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Burden of disability in type II diabetes mellitus and the moderating effects of physical activity

Oyewole OO *et al* Disability-burden and moderating effect of PA

INTRODUCTION

Diabetes remains a public health concern globally, with the epidemic growing in the last decade[1]. It is one of the leading causes of death globally[2]. In 2017, the global prevalence of diabetes was estimated be 476 million people, which is projected to reach 570.9 million by 2025[2] and 693 million people by 2045[3]. There was a prevalence rate of 6059 cases per 100000 in 2017, projected to rise to 7079 cases per 100000 by 2030[4]. Diabetes, coupled with its complications, imposes several burdens on individuals affected by the disease, including economic and psychological limitations[5-7].

The cost of treating diabetes and its complications is a great burden, globally[8-10]. Globally, the annual average cost (both direct and indirect) per person for treating type 2 diabetes mellitus (T2DM) ranged from USD29.91 to USD237.38 (direct costs USD106.53-USD293.79, and indirect costs USD1.92-USD73.4)[11]. This amounts to USD 25.51 billion in economic loss in Africa[12]. Similar economic loss was reported in other parts of the world, including Asia and Europe[6,7,13-16].

Diabetes and its complications cause severe disabilities in individuals with the condition, and often lead to the loss of a healthy life due to disability[17]. Disability-adjusted life years (DALYs), an indicator to measure the burden of disease, have been reported to have increased among people with T2DM[17,18]. Globally, the age-standardized DALY rates increased by 5.07% from 2007 to 2017[18]. In 2017, 67.9 million DALYs were associated with diabetes, with a projection to 79.3 million by 2025[2].

To address the psychosocial issues that may arise from these burdens[5,19], it is necessary to look for moderating factors that may reduce the burden of the disease.

Physical activity (PA) has been shown to be one of the factors that can mitigate these burdens[20]. PA does this in several ways, and through the benefits it confers, such as a reduction of excess fat in the liver and pancreas[21], the reduction of cardiovascular risk factors, and by favorably affecting glycemic parameters[20], thereby ultimately improving haemoglobin A1c (HbA1c)[20,22]. Patient education is another key factor in reducing the burden of diabetes. Individuals with T2Ds who are well-informed and motivated are more successful in maintaining good control of their risk factors and can eventually reduce their cardiovascular risk and slow the progression of microvascular disease[23]. This communication should be client-centered as it moderates the relationship between the burden of diabetes and diabetes distress[24]. Thus, this mini-review discusses the burden of disability in T2DM and the moderating effects of PA.

PROFILE AND PATTERNS OF DISABILITY IN DIABETES

Diabetes was ranked ninth in 2019 WHO global estimates of the leading causes of mortality, showing a 70% increase since the year 2000[25]. Moreover, it is one of the five leading conditions impacting years lived with disability in the Americas[26]. Diabetes is also implicated in the etiology of other conditions. Table 1 shows the percentages of comorbid conditions associated with diabetes in the National Burden of Disease study in South Africa[27].

There are numerous indicators and markers of disability in individuals with T2Ds. One of these markers is weight management. It has been found that a significant proportion (around 85%) of diabetic adults are overweight[28], having a body mass index (BMI) of 25.0 to 29.9; while others are obese, with a BMI over 30. Individuals with a BMI over 40 at baseline were found to gain weight over a 10-year period. Moreover, there was a high proportion of insulin users in this group, confirming the link between insulin use and weight accumulation[29,30].

Keeping an individual's weight stable and within the normal range acts to slow the increase of limitations in diabetic adults[31]. A study by Ferraro *et al*[32] found that the risk of disability was higher for obese individuals, but not always for overweight individuals. Research has shown that 13.6% of patients with T2D will develop some limitation in at least one activity of daily living (ADL) six years post diagnosis; and 38.3% will develop a functional decline at a rate of 1.0% mean decline in function per year[33,34].

It has been suggested that complications related to diabetes are avoidable[35]. This is contingent upon maintaining optimal HbA1c control in the range between 6.5% and 7.0% (48-53 mmol/mol)[36]. However late diagnosis, failure meeting the targeted DM treatment goals, and non-compliance with treatment, can lead to severe complications such as nephropathy, neuropathy, retinopathy, amputations, and stroke[37]. A recurring finding is the physical limitations in both sexes, relating to the loss of function in the lower limbs, which impacts mobility, and is a predictor of the loss of autonomy[38,39].

The global epidemic of T2D has been characterised by the early onset of the disease, typically in people below 40 years of age, who are obese, and who belong to an ethnic minority group. These characteristics are associated with decreased physical fitness and reduced muscle mass[40]. Moreover, there are specific markers of accelerated metabolic aging in T2D, which leads to a ripple effect of functional decline, reduced physical capacity, and increased falls and fractures, typically seen in elderly people[41]. This leads to poorer functional outcomes and prognosis, and a decreased quality of life. Specific limitations are discussed below and are shown in Table 2.

Reduction in body structure and function

Muscle wasting is a condition associated with aging and diabetes and is negatively associated with physical functioning[42]. As there is vascular and neurological impairment in diabetes, there may also be a vulnerability to depressive symptoms and dementia. Cognitive impairment has been shown to be increased in diabetic individuals[43]. In tandem with physical frailty, cognitive impairment is associated with a higher risk of mortality in diabetic individuals[44].

Frailty has been defined as the increased vulnerability to physical and psychological stressors due to decreased physiological reserves in multiple organ systems, which impact the body's ability to maintain homeostasis[45]. Frailty can be diagnosed by confirming three of the following five criteria: Unintentional weight loss; low energy expenditure; slowness; weakness; and exhaustion[46]. While frailty is associated with elderly people, the frailty phenotype in T2D is typically a younger obese individual with multiple comorbidities[47]. Frailty, accompanied by decreased physical function, has emerged as the third complication of T2Ds after the micro- and macro-vascular complications[48]. This is confirmed by the increased prevalence of frailty in 32% to 48% of individuals with diabetes aged 65 years and older, compared to only 5% to 10% of individuals in the general population[49].

Activity limitation

Regular PA is one of the key factors in maintaining optimum blood sugar control in diabetic individuals[22]. However, individuals with cardiovascular conditions may avoid PA out of fear of hurting themselves[50]. This may be attributed to diabetic-related complications and comorbidities such as peripheral neuropathy; foot or leg pains; poor vision; and impaired renal function[51]. However, most individuals in the diabetic population lead sedentary lifestyles[52,53], which may have been exacerbated during the COVID pandemic as people's movements were restricted.

Participation restriction

It has been found that individuals with T2Ds experience musculoskeletal pains twice as often as people in the general population[54]. Meanwhile, common reasons cited for the lack of regular exercise include having little time; bad weather; health problems; a lack of social support and professional coaching; safety considerations; limited access; prohibitive costs of a gym membership; and decreased self-efficacy[55,56]. Furthermore, the fear of stigma regarding their weight, and feelings of shame, inferiority, and inadequacy, may be a barrier to regular PA[57]. Obese individuals may be hypersensitive to people looking at them or making comments regarding their weight, while others feel they are too obese to exercise, or experience discomfort related to their obesity, such as chafing of their thighs or becoming breathless[58].

Functional limitations and disability

There are likely to be greater functional limitations and disabilities in diabetics, due to the comorbidities associated with diabetes. They are usually reported as limitations and impairments in the ADL, which relate to self-care activities, such as feeding, bathing, toileting, and grooming. Impairments in ADL are reported in research studies as they are predictors of morbidity and mortality[38,39]. The ability to perform ADL and the instrumental ADL (IADL) is contingent upon the interplay of multiple physiological and organ systems, such as the musculoskeletal, neurological, vascular and cardiorespiratory systems[59]. Being capable of independence in self-care, or the ADL and IADL, is essential for independent community living and is directly associated with an individual's quality of life[59,60]. Diabetes in Africa usually affects people between the ages of 40 and 60 years, impacting their working lives negatively, and resulting in absenteeism, sick days and decreased productivity[61].

An exploratory study by Huang *et al*[62], of the self-reported goals of individuals with T2Ds who were 65 years and older, revealed that they rated being independent and maintaining their functionality in terms of ADL (71%) higher than maintaining their optimal blood glucose levels (3.5%), avoidance of symptoms (3.5%), or losing weight (14%). A cross-sectional study by Godino *et al*[63] revealed a pattern of diabetic-related disability across four domains in decreasing order, namely ADL, followed by IADL, lower limb mobility, and decreased physical function.

Limitations in sexual functioning

There are many changes that occur in the autonomic nervous systems of diabetic individuals, including the genitourinary system. There is a higher incidence of erectile dysfunction in the diabetic population, affecting 35% to 90% of men[64]. Pathophysiology has implicated multiple factors, including endothelial dysfunction, diabetic comorbidities, and psychological factors[65]. Moreover, erectile dysfunction may be an important marker of silent coronary heart disease and can predict future cardiovascular events, in both diabetic and non-diabetic individuals[65]. As erectile dysfunction can affect self-esteem and trigger anxiety and depression, it is important to address the psychological factors as part of a holistic intervention programme.

In diabetic women, the patterns of sexual dysfunction are more varied and appear less prevalent[66]. However, they may still present with a low level of arousal and sexual drive; decreased vaginal lubrication; orgasmic dysfunction; dyspareunia; or painful intercourse[67]. These problems have been attributed to neuropathy, vascular impairment, and psychological factors. Other studies have identified all the aforementioned factors, as well as anxiety, decreased sexual satisfaction, and recurrent vaginal infections which may affect diabetic women's sexual experiences negatively[68].

EFFECT OF DISABILITY, QUALITY-ADJUSTED LIFE YEARS, AND DALY ON QUALITY OF LIFE

Disability in diabetes can be visible or hidden. Disability is the experience of any condition that makes it more difficult for a person to do certain activities or have equitable access within a given society. Diabetes is considered a disability under the United States of America federal law[69]. This is because it limits the functioning of the endocrine system. Hence, diabetes may be described as a hidden disability when its complications are not obvious.

Certain disabilities may predispose people to diabetes[69]. It is thought that disability could contribute to diabetes risk through an increase in sedentary behavior; muscle disuse; and a change in the ratio of lean-to-fat mass affecting insulin sensitivity in vulnerable adults[69]. However, it is commonly reported that diabetes leads to several disabilities which are said to be gender-specific[70]. Obesity; congestive heart diseases; lower extremity diseases; stroke; and depression, appear to be the most prominent conditions that heighten the disability risk among people with and without diabetes[41].

All health interventions for people with diabetes aim to improve their quality of life as a health outcome. People with diabetes have a poorer quality of life than people with no chronic illnesses, but a better quality of life than people with most other serious chronic diseases. Complications of diabetes are the most important disease-specific determinant of quality of life[71]. The complications of diabetes are the major pointers to the nature of disability that are visible and are important for describing the burden of diabetic disease. Jing *et al*[72], in a systematic review and meta-analysis, classified the factors associated with the quality of life of individuals with diabetes as characteristics related to the disease (the presence of complications, comorbidities like hypertension, the duration of diabetes and insulin use); lifestyles (frequency of physical exercise, dietary controls including consumption of red meat, and the frequency of glucose checks); and mental factors (the presence of depression, anxiety, and worries). The global burden of disease estimates that the use of information on mortality and morbidity, which are described as quality-adjusted life years and DALY, has been useful in quantifying the extent of disability in a disease like diabetes (Figure 1). These two constructs are used in estimating the burden of diseases like diabetes and they are widely accepted as a reference standard in cost-effectiveness analyses[18,73].

EFFECT OF PA ON DIABETES AND ITS COMPLICATION

PA is a core element in DM management and in mitigating its complications. PA plays a key role in maintaining good glycaemic control and other associated metabolic parameters. PA, coupled with diet and medical therapy, has been shown to reduce the complications of DM, and improves quality of life. PA is defined as any bodily movement that substantially increases energy expenditure[22]. The American College of Sports Medicine recommended at least 150 min of moderately intensive aerobic activity, or at least 75 min per week of vigorous aerobic activity, or a combination of both, preferably spread throughout the week[22].

A high prevalence of physical inactivity has been reported worldwide among diabetics, ranging from 31.0% to 61.0% in the United States; 30.7% in Brazil; 31.9% in

Malaysia; and 38.4% in Saudi Arabia[74-76]. Nigeria reported a prevalence between 31% and 62%[77,78]. Many benefits are derived from regular PA (Figure 2). PA improves not only physical health, but also metabolic control, and mental and social-economic well-being. PA is an effective tool in DM management, and aids in reducing the incidence of T2DM in people with impaired glucose tolerance; improving glucose control, blood pressure, lipids and weight control in T2DM; and promoting better bone-health. Increased fitness and function; enhanced feelings of well-being; a reduced risk of depression; and a reduction in morbidity and mortality, culminate in lower healthcare expenditure[22,79-81]; while low PA levels lead to an increased risk of overall and cardiovascular disease mortality in people with diabetes[81].

The mechanism by which PA improves or confers these benefits has been explained through the regulation of glycolipid metabolism disorder. Mechanisms resulting from PA, which improve glucolipid metabolism, include an increase of glucose uptake and utilization in metabolic tissues, such as the skeletal muscle, liver, and adipose tissues, thereby enhancing insulin sensitivity; protecting pancreatic β-cell function; increasing lipid hydrolysis oxidation; alleviating systemic inflammation; and optimising body mass index and systemic condition[82].

Studies have shown that pain; poor health; lack of willpower; lack of energy; lack of skills; lack of social support and the fear of injury are the top obstacles to PA among DM individuals[83]. Identification with, and acceptance of, the new lifestyle; social support; support from healthcare professionals; achievement of results; and coping with ongoing challenges have been identified as motivation to maintain PA[84].

MODERATING EFFECT OF PA ON THE RELATIONSHIP BETWEEN DISABILITY AND QUALITY OF LIFE

The importance of PA in the prevention and management of T2Ds cannot be overemphasized[85]. Evidence has shown that reducing, and frequently breaking up, prolonged sitting with light-intensity PA and standing are among the practical strategies for improving T2Ds prevention and management[86]. Thus, moderately intense PA (60 min to 75 min per day) eliminates the increased risk of death associated with prolonged sitting time[87]. Individuals with T2Ds are more likely to experience a decline in physical function, especially in mid-life[88]. Regular PA has been shown to reduce the decline in function among the population of type 2 diabetic individuals[88].

PA has a direct influence on disability and quality of life. It decreases the self-reported levels of disability and maintains health-related quality of life (HRQoL)[89]. Fatigue, a common disabling clinical complaint among people with T2Ds, is also documented to be positively influenced when sitting is regularly interrupted by brief activity-breaks[90]. Beyond the effect of PA on an individual's disability and HRQoL, PA has demonstrated a moderating effect on the relationship between disability and HRQoL among older adults[91]. For older adults with high levels of PA, the moderating effects on physical disability and HRQoL are significant, suggesting that improved PA reduces the negative impact of a poor quality of life and disability[91].

Although the moderating effects of PA on the relationship between disability and quality of life[91,92] have been studies in the older adult population, there are few, or limited, studies exploring the moderating and mediating effect of PA on the relationship between disability and quality of life in the type 2 diabetic population. This may suggest the focus or direction of future research into PA among people with T2Ds. It will be of interest to explore the dose-response of PA on the relationship between disability and quality of life, as well other factors that may enhance this moderating effect.

IMPROVING PA AMONG PEOPLE WITH DIABETES

Despite expanded data on the benefits of diet, lifestyle modification and PA in diabetes prevention and management, routine PA has declined in recent decades among individuals with diabetes[93]. Therefore, efforts should be directed at increasing PA uptake among this population. The Centers for Disease Control and Prevention identified ten strategies to improve PA in the community to prevent the non-communicable diseases that may predispose individuals to developing diabetes[94].

These strategies include community-wide campaigns; point-of-decision prompts to encourage the use of stairs; individually adapted health behaviour-change programmes; enhanced school-based physical education; social support interventions in community settings; the creation of, or enhanced, access to places for PA combined with informational outreach activities; street-scale urban design and land-use policies, and community-scale urban design and land-use policies; active transport to school, and transportation and travel policies and practices[94]. It is essential to approach these strategies with a predictive, preventive, personalized, and participatory novel approach[93]. In another commentary, strategies to increase PA included measuring PA as a vital sign; encouraging individuals to be physically active at least 150 min per week; creating healthy environments by making it easier to be physically active where we live, learn, work, play, and pray; monitoring the disease incidence in individuals who are physically active, compared those who are not physically active; and spread best practices[95].

Point-of-decision prompts for increasing PA

Evidence abounds about increasing the active use of stairs with point-of-decision prompts[94,96,97]. "Point-of-decision prompts are motivational signs placed on or near stairwells, or at the base of elevators and escalators, encouraging people to use the stairs"[97]. It is a community-based intervention for behavioral change that has increased PA[96]. It has been established that ascending stairs is a vigorous-intensity activity, while descending stairs is moderately intense, based on mean heart rate and perceived exertion responses to self-chosen, continuous stair use[98]. Thus, making use of stairs through point-of-decision prompts may help satisfy the daily recommendation for moderate or vigorous activity. Emerging data is also suggesting that climbing escalators may have similar health benefits or consequences as climbing stairs, when compared to standing on escalators[99]. Thus, promoting point-of-decision prompts to encourage escalator climbing rather than standing on the escalator could promote energy expenditure. However, psychological barriers such as anxiety and depression, which have been associated with the perceived difficulty in using stairs, must be addressed for maximum PA uptake[98].

Technology use to increase PA

Attractive, personalized, and tailored smartphone-based mHealth PA interventions have been shown to increase PA uptake[100-103]. They positively affect an individual's engagement and perception. Smartphone apps and self-monitoring devices are evolving technologies which promote PA uptake[104,105]. It has been suggested that video games that require gross motor activity, such as Exergames, on Nintendo Wii, Xbox and PlayStation, promote healthy weight and PA in the general population[104,106]. The use of social media to jumpstart PA has also been documented[104,105].

Education and counselling to increase PA uptake

One of the strategies to improve PA uptake is education and counselling[95]. An assessment of PA at each visit to a physician or health provider will facilitate proper education and counselling. Asking a client the number of minutes per week she or he participated in PA will reinforce the notion that exercise is a vital part of health just like other vital signs of health, such as blood pressure[95]. A conversation about the importance of PA in health can begin if the individual does not meet exercise goals. The focus should be on letting them understand what is expected of them and teaching them how to change their behaviour from inactivity to daily PA. Lehr *et al*[107] proposed the ABCD of lifestyle counselling to improve individual health, including daily PA uptake. The acronym ABCD represents assess, barriers, commit and demonstrate. The ABCD framework for lifestyle counselling starts with (A) assessing a patient's readiness for change; (B) identifying potential barriers to change; (C) encouraging patients to commit to measurable goals; and (D) helping them demonstrate progress by selecting an appropriate self-monitoring strategy[107].

<u>CONCLUSION</u>

This article explored the limitations and complications that can result from poorly managed diabetes mellitus. These limitations relate to obesity; cardiac complications; renal, vascular and neurological problems; sexual dysfunction; and decreased participation in ADL, IADL, and work. However, PA, in tandem with a healthy diet, appears to be an effective strategy in reducing the long-term complications of T2DM. It will also curb spending in terms of non-communicable diseases, including diabetes. Specifically, PA regulates or moderates' diabetes disability through two mechanisms: the regulation of glucose and lipid metabolism disorders, and the optimisation of body mass index and systemic condition. It is, therefore, imperative to include a prescription of regular, moderate physical exercise/activity in the treatment regimen of all people with T2DM, to improve their medical and functional prognosis and quality of life. Exercise can also be used as a health promotion and prevention strategy in population-level interventions.

Figure Legends

Figure 1 Years of healthy life lived and lost in diabetes. DALYs: Disability-adjusted life years; QALYs: Quality-adjusted life years.

Figure 2 Benefits of physical activity in type 2 diabetes. HBA1c: Haemoglobin A1c.

Table 1 Percentages of comorbid conditions associated with diabetes in the National Burden of Disease[27]

Diabetic-related comorbid conditions	Percentage contribution to national burden of diseases in South Africa
Ischaemic heart disease	14%
Stroke	10%
Hypertension	12%
Renal disease	12%

Table 2 Types of disability in diabetes

Ref.	Type of disability	Summary/remark
Dhamoon *et al*[33], 2014	Decline in function	1% mean decline in function per year was reported
Sakurai *et al*[34], 2012	ADL, IADL disability and functional impairment	After six years of follow-up, 13.6% of patients had developed a new ADL disability and 38.3% had developed a new functional impairment
Gregg *et al*[70], 2000	Physical disability	Among subjects ≥ 60 yr of age with diabetes, 32% of women and 15% of men reported an inability to walk one-fourth of a mile, climb stairs, or do housework, compared with 14% of women and 8% of men without diabetes
Gregg *et al*[38], 2002	Functional disability	The yearly incidence of any functional disability was 9.8% among women with diabetes and 4.8% among women without diabetes
Volpato *et al*[39,41], 2002; Volpato *et al*[41], 2010	Functional/lower extremity disability	Women with diabetes showed a greater prevalence of mobility disability, disabilities in the activities of daily living, and severe walking limitation; their summary mobility performance score (0-12 scale, based on balance, gait speed, chair stands) was 1.4 points lower than in nondiabetic women
Maggi *et al*[42], 2004	Activities of daily living and physical performance	The association between severe and/or total disability on the basis of physical performance tests and diabetes was strong in both sexes

Thein *et al*[44], 2018	ADL and IADL disability	Diabetes was associated with a significantly higher prevalence of CI and/or PF. PF and/or CI were associated with a considerably higher prevalence of IADL
Ahmad *et al*[47], 2022	Impaired physical function	Impaired physical function is a growing problem
Wong *et al*[48], 2013	Physical disability	Diabetes is associated with a strong increase in the risk of physical disability
Godino *et al*[63], 2017	Functional disability	Diabetes patients had a significantly greater burden of functional disability compared to those without diabetes
Malavige and Levy[64], 2009	Erectile dysfunction	A prevalence of erectile dysfunction from 35% to 90% among diabetic men was reported
Omidvar *et al*[67], 2013	Sexual dysfunction	The prevalence of sexual dysfunction was 32.3%. Low sexual desire was seen in 81.8%; disorders of arousal in 78.3%; orgasm disorder in 47.5%; and 35.1% had disorders in resolution areas

ADL: Activity of daily living; IADL: Instrumental activity of daily living; CI: Cognitive impairment; PF: Physical frailty.

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Chinese rural older adults: a moderated mediation analysis of physical disability and physical activity", BMJ Open, 2021
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21 S. Maggi, M. Noale, P. Gallina, C. Marzari, D. Bianchi, F. Limongi, G. Crepaldi. "Physical disability among older Italians with diabetes. The ILSA Study", Diabetologia, 2004
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