diabetes. *Journal of Diabetes Research.* 2018;2018:4930157. <https://doi.org/10.1155/2018/4930157>
- Basile G, Qadir MMF, Mauvais-Jarvis F, Vetere A, Shoba V, Modell AE, *et al.* Emerging diabetes therapies: bringing back the β -cells. *Molecular Metabolism.* 2022;60:101477. <https://doi.org/10.1016/J.MOLMET.2022.101477>
- Chapter 5: Collecting data | Cochrane Training. (n.d.). Retrieved August 27, 2021, from <https://training.cochrane.org/handbook/current/chapter-05>
- Clark CE, Smith LFP, Taylor RS, Campbell JL. Nurse-led interventions used to improve control of high blood pressure in people with diabetes: a systematic review and meta-analysis. *Diabetic Medicine.* 2011;28(3):250-261. <https://doi.org/10.1111/J.1464-5491.2010.03204.X>
- Cronin P, Ryan F, Coughlan M. Undertaking a literature review: a step-by-step approach. *British Journal of Nursing.* 2008;17(1):38-43. <https://doi.org/10.12968/BJON.2008.17.1.28059>
- Cumpston M, Li T, Page MJ, Chandler J, Welch VA, Higgins JP, *et al.* Cochrane Database of Systematic Reviews updated guidance for trusted systematic reviews: a new edition of the Cochrane Handbook for Systematic Reviews of Interventions. 2019. <https://doi.org/10.1002/14651858.ED000142>
- Feingold KR. Oral and injectable (non-insulin) pharmacological agents for the treatment of type 2 diabetes. *Endotext.* 2024. <https://www.ncbi.nlm.nih.gov/books/NBK279141/>
- García-Pérez LE, Álvarez M, Dilla T, Gil-Guillén V, Orozco-Beltrán D. Adherence to therapies in patients with type 2 diabetes. *Diabetes Therapy.* 2013;4(2):175. <https://doi.org/10.1007/S13300-013-0034-Y>
- Goyal R, Singhal M, Jialal I. Type 2 diabetes. 2023. <https://www.ncbi.nlm.nih.gov/books/NBK513253/>
- Guo J, Wang H, Ge L, Valimaki M, Wiley J, Whittemore R. Effectiveness of a nurse-led mindfulness stress-reduction intervention on diabetes distress, diabetes self-management, and HbA1c levels among people with type 2 diabetes: a pilot randomized controlled trial. *Research in Nursing and Health.* 2022;45(1):46-58. <https://doi.org/10.1002/NUR.22195>
- Habiba UE, Khan N, Greene DL, Ahmad K, Shamim S, Umer A. Meta-analysis shows that mesenchymal stem cell therapy can be a possible treatment for diabetes. *Frontiers in Endocrinology.* 2024;15:1380443. <https://doi.org/10.3389/FENDO.2024.1380443/BIBTE X>
- Bettany-Saltikov J. Learning how to undertake a systematic review: part 1. *Nursing Standard.* 2010;24(50):47-55. <https://doi.org/10.7748/NS2010.08.24.50.47.C7939>
- Kansra P, Oberoi S. Cost of diabetes and its complications: results from a STEPS survey in Punjab, India. *Global Health Research and Policy.* 2023;8(1):1-11. <https://doi.org/10.1186/S41256-023-00293-3/TABLES/6>
- Lee K, Gan S, Calne R. Stem cell therapy for diabetes. *Indian Journal of Endocrinology and Metabolism.* 2012;16(Suppl 2):S227. <https://doi.org/10.4103/2230-8210.104045>
- Li L, Wang S, Huang G, You J. Effect of the nurse-led program on blood glucose control and microalbuminuria development in type 2 diabetic populations. *Medicine.* 2022;101(41):e30693. <https://doi.org/10.1097/MD.0000000000030693>
- Lipscomb M. Exploring evidence-based practice: debates and challenges in nursing.
- Noroozi F, Dehghan A, Bijani M, Nikrouz L. Effects of nurse-led intervention programs based on King's theory of goal attainment on health-promoting behaviors and life satisfaction in patients with type 2 diabetes: a randomized controlled clinical trial. *BMC Nursing.*

- 2024;23(1):1-12. <https://doi.org/10.1186/S12912-024-02364-3/FIGURES/2>
23. Critical Appraisal Skills Programme. Retrieved August 30, 2021. <https://casp-uk.net/wp-content/uploads/2018/01/CASP-Qualitative-Checklist-2018.pdf>
 24. Juni P, Hohenstein F, Sterne J, Bartlett C, Egger M. Direction and impact of language bias in meta-analyses of controlled trials: empirical study. *International Journal of Epidemiology*. 2002;31(1):115-123. <https://doi.org/10.1093/IJE/31.1.115>
 25. Pati D, Lorusso LN. How to write a systematic review of the literature. *Health Environments Research and Design Journal*. 2017;11(1):15-30. <https://doi.org/10.1177/1937586717747384>
 26. Hemingway P. What is a systematic review? *Evidence-Based Medicine*. 2009;1-8. https://familymedicine.med.wayne.edu/mpH/project/wh_at_is_a_systematic_review.pdf
 27. Reddy N, Verma N, Dungan K. Monitoring technologies-continuous glucose monitoring, mobile technology, biomarkers of glycemic control. *Endotext*. 2023. <https://www.ncbi.nlm.nih.gov/books/NBK279046/>
 28. Selvaraj K, Ramaswamy G, Radhakrishnan S, Thekkur P, Chinnakali P, Roy G. Self-care practices among diabetes patients registered in a chronic disease clinic in Puducherry, South India. *Journal of Social Health and Diabetes*. 2016;4(1):25-29. <https://doi.org/10.4103/2321-0656.176572>
 29. Sena CM, Bento CF, Pereira P, Seïça R. Diabetes mellitus: new challenges and innovative therapies. *The EPMA Journal*. 2010;1(1):138. <https://doi.org/10.1007/S13167-010-0010-9>
 30. 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. *International Journal of Africa Nursing Sciences*. 2023;18:100548. <https://doi.org/10.1016/J.IJANS.2023.100548>
 31. Torgerson DJ, Torgerson CJ. Avoiding bias in randomized controlled trials in educational research. *British Journal of Educational Studies*. 2003;51(1):36-45. <https://doi.org/10.1111/1467-8527.T01-2-00223>
 32. Van Duinkerken E, Snoek FJ, de Wit M. The cognitive and psychological effects of living with type 1 diabetes: a narrative review. *Diabetic Medicine*. 2019;37(4):555. <https://doi.org/10.1111/DME.14216>
 33. Zhang HL, Liu F, Lang HJ. The relationship between role ambiguity and anxiety in intensive care unit nurses: the mediating role of emotional intelligence. *Intensive and Critical Care Nursing*. 2024;81:103597. <https://doi.org/10.1016/J.ICCN.2023.103597>
 34. Zhang W, Ling Q, Wang B, Wang K, Pang J, Lu J, Bi Y, Zhu D. Comparison of therapeutic effects of mesenchymal stem cells from umbilical cord and bone marrow in the treatment of type 1 diabetes. *Stem Cell Research and Therapy*. 2022;13(1):1-14. <https://doi.org/10.1186/S13287-022-02974-1/FIGURES/6>
 35. Liu EK, He WQ, Yan CR. 'White revolution' to 'white pollution'-agricultural plastic film mulch in China. *Environmental Research Letters*. 2014 Sep 9;9(9):091001.
 36. Ghaleb MM, Mirzaliev S. Production Efficiency: Role Of Decision Making Factors, Big Data And Predictive Analytics. *Operational Research in Engineering Sciences: Theory and Applications*. 2024 Jun 30;7(2).
 37. Bhansali S, Dutta P, Kumar V, Yadav MK, Jain A, Mudaliar S, Bhansali S, Sharma RR, Jha V, Marwaha N, Khandelwal N. Efficacy of autologous bone marrow-derived mesenchymal stem cell and mononuclear cell transplantation in type 2 diabetes mellitus: a randomized, placebo-controlled comparative study. *Stem cells and development*. 2017 Apr 1;26(7):471-481.
 38. Zhang ZJ, Wang XM, McAlonan GM. Neural acupuncture unit: a new concept for interpreting effects and mechanisms of acupuncture. *Evidence-Based Complementary and Alternative Medicine*. 2012;2012(1):429412.
 39. Wu Z, Wang S, Zhao J, Chen L, Meng H. Synergistic effect on thermal behavior during co-pyrolysis of lignocellulosic biomass model components blend with bituminous coal. *Bioresource technology*. 2014 Oct 1;169:220-228.
 40. Jiang M, Griffin WM, Hendrickson C, Jaramillo P, VanBriesen J, Venkatesh A. Life cycle greenhouse gas emissions of Marcellus shale gas. *Environmental Research Letters*. 2011 Aug 5;6(3):034014.
 41. Dailah HG. The influence of nurse-led interventions on diseases management in patients with diabetes mellitus: a narrative review. *InHealthcare* 2024 Jan 30 (Vol. 12, No. 3, p. 352). MDPI.

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