Review Article

Patient-Related Factors Affecting Type 2 Diabetes Medication Non-Adherence: An In-depth Examination of BMI, Knowledge Levels, Treatment Concerns, and Self-Efficacy

Abstract

The goal of this research is to investigate what aspects of care for patients with type 2 diabetes affect their ability to take their medications as prescribed. In particular, the study looks at how factors like BMI, disease knowledge, treatment worries, and self-efficacy are linked to non-adherence. The results are presented, with emphasis on how including these elements into treatment plans can boost patients' likelihood of taking their medications as prescribed and, ultimately, their health.

Keywords: Patient-related factors, Type 2 Diabetes, Medication Non-adherence

Introduction

Patients with type 2 diabetes (T2D) need to be actively involved in their care for the long haul and commit to making permanent changes to their diet and exercise routine (American Diabetes Association, 2020). However, multiple studies have shown that medication non-adherence among people with T2D is still a widespread and major problem, contributing to negative health outcomes and higher healthcare costs (Polonsky & Henry, 2016).“Non-adherence is frequently a hidden problem, undisclosed by patients and unrecognized by prescribers”(Singh et al., 2015).While many variables contribute to this issue, this paper focuses on the role of specific patient-related factors in medication non-adherence: high body mass index (BMI), deficient knowledge about the disease, low levels of concerns towards treatment, and diminished self-efficacy(Abate, 2019; Almadhoun & Alagha, 2018; Wabe et al., 2011; Yusuff et al., 2008).

Medication adherence is pivotal in controlling T2D, as it has been positively linked to improved glycaemic control, lower diabetes-related complications, and improved quality of life (American Diabetes Association, 2020). However, the World Health Organization (WHO) reports that, approximately 50% of patients with chronic illnesses in developed countries do not take their medications as prescribed(Sabate, 2003). Among people with T2D, this rate is even higher, ranging from 38% to 93%, based on the measure of adherence and population studied (Cramer, 2004). Therefore, addressing medication non-adherence becomes a critical area of focus for healthcare providers and policymakers to improve health outcomes and contain costs.

Non-adherence is a multi-dimensional phenomenon influenced by myriad factors. The WHO outlines five dimensions of adherence: socio-economic factors, healthcare team and system-related factors, condition-related factors, therapy-related factors, and patient-related factors (Sabate, 2003). While all are essential, the current paper delves into patient-related factors, identified as crucial determinants of medication non-adherence.

Patient-related factors encompass a broad spectrum of individual characteristics, beliefs, behaviours, and attitudes that can significantly impact medication adherence(Hall & Heath, 2021). By delving into these factors, healthcare providers and policymakers can develop a better understanding of the underlying mechanisms and tailor interventions to enhance adherence rates.

One critical patient-related factor influencing medication non-adherence is socio-economic status(Azharuddin et al., 2021). Factors such as income level, education, and access to healthcare resources can shape a patient's ability to adhere to their medication regimen. Individuals from disadvantaged socio-economic backgrounds may encounter financial restrictions that impede their ability to afford medications or transportation to healthcare facilities (Sabate, 2003). Furthermore, limited education might contribute to a lack of awareness about the importance of medication adherence or obstruct the comprehension of complex treatment regimens (Aminde et al., 2019; Rätsep et al., 2007; van Netten et al., 2019). Comprehending the impact of socio-economic factors is essential for implementing interventions to address financial barriers and provide educational support, thereby improving medication adherence among disadvantaged individuals.

Healthcare team and system-related factors also contribute significantly to patient adherence(Hall & Heath, 2021). The quality of the patient-provider relationship, effective communication, and access to healthcare services can substantially influence medication adherence(Kvarnström et al., 2021). Patients are more likely to adhere to their prescribed medications when they feel supported, heard, and trust their healthcare providers (Kvarnström et al., 2021). However, barriers such as limited access to healthcare facilities or extended waiting times can discourage patients from seeking regular care, leading to non-adherence (Sabate, 2003). Acknowledging the importance of healthcare team and system-related factors underlines the need for patient-centric care models, enhanced provider-patient communication, and improved accessibility to healthcare services to foster medication adherence.

Condition-related factors, including the nature and severity of the illness, can also impact medication adherence(Chew et al., 2015; Sharma, 2023). Patients with type 2 diabetes may experience symptom fluctuations or asymptomatic periods, which can alter their perceived necessity for medication. Additionally, the presence of comorbidities or complications related to the primary condition can further complicate medication regimens and contribute to non-adherence (Chew et al., 2015). Understanding specific condition-related factors that influence adherence allows healthcare providers to tailor interventions to address patient concerns, provide additional support during challenging periods, and simplify treatment regimens when possible.

Therapy-related factors such as the complexity of the medication regimen, side effects, and perceived efficacy of treatment, can significantly impact adherence(Chew et al., 2015). Patients may struggle to consistently adhere to their medication regimen if they have complex dosing schedules or a high pill burden (Lauffenburger et al., 2021). The onset of side effects can also negatively influence adherence, as patients may discontinue medication due to discomfort or worries about potential harm (Sabate, 2003). In their study,Lauffenburger et al. (2021), identified six key themes, four of which were identified as follows: (1) Taking

medication is seen as a very bothersome task (things patients have a hard time keeping in their minds); (2) unfavourable repercussions due to perceived discomfort or illness; (3) Prescribed pharmaceutical regimens often diverge significantly from actual medication regimens, and (4) Medications' physical characteristics (particularly their size and visual similarity to one another) may have a role in patients' failure to take their prescribed doses. Moreover, if patients donot perceive their treatment as effective or fail to understand its benefits, they may be less inclined to stick to the prescribed regimen(Abdullah et al., 2022). Recognizing these therapy-related factors underscores the importance of simplifying treatment regimens, proactively addressing side effects, and educating patients about the positive impacts of adherence on their health outcomes.

By understanding socio-economic, healthcare team and system-related, condition-related, and therapy-related factors that impact patient adherence, healthcare providers and policymakers can create targeted interventions to improve medication adherence rates. Addressing patient-related factors is paramount for fostering patient empowerment, enhancing communication, providing education and support, and tailoring treatment regimens to improve medication adherence in individuals with type 2 diabetes(Świątoniowska et al., 2019).

We focused this study on the patient-related factorsguided by the fundamental premise that, better understanding these factors can foster personalized,patient-centered interventions. Specifically, it investigates the relationships between high BMI, poor disease knowledge, low levels of treatment concerns, and reduced self-efficacy and their impacts on medication adherence in T2D (Abate, 2019; Almadhoun & Alagha, 2018; Wabe et al., 2011; Yusuff et al., 2008). These factors were chosen due to their prevalence among patients with T2D and the potential for modifications through targeted interventions.

Body Mass Index and Medication Non-Adherence

Body Mass Index (BMI), a measure of an individual's weight relative to their height, has been recognized as a significant factor in the development and management of type 2 diabetes.Kassahun et al. (2016), identified a direct correlation between high BMI and the onset of type 2 diabetes, aligning with broader research emphasizing the role of obesity in diabetes risk(Hu, 2011). Further to this, an intriguing relationship has been noted between BMI and medication adherence in patients with type 2 diabetes, presenting a complex dynamic worth investigating.

The relationship between elevated Body Mass Index (BMI) and medication non-adherence embodies a complex interplay of physiological, psychological, and societal aspects, each with a substantial influence on treatment compliance in patients with type 2 diabetes. Physiologically, the trilogy of obesity, insulin resistance, and type 2 diabetes presents a therapeutic challenge.

Obesity, evidenced by a high BMI, instigates a cascade of physiological changes, including the development of insulin resistance, which in turn significantly increases the risk for type 2 diabetes (Kahn et al., 2006; Yaribeygi et al., 2021). Furthermore, the dysregulation of glucose metabolism that accompanies a high BMI often necessitates an intensified and more complicated therapeutic regimen. For instance, patients with higher BMIs often require

multiple medications for glycemic control, along with other medications to manage associated comorbidities such as hypertension and hyperlipidemia (American Diabetes Association, 2020).

Patients with high body mass index and type 2 diabetes frequently experience the burden of polypharmacy, defined as the need for many drugs to control the patient's condition. Patients may get overwhelmed by this therapeutic complexity, which raises the possibility of medication errors, lowers the probability of drug adherence, and may have an effect on clinical outcomes (Marcum et al., 2013). Some people may not take their prescriptions as prescribed because they are afraid of the negative effects or because they find it physically impossible to manage various regimens.

In addition to the foregoing, psychological variables further complicate the delicate relationship between Body Mass Index (BMI) and medication adherence. These characteristics, which are frequently associated with a high BMI, can significantly affect both a person's ability and motivation to adhere to their prescribed medication schedule. Low self-esteem and unpleasant emotions like guilt and shame are common outcomes of having a body mass index (BMI) that is too high. Personal and cultural beliefs about one's weight and health can give birth to these emotions, which are typically exacerbated by prevalent societal norms that stigmatise obesity (Puhl & Heuer, 2010). The patient's self-efficacy, or the confidence they have in their own ability to engage in the behaviours essential to effectively manage their health, may suffer as a result of this negative emotional state (Bandura, 1977). Patients may be less likely to take their medications as prescribed if they have low self-efficacy and donot believe they can successfully control their ailment (Sokol et al., 2005).

Weight-related stigma and societal attitudes towards obesity compound these psychological difficulties, potentially leading to psychosocial stress and depressive symptoms(Ratcliffe & Ellison, 2015). Negative societal views towards obesity can engender discrimination, alienation, and social exclusion, exacerbating psychosocial stress (Puhl & Heuer, 2010). These psychosocial factors are important to consider as both stress and depression have been associated with medication non-adherence (Alzahrani et al., 2019; Gonzalez et al., 2008; Vieira & Santos, 2020). Patients dealing with these psychological strains may find it more challenging to stay consistent with their medication regimen, either due to a lack of motivation, forgetfulness, or a sense of hopelessness(Pettersen et al., 2018).

Additionally, societal stigma towards high BMI and obesity can insidiously infiltrate healthcare settings, culminating in implicit biases among healthcare providers. This may inadvertently impinge on the therapeutic alliance and the communication between healthcare providers and patients, ultimately bearing an impact on medication adherence (Phelan et al., 2015). The biases held by healthcare professionals may manifest as differential treatment, reduced empathy, and inadequate time spent in patient consultations, which can make patients feel marginalized and demotivated, further compromising medication adherence(Gudzune et al., 2013; Puhl et al., 2014).

Moreover, such stigma and bias can disrupt open and effective patient-provider communication, a key factor in promoting medication adherence(Zolnierek & DiMatteo, 2009). When patients feel judged or misunderstood due to their high BMI, they may be less likely to discuss their concerns about medication or potential challenges in adhering to treatment regimens. This dynamic underscore the necessity for bias training and interventions

among healthcare providers to promote a non-judgmental and supportive environment for patients regardless of their BMI (Puhl et al., 2016).

Given the complex interplay and interrelatedness of these physiological, psychological, and societal factors, addressing medication non-adherence in this patient population calls for comprehensive and holistic approaches. These strategies should extend beyond simply imparting knowledge about disease and medication to include tackling the pervasive issue of weight bias in healthcare, promoting empathetic and patient-centered communication, and providing psychological support and practical tools to enhance self-efficacy in medication management(Heisler et al., 2002).

In essence, enhancing medication adherence among patients with type 2 diabetes and high BMI requires healthcare systems and providers to acknowledge and address the intricate web of factors that contribute to non-adherence. Future research and interventions should consider this multi-layered issue from a systemic perspective, ensuring that efforts to promote adherence are sensitive to the unique experiences and challenges faced by this patient population(Caperon et al., 2019).

Knowledge Levels and Medication Non-Adherence

In type 2 diabetes, the degree to which patients comprehend the disease notably impacts health outcomes(Marciano et al., 2019). Indeed, adherence to medication, a crucial factor in disease management, has been unequivocally associated with patients' level of disease knowledge. Comprehensive studies have indicated that a poorer understanding of type 2 diabetes often corresponds to lower adherence to medication when compared with those who have a more robust comprehension of the disease(Ali et al., 2017; Almadhoun & Alagha, 2018; Kassahun et al., 2016; Venkatesan et al., 2018; Wabe et al., 2011).

Within the extensive context of chronic ailments, such as type 2 diabetes, patient comprehension of their individual conditions holds substantial implications for their eventual health outcomes. Central to the management of such diseases, patient adherence to prescribed medication routines stands as an important determinant and is intimately influenced by their degree of awareness regarding their condition(Neto et al., 2019). A wealth of thorough investigations had indicated an inverse correlation between the understanding of type 2 diabetes and medication adherence. Specifically, those patients with a more limited understanding of type 2 diabetes typically exhibit lower medication adherence in comparison to their counterparts who maintain a more profound grasp of the disease (Ali et al., 2017; Almadhoun & Alagha, 2018; Kassahun et al., 2016; Venkatesan et al., 2018; Wabe et al., 2011).

The process of comprehending a disease surpasses mere information accumulation. It necessitates a holistic consciousness and interpretation of the condition, its implications, the importance of steadfast adherence to treatment routines, and the potential ramifications of non-adherence. There is a consistent affirmation in research that the extent of disease knowledge significantly influences patient behaviour, inclusive of adherence to recommended medication(Al-Qazaz et al., 2011; Inzucchi et al., 2014). This connection bears particular weight in the case of type 2 diabetes, a condition mandating long-term adherence to medication for optimal health outcomes (Strain et al., 2014).

BothAli et al. (2017) andKassahun et al. (2016), uncovered a direct relationship between the level of patient understanding of type 2 diabetes and medication adherence. Those patients with a more enhanced understanding of their condition were more likely to adhere to their medication routines, underscoring the importance of disease knowledge in medication adherence. This sentiment was echoed by(Almadhoun & Alagha, 2018), highlighting that enhanced patient education about the disease correlated with improved medication adherence. Such findings affirm the hypothesis that an individual's grasp of their illness critically determines their capacity and readiness to effectively manage it. This encompasses not merely the knowledge of the disease's pathology, but also the implications of uncontrolled glucose levels, the potential risks of complications, and the crucial role of medication in the disease's management (Sarkar et al., 2006).

However, the mere possession of knowledge does not ensure adherence. Venkatesan et al. (2018), asserted that, while knowledge about diabetes is paramount, the practical application of this knowledge holds equal significance for medication adherence. Comprehending the need for the medication, its modus operandi, associated side effects, and the potential outcomes of non-compliance with the prescribed regimen is central to adherence(Foley et al., 2021; Martin et al., 2005). Those patients who appreciate the full scope of their treatment routines tend to demonstrate higher adherence levels, reiterating the importance of disease knowledge in the management of type 2 diabetes. However, in Yap et al. (2015), that was found not to be the case.

In addition, Wabe et al. (2011),underscored that, a comprehensive understanding of the condition can fortify self-efficacy, the belief in one's ability to effectively manage their condition. This amplified self-efficacy subsequently augments medication adherence. Consequently, enhancing disease knowledge can impact medication adherence directly, and indirectly by promoting enhanced self-efficacy(A. M. H. Chen et al., 2014).

Responding to these findings necessitates a multi-dimensional approach on the part of healthcare providers. It is critical to prioritize the enhancement of disease knowledge among patients, factoring in their cultural, linguistic, and educational backgrounds to deliver information that is both comprehensible and practically applicable (Chew et al., 2018). It demands dynamic communication, patient-centric education strategies, and consistent support to aid patients in better comprehending their disease, thus fostering improved medication adherence.

Inadequate disease knowledge could result in patients underestimating the gravity of their condition or the necessity for consistent medication adherence. Moreover, limited health literacy may hinder a patient's ability to grasp intricate medication schedules, consequently leading to less-than-ideal adherence(Bailey et al., 2014). This issue becomes more complex when patients suffer from multiple comorbidities, each demanding different treatment.

The elucidations presented herein underscore the supreme relevance of patient education in the management of diseases. By enhancing patient understanding of type 2 diabetes and incorporating a comprehensive understanding of the disease's nature and treatment methodologies, healthcare providers can efficaciously equip patients to manage their conditions more effectively. This, in turn, bolsters medication adherence and subsequently

contributes to improved health outcomes(Krass et al., 2015). The benefits of patient education span beyond mere acquisition of knowledge, it includes fostering self-efficacy, instilling confidence, and promoting patient autonomy, all of which hold critical importance in the successful management of chronic ailments(A. M. H. Chen et al., 2014; Sarkar et al., 2006).

An exemplary testament to the success of education interventions is the implementation of organized diabetes education programmes. These programmes have demonstrated efficacy in enhancing glucose control, a primary objective in the management of type 2 diabetes(Deakin et al., 2005). Such organized educational interventions typically consist of sessions overseen by healthcare professionals, who impart crucial information about diet, exercise, medication, and other pivotal aspects of diabetes care. These programmes may be administered either individually or in group settings, with both formats showcasing effectiveness.

However, the potential of education in bolstering medication adherence is not confined to structured education programmes. Other interventions that concentrate on health literacy, including clear health communication and easy-to-understand health materials, have also shown promise(Osborn et al., 2009). For instance, the 'Teach-Back' method, where patients communicate their understanding of medical instructions back to the healthcare provider, ensures that patients fully comprehend the information shared, thereby loweringmedicationnon-adherence(Ha Dinh et al., 2016).

Furthermore, technology has introduced new horizons for patient education(Howard et al., 2021; Rosen et al., 2021). Digital health tools, encompassing mobile applications and telehealth services, present innovative avenues for delivering diabetes education(Senbekov et al., 2020). These tools can provide patients with continual access to dependable information, personalized health feedback, and support for disease management (Holmen et al., 2014). Owing to its adaptability and its potential for substantial impact on health outcomes, knowledge emerges as an enticing target for interventions aimed at enhancing medication adherence. Accordingly, future investigations and health policies should maintain their focus on developing and accessing innovative, effective, and scalable educational interventions. The goal is to augment disease knowledge and ultimately medication adherence among individuals with type 2 diabetes.

The compelling evidence provided by the above research findings clearly underscores the paramount importance of patient knowledge in the domain of healthcare. This leads us to an imperative and timely conclusion that, there is an urgent need for more effective patient education initiatives to enhance medication adherence. Such initiatives have the potential to improve patients' understanding of their disease, the associated treatment plan, and the vital role that adherence plays in the effective management of their condition.

One potential method of delivering this education is through regularly scheduled follow-up meetings between healthcare providers and patients. These meetings offer the chance for an ongoing, iterative education process, allowing for information reinforcement and the resolution of any misunderstandings or misconceptions about the disease or its treatment (Bosworth, 2010). In the context of chronic diseases such as type 2 diabetes, such meetings can provide crucial opportunities to review and adjust treatment plans as necessary, further fostering patient adherence.

Another promising approach lies in the use of visual aids to supplement verbal instructions(Abed et al., 2014; Wolff et al., 2009). By presenting complex medical information in a graphical or pictorial format, healthcare providers can significantly improve patient understanding and recall(Houts et al., 2006). For instance, infographics depicting how medication works in the body, the consequences of non-adherence, or the progression of a disease can facilitate patient comprehension, engagement, and consequently, adherence (Katz et al., 2006).

Moreover, the employment of simple, straightforward language cannot be overemphasized. Health literacy, the ability to understand health information and make appropriate health decisions, is a significant issue in patient care (Berkman et al., 2011). Therefore, it is vital that healthcare providers communicate in a language and style that their patients can understand, avoiding complex medical jargon where possible, and ensuring that instructions are clear and unambiguous. The above approaches would go a long way should healthcare personnel consider the patient’s unique circumstances tailoring instruction to the person's specific knowledge gaps and strengths(Castro et al., 2016; Leplege et al., 2007).

It is therefore imperative that healthcare professionals perceive each patient as an individual, uniquely positioned within a specific sociocultural, economic, and psychological context. Tailoring instructions to address the patient's distinct knowledge gaps and strengths emerges as an effective method to manage the inherent heterogeneity in the patient demography(Epstein & Street, 2011). Such a personalized strategy facilitates the recognition of individual patient capabilities and predilections, thereby rendering the education process more interactive, pertinent, and efficacious.

Specifically crucial is the extension of additional support for patients grappling with low literacy or health literacy levels. These individuals frequently encounter formidable obstacles in comprehending, deciphering, and applying health-related information (Berkman et al., 2011). By acknowledging this impediment and modifying their approach accordingly, healthcare professionals can enhance their support for these patients in managing their disease. This might encompass the employment of simple language, visual aids, teach-back methods, and other strategies crafted to boost comprehension and foster retention of critical information(Cavanaugh et al., 2009; Katz et al., 2006).

Addressing prevalent myths and misconceptions about diabetes and its management constitutes another crucial aspect of this individualized strategy. Misinformation can significantly obstruct patient adherence, leading to erroneous beliefs about the disease, its treatment, and the ramifications of non-adherence (Al Sayah et al., 2015). Consequently, a key component of patient education should involve the identification and correction of these misconceptions. This will not only enhance patients' understanding of their condition but also engender a sense of confidence in their ability to manage it, potentially boosting adherence rates(Al Sayah et al., 2015).

In sum, the integration of individualized, patient-centered education strategies bears significant potential in fostering medication adherence and augmenting the management of type 2 diabetes(Siddharthan et al., 2016). These methods necessitate a profound understanding of each patient's unique context and the challenges they confront, highlighting the requirement for healthcare providers to remain attuned to their patients' specific needs and preferences.

Treatment Concerns and Medication Non-Adherence

The extent of a patient's concern regarding their medication treatment emerges as a pivotal factor considerably impacting adherence in the context of type 2 diabetes management(Mahan & Mahammad, 2022). Despite often being disregarded or underappreciated in clinical settings, the degree of concern a patient harbours about their medication regimen profoundly affects their motivation to adhere to prescribed treatments(Mostafavi et al., 2021). Two separate studies have underscored the correlation between diminished concern about diabetes medication and non-adherence, emphasising the necessity to address this determinant in fostering adherence (Abate, 2019; Almadhoun & Alagha, 2018).

Patients' concernsregarding their medication treatment mirror their perceptions, beliefs, and attitudes towards the efficacy, necessity, and potential risks linked with prescribed medications(Winkley et al., 2020; Zelikovsky & Nelson, 2021). In instances where patients demonstrate low levels of concern, they might underestimate the significance of medication adherence or trivialise the potential repercussions of non-adherence. Such a mindset can give rise to a casual attitude towards adhering to their prescribed regimens, culminating in inconsistent medication-taking behaviours(Wei et al., 2017).

The investigation conducted by Abate (2019), probed the association between treatment apprehensions and medication adherence among patients with type 2 diabetes. The study unveiled that, patients demonstrating lower degrees of concern were more prone to display non-adherent behaviours. Such patients might regard their medication as less crucial to their overall health or have doubts about its efficacy. Consequently, they may be less driven to adhere to the prescribed regimen, resulting in poor treatment outcomes.

In a similar vein, Almadhoun and Alagha (2018), scrutinised the effect of concerns pertaining to diabetes medication on adherence among patients with type 2 diabetes. Their research illustrated a significant connection between low concern about medication and non-adherence. Patients manifesting reduced concerns might hold reservations or uncertainties about their treatment's necessity or fear potential side effects. Such misgivings can obstruct their commitment to consistent medication use, hampering their capacity to achieve optimal glycaemic control and manage their condition effectively.

Within a broader perspective, these findings imply that patients who underestimate the severity of their condition may concurrently undervalue the necessity of rigorously adhering to their medication schedule. Moreover, a lack of concern about the medication treatment may reflect a more significant issue: an overall deficient understanding of the disease and the critical role medication plays in its management(García-Pérez et al., 2013).

Patients afflicted with type 2 diabetes might disregard the potential advantages of medication due to various perceived impediments that obstruct their adherence. These impediments has to do with worries about side effects, the intricacy of the medication regimen, and societal stigma attached to consuming medications for diabetes(Polonsky & Henry, 2016). Conversely, patients might also underappreciate the potential consequences of non-adherence, failing to acknowledge the damaging impacts it can inflict on their health and well-being.

A prevalent impediment to medication adherence is the apprehension of encountering side effects(Medi et al., 2015). Patients might fear adverse reactions or discomfort that could stem from consuming their prescribed medications. Such concerns can incite hesitation or evasion of the medication regimen, as patients juxtapose the potential risks against the perceived benefits. However, it is vital to highlight that healthcare providers can address these concerns by offering accurate information about potential side effects and reassuring patients that adverse reactions can be controlled or mitigated.

The complexity associated with the medication regimen represents another impediment that can foster non-adherence(Alves-Conceição et al., 2018). Patients might find it tasking to adhere to a schedule that mandates multiple medications or specific timing requirements. They may grapple to remember which medications to consume and when, culminating in inconsistent adherence. This complexity can be particularly daunting for patients grappling with other daily responsibilities or cognitive impairments(Jude et al., 2022). To counter this impediment, healthcare providers can simplify medication regimens, provide explicit instructions, and employ reminder tools or technology to assist patients in adhering to their prescribed regimen.

Societal stigma can also influence patients' attitudes towards medication adherence(Jaam et al., 2018). Some individuals might view consuming medications for diabetes as a testament to weakness or failure, triggering feelings of embarrassment or shame(Brunton, 2022). This stigma can erect a barrier to adherence, as patients may exhibit reluctance to openly discuss their medication use or seek support. Healthcare providers should foster a non-judgmental and supportive atmosphere, wherein patients feel at ease discussing their concerns and addressing any stigmatizing beliefs. Educating patients about the common misconceptions surrounding diabetes and its treatment can help assuage stigma and champion adherence.

Conversely, patients might fail to fully comprehend the potential ramifications of non-adherence to their medication regimen. Poor glycaemic control, an augmented risk of diabetes-related complications, and a heightened likelihood of hospital admissions are among the potential repercussions (Cramer, 2004). When patients do not grasp the grave implications of non-adherence, they might prioritize short-term convenience or immediate desires over the long-term benefits of medication adherence. Healthcare providers play an integral role in educating patients about the connection between adherence and health outcomes, underlining the importance of consistent medication use in managing diabetes effectively.

Addressing the above challenges necessitate a comprehensive approach. Healthcare providers should aim not only to improve patient education about the disease and its management, as previously discussed, but also heighten awareness about the importance of medication adherence and the consequences of non-adherence. In a practical setting, this could involve clarifying to patients the correlation between medication adherence and long-term health outcomes, openly addressing patients' concerns or misconceptions about medication, and assuring them of the benefits and safety of the medication(Osterberg & Blaschke, 2005).

Moreover, the emphasis on developing a patient-centred approach to care, as indicated earlier, is particularly pertinent when considering patients' levels of concern about diabetes medication treatment. Actively seeking and addressing patients' concerns not only enhances adherence but also plays a crucial role in tackling non-adherence. By involving patients in decision-making about their treatment and addressing their concerns, healthcare providers

can increase patients' sense of control and commitment to the treatment plan, thereby improving medication adherence(Heisler et al., 2002). Therefore, to effectively address non-adherence, it becomes essential to enhance patient education, address misconceptions, and promote a patient-centered approach to care.

Self-Efficacy and Medication Non-Adherence

In health behaviours theory, self-efficacy stands as a core construct in understanding and predicting behaviour change(McDowell, 2023; Murray, 2019). Rooted in Bandura's Social Cognitive Theory, self-efficacy refers to an individual's belief in their capacity to execute behaviours necessary to attain certain goals(Bandura, 1977). In the context of type 2 diabetes, this refers to a patient's belief in their ability to effectively carry out the behaviours needed to manage their disease, such as adhering to a medication regimen, maintaining a balanced diet, or engaging in regular physical activity.

Building on the crucial insights gleaned from the studies conducted byWabe et al. (2011) and Yusuff et al. (2008), the association between low self-efficacy and medication non-adherence elucidates an integral facet of managing chronic conditions like type 2 diabetes. The psychological concept of self-efficacy, which can be defined as "the idea that one has the ability to do the actions that will lead to a desired outcome" (Bandura, 1977), is crucial in the adoption and maintenance of healthy practises. Some patients may have second thoughts about their ability due to their impressions of their own inadequacy or the complexity of required healthcare procedures. The failure to stick to medication schedules is often the direct result of this doubt, which emerges as low self-efficacy. When it comes to chronic diseases, where regular medication adherence is crucial for maintenance and control, this kind of discord can have devastating effects (Conn et al., 2009).

This feeling of inadequacy is not limited to just medicationadherence but can affect other areas of disease management as well. Changes in nutrition, exercise, and glucose monitoring may all play a role, as all three are crucial to managing diabetes well (Aljasem et al., 2001; Forouhi et al., 2018). As a result, one's self-efficacy can have far-reaching consequences and dramatically affect how they approach disease management generally.In the study by Sokol et al. (2005),they showed how serious and negative the results might be when patients donot follow their treatment plans. Their findings support the idea that treatment compliance has a direct impact on patient outcomes, such as blood sugar control, hospitalisation rates, and overall healthcare expenditures.There may be a vicious loop if the relationship between self-efficacy and medication adherence is considered.Inadequate glucose control, stemming from medication non-compliance, may further erode a patient's self-confidence and capacity to managediabetes. This compromised self-efficacy could, subsequently, deter medication adherence even further, thereby exacerbating their health status(Gherman et al., 2011).

The research study conducted by Gherman et al. (2011), underscores an important phenomenon at the interface of self-efficacy and medication adherence in the context of type 2 diabetes management. This work elucidates the potential for a self-perpetuating cycle where inadequate glucose control, resulting from non-adherence to medication, could further undermine a patient's confidence in his/her ability to manage diabetes effectively. This diminished self-efficacy, in turn, can act as a barrier to medication adherence, thereby exacerbating the individual's health condition and potentially leading to a deterioration in health status.

This cycle, which can be termed as the vicious cycle of self-efficacy and non-adherence, highlights a complex interaction between psychological and behavioural aspects of disease management(Doyle et al., 2021). On the one hand, self-efficacy drives behaviour, in this case, medication adherence. On the other hand, the consequences of that behaviour, represented by glucose control, in turn, affect the individual's self-efficacy (Bandura, 1977).This occurrence can be explained by Bandura's social cognitive theory, which views self-efficacy as a critical element in determining health-related behaviours (Bandura, 1977). This theory proposes that self-efficacy promotes health behaviours in multiple ways, including through effects on intentions, anticipated outcomes, and anticipated obstacles and enablers. In the context of diabetes, this means that those with higher levels of self-efficacy are more likely to take their medications as prescribed. Conversely, low self-efficacy could lead to non-adherence and poor glucose control, thereby reinforcing the patient's doubts about their ability to manage their condition and perpetuating the vicious cycle.

The implication offindings by Bandura (1977) and Gherman et al. (2011), therefore, is that, interventions aimed at enhancing self-efficacy can play a pivotal role in breaking this vicious cycle and improve health outcomes.This could be achieved by employing various strategies such as patient education, goal setting, problem-solving training, and providing social and emotional support.A holistic strategy is, thus, required to address self-efficacy in diabetes treatment. First, it is incumbent upon healthcare providers to consider and help patients overcome any barriers to drug adherence. Improving disease awareness, highlighting the significance of drug adherence, and providing actionable solutions to overcome specific hurdles are all possible ways to achieve this goal(Bos-Touwen et al., 2015).

The initial phase of this holistic strategy involvesthorough patient education aimed at increasing disease literacy. Healthcare providers must ensure patients grasp the intricacies of type 2 diabetes, its associated risks, and the critical role of medications in disease management and preventing complications (Cavanaugh et al., 2009). These instructional interventions should be designed keeping in mind the patient's existing knowledge levels, health literacy, and preferred learning methods. Leveraging diverse pedagogical tools like visual aids, straightforward language, and interactive sessions can amplify the efficiency of these interventions (Cavanaugh et al., 2009).Next, the significance of medication non-adherence needs to be highlighted. Healthcare providers should explain to patients how steady medication adherence can regulate blood glucose levels, prevent disease progression, and augment overall health outcomes. Patients should also be informed about the potential repercussions of non-adherence, including the risk of complications and exacerbation of the disease (Krass et al., 2015).

Furthermore, healthcare providers should collaborate with patients to identify specific impediments to medication compliance. These hindrances can be manifold, encapsulating factors such as intricate medication schedules, side effects, forgetfulness, lack of social support, or even systemic factors like medication costs or access to healthcare services (Vervloet et al., 2012). Upon identifying these barriers, healthcare providers can offer tailored strategies to surmount them, which could include simplifying the medication regimen, providing reminders or pillboxes for forgetfulness, connecting patients with social support groups, or assisting them to navigate healthcare services to enhance access (Vervloet et al., 2012).It is also crucial to foster active patient involvement in their own care. This can be achieved through shared decision-making processes, where patients contribute to selecting

treatment options that align best with their preferences and lifestyle. Engaging patients in this manner can boost their sense of control over their health, thereby amplifying self-efficacy and medication adherence(Joosten et al., 2008).

Interventions that could boost self-efficacy include creating goals, solving problems, and developing skills in self-monitoring(Chen et al., 2021). Patients should be encouraged to set SMART (specific, measurable, achievable, relevant, and time-bound) goals in order to improve their adherence to therapy. Then, they and their healthcare practitioners can collaborate on an approach to reaching their goals (Lorig & Holman, 2003). Patients can learn to overcome obstacles by improving their problem-solving abilities.They may need to discover strategies to incorporate medicine-taking into their daily routines, which may entail seeking support from healthcare experts, communicating proactively with pharmacists or nurses, using medication reminder technologies, or all of the above. By working through issues on their own, patients are more likely to believe in themselves and stick to their treatment plan.

Patients can be prompted to keep a log of their prescription use, blood sugar levels, and other health data. Through this method of self-monitoring, patients can learn how their drug adherence habits affect their health. Self-monitoring allows patients to detect when they are deviating from their treatment plan and make adjustments as necessary. Patients' confidence in their own ability to take care of their health is bolstered when they engage in this cycle of introspection and course correction. Health care providers can also help diabetics learn to self-monitor by setting achievable goals with them, teaching them how to solve problems, and more. To further ensure patients adhere to their prescription schedule, healthcare providers can give continuing help and monitoring. Patients are more likely to follow through with their treatment plans if their healthcare practitioners encourage them to do so in a cooperative and empowering environment.

For individuals with diabetes, self-efficacy is an important factor in maintaining adherence to treatment.Patients with type 2 diabetes need to have their self-efficacy addressed and ways to boost self-efficacy incorporated into their care plans if they are to improve their medication adherence.

Conclusion

In conclusion, medication non-adherence is a major problem in the treatment of type 2 diabetes, and it is affected by a wide range of circumstances. Important patient factors add another layer of complication, including body mass index, extent of education, worries about therapy, and self-efficacy. To effectively combat pharmaceutical non-adherence, healthcare providers must have a thorough understanding of the aforementioned issues. Medication non-adherence can be reduced and health outcomes for people with type 2 diabetes can be improved with the use of these individualized interventions.

REFERENCES

Abate, T. W. (2019). Medication non-adherence and associated factors among diabetes patients in Felege Hiwot Referral Hospital, Bahir Dar city administration, Northwest Ethiopia. *BMC Research Notes*, *12*(1), 175. https://doi.org/10.1186/s13104-019-4205-4

Abdullah, N. F., Khuan, L., Theng, C. A., & Sowtali, S. N. (2022). Prevalence and reasons influenced medication non-adherence among diabetes patients: A mixed-method study. *Journal of Diabetes & Metabolic Disorders*, *21*(2), 1669–1678. https://doi.org/10.1007/s40200-022-01118-9

Abed, M. A., Himmel, W., Vormfelde, S., & Koschack, J. (2014). Video-assisted patient education to modify behavior: A systematic review. *Patient Education and Counseling*, *97*(1), 16–22. https://doi.org/10.1016/j.pec.2014.06.015

Al Sayah, F., Majumdar, S. R., Egede, L. E., & Johnson, J. A. (2015). Associations Between Health Literacy and Health Outcomes in a Predominantly Low-Income African American Population with Type 2 Diabetes. *Journal of Health Communication*, *20*(5), 581–588. https://doi.org/10.1080/10810730.2015.1012235

Ali, M., Alemu, T., & Sada, O. (2017). Medication adherence and its associated factors among diabetic patients at Zewditu Memorial Hospital, Addis Ababa, Ethiopia. *BMC Research Notes*, *10*(1), 676. https://doi.org/10.1186/s13104-017-3025-7

Almadhoun, M., & Alagha, H. (2018). *Assessment of Medication Adherence and its Association with Glycemic Control among Type-2 Diabetes Mellitus Patients in Gaza–Palestine*.

Al-Qazaz, H. K., Sulaiman, S. A., Hassali, M. A., Shafie, A. A., Sundram, S., Al-Nuri, R., & Saleem, F. (2011). Diabetes knowledge, medication adherence and glycemic control

among patients with type 2 diabetes. *International Journal of Clinical Pharmacy*, *33*(6), 1028–1035. https://doi.org/10.1007/s11096-011-9582-2

Alves-Conceição, V., Rocha, K. S. S., Silva, F. V. N., Silva, R. O. S., Silva, D. T. da, & Lyra-Jr, D. P. de. (2018). Medication Regimen Complexity Measured by MRCI: A Systematic Review to Identify Health Outcomes. *Annals of Pharmacotherapy*, *52*(11), 1117–1134. https://doi.org/10.1177/1060028018773691

Alzahrani, A., Alghamdi, A., Alqarni, T., Alshareef, R., & Alzahrani, A. (2019). Prevalence and predictors of depression, anxiety, and stress symptoms among patients with type II diabetes attending primary healthcare centers in the western region of Saudi Arabia: A cross-sectional study. *International Journal of Mental Health Systems*, *13*(1), 48. https://doi.org/10.1186/s13033-019-0307-6

American Diabetes Association. (2020). 9. Pharmacologic Approaches to Glycemic Treatment: Standards of Medical Care in Diabetes-2020. *Diabetes Care*, *43*(Suppl 1), S98–S110. https://doi.org/10.2337/dc20-S009

Aminde, L. N., Tindong, M., Ngwasiri, C. A., Aminde, J. A., Njim, T., Fondong, A. A., & Takah, N. F. (2019). Adherence to antidiabetic medication and factors associated with non-adherence among patients with type-2 diabetes mellitus in two regional hospitals in Cameroon. *BMC Endocrine Disorders*, *19*(1), 35. https://doi.org/10.1186/s12902-019-0360-9

Azharuddin, M., Adil, M., Sharma, M., & Gyawali, B. (2021). A systematic review and meta-analysis of non-adherence to anti-diabetic medication: Evidence from low- and middle-income countries. *International Journal of Clinical Practice*, *75*(11), e14717. https://doi.org/10.1111/ijcp.14717

Bailey, S. C., Brega, A. G., Crutchfield, T. M., Elasy, T., Herr, H., Kaphingst, K., Karter, A. J., Moreland-Russell, S., Osborn, C. Y., Pignone, M., Rothman, R., & Schillinger, D.

(2014). Update on Health Literacy and Diabetes. *The Diabetes Educator*, *40*(5), 581–604. https://doi.org/10.1177/0145721714540220

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low Health Literacy and Health Outcomes: An Updated Systematic Review. *Annals of Internal Medicine*, *155*(2), 97–107. https://doi.org/10.7326/0003-4819-155-2-201107190-00005

Bos-Touwen, I., Schuurmans, M., Monninkhof, E. M., Korpershoek, Y., Spruit-Bentvelzen, L., Graaf, I. E. der, Wit, N. de, & Trappenburg, J. (2015). Patient and Disease Characteristics Associated with Activation for Self-Management in Patients with Diabetes, Chronic Obstructive Pulmonary Disease, Chronic Heart Failure and Chronic Renal Disease: A Cross-Sectional Survey Study. *PLOS ONE*, *10*(5), e0126400. https://doi.org/10.1371/journal.pone.0126400

Bosworth, H. (2010). *Improving Patient Treatment Adherence: A Clinician's Guide*. Springer. https://link.springer.com/book/10.1007/978-1-4419-5866-2

Brunton, S. A. (2022). Blame and Shame: The Stigma of Diabetes. *Clinical Diabetes*, *40*(1), 9. https://doi.org/10.2337/cd21-0127

Caperon, L., Arjyal, A., C, P. K., Kuikel, J., Newell, J., Peters, R., Prestwich, A., & King, R. (2019). Developing a socio-ecological model of dietary behaviour for people living with diabetes or high blood glucose levels in urban Nepal: A qualitative investigation. *PLOS ONE*, *14*(3), e0214142. https://doi.org/10.1371/journal.pone.0214142

Castro, E. M., Van Regenmortel, T., Vanhaecht, K., Sermeus, W., & Van Hecke, A. (2016). Patient empowerment, patient participation and patient-centeredness in hospital care:

A concept analysis based on a literature review. *Patient Education and Counseling*, *99*(12), 1923–1939. https://doi.org/10.1016/j.pec.2016.07.026

Cavanaugh, K., Wallston, K. A., Gebretsadik, T., Shintani, A., Huizinga, M. M., Davis, D., Gregory, R. P., Malone, R., Pignone, M., DeWalt, D., Elasy, T. A., & Rothman, R. L. (2009). Addressing Literacy and Numeracy to Improve Diabetes Care: Two randomized controlled trials. *Diabetes Care*, *32*(12), 2149–2155. https://doi.org/10.2337/dc09-0563

Chen, A. M. H., Yehle, K. S., Albert, N. M., Ferraro, K. F., Mason, H. L., Murawski, M. M., & Plake, K. S. (2014). Relationships between health literacy and heart failure knowledge, self-efficacy, and self-care adherence. *Research in Social and Administrative Pharmacy*, *10*(2), 378–386. https://doi.org/10.1016/j.sapharm.2013.07.001

Chen, W.-C., Kuo, C.-C., Lin, C.-C., & Wu, C.-C. (2021). A preliminary study on the effects of the Peer-Led Self-Management (PLSM) program on self-efficacy, self-management, and physiological measures in older adults with diabetes: A block randomized controlled trial. *Geriatric Nursing*, *42*(2), 386–396. https://doi.org/10.1016/j.gerinurse.2021.01.011

Chew, B.-H., Hassan, N.-H., & Sherina, M.-S. (2015). Determinants of medication adherence among adults with type 2 diabetes mellitus in three Malaysian public health clinics: A cross-sectional study. *Patient Preference and Adherence*, *9*, 639–648. https://doi.org/10.2147/PPA.S81612

Cramer, J. A. (2004). A Systematic Review of Adherence With Medications for Diabetes. *Diabetes Care*, *27*(5), 1218–1224. https://doi.org/10.2337/diacare.27.5.1218

Deakin, T. A., McShane, C. E., Cade, J. E., & Williams, R. (2005). Group based training for self- management strategies in people with type 2 diabetes mellitus. *Cochrane*

Database of Systematic Reviews, *2*. https://doi.org/10.1002/14651858.CD003417.pub2

Doyle, E. A., Page, A., & Nagel, K. (2021). Psychosocial Challenges of Diabetes. In W. V. Tamborlane (Ed.), *Diabetes in Children and Adolescents: A Guide to Diagnosis and Management* (pp. 155–161). Springer International Publishing. https://doi.org/10.1007/978-3-030-64133-7_15

Epstein, R. M., & Street, R. L. (2011). The Values and Value of Patient-Centered Care. *The Annals of Family Medicine*, *9*(2), 100–103. https://doi.org/10.1370/afm.1239

Foley, L., Larkin, J., Lombard-Vance, R., Murphy, A. W., Hynes, L., Galvin, E., & Molloy, G. J. (2021). Prevalence and predictors of medication non-adherence among people living with multimorbidity: A systematic review and meta-analysis. *BMJ Open*, *11*(9), e044987. https://doi.org/10.1136/bmjopen-2020-044987

García-Pérez, L.-E., Álvarez, M., Dilla, T., Gil-Guillén, V., & Orozco-Beltrán, D. (2013). Adherence to Therapies in Patients with Type 2 Diabetes. *Diabetes Therapy*, *4*(2), 175–194. https://doi.org/10.1007/s13300-013-0034-y

Gherman, A., Schnur, J., Montgomery, G., Sassu, R., Veresiu, I., & David, D. (2011). How Are Adherent People More Likely to Think? A Meta-Analysis of Health Beliefs and Diabetes Self-Care. *The Diabetes Educator*, *37*(3), 392–408. https://doi.org/10.1177/0145721711403012

Gonzalez, J. S., Peyrot, M., McCarl, L. A., Collins, E. M., Serpa, L., Mimiaga, M. J., & Safren, S. A. (2008). Depression and Diabetes Treatment Nonadherence: A Meta-Analysis. *Diabetes Care*, *31*(12), 2398–2403. https://doi.org/10.2337/dc08-1341

Gudzune, K. A., Beach, M. C., Roter, D. L., & Cooper, L. A. (2013). Physicians build less rapport with obese patients. *Obesity*, *21*(10), 2146–2152. https://doi.org/10.1002/oby.20384

Ha Dinh, T. T., Bonner, A., Clark, R., Ramsbotham, J., & Hines, S. (2016). The effectiveness of the teach-back method on adherence and self-management in health education for people with chronic disease: A systematic review. *JBI Evidence Synthesis*, *14*(1), 210. https://doi.org/10.11124/jbisrir-2016-2296

Hall, G. L., & Heath, M. (2021). Poor Medication Adherence in African Americans Is a Matter of Trust. *Journal of Racial and Ethnic Health Disparities*, *8*(4), 927–942. https://doi.org/10.1007/s40615-020-00850-3

Heisler, M., Bouknight, R. R., Hayward, R. A., Smith, D. M., & Kerr, E. A. (2002). The Relative Importance of Physician Communication, Participatory Decision Making, and Patient Understanding in Diabetes Self-management. *Journal of General Internal Medicine*, *17*(4), 243–252. https://doi.org/10.1046/j.1525-1497.2002.10905.x

Holmen, H., Torbjørnsen, A., Wahl, A. K., Jenum, A. K., Småstuen, M. C., Årsand, E., & Ribu, L. (2014). A Mobile Health Intervention for Self-Management and Lifestyle Change for Persons With Type 2 Diabetes, Part 2: One-Year Results From the Norwegian Randomized Controlled Trial RENEWING HEALTH. *JMIR MHealth and UHealth*, *2*(4), e3882. https://doi.org/10.2196/mhealth.3882

Houts, P. S., Doak, C. C., Doak, L. G., & Loscalzo, M. J. (2006). The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence. *Patient Education and Counseling*, *61*(2), 173–190. https://doi.org/10.1016/j.pec.2005.05.004

Howard, T., Ahluwalia, R., & Papanas, N. (2021). The Advent of Artificial Intelligence in Diabetic Foot Medicine: A New Horizon, a New Order, or a False Dawn? *The International Journal of Lower Extremity Wounds*, 15347346211041866. https://doi.org/10.1177/15347346211041866

Hu, F. B. (2011). Globalization of Diabetes: The role of diet, lifestyle, and genes. *Diabetes Care*, *34*(6), 1249–1257. https://doi.org/10.2337/dc11-0442

Inzucchi, S. E., Bergenstal, R. M., Buse, J. B., Diamant, M., Ferrannini, E., Nauck, M., Peters, A. L., Tsapas, A., Wender, R., & Matthews, D. R. (2014). Management of Hyperglycemia in Type 2 Diabetes, 2015: A Patient-Centered Approach: Update to a Position Statement of the American Diabetes Association and the European Association for the Study of Diabetes. *Diabetes Care*, *38*(1), 140–149. https://doi.org/10.2337/dc14-2441

Jaam, M., Hadi, M. A., Kheir, N., Mohamed Ibrahim, M. I., Diab, M. I., Al-Abdulla, S. A., & Awaisu, A. (2018). A qualitative exploration of barriers to medication adherence among patients with uncontrolled diabetes in Qatar: Integrating perspectives of patients and health care providers. *Patient Preference and Adherence*, *12*, 2205–2216. https://doi.org/10.2147/PPA.S174652

Joosten, E. A. G., DeFuentes-Merillas, L., de Weert, G. H., Sensky, T., van der Staak, C. P. F., & de Jong, C. A. J. (2008). Systematic Review of the Effects of Shared Decision-Making on Patient Satisfaction, Treatment Adherence and Health Status. *Psychotherapy and Psychosomatics*, *77*(4), 219–226. https://doi.org/10.1159/000126073

Jude, E. B., Malecki, M. T., Gomez Huelgas, R., Prazny, M., Snoek, F., Tankova, T., Giugliano, D., & Khunti, K. (2022). Expert Panel Guidance and Narrative Review of Treatment Simplification of Complex Insulin Regimens to Improve Outcomes in Type 2 Diabetes. *Diabetes Therapy*, *13*(4), 619–634. https://doi.org/10.1007/s13300-022-01222-2

Kahn, S. E., Hull, R. L., & Utzschneider, K. M. (2006). Mechanisms linking obesity to insulin resistance and type 2 diabetes. *Nature*, *444*(7121), Article 7121. https://doi.org/10.1038/nature05482

Kassahun, T., Eshetie, T., & Gesesew, H. (2016). Factors associated with glycemic control among adult patients with type 2 diabetes mellitus: A cross-sectional survey in Ethiopia. *BMC Research Notes*, *9*(1), 78. https://doi.org/10.1186/s13104-016-1896-7

Katz, M. G., Kripalani, S., & Weiss, B. D. (2006). Use of pictorial aids in medication instructions: A review of the literature. *American Journal of Health-System Pharmacy*, *63*(23), 2391–2397. https://doi.org/10.2146/ajhp060162

Krass, I., Schieback, P., & Dhippayom, T. (2015). Adherence to diabetes medication: A systematic review. *Diabetic Medicine*, *32*(6), 725–737. https://doi.org/10.1111/dme.12651

Kvarnström, K., Westerholm, A., Airaksinen, M., & Liira, H. (2021). Factors Contributing to Medication Adherence in Patients with a Chronic Condition: A Scoping Review of Qualitative Research. *Pharmaceutics*, *13*(7), Article 7. https://doi.org/10.3390/pharmaceutics13071100

Lauffenburger, J. C., Haff, N., McDonnell, M. E., Solomon, D. H., Antman, E. M., Glynn, R. J., & Choudhry, N. K. (2021). Exploring patient experiences coping with using multiple medications: A qualitative interview study. *BMJ Open*, *11*(11), e046860. https://doi.org/10.1136/bmjopen-2020-046860

Leplege, A., Gzil, F., Cammelli, M., Lefeve, C., Pachoud, B., & Ville, I. (2007). Person-centredness: Conceptual and historical perspectives. *Disability and Rehabilitation*, *29*(20–21), 1555–1565. https://doi.org/10.1080/09638280701618661

Mahan, S. J., & Mahammad, M. M. (2022). Beliefs about medicine among sample of Iraqi Type 2 Diabetic Patients in Karbala. Iraq: Across sectional study. *Journal of*

Population Therapeutics and Clinical Pharmacology, *29*(04), Article 04. https://doi.org/10.47750/jptcp.2022.1012

Marciano, L., Camerini, A.-L., & Schulz, P. J. (2019). The Role of Health Literacy in Diabetes Knowledge, Self-Care, and Glycemic Control: A Meta-analysis. *Journal of General Internal Medicine*, *34*(6), 1007–1017. https://doi.org/10.1007/s11606-019-04832-y

Martin, L. R., Williams, S. L., Haskard, K. B., & DiMatteo, M. R. (2005). The challenge of patient adherence. *Therapeutics and Clinical Risk Management*, *1*(3), 189–199. https://doi.org/10.2147/tcrm.s12160382

McDowell, I. (2023). Theoretical Models of Health Behavior. In I. McDowell (Ed.), *Understanding Health Determinants: Explanatory Theories for Social Epidemiology* (pp. 253–306). Springer International Publishing. https://doi.org/10.1007/978-3-031-28986-6_6

Medi, R., Mateti, U., Kanduri, K., & Konda, S. (2015). Medication adherence and determinants of non-adherence among south Indian diabetes patients. *Journal of Social Health and Diabetes*, *03*(01), 048–051. https://doi.org/10.4103/2321-0656.140892

Mostafavi, F., Alavijeh, F. Z., Salahshouri, A., & Mahaki, B. (2021). The psychosocial barriers to medication adherence of patients with type 2 diabetes: A qualitative study. *BioPsychoSocial Medicine*, *15*(1), 1. https://doi.org/10.1186/s13030-020-00202-x

Murray, A. (2019). Measure Development and Validation of a Self-Efficacy Scale for Advance Care Planning. *Open Access Dissertations*. https://doi.org/10.23860/diss-murray-alexandra-2019

Neto, J. A. C., Costa, L. A., Estevanin, G. M., Bignoto, T. C., Vieira, C. I. R., Pinto, F. A. R., & Ferreira, R. E. (2019). Functional Health Literacy in chronic cardiovascular

patients. *Ciência & Saúde Coletiva*, *24*, 1121–1132. https://doi.org/10.1590/1413-81232018243.02212017

Osborn, C. Y., Cavanaugh, K., Wallston, K. A., White, R. O., & Rothman, R. L. (2009). Diabetes Numeracy: An overlooked factor in understanding racial disparities in glycemic control. *Diabetes Care*, *32*(9), 1614–1619. https://doi.org/10.2337/dc09-0425

Osterberg, L., & Blaschke, T. (2005). Adherence to Medication. *New England Journal of Medicine*, *353*(5), 487–497. https://doi.org/10.1056/NEJMra050100

Pettersen, T. R., Fridlund, B., Bendz, B., Nordrehaug, J. E., Rotevatn, S., Schjøtt, J., & Norekvål, T. M. (2018). Challenges adhering to a medication regimen following first-time percutaneous coronary intervention: A patient perspective. *International Journal of Nursing Studies*, *88*, 16–24. https://doi.org/10.1016/j.ijnurstu.2018.07.013

Polonsky, W. H., & Henry, R. R. (2016). Poor medication adherence in type 2 diabetes: Recognizing the scope of the problem and its key contributors. *Patient Preference and Adherence*, *10*, 1299–1307. https://doi.org/10.2147/PPA.S106821

Puhl, R. M., & Heuer, C. A. (2010). Obesity Stigma: Important Considerations for Public Health. *American Journal of Public Health*, *100*(6), 1019–1028. https://doi.org/10.2105/AJPH.2009.159491

Puhl, R. M., Latner, J. D., King, K. M., & Luedicke, J. (2014). Weight bias among professionals treating eating disorders: Attitudes about treatment and perceived patient outcomes. *International Journal of Eating Disorders*, *47*(1), 65–75. https://doi.org/10.1002/eat.22186

Ratcliffe, D., & Ellison, N. (2015). Obesity and Internalized Weight Stigma: A Formulation Model for an Emerging Psychological Problem. *Behavioural and Cognitive Psychotherapy*, *43*(2), 239–252. https://doi.org/10.1017/S1352465813000763

Rätsep, A., Oja, I., Kalda, R., & Lember, M. (2007). Family doctors' assessment of patient- and health care system-related factors contributing to non-adherence to diabetes mellitus guidelines. *Primary Care Diabetes*, *1*(2), 93–97. https://doi.org/10.1016/j.pcd.2007.03.002

Rosen, J. M., Adams, L. V., Geiling, J., Curtis, K. M., Mosher, R. E., Ball, P. A., Grigg, E. B., Hebert, K. A., Grodan, J. R., Jurmain, J. C., Loucks, C., Macedonia, C. R., & Kun, L. (2021). Telehealth's New Horizon: Providing Smart Hospital-Level Care in the Home. *Telemedicine and E-Health*, *27*(11), 1215–1224. https://doi.org/10.1089/tmj.2020.0448

Sabate, E. (2003). *Adherence to long-term therapies: Evidence for action*. WHO.

Sarkar, U., Fisher, L., & Schillinger, D. (2006). Is Self-Efficacy Associated With Diabetes Self-Management Across Race/Ethnicity and Health Literacy? *Diabetes Care*, *29*(4), 823–829. https://doi.org/10.2337/diacare.29.04.06.dc05-1615

Senbekov, M., Saliev, T., Bukeyeva, Z., Almabayeva, A., Zhanaliyeva, M., Aitenova, N., Toishibekov, Y., & Fakhradiyev, I. (2020). The Recent Progress and Applications of Digital Technologies in Healthcare: A Review. *International Journal of Telemedicine and Applications*, *2020*, e8830200. https://doi.org/10.1155/2020/8830200

Sharma, A. (2023). Differentials in Medication Non-adherence in India: Does Place of Living Matter? In N. Biloria, G. Sebag, & H. Robertson (Eds.), *The Empathic City: An Urban Health and Wellbeing Perspective* (pp. 241–256). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-32840-4_11

Siddharthan, T., Rabin, T., Canavan, M. E., Nassali, F., Kirchhoff, P., Kalyesubula, R., Coca, S., Rastegar, A., & Knauf, F. (2016). Implementation of Patient-Centered Education for Chronic-Disease Management in Uganda: An Effectiveness Study. *PLOS ONE*, *11*(11), e0166411. https://doi.org/10.1371/journal.pone.0166411

Singh, S., Shankar, P., Kumar Singh, D., Nath, R., Sachan, A., & Dixit, R. (2015). Importance of Pharmacotherpeutic adherence. *World Journal of Pharmacy and Pharmaceutical Sciences*, *4*, pp-876.

Świątoniowska, N., Sarzyńska, K., Szymańska-Chabowska, A., & Jankowska-Polańska, B. (2019). The role of education in type 2 diabetes treatment. *Diabetes Research and Clinical Practice*, *151*, 237–246. https://doi.org/10.1016/j.diabres.2019.04.004

van Netten, J. J., Seng, L., Lazzarini, P. A., Warnock, J., & Ploderer, B. (2019). Reasons for (non-)adherence to self-care in people with a diabetic foot ulcer. *Wound Repair and Regeneration*, *27*(5), 530–539. https://doi.org/10.1111/wrr.12728

Venkatesan, M., Dongre, A. R., & Ganapathy, K. (2018). A Community-Based Study on Diabetes Medication Nonadherence and its Risk Factors in Rural Tamil Nadu. *Indian Journal of Community Medicine*, *43*(2), 72–76. https://doi.org/10.4103/ijcm.IJCM_261_17

Vervloet, M., Linn, A. J., van Weert, J. C. M., de Bakker, D. H., Bouvy, M. L., & van Dijk, L. (2012). The effectiveness of interventions using electronic reminders to improve adherence to chronic medication: A systematic review of the literature. *Journal of the American Medical Informatics Association*, *19*(5), 696–704. https://doi.org/10.1136/amiajnl-2011-000748

Vieira, J. F. F., & Santos, P. (2020). Medication adherence in type 2 diabetes mellitus patients: A cross-sectional study. *Revista Portuguesa de Medicina Geral e Familiar*, *36*(2), Article 2. https://doi.org/10.32385/rpmgf.v36i2.12395

Wabe, N. T., Angamo, M. T., & Hussein, S. (2011). Medication adherence in diabetes mellitus and self management practices among type-2 diabetics in Ethiopia. *North American Journal of Medical Sciences*, *3*(9), 418–423. https://doi.org/10.4297/najms.2011.3418

Wei, L., Champman, S., Li, X., Li, X., Li, S., Chen, R., Bo, N., Chater, A., & Horne, R. (2017). Beliefs about medicines and non-adherence in patients with stroke, diabetes mellitus and rheumatoid arthritis: A cross-sectional study in China. *BMJ Open*, *7*(10), e017293. https://doi.org/10.1136/bmjopen-2017-017293

Winkley, K., Upsher, R., Polonsky, W. H., & Holmes-Truscott, E. (2020). Psychosocial aspects and contributions of behavioural science to medication-taking for adults with type 2 diabetes. *Diabetic Medicine*, *37*(3), 427–435. https://doi.org/10.1111/dme.14214

Wolff, K., Cavanaugh, K., Malone, R., Hawk, V., Gregory, B. P., Davis, D., Wallston, K., & Rothman, R. L. (2009). The Diabetes Literacy and Numeracy Education Toolkit (DLNET). *The Diabetes Educator*, *35*(2), 233–245. https://doi.org/10.1177/0145721709331945

Yap, C. C., Tam, C. L., Muniyandy, S., & Kadirvelu, A. (2015). Personal Attributions, Emotion Managements, Social Supports, and Diabetes Knowledge in Diabetes Self-care Adherence. *Public Health*, *7*(6).

Yaribeygi, H., Maleki, M., Sathyapalan, T., Jamialahmadi, T., & Sahebkar, A. (2021). Obesity and Insulin Resistance: A Review of Molecular Interactions. *Current Molecular Medicine*, *21*(3), 182–193. https://doi.org/10.2174/1566524020666200812221527

Yusuff, K. B., Obe, O., & Joseph, B. Y. (2008). Adherence to anti-diabetic drug therapy and self management practices among type-2 diabetics in Nigeria. *Pharmacy World & Science: PWS*, *30*(6), 876–883. https://doi.org/10.1007/s11096-008-9243-2

Zelikovsky, N., & Nelson, E. (2021). Illness perceptions and beliefs about medication: Impact on health-related quality of life in adolescent kidney transplant recipients. *Pediatric Transplantation*, *25*(3), e13988. https://doi.org/10.1111/petr.13988

Zolnierek, K. B. H., & DiMatteo, M. R. (2009). Physician Communication and Patient Adherence to Treatment: A Meta-analysis. *Medical Care*, *47*(8), 826–834. https://doi.org/10.1097/MLR.0b013e31819a5acc