



Outcome of nurse-led education on coping skills and quality of life among diabetes mellitus patients at selected secondary healthcare facilities in Kaduna State: Study proposal

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Received: 31st August 2024

Revised: 27th October 2024

Accepted: 3rd November 2024



Abstract

Background: Diabetes is a chronic condition that significantly affects patients' overall health and well-being, necessitating effective management strategies that include patient education. The general goal of the study is to examine the outcome of nurse-led education on coping skills and health-related quality of life (HRQoL) among diabetes patients in Kaduna State, Nigeria.

Objectives: This study proposal describes the specific objectives, measurable variables and how the data would be collected, as well as the realistic scope and time limitations of the project.

Methods: Adopting a quasi-experimental pre-test and post-test design with a control group, the research will recruit patients from healthcare facilities, providing the intervention group with a structured educational program while the control group receives standard care. Data will be collected at the beginning and after six months to measure changes in coping mechanisms and HRQoL.

Expected outcomes: This includes identifying effective coping strategies, understanding the impact of diabetes on HRQoL, and highlighting how nurse-led interventions can improve patient self-management in a resource-limited setting. However, the study may face limitations such as limited generalizability, potential biases in data collection, and short-term measurement of outcomes that may not capture long-term effects.

Significance of proposed study: These findings are anticipated to inform healthcare professionals and policymakers about improving diabetes management in developing countries.

Keywords: Diabetes mellitus, nurse-led education, quality of life, coping behavior, secondary healthcare facilities, health outcome

Introduction

Diabetes mellitus is a chronic metabolic disorder caused by impaired insulin production or action, leading to high blood glucose levels. (Gooderick et al., 2011). There are several types of diabetes mellitus, including Type I diabetes, an autoimmune condition where the body's immune system attacks insulin-producing cells, Type II diabetes, a metabolic disorder characterized by insulin resistance and impaired insulin secretion, LADA (latent autoimmune diabetes in adults), a form of type 1 diabetes that develops in adults, MODY (maturity-onset diabetes of the young), a rare, genetic form of diabetes, and gestational diabetes, a condition that develops during pregnancy, often resolving after childbirth. Type II diabetes is the most prevalent form, accounting for 90-95% of cases. It is one of the world's leading non-communicable diseases (P et al., 2022)

Diabetes is having a blood glucose level of ≥ 126 milligrams per deciliter (mg/dL) after an eight-hour fast (not eating anything), or by having a non-fasting glucose level of ≥ 200 mg/dL along with symptoms of diabetes; or a glucose level of ≥ 200 mg/dL on a two-hour glucose tolerance test, or a hemoglobin A1c of $\geq 6.5\%$ (Harreiter & Roden, 2023).

Diabetes care in Kaduna State is primarily provided by general practitioners and medical officers in public hospitals. Specialist care is limited, with only a few endocrinologists and diabetes specialists available in the state. According to a study published in the Nigerian Journal of Clinical Practice, only 12% of patients with diabetes in Kaduna State received care from a specialist (Uloko et al., 2018)

Nigeria faces a high prevalence of diabetes, with about 6 million adults affected and an estimated two-thirds remaining undiagnosed. This burden strains the weak health systems in sub-Saharan Africa, leading to increased diabetes-related complications and deaths (Ukah et al., 2023).

Diabetes care is complex and stressful, especially in developing countries. It includes daily self-management (blood glucose monitoring, medication, diet, exercise), which can be emotionally demanding. Treatment aims to prevent complications and preserve quality of life and well-being (Tariq, 2023).

Nursing intervention, defined as implementing patient care plans, encompasses education, coordination, and evaluation of self-management. It complements medical treatment and has been shown to provide comparable outcomes to physician-led primary care (Lee & Lee, 2024).

Adaptive coping strategies support health outcomes in diabetes management. Conversely, maladaptive strategies can affect both metabolic control and psychosocial outcomes (e.g., quality of life, depression). Quality of life (QOL) is a multidimensional measure of well-being, influenced by cultural and personal factors. It has gained importance in health care as the focus shifts from treating diseases to promoting well-being (Sheth et al., 2023).

Health quality of life (QoL) indicators predict long-term health, well-being, and productivity. Individuals with type 2 diabetes (T2D) experience lower QoL than healthy individuals, particularly with treatment complications. Improved QoL is a primary goal of T2D management interventions (Mendorf et al., 2023).

Conceptual frameworks

Overview of Diabetes Mellitus: DM is characterized by hyperglycemia due to dysfunctions in carbohydrate, lipid, and protein metabolism, primarily arising from issues with insulin secretion or action. The World Health Organization (WHO) identifies DM as an epidemic, with a significant increase in prevalence projected globally, estimating 387 million affected individuals, rising to over 640 million by 2040 (Giovannini et al., 2016).

Classification and Pathophysiology: The American Diabetes Association (ADA) classifies diabetes into four main types: Type 1 diabetes mellitus (T1DM), Type 2 diabetes mellitus (T2DM), gestational diabetes mellitus (GDM), and other specific types. T1DM is an autoimmune condition leading to insulin deficiency, while T2DM, which accounts for 90–95% of cases, is characterized by insulin resistance and β -cell dysfunction (American Diabetes Association Professional Practice Committee, 2022).

Type 1 Diabetes Mellitus: T1DM is marked by the autoimmune destruction of pancreatic β -cells, leading to insulin deficiency. It can present rapidly or gradually, with various immune markers aiding in diagnosis. Latent autoimmune diabetes in adults (LADA) is a form of T1DM that can be misdiagnosed as T2DM (Kahaly & Hansen, 2016).

Type 2 Diabetes Mellitus: T2DM is primarily linked to lifestyle factors, obesity, and genetic predispositions. It develops slowly, often going undiagnosed until complications arise. Management typically involves lifestyle changes and may require medication as the disease progresses (Umpierrez & Korytkowski, 2016).

Gestational Diabetes Mellitus: GDM occurs during pregnancy and usually resolves after delivery. However, it increases the risk of developing T2DM later in life (Ozbek et al., 2010).

Other Types of Diabetes: These include diabetes resulting from genetic defects, endocrine disorders, exocrine pancreatic diseases, and drug-induced diabetes (Ozbek et al., 2010).

Management of Diabetes: Effective management includes lifestyle modifications, medical nutrition therapy, and pharmacological interventions. Emerging therapies such as gene therapy, stem cell therapy, and nanotechnology are being explored to improve diabetes care (Dunbar et al., 2018).

Epidemiology and Quality of Life: The review discusses the rising prevalence of diabetes, particularly in low- and middle-income countries, and its impact on quality of life, emphasizing the need for effective prevention and management strategies (Saeedi et al., 2019).

Coping Strategies: Effective coping mechanisms, including active coping, religious coping, and support groups, are crucial for individuals managing diabetes (Megari, 2013).

Statement of the Problem

Diabetes mellitus is a chronic metabolic disorder that significantly affects patients' health and quality of life. The rising prevalence of diabetes, particularly in developing countries like Nigeria, presents a major public health challenge (Ekoru et al., 2019). Approximately 8% of adult Nigerians are estimated to live with diabetes, with many cases remaining undiagnosed, leading to increased complications and strain on healthcare systems (Anyanti et al., 2021). Diabetes mellitus is a major health concern, especially in areas like Kaduna State, Nigeria, where the disease is increasingly prevalent, affecting around 6 million adults, with many more cases likely going undetected (Uloko et al., 2018).

Diabetes management is complex and stressful, involving daily self-monitoring, medication adjustments, and lifestyle changes. This burden can lead to diabetes-specific distress among patients (Ekoru et al., 2019). Patients often experience emotional distress linked to the demands of managing a chronic condition, which can negatively affect their quality of life (Ekoru et al., 2019). This situation has led to increased complications and mortality rates, straining already limited health systems in the area 2 resulting to the need to identify and evaluate the coping strategies

employed by diabetes patients, as adaptive strategies are essential for better health outcomes (Aschalew et al., 2019).

The study aims to investigate the impact of nurse-led education on coping strategies and health-related quality of life (HRQoL) among diabetes patients in selected secondary healthcare facilities in Kaduna State, Nigeria.

Broad Aim and Specific Objectives

The general goal of this study is to investigate the outcome of nurse-led education on coping skills and health-related quality of life among diabetes patients in selected secondary healthcare facilities in Kaduna State, Nigeria.

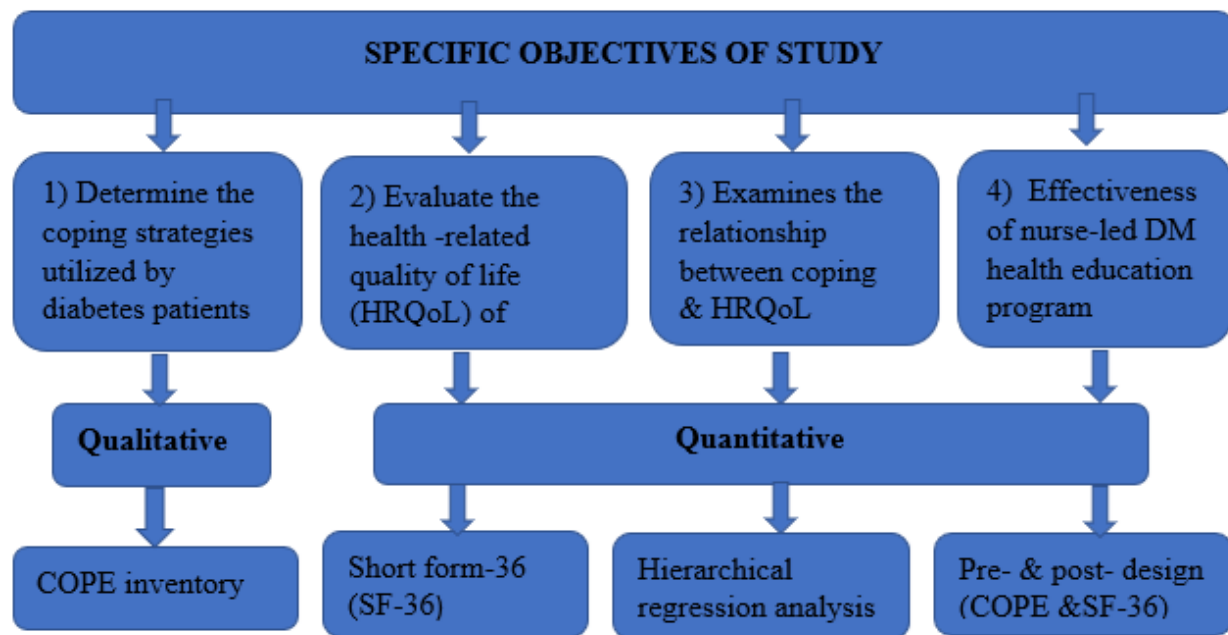


Fig 1: Specific Objectives

Research Questions

The study proposes the following research questions aligned with its objectives:

1. What coping strategies do diabetes mellitus patients employ?
2. How does diabetes impact the health-related quality of life of patients?

3. What is the relationship between coping strategies and health-related quality of life outcomes?
4. How effective is the nurse-led education program in improving patient outcomes?

Hypotheses

The research is guided by the following hypotheses that there will be a significant difference in

1. utilization of various coping strategies between DM and non-DM individuals
2. health-related quality of life between DM and non-DM individuals
3. correlation between effective coping strategies and improved quality of life
4. outcomes of coping skills and HRQoL between nurse-led education and normal care

Study design

This is outlined on table 1, to complement the summary highlight of figure 1

Table 1: formatted table for proposal method

Objectives	Hypothesis	Methods	Research designs
To examine coping strategies among DM patients	DM patients utilize various coping strategies to manage the physical, emotional, and social impacts of their condition.	Qualitative analysis	cross-sectional survey- collecting data at a single point in time, which would be sufficient to understand the coping strategies.
To determine the HRQoL among DM patients	There will be a significant difference in the HRQoL among individuals with DM compared to those without the condition.	Quantitative analysis	cross-sectional survey- collecting data at a single point in time, which would be sufficient to understand the coping strategies
To examine the relationship between coping strategies and HRQoL in DM patients	There is a significant correlation between coping strategies and HRQoL in DM, with more effective coping strategies leading to a higher HRQoL.	Quantitative analysis	Correlational study - Examination of the relationship between coping strategies and HRQoL in DM patients
To determine the Outcome of Nurse led education	Providing nurse-led education will positively impact patient outcomes.	Quantitative analysis	Quasi- experimental -pre- and post-test measures can be used to measure changes in outcomes before and after the

Data Collection

Population: The study will focus on diabetes mellitus patients in Kaduna State, Nigeria. It will aim to understand their coping strategies and health-related quality of life. The participants will include registered patients aged 18-70 years with Type 2 diabetes mellitus who will be willing to participate, attend a nurse-led educational program, be clinically stable, fully conscious, and able to communicate, at the time of the study. The study will involve both qualitative and quantitative analyses to gather comprehensive insights into their future experiences and coping mechanisms.

Setting: The data collection will occur in hospital conference halls in selected secondary healthcare facilities in Kaduna State. The study will be carried out in six selected secondary health care facilities. These are General Hospital kafanchan & general hospital kachia in the Southern senatorial district, General Hospital Sabo and general hospital kujama in the Central senatorial district, General Hospital Sabon Gari and general hospital makarfi in the Northern senatorial district. This selection was to ensure uniformity and equal status of health facilities selected. These settings are chosen to ensure that participants can engage comfortably in discussions and interviews regarding their health management and coping strategies. The research assistants, who are trained nurses, will facilitate these sessions to maintain a supportive and ethical environment for participants.

Data will be collected using the following instruments: Brief COPE - The Brief COPE is a self-report questionnaire that will be administered to participants to assess their coping strategies and behaviors. This instrument consists of 28 items, divided into 14 scales, each with 2 items, which are designed to measure various coping dimensions, including active coping, planning, positive reframing, acceptance, humor, religion, emotion-focused coping, denial, substance use, behavioral disengagement, venting, self-blame, self-distraction, and emotional support. The Brief COPE will be administered to participants in a paper-and-pencil format or online, depending on the participant's preference. Participants will be introduced to the questionnaire by the researcher, who will provide clear instructions on how to complete the instrument. The response format will involve participants rating each item on a 4-point Likert scale, ranging from 1 (I haven't been doing this at all) to 4 (I've been doing this a lot), allowing them to indicate the frequency with which they use each coping strategy. Short Form Health Survey (SF-36) - This instrument will measure the

health-related quality of life of patients before and after the implementation of the nurse-led education program.

Interviews - Conducted by trained nurse research assistants to gather qualitative data on coping strategies among diabetes patients. The collection process will ensure anonymity and confidentiality, with participants providing health information voluntarily. The study will present only overall statistical results, not individual data, to protect participant privacy.

Operational plan: This is summarized on table 2

Table 2. Summary of operational plan

Objective	Statistical Tools	Method of Achievement
1. Determine the coping strategies among diabetes mellitus patients.	Descriptive Statistics	Conduct surveys/questionnaires (B Brief COPE) to collect data on various coping strategies used by patients. Analyze the data using descriptive statistics to summarize the findings.
2. Determine the health-related quality of life among diabetes mellitus patients.	Descriptive and Inferential Statistics	Administer standardized quality of life instruments SF-36 to patients. Use descriptive statistics to summarize quality of life scores and inferential statistics (T-tests) to determine differences between groups if necessary.
3. Determine the relationship between coping strategies and health-related quality of life among diabetes patients.	Correlation Analysis	After assessing both coping strategies and quality of life scores, conduct correlation analysis to explore the relationship between these two variables, determining the strength and direction of their association.
4. Determine the outcome of nurse-led education.	Pre-post Intervention Analysis	Assess patients' knowledge/skills before and after a nurse-led educational program using questionnaires. Analyze pre and post data using paired statistical tests to quantify the effectiveness of the educational intervention.

Scope of the Study: The research aims to assess nurse-led education's impact on coping strategies and health-related quality of life (QoL) among diabetes mellitus patients in selected secondary

healthcare facilities in Kaduna State, Nigeria. The study is set in Kaduna State, which provides specific regional insights into diabetes management and coping strategies

Limitations of the Study: The findings may not be broadly applicable outside of the specific context of Kaduna State or other similar regions due to cultural and systemic differences, Potential biases may arise from the selection process of participants, which could affect the validity of the results. While there will be control measures, the absence of a fully randomized control group may limit the rigor of the findings, Self-reporting methods could introduce bias, as participants may provide socially desirable responses rather than accurate accounts of their experiences, The study's design only allows for short-term outcome assessments, which may not capture the long-term effects of nurse-led education on patient coping and QoL and The potential for a small sample size could affect the statistical power of the study, leading to inconclusive results.

Justification for Statistical Options

To determine the coping strategies that diabetes mellitus patients will employ, researcher will utilize descriptive statistics to summarize the data, along with reliability analysis to assess the consistency of the questionnaires that will be used. thematic analysis will also be applied. The conventional level of significance will typically be set at 0.05, with a P-value of less than 0.05 indicating statistical significance in the coping strategies that will be discovered.

When evaluating the health-related quality of life among diabetes patients, descriptive statistics will again play a vital role, complemented by statistical tests such as T-tests or ANOVA for comparing groups. Additionally, regression analysis will help predict various factors that will influence quality of life. A P-value below 0.05 will signify significant differences in the quality of life scores, illustrating the impact of diabetes on the patients' well-being.

To explore the relationship between coping strategies and quality of life, correlation analysis—utilizing methods like Pearson or Spearman correlation—will reveal the strength of these relationships. Further exploration through regression analysis will identify predictive factors, while structural equation modeling will assess more complex relationships among variables. Maintaining the typical level of significance at 0.05, a P-value under this threshold will indicate a meaningful relationship between coping strategies and patients' quality of life.

Lastly, to assess the outcomes of nurse-led education, researchers may employ paired T-tests for before-and-after comparisons, ANOVA for evaluating multiple groups or time points, and Chi-square tests for categorical outcomes. Again, the level of significance will generally be kept at 0.05, and obtaining a P-value of less than 0.05 will suggest that the nurse-led education effectively influences patient outcomes. These statistical methods and considerations will enable a structured approach to gain insights into the complexities of health management for diabetes mellitus patients in the future.

Strengths, Weaknesses, Opportunities, and Threats of the Study

This study focuses on nurse-led education for diabetes patients in Kaduna State, Nigeria, aiming to explore coping strategies and assess HRQoL.

- Strength includes innovative patient care approaches, localized insights, and ethical considerations.
- Weaknesses encompass limited generalizability, potential sampling biases, lack of a control group, reliance on self-reported data, a short-term focus, resource constraints, and individual patient differences that complicate analysis.
- The study explores opportunities to improve diabetes management in Nigeria and similar regions, such as informing better strategies, contributing to policymaking, empowering patients with knowledge and coping skills, enhancing healthcare professionals' training, promoting nurse-led interventions, fostering community engagement in awareness initiatives, and collaborating with local and international health organizations. By focusing on health-related quality of life, the overall well-being of diabetes patients can be enhanced.
- Threats include weaknesses in Nigeria's healthcare system, economic constraints, cultural attitudes, political unrest, limited funding, increasing diabetes prevalence, stigma, and shifting healthcare policies, all of which may impact the implementation and relevance of the study.

Expected Outcomes

The study anticipates identifying effective coping strategies, understanding the factors affecting health-related quality of life (QoL), and evaluating the effectiveness of nurse-led education programs. It will examine coping strategies among patients with diabetes mellitus, determine the

quality of life of these patients, investigate the relationship between coping strategies and quality of life, and evaluate the outcomes of nurse-led education on these aspects. Overall, the findings are expected to contribute valuable insights into improving diabetes management and enhancing the role of nurses in patient education

Relevance of the Study

The study aims to improve diabetes management through education. It aims to enhance health-related quality of life for individuals with type 2 diabetes, who typically experience lower quality of life due to the disease's complications. The research will examine various coping strategies utilized by diabetes patients, contributing to a deeper understanding of how these strategies affect health outcomes. Findings will provide valuable information for policymakers and healthcare professionals about the role of nurses in diabetes management, which is crucial in regions with limited healthcare resources. The study addresses a significant gap in knowledge regarding nurse-led education's effectiveness in this context, particularly in Kaduna State, where diabetes prevalence is rising. Utilizing a quasi-experimental design with pre-test and post-test measures will provide robust evidence of the intervention's effectiveness. The study's outcomes may influence healthcare practices and policies in low- and middle-income countries facing similar healthcare challenges. It proposes a structured nurse-led education program aimed at empowering patients, which is essential for effective chronic disease management.

Adaptability of protocol in practice

The protocol for investigating the impact of nurse-led education on diabetes patients' coping skills and quality of life in Kaduna State can be implemented through various strategies. This includes integrating the program into healthcare systems by collaborating with facilities and gaining policy support. Training programs for nurses and continuous professional development are also essential, along with allocating resources for educational materials and securing funding. Community engagement through awareness campaigns and involving patients and families in the educational process is crucial. Monitoring and evaluation through established metrics and feedback mechanisms are necessary for program improvement. Adapting the program to the local context by being culturally sensitive and flexible in implementation is also vital. Sustainability

requires long-term commitment from healthcare facilities and integration of findings into routine care protocols.

Key areas to address successful implementation include collaboration, training, resource allocation, community engagement, and continuous evaluation. By focusing on these aspects, the nurse-led education program can effectively enhance coping skills and quality of life for diabetes patients in Kaduna State.

Timeframe

Literature Review will be Conducted initially to provide a global perspective and context for the study. Data Collection Duration is Six months. The Frequency of the Nurse-led group education sessions (8-10 patients) held fortnightly for 1.5 hours each session. Data will be collected via structured interviews using the Brief COPE and Short Form Health Survey (SF-36). Participants drawn from selected secondary healthcare facilities in Kaduna State. Involves ethical approval and consent processes prior to data collection. The intervention group receives nurse-led education, while the control group continues with usual care.

Measurements will be collected at baseline and again at six months post-intervention to evaluate changes in coping strategies and health-related quality of life.

Ethic's considerations

The study will first obtain ethical approval from this institution. A supportive letter from Novena University will be submitted to the Research and Ethical Committee of this ministry for further approval. After receiving approval from the Kaduna State Ministry of Health, the study will be taken to selected hospitals, where consent to conduct the study will also be obtained.

Reference

- American Diabetes Association Professional Practice Committee. (2022). 6. Glycemic Targets: Standards of Medical Care in Diabetes-2022. *Diabetes Care*, 45(Suppl 1), S83–S96. <https://doi.org/10.2337/dc22-S006>
- Anyanti, J., Akuiyibo, S. M., Fajemisin, O., Idogho, O., & Amoo, B. (2021). Assessment of the level of knowledge, awareness and management of hypertension and diabetes among adults in Imo and Kaduna states, Nigeria: A cross-sectional study. *BMJ Open*, 11(3). <https://doi.org/10.1136/bmjopen-2020-043951>
- Aschalew, A. Y., Yitayal, M., Minyihun, A., & Bisetegn, T. A. (2019). Self-care practice and associated factors among patients with diabetes mellitus on follow up at University of

- Gondar Referral Hospital, Gondar, Northwest Ethiopia. *BMC Research Notes*, 12(1). <https://doi.org/10.1186/s13104-019-4630-4>
- Dunbar, C. E., High, K. A., Joung, J. K., Kohn, D. B., Ozawa, K., & Sadelain, M. (2018). Gene therapy comes of age. *Science (New York, N.Y.)*, 359(6372). <https://doi.org/10.1126/science.aan4672>
- Ekoru, K., Doumatey, A., Bentley, A. R., Chen, G., Zhou, J., Shriner, D., Fasanmade, O., Okafor, G., Eghan, B., Agyenim-Boateng, K., Adeleye, J., Balogun, W., Amoah, A., Acheampong, J., Johnson, T., Oli, J., Adebamowo, C., Collins, F., Dunston, G., ... Rotimi, C. (2019). Type 2 diabetes complications and comorbidity in Sub-Saharan Africans. *EClinicalMedicine*, 16, 30–41. <https://doi.org/10.1016/j.eclinm.2019.09.001>
- Giovannini, P., Howes, M. J. R., & Edwards, S. E. (2016). Data on medicinal plants used in Central America to manage diabetes and its sequelae (skin conditions, cardiovascular disease, kidney disease, urinary problems and vision loss). *Data in Brief*, 7, 1217–1220. <https://doi.org/10.1016/j.dib.2016.03.102>
- Gooderick, D., Dashora, U., & Kumar, S. (2011). Ketoacidosis in type 2 diabetes- is it type 1 and 1/2 diabetes? *Case Reports*, 2011(aug11 1), bcr0720114460–bcr0720114460. <https://doi.org/10.1136/bcr.07.2011.4460>
- Harreiter, J., & Roden, M. (2023). Diabetes mellitus: definition, classification, diagnosis, screening and prevention (Update 2023). *Wiener Klinische Wochenschrift*, 135, 7–17. <https://doi.org/10.1007/s00508-022-02122-y>
- Kahaly, G. J., & Hansen, M. P. (2016). Type 1 diabetes associated autoimmunity. *Autoimmunity Reviews*, 15(7), 644–648. <https://doi.org/10.1016/j.autrev.2016.02.017>
- Lee, E. J., & Lee, E. J. (2024). Nursing intervention analysis: Understanding the characteristics of trauma patients in a regional emergency medical center. *Journal of Nursing Education and Practice*, 14(9), 21. <https://doi.org/10.5430/jnep.v14n9p21>
- Megari, K. (2013). Quality of Life in Chronic Disease Patients. *Health Psychology Research*, 1(3), e27. <https://doi.org/10.4081/hpr.2013.e27>
- Mendorf, S., Heimrich, K. G., Mühlhammer, H. M., Prell, T., & Schönenberg, A. (2023). Trajectories of quality of life in people with diabetes mellitus: results from the survey of health, ageing and retirement in Europe. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1301530>
- Ozbek, M. N., Senée, V., Aydemir, S., Kotan, L. D., Mungan, N. O., Yuksel, B., Julier, C., & Topaloglu, A. K. (2010). Wolcott-Rallison syndrome due to the same mutation (W522X) in EIF2AK3 in two unrelated families and review of the literature. *Pediatric Diabetes*, 11(4), 279–285. <https://doi.org/10.1111/j.1399-5448.2009.00591.x>
- P, V., P, N. swamy, & P, V. (2022). Review on diabetes mellitus. *Journal of Innovations in Applied Pharmaceutical Science (JIAPS)*, 24–27. <https://doi.org/10.37022/jiaps.v7i1.273>
- Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., Ogurtsova, K., Shaw, J. E., Bright, D., Williams, R., & IDF Diabetes Atlas Committee. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes



- Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, 157, 107843. <https://doi.org/10.1016/j.diabres.2019.10784>
- Sheth, M. S., Castle, D. J., Wang, W., Lee, A., Jenkins, Z. M., & Hawke, L. D. (2023). Changes to coping and its relationship to improved wellbeing in the optimal health program for chronic disease. *SSM - Mental Health*, 3. <https://doi.org/10.1016/j.ssmmh.2023.100190>
- Tariq, M. U. (2023). Future Health Care and Medical Entrepreneurship in the Age of Pandemic. In *Medical Entrepreneurship* (pp. 133–149). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-6696-5_9
- Ukah, E. D., Oguntade, E. S., & Oladimeji, D. M. (2023). Factors associated with type 2 diabetes mellitus comorbidity among adult patients: a retrospective clinical audit of a medical centre in Abuja, Nigeria. *Journal of Global Health Reports*, 7. <https://doi.org/10.29392/001c.88106>
- Umpierrez, G., & Korytkowski, M. (2016). Diabetic emergencies - ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. *Nature Reviews Endocrinology*, 12(4), 222–232 <https://doi.org/10.1038/nrendo.2016.15>.