REVIEW ARTICLE

THE GLOBAL CHALLENGES OF TYPE 2 DIABETES: TRENDS, BARRIERS, AND FUTURE PERSPECTIVES

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Abstract:

Type 2 diabetes mellitus (T2DM) poses a considerable challenge to global health, with its incidence rising sharply, especially in low- and middle-income countries (LMICs). Epidemiological evidence indicates that T2DM constitutes more than 90% of all diabetes cases globally, influenced by factors such as urbanisation, an aging demographic, sedentary lifestyles, and changes in dietary habits. While high-income nations are experiencing a stabilisation in incidence rates, LMICs are witnessing an unprecedented surge, exacerbated by inadequate healthcare systems and unequal access to medical services. The management of T2DM is obstructed by various barriers, including socioeconomic inequalities, difficulties in adhering to lifestyle modifications and treatment regimens, and systemic shortcomings like inadequate screening processes and a shortage of trained healthcare professionals. These challenges not only hinder early detection but also worsen complications, leading to increased morbidity and healthcare expenditures. Nevertheless, progress in pharmacological and technological fields provides a glimmer of hope. Global initiatives, such as the WHO Global Diabetes Compact, stress the importance of collaborative efforts to improve prevention and management strategies. Tackling T2DM necessitates a holistic approach that includes healthcare reforms, the integration of technology, and international cooperation. This review analyses the worldwide trends associated with T2DM, highlights significant obstacles to effective management, and investigates new strategies aimed at alleviating its effects.

Introduction:

Diabetes mellitus is a common endocrine disorder worldwide. There are two common types of this condition: type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM). T2DM accounts for approximately 90% of diabetes mellitus cases worldwide and is not dependent on the hormone insulin. This condition, which is characterised by hyperglycaemia, occurs as a result of insulin resistance. However, T1DM occurs due to autoimmune destruction of insulin-producing beta cells in the pancreas.[1] Moreover, there are differences in the risk factors for both types. T1DM is more likely to develop in children and often there is a family history present. T2DM is more likely to affect overweight adults over the age of 45 and again, there is usually a family history present.[2]

Those with T2DM are also prone to various complications. There is an increased risk of heart

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conditions such as stroke, myocardial infarctions and peripheral artery disease. This is due to high levels of blood glucose damaging blood vessels. As mentioned, T2DM is associated with increased weight and age; both factors resulting in heart disease. Subsequently, heart disease is the leading cause of death for type 2 diabetics. Another major complication of T2DM is diabetic nephropathy leading to a gradual decline in kidney function. Diabetic retinopathy is another complication and can lead to gradual vision loss. Individuals may also experience diabetic neuropathy associated with nerve damage .[3] It is clear that without preventive measures, T2DM can seriously reduce quality of life for affected individuals.

The incidence of diabetes is escalating at a concerning pace worldwide, posing a major public health dilemma. In 2021, approximately 537 million adults were diagnosed with diabetes, accounting for 10.5% of the global adult demographic. Forecasts suggest that this figure may rise to 783 million by 2045 .[4] Compounding the situation, nearly half of those affected remain undiagnosed, especially in low- and middle-income countries (LMICs), where access to healthcare is often restricted. Additionally, T2DM imposes a significant economic strain, with healthcare expenditures surpassing $966 billion annually .[5,6]

The global challenge encompasses not only the management of the increasing case numbers but also the need to rectify disparities in access to care, early diagnosis, and preventive measures. A high body mass index (BMI) continues to be the primary modifiable risk factor; however, initiatives to address this must take into account socioeconomic and structural obstacles, particularly in LMICs. Implementing policies that promote healthier lifestyles and strengthen healthcare systems is essential to mitigate this crisis.[7]

To confront these challenges, international health organizations, such as the World Health Organisation and the International Diabetes Federation, advocate for comprehensive strategies that prioritize prevention, early detection, and equitable healthcare access.[7]

This research aims to explore the global trends in T2DM prevalence, the obstacles to effective management, and the progress in therapeutic and technological innovations. The review concludes by underscoring the necessity for global collaboration to combat the disease and enhance healthcare equity.

Global Prevalence and Incidence of T2D:
Type 2 diabetes mellitus (T2D) has emerged as one of the most pressing global health challenges of the 21st century. According to the International Diabetes Federation,[8] over 540 million adults (aged between 20-79) were living with diabetes as of 2021, with T2D comprising approximately 90% of these cases. This prevalence represents a significant increase from past decades, signalling an escalating global crisis. Without effective interventions, the IDF projects the number to exceed 783 million by 2045. The surge in T2D cases is driven by a complex interplay of factors, including aging populations, urbanization, and lifestyle changes such as dietary shifts and reduced physical activity.

The incidence of T2D also reflects disparities in socio-economic conditions and healthcare systems. While high-income countries (HICs) report a stabilization of new cases, thanks to improved awareness, preventive measures, and better healthcare infrastructure; low- and middle-income countries (LMICs) are experiencing an alarming rise. These variations highlight the need for tailored approaches to prevention and management based on regional contexts and resources.

The prevalence and impact of T2D vary considerably between regions, revealing stark contrasts between high-income and low-income countries.

- High-Income Countries (HICs): Nations in North America, Western Europe, and parts of Oceania have historically reported higher T2D prevalence rates due to obesity, aging populations, and sedentary lifestyles. While the overall burden remains significant, the incidence in these regions has shown signs of plateauing. Enhanced public health initiatives, such as community-based interventions promoting physical activity and healthy diets, have played a critical role. Additionally, improved healthcare access and early diagnosis have mitigated the progression of the disease. Despite this stabilization, the economic burden remains disproportionately high, as managing diabetes-related complications requires substantial resources.

- Low- and Middle-Income Countries (LMICs): The sharpest increases in T2D cases are observed in regions such as Southeast Asia, Sub-Saharan Africa, and parts of South America. In 2013, LMIC contributed 77% of people living with diabetes and the prevalence is projected to increase.[9]

Urbanization, industrialization, and dietary transitions are major drivers of this trend. For example, the growing availability and affordability of energy-dense, nutrient-poor processed foods have contributed to higher rates of obesity and metabolic disorders in these regions.

Coupled with limited access to healthcare services and lack of awareness, many cases of diabetes go undiagnosed or are diagnosed late, resulting in severe

complications and increased mortality. Patients may not be able to manage their diabetes well and this can lead to preventable complications. [10]

Additionally, cultural factors, such as preferences for high-carbohydrate staple foods and reduced emphasis on physical activity, exacerbate the problem.

There is a trend in low income countries where increasing wealth and education correlate to increasing diabetes risk – this is in contrast to high income countries where lower levels of education increase risk of diabetes.[11]

• Genetic and Ethnic Considerations: In regions like South Asia and the Middle East, genetic predispositions increase vulnerability to T2D, even at lower body mass indices. [12]

Individuals with a first-degree relative affected by type 2 diabetes exhibit approximately a threefold increased risk of developing the condition compared to those without a positive family history. It is possible that epigenetic changes such as histone acetylation, DNA modification and non-coding RNA are responsible for some of the heritability of T2D, and increased prevalence in these regions may lead to a cycle of greater risk.

The contrast between these regions underscores the inequities in health outcomes and the need for globally coordinated but locally tailored strategies to curb the rising burden of T2D.

Risk Factors for T2D:
Understanding the primary risk factors for T2D is essential for designing effective prevention strategies. While the interplay of genetic, environmental, and lifestyle factors varies, several universal drivers have been identified:

1. Obesity and Sedentary Lifestyles: Obesity is the leading modifiable risk factor for T2D. According to the World Health Organization global obesity rates in adults have doubled since 1990 and in adolescents it has increased by a factor of 4.[5] The proliferation of sedentary lifestyles, characterized by reduced physical activity and increased screen time, further contributes to insulin resistance and glucose intolerance. Urbanization has amplified these issues, with many individuals adopting car-dependent transportation and desk-bound jobs.

2. Dietary Changes: The transition from traditional diets rich in fiber and plant-based foods to modern diets high in refined sugars, fats, and processed foods has significantly increased the prevalence of obesity and metabolic syndrome, both of which are precursors to T2D. This phenomenon is particularly pronounced in urban areas of LMICs.

` Genetics and Family History: Genetic predisposition plays a pivotal role in T2D risk. Individuals with a family history of diabetes, particularly those of South Asian, Hispanic, or African ancestry, face heightened susceptibility. For example, South Asians exhibit a predisposition to abdominal obesity and insulin resistance, even at relatively low body weights. Certain genetic markers like TCF7L2 are risk factors for T2D however, it must be noted that traditional markers like BMI are more accurate predictors.[13]

3. Socioeconomic and Environmental Factors: Poverty and limited access to healthcare exacerbate T2D prevalence in LMICs. Poor communities are often "food deserts," where nutritious options are scarce, and unhealthy processed foods dominate. Furthermore, inadequate healthcare systems delay diagnosis and treatment, leading to higher rates of complications. Programmes focused on tackling issues like poor diet and lack of physical activity in LMICs have shown promise in reducing T2 diabetic risk.[14]

4. Aging Populations: With increasing life expectancy, the proportion of older adults—a group inherently at higher risk for T2D—is growing. This demographic shift has been a significant driver of diabetes prevalence, particularly in HICs.[15]

5. Urbanization: As rural populations migrate to cities; lifestyle changes occur rapidly. Urban environments often encourage high-calorie diets and reduced physical activity, accelerating the risk of developing T2D. Moreover, urban settings frequently lack sufficient infrastructure to promote healthy behaviors, such as parks or safe walking paths.

6. Other Emerging Factors: Recent studies highlight the role of environmental pollutants, stress, and sleep disturbances in increasing T2D risk. These factors are becoming increasingly relevant as modernization and industrialization progress.

The interplay of these factors highlights the complexity of addressing the T2D epidemic. Multifaceted approaches combining public health policies, community education, and individual behaviour changes are necessary to mitigate the disease's growing burden.

Healthcare Access and Systemic Issues
One of the biggest obstacles in managing T2DM is unjust access to health services, especially in LMICs. More than one in five people with diabetes lives in an

LMIC, according to the International Diabetes Federation (IDF), with medical systems lagging behind and drugs used to treat diabetes, including insulin, not readily available .[16] Also, rising healthcare costs in developed countries perpetuate treatment disparities by making it difficult to access even in resource-constrained environments.

Socio-Economic Inequality:

Economic inequalities are important in affecting diabetes. There is evidence that poorer people are diagnosed later on due to financial barriers, at this point they present with severe side effects including neuropathy and retinopathy .[17] Furthermore, good foods and opportunities for exercise may be limited for the poor, leading to more recourse to high-calorie, low-nutrient diets that make glycaemic control worse.

Diabetes Management: Cultural and Behavioural Factors

Cultural beliefs and practices affect the diabetes management. For instance, in many communities, diabetes diagnosis is stigmatized, and patients are told to keep it a secret or to not seek medical care .[18] Other times, folk remedies take priority over scientific interventions and treatment is slacked off. Behavioural resistance (not taking medications and lifestyle changes prescribed) is another important factor, often caused by lack of knowledge about diabetes and complications.

Psychological Resilience:

Among the psychosocial issues, these include diabetes pain and depression, which are becoming more and more evident as major inhibitors of control. A meta-analysis revealed that depression affects diabetes care compliance in nearly one in three patients with T2D .[19] The absence of mental health services in healthcare systems makes these difficulties only worse, leading to a demand for diabetes and mental health care together.

Lack of policies and awareness:

Despite the world's burden of diabetes, policy actions are not in place everywhere. National diabetes programmes are either not available or poorly funded in many LMICs due to a lack of economic resources. Furthermore, most public health initiatives are not extended to rural and underserved communities where diabetes rates are on the rise .[20] There needs to be more effective pressure on to put diabetes care first and allocate resources more justly.

Successfully treating Type 2 Diabetes Mellitus means closing the access to healthcare loopholes at multiple levels, from socioeconomic inequities to stigma. Mental health care should be integrated, and more robust policy responses encouraged to address these barriers as well. Governments, health workers, and citizens need to collaborate in order to provide diabetes care that is both fair and sustainable.

Advances and Future Perspectives in Management:
Introduction

Diabetes currently has a broad range of treatment options; however each has their own complications, these can include side effects, application method, ease of access or associated costs. Development of treatments target reduction of diabetes incidence and reduce the implication of complications on quality of life [21]

Pharmacological advances:
GLP-1 receptor agonists

Glucagon-like peptide-1 (GLP-1) receptor agonists are a class of medications which treat type 2 diabetes by amplifying glucose-dependent insulin secretion, reducing glucagon secretion post-meal [22] Recent advancements focused on increasing compliance to the drug as well as ease of administration. Long-acting GLP-1 analogues, mainly semaglutide, are designed for once-weekly administration.[22] Their prolonged action is achieved through increased albumin affinity as well as stability against metabolic degradation .[22]

SGLT2 inhibitors

Sodium-glucose cotransported-2 inhibitors (SGLT2 inhibitors) block reabsorption of glucose in the kidneys, leading to increased glucose excretion via urine. This treats type 2 diabetes by lowering blood glucose independently of insulin .[23] Modern advancements have focused on improving cardiovascular and renal outcomes in patients who are prescribed SGLT2 inhibitors, where clinical trials demonstrated weight loss and reduced blood pressure .[24] Although SGLT2 inhibitors already provide renal and cardiovascular protection, maximising this and reducing side effects simultaneously enhances their therapeutic potential.[25]

Metformin

Metformin is the preferred first-line management of type 2 diabetes and treatment with it begun in 1957 [26] Metformin is plagued with side effects and constraints to metformin bioavailability, leading to its underutilisation .[27]

Fast-dissolving tablets provide an alternative route of administration for patients with difficulty swallowing, it allows for rapid disintegration and absorption of metformin in the mouth. To combat the low bioavailability of oral metformin, micro and nanoparticles were developed, allowing for enhanced metformin stability and bioavailability, this is essential

in allowing for its controlled and sustained release .[27]

Microneedles are another invention which aims to improve compliance to metformin treatment, providing a minimally invasive transdermal delivery and bypassing the gastrointestinal tract (GI), avoiding any common GI side effects .[27] All these delivery systems aim to increase compliance of metformin, whilst also enhancing the bioavailability of metformin, meaning an improved pharmacokinetic profile.

Technological innovations:

Continuous Glucose Monitoring (CGM)
CGM is a technology allowing for real-time monitoring of glucose in the interstitial fluid, it is done using a subcutaneous sensor which measures glucose levels every few minutes .[28] It initially set out to work co-operatively with insulin pumps in patients with type 1 diabetes, however, has developed over time to work in patients with type 2 diabetes. In patients with type 2 diabetes, CGM allows for better self-management and compliance to their treatment .[28] Clinical studies demonstrated that CGM was more effective than self-monitoring of blood glucose, where HbA1c levels (average blood sugar over the last two to three months) were reduced with CGM .[28]

Use of Artificial Intelligence in the Management of Type 2 Diabetes
Artificial Intelligence (AI) has a range of capabilities in improving management of type 2 diabetes. Even before onset, AI can be used to predict diabetes, enabling early intervention, important for public health .[29] AI driven tools can be a great asset for patients by adjusting medication dosages in real time based on CGM, further reducing risk of complications . Furthermore, AI can assist in managing modifiable risk factors, including diet and exercise plans, catering to individual needs .[29] In conclusion AI can have a great impact in improving patient outcomes, enhancing adherence to treatment protocols, as well as minimising overall costs.

Global initiatives and policy recommendations
The World Health Organisation (WHO) launched the Global Diabetes Compact aimed at reducing the risk of diabetes, whilst also ensuring unbiased, affordable and quality care across the world .[30] Its focus in integrating diabetes care into primary healthcare, utilising technologies such as CGM and promoting public health policies for the prevention of diabetes through lifestyle changes .[30] The initiative aims to utilising medical advancements and aims for collaboration with the hopeful outcome of a reduction in global diabetes burden.

NICE (National Institute for Health and Care Excellence) guidelines stress the requirement of personalised care plans based on individual preferences, comorbidities and risks from polypharmacy .[31] Their recommendation is a structured education which can be used worldwide, aiming for improved adherence and self-management .[31] These policies also promote the use of CGMs, and AI based tools to improve quality of care and reduce chances of long-term complications.

Discussion:

Key Findings and Interconnections
This paper has examined the multifaceted global challenge posed by type 2 diabetes mellitus (T2DM), highlighting critical aspects such as epidemiological trends, barriers to effective management, and recent advancements in treatment and prevention.

1. *Epidemiological Trends*: The global prevalence of T2DM has reached alarming levels, with over 540 million adults affected in 2021, a number projected to exceed 700 million by 2045 .[5] While high-income countries have seen stabilization in incidence rates due to improved public health measures, LMICs are witnessing rapid increases driven by urbanization, dietary transitions, and population aging .[32]

2. *Barriers to Management*: Key challenges include the socioeconomic burden of treatment, healthcare system inefficiencies, and patient-level barriers such as medication non-adherence and low health literacy .[33] These barriers are interconnected, creating a cycle of poor disease management and adverse outcomes, especially in resource-limited settings .[34]

3. *Advances in Management*: Innovations in pharmacological treatments, such as GLP-1 receptor agonists and SGLT2 inhibitors, have demonstrated efficacy in improving glycemic control and reducing cardiovascular risks .[35] Additionally, technological advancements like continuous glucose monitoring (CGM) systems and AI-driven tools are transforming diabetes management by enabling personalized care and early intervention .[36]

Implications for Public Health and Clinical Practice
The findings underscore several implications for public health and clinical practice:

- *Strengthening Policies*: Governments and policymakers must implement robust policies to address the root causes of T2DM, such as obesity and sedentary lifestyles. Policies should promote

healthy eating, physical activity, and urban planning conducive to wellness .[37]

- *Improving Healthcare Systems*: Investments in healthcare infrastructure, workforce training, and the availability of affordable medications are essential. Strengthening primary healthcare systems can enhance early diagnosis and long-term management .[38]

- *Fostering Community Engagement*: Public health campaigns tailored to local cultural contexts can improve health literacy, reduce stigma, and empower communities to adopt healthier lifestyles. Engaging community leaders and leveraging grassroots efforts are critical for sustainable impact .[6]

- *Adopting Integrated Care Models*: Coordinated care models that link primary, secondary, and tertiary care settings are needed to streamline patient management and improve outcomes. Incorporating digital tools into these models can enhance efficiency and accessibility .[36]

- *Equity in Care Delivery*: Addressing social determinants of health, such as poverty and education disparities, is crucial to reducing the disproportionate impact of T2DM on marginalized populations .[33]

Future Directions:

Future strategies should emphasize:

- *Innovative Research*: Further research into the genetic and environmental factors driving T2DM can inform targeted preventive measures and therapies .[32]

- *Sustainability*: Interventions must balance immediate needs with long-term goals, ensuring that programs remain adaptable and resource-efficient.[37]

- *Global Collaboration*: International initiatives, such as the WHO Global Diabetes Compact, provide a foundation for addressing T2DM collectively. Cooperation between governments, NGOs, and the private sector is essential for scaling solutions and ensuring equitable distribution (WHO, 2021).[37]

Conclusion:

The Urgent Need for Global Action

The escalating prevalence of T2DM underscores the need for coordinated, multi-sectoral action. Beyond beinga medical condition, T2DM is a socioeconomic issue that exacerbates health disparities and imposes a heavy burden on individuals and healthcare systems globally. The disproportionate impact on LMICs further highlights the need for targeted and equitable interventions.

Call to Action:

A unified response is required from healthcare professionals, policymakers, researchers, and community leaders:

1. *Healthcare Professionals*: Practitioners must integrate evidence-based approaches, such as personalized medicine and advanced technologies, into routine care. Patient education and empathetic communication are critical to fostering adherence and improving outcomes .[36]

2. *Policymakers*: Governments must prioritize diabetes prevention and management through public health initiatives, subsidies for essential medications, and the establishment of supportive healthcare infrastructure .[37]

3. *Researchers*: Continued exploration of the genetic, metabolic, and environmental underpinnings of T2DM is vital. Interdisciplinary research can bridge biomedical advances with social and behavioral insights .[32]

4. *Community Leaders*: Local leaders and organizations must spearhead initiatives to address cultural and societal barriers, promoting awareness and early intervention in vulnerable populations .[4]

Building Sustainable Solutions:

To ensure long-term success, interventions must:

1. Focus on prevention, addressing root causes such as obesity and inactivity.

2. Be adaptable to demographic and cultural changes.

3. Leverage global frameworks like the WHO Global Diabetes Compact to foster international cooperation .[37]

Final Thoughts:

The rising tide of T2DM demands immediate, comprehensive action. Advances in science, technology, and policy offer a roadmap for tackling this epidemic. By embracing equity and sustainability, the global community can mitigate the impact of T2DM, improve quality of life for millions, and build resilient healthcare systems for future challenges. The time to act is now.

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References:

1. Nathan, D. M., Meigs, J. and Singer, D. E. 'The epidemiology of cardiovascular disease in type 2 diabetes mellitus: how sweet it is … or is it?', *The Lancet (British edition)*, 1997,350(1), pp. S4–S9. doi: 10.1016/ S0140-6736(97)90021-0.

2. Zimmet, P. Z.,'Diabetes and its drivers: The largest epidemic in human history?', *Clinical Diabetes and Endocrinology*,2017, 3(1), pp. 1–1. doi: 10.1186/s40842 -016-0039-3.

3. Papatheodorou, K. et al. (2018) 'Complications of Diabetes 2017', *Journal of Diabetes Research*, 2018, pp. 3086167–4. doi: 10.1155/2018/3086167.

4. International Diabetes Federation (2021) Diabetes now affects one in 10 adults worldwide. Available at: https:/ /www.idf.org (Accessed: 3 December 2024).

5. World Health Organization , Urgent action needed as global diabetes cases increase four-fold over past decades, 2024. Available at: https://www.who.int (Accessed: 3 December 2024).

6. International Diabetes Federation, Diabetes now affects one in 10 adults worldwide, 2021. Available at: https:/ /www.idf.org (Accessed: 3 December 2024).

7. Institute for Health Metrics and Evaluation , Global diabetes cases to soar from 529 million to 1.3 billion by 2050, 2023. Available at: https://www.healthdata. org (Accessed: 3 December 2024)

8. Hossain MJ, Al-Mamun M, Islam MR. Diabetes mellitus, the fastest growing global public health concern: Early detection should be focused. Health Sci Rep. 2024 Mar 22;7(3):e2004. doi: 10.1002/hsr2.2004. PMID: 38524769; PMCID: PMC10958528.

9. Han Cho N, Forouhi N, Guariguata L, Hambleton I, Li R, Majeed A, et al. (2015) *IDF Diabetes Atlas - Seventh Edition*. Retrieved from: www.diabetesatlas.org (Accessed 03 December 2024).

10. Karachaliou, F., Simatos, G. and Simatou, A. (2020) 'The challenges in the development of diabetes prevention and care models in low-income settings', *Frontiers in Endocrinology*, 11. doi:10.3389/fendo. 2020.00518.

11. Seiglie, J.A. et al. 'Diabetes prevalence and its relationship with education, wealth, and BMI in 29 low- and middle-income countries', *Diabetes Care*, 43(4),2020, pp. 767–775. doi:10.2337/dc19-1782.

12. Pham, T.M. et al. 'Ethnic differences in the prevalence of type 2 diabetes diagnoses in the UK: Cross-sectional analysis of the Health Improvement Network Primary Care Database', *Clinical Epidemiology*, 2019,Volume 11, pp. 1081–1088. doi:10.2147/clep.s227621.

13. Ali, O., 'Genetics of type 2 diabetes', *World Journal of Diabetes*, 2013,4(4), p. 114. doi:10.4239/wjd.v4.i4.114.

14. Shirinzadeh, M. et al. , The effect of community-based programs on diabetes prevention in low- and middle-income countries: A systematic review and meta-analysis. *Globalization and Health*, BioMed Central, 2019. Available at: https://doi.org/10.1186/s12992-019-0451-4 (Accessed: 03 December 2024).

15. Bradley, D. , 'Type 2 diabetes in the elderly: Challenges in a unique patient population', *Journal of Geriatric Medicine and Gerontology*, 2016,2(2). doi:10.23937/ 2469-5858/1510014.

16. International Diabetes Federation . *IDF Diabetes Atlas (9th ed.).* International Diabetes Federation , 2019. https://diabetesatlas.org/atlas/ninth-edition/

17. 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., 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*,2019, 157, 107843. https://doi.org/ 10.1016/j.diabres.2019.107843.

18. Shaw, J. E., Sicree, R. A., & Zimmet, P. Z., Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, 2010, 87(1), 4–14. https://doi.org/10.1016/j.diabres. 2009.10.007.

19. Ali, S., Stone, M. A., Peters, J. L., Davies, M. J., & Khunti, K. , The prevalence of co-morbid depression in adults with Type 2 diabetes: A systematic review and meta-analysis. *Diabetic Medicine*,2006 23(11), 1165– 1173. https://doi.org/10.1111/j.1464-5491.2006. 01943.x

20. World Health Organization, *Global report on diabetes.* World Health Organization, 2016. https:// www.who.int/publications/i/item/9789241565257.

21. Galindo RJ, Trujillo JM, Low Wang CC, McCoy RG. Advances in the management of type 2 diabetes in adults. BMJ Med. 2023 Sep 4;2(1):e000372. doi: 10.1136/bmjmed-2022-000372. PMID: 37680340; PMCID: PMC10481754.

22. Lau J, Bloch P, Schäffer L, Pettersson I, Spetzler J, Kofoed J, Madsen K, Knudsen LB, McGuire J, Steensgaard DB, Strauss HM, Gram DX, Knudsen SM, Nielsen FS, Thygesen P, Reedtz-Runge S, Kruse T. Discovery of the Once-Weekly Glucagon-Like Peptide-1 (GLP-1) Analogue Semaglutide. J Med Chem. 2015 Sep 24;58(18):7370-80. doi: 10.1021/acs. jmedchem.5b00726. Epub 2015 Sep 11. PMID: 26308095.

23. Wang, K.L., Liu, C.J., Chao, T.F., et al., Risk of New-Onset Diabetes Mellitus versus Reduction in Cardiovascular Events with Statin Therapy. The American Journal of Cardiology,2014, 113, 631-636. ps://doi.org/10.1016/j.amjcard.2013.10.043.