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Quality of Life and Long-Term Complications of Diabetic Patients in Bangladesh: Does Treatment Pattern Differ the Quality of Life of Diabetic Patients?

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Abstract

Background: Diabetes Mellitus (DM) is a growing health issue in Bangladesh, with significant complications affecting the quality of life (QoL). This study aims to assess long-term complications, treatment patterns, and QoL of diabetic patients during COVID-19. **Methods:** A cross-sectional study was conducted on 385 diabetic patients (aged 18-80) from tertiary hospitals in Dhaka and Mymensingh between May and October 2022. Data were collected via a semi-structured questionnaire on sociodemographics, complications, treatment patterns, and QoL (SF-12 scale). Chi-square tests, ANOVA, and linear regression were used for inferential analysis. **Results:** The sample predominantly included middle-aged males (41 - 55 years) with type 2 diabetes. Diabetic retinopathy (34.5%), polyneuropathy (32.2%), and hypertension (52.3%) were the most common complications. Oral medications were used by 59.7% of patients, with 29.1% on insulin. Chi-square analysis showed a significant association between treatment adherence and complications ($p < 0.05$), with insulin users exhibiting more complications than those using oral medications. ANOVA revealed that insulin users had significantly lower QoL scores compared to oral medication users ($p < 0.01$). Linear regression analysis indicated that treatment adherence and age were significant predictors of QoL ($\beta = 0.45$, $p < 0.01$). Poor treatment adherence was associated with poorer QoL. **Conclusion:** Complications in diabetic patients significantly affect QoL in Bangladesh. Treatment adherence, especially with oral medications, positively impacts QoL. There is a need for improved access to diabetes care to manage

complications and enhance the overall well-being of diabetic patients.

Keywords

Diabetes Mellitus, Quality of Life, Long-Term Complications, Treatment Patterns, Bangladesh

1. Introduction

Diabetes Mellitus (DM) is a chronic metabolic disorder marked by elevated blood glucose levels due to insufficient insulin production or impaired insulin action, impacting millions globally, with an increasing prevalence in Bangladesh [1] [2]. As of 2021, diabetes affected an estimated 537 million adults worldwide, while over 8 million adults in Bangladesh are projected to live with the condition—a figure expected to rise significantly [3] [4]. This escalating prevalence adds strain on healthcare systems as diabetes significantly contributes to morbidity, mortality, and healthcare costs [5].

Pharmacological management of diabetes primarily involves oral hypoglycemic agents and injectable insulin, each influencing patient health and quality of life (QoL) differently. Oral hypoglycemic agents, mainly prescribed for type 2 diabetes, enhance insulin sensitivity and reduce glucose absorption. However, prolonged use of these agents can lead to side effects like hypoglycemia and gastrointestinal issues, which affect daily activities and overall well-being [6]. In contrast, injectable insulin, essential for managing type 1 and advanced type 2 diabetes, provides direct glucose control but requires careful monitoring to prevent hypoglycemia. This necessity for vigilance can create physical and emotional strain, often impacting QoL due to increased stress and lifestyle limitations [7].

Diabetes complications are both extensive and progressive, affecting nearly every organ system and significantly impacting QoL. Chronic hyperglycemia can lead to microvascular complications such as retinopathy, nephropathy, and neuropathy, as well as macrovascular issues like cardiovascular disease and stroke, all contributing to elevated morbidity and mortality among people with diabetes [8] [9]. Furthermore, prolonged diabetes duration increases the risk of peripheral artery disease and neuropathy, raising the likelihood of lower-limb amputations and further impairing mobility and independence [10]. Understanding the effect of distinct treatment patterns on the progression of these complications and QoL outcomes is crucial for refining diabetes management strategies.

QoL for diabetic patients encompasses physical, psychological, and social domains, encompassing how well individuals adapt to and manage their condition. For patients in Bangladesh, limited healthcare resources, socioeconomic barriers, and high rates of complications—including neuropathy, retinopathy, and cardiovascular disease—add further challenges to achieving optimal QoL [11]. These issues have been exacerbated by the COVID-19 pandemic, which has disrupted

healthcare systems globally, disproportionately affecting individuals with chronic conditions like diabetes [12]. Studies have shown that diabetic patients face a heightened risk of severe COVID-19 outcomes, including ICU admission and mortality, due to increased susceptibility to complications [13].

In Bangladesh, the COVID-19 pandemic has further challenged diabetes management by limiting access to healthcare, regular monitoring, and medication supplies, potentially compromising glycemic control and elevating the risk of long-term complications [14]-[16]. Pandemic-related movement restrictions and reduced healthcare accessibility have disrupted the continuity of diabetes care, which is essential for controlling blood glucose levels and preventing complications [17]-[19].

This study aims to assess the status of long-term complications and QoL among diabetic patients in Bangladesh, focusing on how different treatment patterns—specifically oral hypoglycemic agents versus injectable insulin—may influence these outcomes. By examining the influence of treatment adherence, lifestyle adjustments, and healthcare access on QoL, this research seeks to provide insights into optimizing diabetes management strategies, thereby informing policies to alleviate the diabetes burden on Bangladesh's healthcare system.

2. Methods

2.1. Study Design and Setting

A cross-sectional study was conducted on 385 diabetic patient slum dwellers aged 18 - 80 years between May 2022 and October 2022 in the outpatient department of three tertiary hospitals in Dhaka and Mymensingh districts in Bangladesh, Bangladesh.

2.2. Sample Size, Sample Selection Procedure and Recruitment

The study involved 385 diabetic patients from three tertiary diabetic hospital, selected through a convenient sampling technique applied to diabetes or endocrinology department of the hospital. Participants were recruited from the outpatient and inpatient departments of three tertiary hospitals in Dhaka and Mymensingh. Outpatients waiting for consultations were approached, informed about the study, and assessed for eligibility. For inpatients, a bed-to-bed approach was used, where each admitted patient was screened based on inclusion criteria. The inclusion criteria encompassed adults aged 18 - 80 years, diagnosed with diabetes mellitus (type 1 or type 2), who were receiving treatment from the selected hospitals. Participants had to be capable of providing informed consent and independently responding to the questionnaire. The exclusion criteria eliminated patients with severe non-diabetic medical conditions, such as advanced cancer, end-stage renal disease, or cognitive impairments. Additionally, individuals unwilling to participate or unable to respond independently, such as those critically ill or with communication difficulties, were excluded.

Sample size was calculated using the formula of Cochran's,

$$n = \frac{(Z)^2 \times p(1-p)}{d^2}.$$

With a 5% margin of error (e), considering the prevalence of quality of life of diabetic patient people (p = 53.00%) as reported in a similar study in India [20], the standard normal variate of 1.96 (z), the required sample size was 384.

2.3. Data Collection Procedure

A semi-structured questionnaire (see in **Appendix**) was developed using the Kobo Toolbox, and the data were collected using a face-to-face interview. The questionnaire was developed based on previously published researches, with slight adjustments for the study cohort [19] [21]. Five trained surveyor's/data collectors were appointed for the data collection purpose. The questionnaire consisted of sociodemographic information, diabetes-related information, comorbidities, complications, investigations, and QoL assessment. We have translated English questioner into Bengali back translations with the help to expert. The interview process involved administering the SF-12 Questionnaire to measure the quality of life. Special attention was given to ensuring the privacy and comfort of participants during the data collection process, and steps were taken to minimize social desirability bias. Trained research assistants conducted a face-to-face interview of the patients outdoors after giving consent for inclusion. Before interviews, they explained the nature and purpose of the study to the participant.

2.4. Measures

Participants completed a questionnaire comprising of sociodemographic information, diabetic related information's and the quality of life information's using SF-12.

2.4.1. Sociodemographic Characteristics

Socio-demographic data were collected, including age, gender, place of residence, education level, religion, Occupation, marital status and income.

2.4.2. Diabetes-Related Information, Comorbidity Profile, and Complications

The second section comprised questions related to patients' diabetes, asking about the duration of diabetes, name, and duration of anti-diabetic agents used. Patients' body mass index (BMI) was calculated from their height and weight at the time of the interview, and they were asked for a history of hypertension (HTN). Documented complications were recorded in this section. The complications queried were nephropathy, retinopathy, neuropathy, stroke, coronary artery disease (CAD), peripheral artery disease (PAD), and diabetic foot.

2.4.3. Treatment Patterns/Adherence of Diabetes Mellitus

The study categorized treatment patterns into two types: insulin therapy and oral hypoglycemic drugs.

Insulin Therapy:

Patients relied on insulin, often prescribed for type 1 diabetes or advanced type 2 diabetes when oral medications were insufficient.

Oral Hypoglycemic Drugs:

Patients used oral medications like metformin or sulfonylureas, primarily for managing type 2 diabetes in its earlier stages.

2.4.4. Short Form-12 (SF-12) for Quality of Life

The SF-12 Quality of Life scale is a shorter version of the QoL-36 scale widely used to measure an individual's quality of life and/or health-related quality of life [22]. It's a brief, easy-to-use, and robust instrument to measure the quality of life, which was developed by Ware *et al.* in 1995 [23]. Islam *et al.* translated, culturally adapted, and validated the English version of "Short Form SF-12" into Bengali in 2017 [24].

This scale assesses the quality of life in terms of overall health (Item 1), physical function (Items 2 and 3), physical health (Items 4 and 5), physical problems (Items 7 and 6), physical pain (Item 8), social functioning (Item 9), vitality and vital energy (Item 11), and mental health (items 10 and 12). The 12 items are used to derive two summary measures, i.e., physical component summary (PCS) and mental component summary (MCS), each containing six questions [25]. Items are rated on a three to six-point Likert scale; a lower score indicates poor health. Scores of negative items (# 2, 3, 4, 5, 6, 7, 11, and 12) are reversed so that a higher score indicates better health. According to the scoring manual, scores were transformed into the 0 to 100 range. A higher score indicates higher levels of QoL [26] [27]. This study used the mean score for the US population as a cut-off, as no reference score was calculated for the Bangladeshi population. The average PCS-12 and MCS-12 scores for the United States population are 50 (out of 100) [28].

2.5. COVID-19 Precautions

To ensure participant and researcher safety, strict COVID-19 precautions were followed. Data collection was primarily conducted via telephonic or virtual interviews to minimize in-person contact. For essential face-to-face interactions, both researchers and participants used personal protective equipment (PPE), including masks and gloves. Social distancing of six feet was maintained, and all areas were sanitized between sessions.

2.6. Ethical Approval and Consent Details

This study has received ethical approval from the Institutional Review Committee of Primeasia University (Reference number: **#PAU 23/14-34**). Prior to participation, all individuals provided informed written consent, underscoring the voluntary nature of their involvement and the confidentiality of their data. Adhering to the ethical principles outlined in the Declaration of Helsinki, every aspect of data collection was conducted with utmost regard for the well-being and rights of the participants.

2.7. Statistical Analysis

The statistical analysis for this study is structured to build upon the completed descriptive statistics, which provide frequencies, percentages, and counts for demographic and background variables, including age, gender, education, and income level. Following this, bivariate analysis examines associations between each independent variable and the main outcome variable. Chi-square tests assess significant associations for categorical variables. For continuous variables, ANOVA are used to compare mean scores across SF-12 sub-groups, respectively.

In addition, multivariate analysis is conducted to control for potential confounding factors and identify independent predictors of the outcome. This involves linear regression, with all significant predictors from the bivariate analysis included, along with other essential demographic factors, to ensure a well-adjusted model. Results from this model are reported as beta and p values for a clear interpretation of each predictor's effect on the outcome. Assumptions and model fit are carefully assessed.

3. Result

Table 1 shows the socio-demographic characteristics of the participants. The study sample primarily consisted of individuals aged 41 to 55 years, accounting for 40.8% of the participants. The sample comprised 56.9% males. The predominant form of diabetes identified was Type II, affecting 73.8% of participants. A majority of the participants lived in urban areas (53.8%). Concerning educational attainment, 23.1% of the participants had completed primary education. The majority of participants, constituting 91.4% of the sample, identified as Muslim. The study sample was primarily composed of housewives (32.7%) and married individuals (95.3%), with a majority having a monthly household income between 21,000 and 30,000 Bangladeshi Taka (51.4%), reflecting a largely married, moderate-income demographic.

Table 1. Sociodemographic characteristics of study participants.

Variable name	Categories	Frequency	Percentage
Age category	18 - 25	07	1.8%
	26 - 40	105	27.3%
	41 - 55	157	40.8%
	>56	116	30.1%
Sex	Male	219	56.9%
	Female	166	43.1%
Type of DM	Type I	96	24.9%
	Type II	284	73.8%
	Gestational	5	1.3%
Place of residence	Rural	91	23.6%
	Urban	207	53.8%
	Suburban	87	22.6%

Continued

Educational level	Illiterate	37	9.60%
	Primary	89	23.1%
	SSC	83	22.6%
	HSC	88	22.9%
	Graduate & above	88	22.9%
Religion	Muslim	352	91.4%
	Hindu	32	8.30%
	Christen	1	0.30%
	Others	-	-
Occupation	Government service holder	33	8.6%
	Private service	85	22.1%
	Business	87	22.6%
	Housewife	126	32.7%
	Others	54	14.0%
Marital status	Unmarried	18	4.7%
	Married	367	95.3%
Monthly household income (in Taka)	Less than 10000 tk	02	0.50%
	10000 - 20000 tk	48	12.5%
	21000 - 30000 tk	198	51.4%
	More than 30000 tk	137	35.6%

Table 2 outlines the prevalence of both macro-vascular and micro-vascular complications among participants. In the macro-vascular category, the most frequent complication was stroke, reported by 15.8% of participants, while myocardial infarction and heart failure were less common, affecting 10.1% and 8.3%, respectively. Peripheral vascular complications were rare, with foot ulcers in 7.3% of cases and amputations in only 0.8%. Among micro-vascular complications, diabetes retinopathy was the most prevalent, occurring in 34.5% of participants, followed closely by diabetes polyneuropathy (32.2%) and diabetes nephropathy (29.1%). One-eye blindness was uncommon, affecting only 2.3% of the participants.

Table 2. Prevalence of macro-vascular and micro-vascular complications among study participants.

Complication				Frequency	Percentage
Macro-vascular	Cardiovascular	Myocardial infraction	Yes	39	10.1%
			No	346	89.9%
		Heart failure	Yes	32	8.3%
			No	353	91.7%
	Cerebrovascular	Stroke	Yes	61	15.8%
			No	324	84.2%
	Peripheral vascular	Foot ulcer	Yes	28	7.3%
			No	357	92.7%
		Amputations	Yes	3	0.80%
			No	382	99.2%

Continued

Micro-vascular	Cardiovascular	Diabetes polyneuropathy	Yes	124	32.2%
			No	261	67.8%
	Nephrology	Diabetes nephropathy	Yes	112	29.1%
			No	273	70.9%
	Ophthalmological	Diabetes retinopathy	Yes	133	34.5%
			No	252	65.5%
		One eye blindness	Yes	9	2.3%
			No	376	97.7%

Table 3 showed most participants in the study had been living with diabetes for less than 5 years (55.3%), while 28.6% had diabetes for 6 - 10 years, 10.4% for 11 - 15 years, and 5.7% for over 16 years. A significant majority (80.8%) reported having checked their random blood sugar (RBS) levels in the past three months, with an average RBS of 11.88 ± 4.74 mmol/L among those who did. In terms of family history, 46.5% had parents with diabetes, 39.2% had diabetic siblings, and 19.2% had diabetic children. For diabetes management, 59.7% used medication, 29.1% used insulin, and 11.2% used both. 67.3% of participants reported regular adherence, while 32.7% did not. Half of the participants (50.1%) reported experiencing hypoglycemia, while 52.3% had hypertension, indicating common comorbidities. Additionally, 30.1% reported high cholesterol levels, 11.9% had thyroid disease, and 37.9% had allergies. Regarding lifestyle factors, 22.9% of participants reported smoking, with the majority (77.1%) being non-smokers.

Table 3. Health and lifestyle characteristics related to diabetes management among study participants.

Variable	Category	Frequency	Percentage (%)
How long do you have diabetes?	<5 Year	213	55.3%
	6 - 10 Year	110	28.6%
	11 - 15 Year	40	10.4%
	>16	22	5.7%
Did you check up RBS in last three months?	Yes	311	80.8%
	No	74	19.2%
Did you check up RBS in last three months? If yes? What is your result? (years, mean ± SD)		11.88 ± 4.74	
Parents history of diabetics	Yes	179	46.5%
	No	206	53.5%
Siblings history of diabetes	Yes	151	39.2%
	No	234	60.8%
Children history of diabetes	Yes	74	19.2%
	No	311	80.8%
Type of medication	Insulin	112	29.1%
	Drug	230	59.7%
	Both	43	11.2%

Continued

Do you maintain regular blood sugar?	Yes	259	67.3%
	No	126	32.7%
Have you ever faced hypoglycemia?	Yes	193	50.1%
	No	192	58.7%
Do you have hypertension?	Yes	183	52.3%
	No	167	49.9%
Do you have high cholesterol?	Yes	116	30.1%
	No	269	69.9%
Do you have thyroid disease?	Yes	46	11.9%
	No	339	88.1%
Do you have any allergies?	Yes	146	37.9%
	No	239	62.1%
Do you smoke?	Yes	88	22.9%
	No	297	77.1%

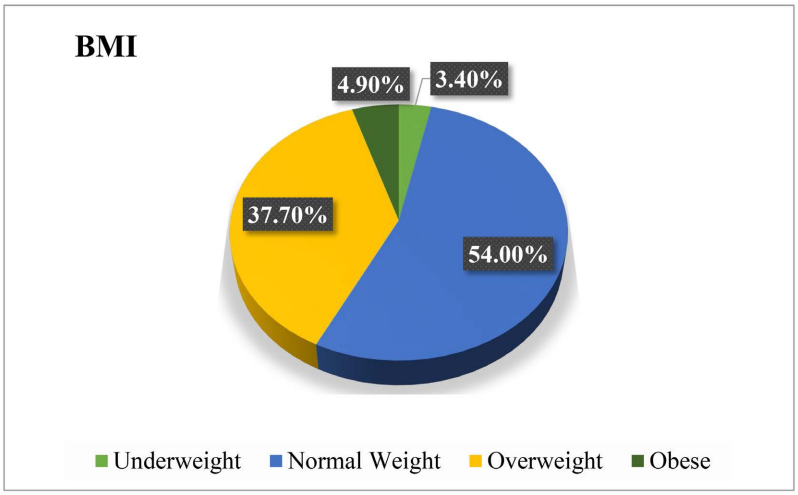

Figure 1. Percentage of BMI of the respondents.

Figure 1 BMI categories showed that 3.4% of participants were underweight, 54.0% had normal weight, 37.7% were overweight, and 4.9% were obese.

Table 4 shows the results of the One-way ANOVA test indicate that the type of treatment (insulin, drug, or both) has a significant association with the PCS-12 (Physical Component Summary) scores, with a p-value of less than 0.001. This suggests that physical health outcomes, as measured by PCS-12, vary significantly depending on the treatment type, with drug treatment showing a higher mean PCS-12 score (40.66) compared to insulin (37.56) and both treatments combined (36.71). However, there is no significant association between treatment type and MCS-12 (Mental Component Summary) scores, as indicated by a p-value of 0.14, meaning mental health outcomes do not vary significantly across different treatment types.

Table 4. Comparison of physical and mental health scores (PCS-12 and MCS-12) across different diabetes treatment types.

Treatment type	Quality of life scores					
	PCS-12			MCS-12		
	Mean	Frequency	P-value	Mean	Frequency	P-value
Insulin	37.56	112		44.81	112	
Drug	40.66	230	**P < 0.001**	44.83	230	**0.14**
Both	36.71	43		42.89	43	

***The association has been measured by One-way ANOVA test, where $p < 0.05$ considered as significant.

The multivariable linear regression analysis in Table 5 reveals several significant variables affecting quality of life scores, measured by both the Mental Component Summary (MCS-12) and Physical Component Summary (PCS-12). Age is significantly associated with a decrease in PCS-12 scores, with each additional year of age contributing to a 0.12-point decline in physical quality of life ($p < 0.001$), while no significant effect is seen on MCS-12. For diabetes type, individuals with Type II diabetes have a 1.83-point higher PCS-12 score compared to those with Type I diabetes ($p = 0.015$), suggesting better physical quality of life among Type II diabetes patients. Marital status shows that being married is associated with a 3.22-point decrease in MCS-12 scores ($p = 0.03$), indicating a lower mental quality of life among married individuals compared to unmarried ones. Diabetes retinopathy is associated with a significant 2.23-point decrease in MCS-12 scores for those affected by retinopathy ($p = 0.003$), suggesting a significant decline in mental quality of life for these individuals. Diabetes nephropathy, on the other hand, shows a positive association with PCS-12, with a 1.48-point increase in physical quality of life for those without nephropathy ($p = 0.04$).

Table 5. Relationship between quality of life and independent variables.

Name of variable	Categories	MCS-12		PCS-12	
		beta	p	beta	p
Age		−0.02	0.43	−0.12	**<0.001**
Sex	Male (Ref)				
	Female	1.47	0.16	−0.52	0.62
Types of diabetes	Type I (Ref)				
	Type II	0.596	0.42	1.83	0.01
	Gestational DM	3.08	0.28	0.380	0.89
Education	Illiterate (Ref)				
	Primary	−1.35	0.26	−1.06	0.38
	SSC	−2.07	0.09	1.17	0.34
	HSC	−0.54	0.68	0.84	0.53
	Graduate and above	−2.26	0.13	0.34	0.82

Continued

Occupation	Government service Holder (Ref)				
	Private service	2.29	0.07	−0.02	0.98
	Business	−0.78	0.55	−0.44	0.73
	Housewife	−0.12	0.93	−0.78	0.60
	Others	2.03	0.15	−1.09	0.44
Marital status	Unmarried (Ref)				
	Married	−3.22	**0.03**	−2.31	0.13
Income	Less than 10000 tk (Ref)				
	10,000 - 20,000 tk	−0.07	0.98	5.85	0.19
	21,000 - 30,000 tk	−0.48	0.91	4.28	0.32
	More than 30,000 tk	−1.13	0.79	4.97	0.26
Long term complications of DM					
Diabetes polyneuropathy	Yes (Ref)				
	No	0.21	0.77	−1.10	0.13
Diabetes nephropathy	Yes (Ref)				
	No	0.47	0.51	1.48	**0.04**
Diabetes retinopathy	Yes (Ref)				
	No	−2.23	**0.003**	−0.65	0.37
Diabetes one eye blindness	Yes (Ref)				
	No	1.25	0.54	2.39	0.24
Myocardial infraction	Yes (Ref)				
	No	−0.06	0.95	1.02	0.37
Heart failure	Yes (Ref)				
	No	2.01	0.09	1.78	0.14
Stroke	Yes (Ref)				
	No	0.19	0.84	0.58	0.56
Foot ulcer	Yes (Ref)				
	No	−0.11	0.92	−2.20	0.087
Amputations	Yes (Ref)				
	No	−3.27	0.35	4.82	0.17

*Ref = Reference category.

4. Discussion

The findings of this study provide significant insights into the socio-demographic characteristics, complications, and quality of life among individuals with diabetes in Bangladesh. These findings were supported by similar or contrasting findings from national and international studies [29] [30].

The high prevalence of middle-aged participants (41 - 55 years) and the predominance of males (56.9%) in the study can be attributed to lifestyle changes and

occupational stress commonly observed in this age group and gender. Men in Bangladesh are often exposed to high-calorie diets and sedentary lifestyles, which increase their vulnerability to Type II diabetes [31] [32]. Similar patterns have been reported in other low- and middle-income countries (LMICs), where urbanization and industrialization contribute to rising diabetes prevalence among men in their middle years [33] [34]. For example, a study conducted in India also found higher diabetes prevalence among urban male populations due to similar risk factors [35].

The urban predominance (53.8%) in this study reflects the role of urbanization in increasing diabetes risk through reduced physical activity and dietary changes. However, contrasting findings from some rural-focused studies in Bangladesh suggest that rural areas are also experiencing rising diabetes prevalence, driven by increased access to processed foods and changing lifestyles [36]-[39].

The low educational attainment (23.1% completing primary education) highlights the challenge of health literacy in managing diabetes effectively. Education significantly influences self-management behaviors, as evidenced by a global study published in *Diabetes Care*, which showed that higher education levels are associated with better glycemic control [40].

The high prevalence of macrovascular complications, particularly stroke (15.8%), and microvascular complications, such as retinopathy (34.5%), reflects suboptimal diabetes management. Stroke's prominence may be due to delayed diagnosis and inadequate control of hypertension and dyslipidemia, which are common in the Bangladeshi diabetic population. This is consistent with findings from a study in Pakistan, which reported similar rates of cerebrovascular complications among poorly managed diabetic patients [41].

The prevalence of retinopathy and neuropathy aligns with findings from the Diabetes Control and Complications Trial, which established that prolonged hyperglycemia exacerbates microvascular damage [42]. The relatively lower prevalence of peripheral vascular complications in this study (e.g., foot ulcers at 7.3%) compared to global studies may indicate a younger diabetic population or increased awareness of foot care among participants [43].

The significant association between treatment type and PCS-12 scores suggests that patients on drug treatments experience better physical quality of life compared to those on insulin or combined therapies. This could be due to disease severity, as individuals requiring insulin often have advanced diabetes and associated complications. Similar findings were reported in a Nigerian study, where insulin-dependent diabetics had lower physical health scores compared to those on oral hypoglycemic agents [44].

Mental quality of life (MCS-12) showed no significant association with treatment type, indicating that psychosocial factors, rather than treatment modality, play a dominant role in mental health outcomes. Married participants reported lower mental health scores, potentially due to increased caregiving and familial responsibilities, a finding supported by studies from China and India that

highlight the psychological burden on caregivers and married diabetic patients [45] [46].

The decline in physical quality of life with increasing age is consistent with physiological aging and its impact on mobility and disease management. Interestingly, Type II diabetics had higher PCS-12 scores compared to Type I, likely because Type I diabetes typically manifests earlier in life and requires more intensive management, contributing to physical and emotional strain [46].

The prevalence of hypoglycemia (50.1%) and hypertension (52.3%) in this study is comparable to findings from the Bangladesh Demographic and Health Survey (BDHS), which also highlights high rates of comorbidities among diabetics [47]. Internationally, the prevalence of hypoglycemia is reported to vary, with higher rates in LMICs like Bangladesh compared to high-income countries due to limited access to glucose monitoring tools and patient education [48].

Contrasting findings were observed in studies from developed countries, such as the UK Prospective Diabetes Study (UKPDS), where better healthcare access led to lower rates of severe hypoglycemia and improved overall quality of life [49]. This underscores the need for systemic improvements in diabetes care infrastructure in Bangladesh, including affordable access to glucometers, insulin, and educational programs.

The finding that 46.5% of participants had a parental history of diabetes highlights the strong genetic predisposition in this population, which aligns with global research emphasizing hereditary risk factors in Type II diabetes. Family history's role in increasing diabetes risk has been well-documented, including in studies from South Asia, which share similar genetic and lifestyle profiles.

5. Conclusion

This study sheds light on the socio-demographic and clinical factors influencing diabetes-related complications and quality of life in Bangladesh. The findings align with global evidence while emphasizing the unique challenges faced by the Bangladeshi population. Future research should adopt longitudinal designs to explore causal relationships and evaluate the effectiveness of tailored interventions in improving both physical and mental health outcomes for diabetics.

6. Recommendations

To reduce the diabetes burden in Bangladesh, targeted strategies are essential. Strengthening primary healthcare systems through early diagnosis, provider training, and integrated diabetes care is crucial. Subsidizing medications and offering community-based diagnostic services can improve access for low-income populations. Patient education on lifestyle changes, medication adherence, and complication prevention should be prioritized. Expanding specialized care via diabetes clinics and telemedicine can address geographical barriers. Addressing urban-rural disparities through rural health initiatives and community health workers is vital. Developing national diabetes guidelines, increasing funding, and

investing in research and surveillance will ensure evidence-based interventions and improved patient outcomes.

Declarations

Consent for Publications

Informed consent for publication was obtained verbally from all participants or their legally authorized representatives prior to data collection. Non-essential identifying details have been omitted to protect participant confidentiality.

Conflicts of Interest

The authors declare no conflicts of interest for this work and any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work.

Funding Statement

No funding was received for this study.

Ethical Approval and Informed Consent Statements

The study protocol received approval from the Ethical Review Committee of the Primeasia University, Bangladesh. Informed consent was obtained from all adult participants and minors' parents or legal guardians, following a thorough explanation of the study's aims and procedures. Participants' personal information was handled with strict confidentiality following ethical standards.

Data Availability Statement

The data supporting this study are available from the corresponding author upon reasonable request.

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Appendix

QUESTIONNAIRE

- Patients Name ----------Present Address
- Patient's Phone No ----------E-mail Address

Socio-Demographic Status			
SL		**Entitle**	**Code**
1.	Age	_____	
2.	Gender	☐1. Male ☐ 2. Female	
3.	Type of Diabetes	☐1. Type I ☐2. Type II	
4.	Place of residence	☐1. Rural ☐2. Urban ☐3. Suburban	
5.	Religious	☐1. Muslim ☐2. Hindu ☐3. Christan ☐4. Others	
6.	Educational Level	☐1. Illiterate ☐2. Primary ☐3. SSC ☐4. HSC ☐5. Graduate & Above	
7.	Occupational	☐1. Government Service Holder ☐2. Private Service Holder ☐3. Business ☐4. Housewife ☐5. Others	
8.	Marital Status	☐1. Unmarried ☐2. Married	
9.	Monthly Household Income	☐1. Less than 10,000 tk ☐2. 10,000 - 20,000 tk ☐3. 21,000 - 30,000 tk ☐4. More than 30,000 tk	
Diabetics Related Questions			
10.	How long do you have diabetes?	_____	
11.	Did You check up RBS in Last Three months?	☐1. Yes ☐2. No	
12.	If yes? What is your result?	_____	
13.	Parents history of Diabetics	☐1. Yes ☐2. No	

14.	Siblings history of Diabetes	☐1. Yes ☐2. No
15.	Children History of Diabetes	☐1. Yes ☐2. No
16.	Type of medication	☐1. Drug ☐2. Insulin From When? _____
17.	Do you maintain regular?	☐1. Yes ☐2. No
18.	Do you face hypoglycemia?	☐1. Yes ☐2. No
19.	Do you have hypertension?	☐1. Yes ☐2. No
20.	Do you have high cholesterol?	☐1. Yes ☐2. No
21.	Do you have Thyroid Disease?	☐1. Yes ☐2. No
22.	Do you have any allergies?	☐1. Yes ☐2. No
23.	Do you smoke?	☐1. Yes ☐2. No
	Anthropometric Measurement	
24.	Height in cm	_____
25.	Weight in kg	_____
	Long Term Complication	
	Micro-Vascular	
	Cardiovascular	
26.	**Do you Have?**	
	I. Diabetes polyneuropathy	☐1. Yes ☐2. No
	Nephrological	
27.	**Do you Have?**	
	I. Diabetes nephropathy	☐1. Yes ☐2. No
	Ophthalmological	
28.	**Do you Have?**	
	I. Diabetes retinopathy	☐1. Yes ☐2. No
	II. One eye blindness	☐1. Yes ☐2. No
	Macro-Vascular	
	Cardiovascular	
29.	**Do you Have?**	
	I. Myocardial Infraction	☐1. Yes ☐2. No
	II. Heart failure	☐1. Yes ☐2. No
	Cerebrovascular	
30.	**Do you have experience with Stoke?**	
	I. Stroke	☐1. Yes ☐2. No
	Peripheral Vascular	
31.	**Do you Have?**	
	I. Foot ulcer	☐1. Yes ☐2. No
	II. Amputations	☐1. Yes ☐2. No

Quality Of Life (QoL)		
32.	In general, would you say your health is:	☐1. Excellent ☐2. Very good ☐3. Good ☐4. Fair ☐5. Poor

The following two questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

33.	Moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	☐1. Yes, Limited a Lot ☐2. Yes, Limited a Little ☐3. No, Not limited at all
34.	Climbing several flights of stairs.	☐1. Yes, Limited a Lot ☐2. Yes, Limited a Little ☐3. No, Not limited at all

During the past 4 weeks, have you had any of the following problems with your work or other regular activities as a result of your physical health?

35.	Accomplished less than you would like.	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time
36.	Were limited in the kind of work or other activities.	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

37.	Accomplished less than you would like.	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time
38.	Did work or activities less carefully than usual.	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time

39.	During the past 4 weeks, how much did pain interfere with your normal work (including work outside the home and housework)?	☐1. Not at all ☐2. A little bit ☐3. Moderately ☐4. Quite a bit ☐5. Extremely

These questions are about how you have been feeling during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks?

40.	Have you felt calm & peaceful?	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time
41.	Did you have a lot of energy?	☐1. All of the time ☐2. Very little time ☐3. Sometimes ☐4. Most of the time ☐5. None of the time
42.	Have you felt down-hearted and blue?	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time
43.	During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)	☐1. All of the time ☐2. Very little time ☐3. sometimes ☐4. Most of the time ☐5. None of the time