Understanding self-care challenges and barriers among multimorbid patients with type 2 diabetes mellitus in primary care settings: Findings from Central Vietnam

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Abstract

Background: The rising burden of type 2 diabetes among multimorbidity patients poses a significant challenge, highlighting the need to identify self-care barriers and implement effective strategies to enhance glycemic control. This study aims to provide insights crucial for developing tailored behavioural interventions to improve diabetes management in primary care. **Methods:** A cross-sectional descriptive study was conducted on 879 people with diabetes (PWDs) in primary care. Diabetes self-care behaviours (DSC), including diet, exercise, self-monitoring of blood glucose (SMBG), foot care, and medication adherence, were assessed using the Summary of Diabetes Self-Care Activities instrument. Barriers to DSC were identified using the health belief model. Multivariate general linear models and logistic regression analyses were employed to examine the predictors of DSC in the context of multimorbidity. **Results:** Most PWD (75.4%) poorly adhered to self-care. Medication (93.7%) and healthy diet (62.3%) had the highest adherence, while SMBG (1.0%) and foot care (14.9%) were the least performed. Being retired (OR 2.1, 95%CI 1.2-3.6), longer diabetes duration (OR=1.5, 95%CI 1.1-2.1), normal BMI (OR=2.9, 95%CI 1.3-6.2) or obese/overweight (OR=4.0, 95%CI 1.8-8.8), absence of diabetic foot disorders (OR=4.3, 95%CI 1.3-14.5) or cardiovascular diseases (OR=1.5, 95%CI 1.0-2.3), and healthcare visits ≥5 times annually (OR=1.9, 95%CI 1.4 - 2.9) were associated with good self-care practice. Hypercholesterolemia, peripheral artery disease, coronary artery disease, and diabetic foot disorders significantly affected DSC practices ($p<0.05$, $\eta p^2=0.02$). PWDs perceived SMBG, foot care, and diet adherence as the most challenging aspects of DSC. A common barrier was the insufficient guidance from health providers on proper DSC practices. **Conclusion:** Our study emphasises poor adherence and significant challenges to self-care among multimorbid PWD. Strengthening primary care capacity and adopting a multidisciplinary, team-based approach, as well as further studies exploring the role of self-efficacy in reinforcing self-care behaviours, can improve diabetes primary care.

Keywords: *self-care, diabetes mellitus, comorbidity, primary care, Vietnam.*

1. INTRODUCTION

Diabetes mellitus type 2 (T2DM) has been becoming an urgent global health condition, particularly in low- and middle-income countries [1]. In Vietnam, the percentage of people diagnosed with diabetes (PWDs) is predicted to reach 7.1% in 2045 [1]. A previous study in Vietnam showed that over 60% of PWD had poor glycaemic and metabolic control [2]. This higher-than-expected rise in prevalence and poor control of diabetes significantly impact the performance of chronic healthcare systems in Vietnam. Moreover, people with T2DM have a significantly increased risk of developing concurrent chronic conditions compared to those without the disease [3], which can exacerbate the overall burden of the disease and pose unique challenges in clinical management [4].

Promoting self-care for PWDs is the cornerstone of diabetes management. The significant contribution of diabetes self-care (DSC) in improving

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glycaemic control, reducing the risk of diabetes complications, and enhancing the quality of life has been extensively described in the literature [5], [6]. Nevertheless, adherence to DSC behaviours is still low [5], [7]. Poor DSC indicates inadequate awareness and skills, environmental and cultural factors, poor patient-physician relationships, and a lack of integrated care for PWD [8-10].

The World Health Organization (WHO) has declared a global action plan to improve diabetes and non-communicable diseases (NCDs) management through primary health care (PHC) and universal health coverage [11]. In Vietnam, efforts have been made to transition the management of NCDs from specialised hospitals to the PHC system, focusing on patient-centred care and adopting family medicine principles [12]. Nonetheless, PHC responses to NCDs remain weak [13]; inadequate human resources, low quality of services, and lack of essential drugs and NCD training programs hinder effective NCD management at the PHC level [8].

In Vietnam, although several studies on some aspects of diabetes adherence were carried out, limited comprehensive studies with valid Vietnamese instruments exist to evaluate the overall DSC practice of PWD. DSC interventions and coordination among different disciplines are also scarce in motivating DSC practice. This study aims to explore the practical difficulties these patients encounter in managing their multiple chronic conditions daily and identify common barriers that hinder effective self-care practices. By providing systematic evidence, this research seeks to support health providers and policymakers in driving enhancements in primary care delivery for NCDs, particularly patients with T2DM and multimorbidity in PHC settings where data availability is limited.

2. MATERIALS AND METHODS

2.1. Study design and sample

A cross-sectional descriptive study was conducted in 2018. Participants were selected if they met the following criteria: diagnosed with T2DM for at least one year, receiving care at a PHC facility, and had at least one additional chronic condition. A total of 879 PWDs completed the diabetes survey. A multistage sampling approach was employed to obtain a representative sample to grasp the differences in health care delivery and economic conditions across Thua Thien Hue and Khanh Hoa provinces in Central Vietnam. PWDs were invited to participate, and those who agreed provided informed consent. Trained research assistants conducted face-to-face interviews at participants' homes using a structured questionnaire.

2.2. Study measurements

Demographics, health conditions, medical history, and diabetic characteristics were collected from the patient booklets. Weight, height, and waist-hip circumferences were measured during the interview. Blood pressure (BP) was measured twice, with an average of the two readings categorised into normal BP, high-normal BP, and hypertension [14]. Smoking status and alcohol consumption were assessed. Alcohol consumption was classified into two categories using the AUDIT-C assessment tool: low-risk and at-risk drinking [15]. In this study, the term "multimorbid condition" describes any health condition coexisting with T2DM. This includes both conditions that are direct complications of diabetes, such as diabetic retinopathy or nephropathy, and those that are not directly caused by diabetes but often co-occur, such as hypertension or hypercholesterolemia. This broad definition was adopted to reflect the clinical reality where distinguishing between comorbidities and complications can be complex [16], especially since some conditions like hypertension might be both a risk factor for and a consequence of diabetes.

The Summary of Diabetes Self-care Activities (SDSCA) instrument was used to assess DSC among PWDs, consisting of ten core items assessing four aspects of diabetes regimen, namely diet, exercise, SMBG, and foot care, one question assessing smoking behaviour, and 14 other optional items addressing specific self-care behaviours such as medication use [17]. In our study, we used ten core questions and two specific questions on medical adherence and excluded the smoking question, which was treated as a demographic factor rather than a DSC behaviour [18], [19]. The Vietnamese version was validated through forward and backward translation and piloted with 30 PWDs. The final version included 12 items regarding five dimensions of DSC: diet (4 items), physical activity (2 items), SMBG (2 items), medication adherence (2 items), and foot care (2 items). DSC practices were assessed using a 0-7 scale, indicating the number of days participants performed each activity, with the fat consumption item inverted. A "77 = Do not use oral medication/insulin" option was provided for medication adherence. The item scores were averaged, resulting in an overall DSC score. For PWDs who did not have any diabetes treatment or followed a diet and exercise therapy only, the items of medication adherence were not used to calculate

the overall DSC. Depending on the treatment, we used only 1 item of medication adherence to calculate overall DSC for PWDs using oral medication or injections. The overall DSC score ranged from 0 to 7, with a cut-off of 4 days used to categorise DSC practices as good or poor [20].

Participants also reported their perceived barriers to adherence to DSC, with questions developed based on the Health Belief Model and results of Vanderlee L et al. study (2016) [21]. These questions related to patients' preferences, perceived severity, perceived benefit, perceived barrier, self-efficacy, social support, and recommendations from health care providers.

2.3. Statistical analysis

Epidata 3.1, SPSS 18.0, and MS. Excel were used for data entry and analysis. All data were anonymised when analysed to ensure participants' confidentiality. Descriptive analysis and the Chi-square tests were utilised. A multivariate general linear model was utilised to assess how various comorbidities and complications influence different domains of self-care practices among participants. Bivariable and multivariable logistic regression analyses examined self-care predictors among PWDs. Variables with a p-value < 0.2 at bivariable logistic regression analysis were entered into the multivariable logistic regression model. A p-value of < 0.05 was considered statistically significant.

2.4. Ethical approval

This study was approved by the Ethical Committee in Biomedical Research of Hue University of Medicine and Pharmacy, Vietnam, issued on 28 March 2017. Written consent was obtained from the participants involved in the study after they were fully informed about the study. All participants had the right to withdraw from the study at any time.

3. RESULTS

Socio-demographic and clinical characteristics of participants

The study population had an average age of 65.3 years (SD: 10.7), predominantly female (68.4%) (Table 1). Urban areas showed higher obesity and comorbidities/complications rates than rural areas (p<0.05). Diabetes duration was 6.7 years on average, with 22.2% reporting a family history. Oral medication was the major treatment (86.8%). The awareness of HbA1c levels was low, with only 11.7% aware of their last result, averaging 8.7 mmol/l (SD 3.6). The mean number of comorbidities and complications was 2.9 (SD: 1.7). Hypertension (71.1%), diabetic retinopathy (44.4%), hypoglycemia (41.3%), hypercholesterolemia (35.8%), neuropathy without back pain (26.6%), and cardiovascular diseases (24.5%) were the most common comorbidities and complications.

Table 1. Socio-demographic and clinical characteristics of participants

General characteristics and health behaviours, n (%)	Urban areas (n = 507)	Rural areas (n = 372)	Total (n = 879)	p-value
Age (Mean (SD): 65.3 (10.7))				
≤ 44	11 (2.2)	10 (2.7)	21 (2.4)	
45 – 64	223 (44.0)	182 (48.9)	405 (46.1)	0.28
≥ 65	273 (53.8)	180 (48.4)	453 (51.5)	
Gender				
Male	170 (33.5)	108 (29.0)	278 (31.6)	0.16
Female	337 (66.5)	264 (71.0)	601 (68.4)	
Highest qualification				
Under primary school	145 (28.6)	170 (45.7)	315 (35.8)	
Primary school	127 (25.0)	102 (27.4)	229 (26.1)	
Junior high school	80 (15.8)	39 (10.5)	119 (13.5)	**<0.001**
Senior high school	94 (18.5)	49 (13.2)	143 (16.3)	
College and above	61 (12.0)	12 (3.2)	73 (8.3)	
Active smoking	95 (18.7)	68 (18.3)	163 (18.5)	0.93
At-risk alcohol drinking	54 (10.7)	28 (7.5)	82 (9.3)	0.13

BMI				
Underweight	37 (7.3)	42 (11.3)	79 (9.0)	
Normal weight	224 (44.2)	188 (50.5)	412 (46.9)	**0.004**
Overweight/ Obesity	246 (48.5)	142 (38.2)	388 (44.1)	
Blood pressure				
Normal	118 (23.3)	100 (26.9)	218 (24.8)	
Prehypertension	104 (20.5)	82 (22.0)	186 (21.2)	0.3
Hypertension	285 (56.2)	190 (51.1)	475 (54.0)	
Having a family history of diabetes	121 (23.9)	74 (19.9)	195 (22.2)	0.16
Duration of diabetes (Mean (SD): 6.7(6.3))				
≤ 7 years	306 (60.4)	286 (76.9)	592 (67.3)	**<0.001**
> 7 years	201 (39.6)	86 (23.1)	287 (32.7)	
Kind of treatment				
Not having any treatment for diabetes	10 (2.0)	15 (4.0)	25 (2.9)	
Lifestyle modification	10 (2.0)	14 (3.8)	24 (2.7)	
Oral medication	444 (87.6)	319 (85.8)	763 (86.8)	0.11
Injectable medication	23 (4.5)	8 (2.1)	31 (3.5)	
Combining injectable and oral medication	20 (3.9)	16 (4.3)	36 (4.1)	
Number of multimorbid conditions (Mean (SD): 2.9 (1.7))				
1 disease	111 (21.9)	99 (26.6)	210 (23.9)	0.11
≥ 2 diseases	396 (78.1)	273 (73.4)	669 (76.1)	
Comorbidity/Complication				
Hypertension	360 (71.0)	267 (71.8)	627 (71.3)	0.82
Diabetic retinopathy	230 (45.4)	160 (43.0)	390 (44.4)	0.49
Hypoglycemia	225 (44.4)	138 (37.1)	363 (41.3)	**0.03**
Hypercholesterolemia	206 (40.6)	109 (29.3)	315 (35.8)	**0.001**
Neuropathy without back pain	151 (29.8)	83 (22.3)	234 (26.6)	**0.01**
Cardiovascular diseases	131 (25.8)	84 (22.6)	215 (24.5)	0.3
Peripheral artery disease	56 (11.0)	39 (10.5)	95 (10.8)	0.83
Coronary artery disease	63 (12.4)	29 (7.8)	92 (10.5)	**0.03**
Obesity	52 (10.3)	37 (9.9)	89 (10.1)	0.91
Nephropathy	29 (5.7)	23 (6.2)	52 (5.9)	0.77
Diabetic foot disorders	15 (3.0)	20 (5.4)	35 (4.0)	0.08

Self-care and diabetes management

On average, participants adhered to self-care behaviours for about 3.24 days per week (SD 1.1), with 24.6% practising good self-care. Medication adherence was the highest at 6.63 ± 1.44 days per week (93.7%), followed by healthy diet adherence at 4.36 ± 1.8 days (62.3%). The lowest compliance was seen in SMBG (98.9% non-compliance). Among insulin users (n = 67), only 6.0% checked their blood glucose more than four days per week. Foot care adherence was also low, with only 14.9% practising it well (1.75 ± 2.49 days).

The multivariate general linear model analysis (Table 2) provides insights into how various diabetic comorbidities/complications influence different aspects of DSC practices. Conditions such as hypercholesterolemia (F = 3.09, ηp^2=0.02, p<0.01), peripheral artery disease (F=2.6, ηp^2=0.02, p<0.05), coronary artery disease(F=2.6, p<0.05, ηp^2=0.02), diabetic foot disorders (F=3.21, ηp^2=0.02, p<0.01) exhibited significant effects on self-care practices, suggesting moderate effects on how patients manage their diet, exercise, and other care routines. No statistically significant associations were found between the remaining comorbidities/complications and diabetes self-care practices.

The univariate analysis provided further insights into how specific comorbidities/complications influence distinct self-care behaviours. Retinopathy (B=-0.08, F=6.6, p<0.05) and diabetic foot disorders (B=-0.2, F=4.21, p<0.05) were associated with decreased SMBG monitoring. Coronary artery disease exhibited contrasting effects, with a positive association with SMBG (B=0.27, F=5.8, p<0.05) and a negative correlation to medication adherence (B=-0.39, F=7.1, p<0.01). Peripheral artery disease negatively impacted exercise (B=-0.83, F=9.5, p<0.01). Nephropathy was linked to better foot care (B=0.81, F=4.9, p<0.05). Hypercholesterolemia promoted exercise (B=0.54, F=9.6, p<0.01) and medication adherence (B=0.14, F=4.58, p<0.05). However, diet adherence was impaired by diabetic foot disorders (B=-0.64, F=3.99, p<0.05) and nephropathy (B=-0.31, F=4.85, p<0.05).

Table 2. Self-care practice domains by multimorbidity conditions among PWD

	Univariate					Multivariate	
	Diet	**Exercise**	**Medication**	**SMBG**	**Footcare**	**F**	***ηp²***
Hypertension							
Mean (SD)	4.45 (1.76)	3.75 (2.5)	6.64 (1.4)	0.28 (0.99)	1.83 (2.52)		
B (95% CI)	0.13 (-0.14 - 0.4)	-0.34 (-0.71 - 0.02)	0.07 (-0.15 - 0.28)	0.11 (-0.03 - 0.25)	0.04 (-0.35 - 0.42)	1.52	0.01
F (ηp^2)	0.91 (0.001)	3.38 (0.004)	0.34 (<0.001)	2.22 (0.003)	0.04 (< 0.001)		
Diabetic retinopathy							
Mean (SD)	4.39 (1.81)	3.79 (2.46)	6.58 (1.52)	0.36 (1.1)	1.85 (2.58)	1.54	
B (95% CI)	-0.05 (-0.3 - 0.19)	-0.11 (-0.44 - 0.22)	0.16 (0.04 - 0.29)	-0.08 (-0.28 - 0.11)	0.06 (-0.28 - 0.41)		0.01
F (ηp^2)	0.18 (< 0.001)	0.43 (0.001)	0.72 (0.001)	**6.6 (0.01)***	0.12 (0.000)		
Hypoglycemia							
Mean (SD)	4.52 (1.75)	3.89 (2.34)	6.6 (1.5)	0.31 (1.03)	1.81 (2.53)		
B (95% CI)	0.17 (-0.73 - 0.42)	0.05 (-0.28 - 0.39)	-0.05 (-0.24 - 0.15)	0.08 (-0.05 - 0.21)	-0.02 (-0.37 - 0.32)	0.73	< 0.01
F (ηp^2)	1.9 (0.002)	0.1 (< 0.001)	1.6 (0.002)	0.2 (< 0.001)	0.02 (< 0.001)		
Hypercholesterolemia							
Mean (SD)	4.51 (1.8)	4.2 (2.27)	6.63 (1.47)	0.36 (1.08)	1.75 (2.36)		
B (95% CI)	0.14 (-0.11 - 0.39)	0.54 (0.2 - 0.89)	0.14 (0.01 - 0.27)	0.003 (-0.2 - 0.21)	-0.1 (-0.46 - 0.25)	**3.09****	**0.02**
F (ηp^2)	1.23 (0.001)	**9.64 (0.012)****	**4.58 (0.006)***	0.001 (< 0.001)	0.32 (< 0.001)		
Neuropathy without back pain							
Mean (SD)	4.19 (1.81)	3.94 (2.43)	6.59 (1.56)	0.36 (1.21)	1.72(2.45)		
B (95% CI)	-0.31 (-0.58 - -0.03)	0.12 (-0.26 - 0.49)	-0.04 (-0.26 - 0.18)	0.12 (-0.02 - 0.26)	-0.14 (-0.53 - 0.25)	1.94	0.01
F (ηp^2)	**4.85 (0.01)***	0.37 (< 0.001)	2.87 (0.003)	0.15 (< 0.001)	0.49 (0.001)		

Cardiovascular diseases							
Mean (SD)	4.26 (1.83)	3.66 (2.41)	6.49 (1.67)	0.37 (1.02)	1.69 (2.46)		0.01
B (95% CI)	-0.22 (-0.5 - 0.06)	-0.25 (-0.63 - 0.13)	-0.18 (-0.41 - 0.45)	0.14 (-0.003 - 0.29)	-0.17 (-0.57 - 0.23)	1.79	
F (ηp^2)	2.34 (0.003)	1.68 (0.002)	2.4 (0.003)	3.7 (0.004)	0.71 (0.001)		
Peripheral artery disease							
Mean (SD)	4.49 (1.6)	3.11 (2.48)	6.6 (1.56)	0.41 (1.08)	1.65 (2.05)		
B (95% CI)	0.07 (-0.31 - 0.46)	-0.83 (-1.36 - -0.3)	-0.03 (-0.34 - 0.29)	0.16 (-0.04 - 0.36)	-0.19 (-0.75 - 0.36)	**2.6***	**0.02**
F (ηp^2)	0.14 (< 0.001)	**9.47 (0.01)****	2.49 (0.003)	0.03 (< 0.001)	0.47 (0.001)		
Coronary artery disease							
Mean (SD)	4.3 (1.96)	3.86 (2.39)	6.28 (2.07)	0.51 (1.4)	1.59 (2.23)		**0.02**
B (95% CI)	-0.14 (-0.53 - 0.26)	0.01 (-0.53 - 0.54)	-0.39 (-0.7 - -0.07)	0.27 (0.07 - 0.48)	-0.25 (-0.81 - 0.3)	**2.6***	
F (ηp^2)	0.47 (0.001)	0.001 (< 0.001)	**7.08 (0.01)****	**5.78 (0.01)***	0.8 (0.001)		
Obesity							
Mean (SD)	4.29 (1.86)	3.56 (2.45)	6.67 (1.37)	0.32 (1.16)	1.65 (2.47)		< 0.01
B (95% CI)	-0.15 (-0.55 - 0.25)	-0.32 (-0.87 - 0.23)	0.05 (-0.27 - 0.37)	0.06 (-0.15 - 0.26)	-0.19 (-0.76 - 0.38)	0.48	
F (ηp^2)	0.51 (0.001)	1.32 (0.002)	0.29 (< 0.001)	0.09 (< 0.001)	0.42 (0.001)		
Nephropathy							
Mean (SD)	4.18 (1.93)	3.56 (2.6)	6.55 (1.51)	0.31 (0.77)	2.58 (2.79)		0.01
B (95% CI)	-0.26 (-0.76 - 0.25)	-0.31 (-1.0 - 0.38)	-0.08 (-0.49 - 0.33)	0.05 (-0.21 - 0.31)	0.81 (0.09 - 1.52)	1.56	
F (ηp^2)	1.01 (0.001)	0.79 (0.001)	0.16 (< 0.001)	1.44 (< 0.001)	**4.89 (0.01)***		
Diabetic foot disorders							
Mean (SD)	3.8 (2.08)	3.16 (2.63)	6.44 (1.78)	0.59 (1.41)	2.66 (2.83)		**0.02**
B (95% CI)	-0.64 (-1.27 - -0.01)	-0.72 (-1.58 - 0.14)	-0.2 (-0.71 - 0.31)	0.34 (0.01 - 0.67)	0.87 (-0.03 - 1.76)	**3.21****	
F (ηp^2)	**3.99 (0.01)***	2.73 (0.003)	**4.21 (0.01)***	0.57 (0.001)	3.64 (0.004)		

***p < 0.05, **p < 0.01**

Table 3 indicates that being retired (OR=2.1, 95%CI: 1.2-3.6, p=0.01), having diabetes for over seven years (OR=1.5, 95%CI: 1.1-2.1, p=0.02), and frequent healthcare visits (OR=1.9, 95%CI:1.4-2.9, p<0.001) were significantly associated with better diabetes self-care practices. Individuals with normal BMI or obesity/overweight had 3-4 times increased odds of better self-care routines than underweight people. Notably, the absence of diabetic foot disorders correlated with 4.3 times higher odds, and the absence of cardiovascular diseases correlated with 1.5 times higher odds of good self-care practices. However, age, highest qualification, and treatment regimen were not significantly associated with DSC practice (p>0.05) in this multivariate logistic regression.

Table 3. Multivariate logistic regression analysis of factors related to good self-care practices

Variables (n=879)	Self-care practice, n (%)		OR (95% CI)	p-value
	Poor (n=663)	Good (n=216)		
Age				
< 65	330 (49.8)	96 (44.4)	1	0.35
≥ 65	333 (50.2)	120 (55.6)	1.19 (0.83 - 1.71)	
Highest qualification				
Primary school	423 (63.8)	121 (56.0)	1	0.49
Junior high school and above	240 (36.2)	95 (44.0)	1.14 (0.79 - 1.64)	
Occupation				
Currently working	196 (29.6)	52 (24.2)	1	
Workless	399 (60.3)	120 (55.8)	1.05 (0.69 - 1.6)	0.81
Retired	67 (10.1)	43 (20.0)	2.07 (1.18 - 3.63)	**0.01**
Duration of diabetes				
≤ 7 years	462 (69.7)	130 (60.2)	1	**0.02**
> 7 years	201 (30.3)	86 (39.8)	1.5 (1.06 - 2.12)	
BMI				
Underweight	71 (10.7)	8 (3.7)	1	
Normal	317 (47.8)	95 (44.0)	2.85 (1.3 - 6.23)	**0.009**
Obesity/ Overweight	275 (41.5)	113 (52.3)	4.0 (1.82 - 8.77)	**0.001**
Having Diabetic foot disorders				
Yes	32 (4.8)	3 (1.4)	1	**0.02**
No	631 (95.2)	213 (98.6)	4.3 (1.28 - 14.46)	
Having Cardiovascular diseases				
Yes	172 (25.9)	43 (19.9)	1	**0.04**
No	491 (74.1)	199 (80.1)	1.54 (1.02 - 2.32)	
Number of comorbidities/complications				
1 disease	165 (24.9)	20 (20.8)	1	0.28
≥ 2 diseases	498 (75.1)	171 (79.2)	1.25 (0.83 - 1.88)	
Kind of treatment				
Lifestyle modification	21 (3.2)	3 (1.4)	1	
Oral medication	570 (86.0)	193 (89.3)	2.5 (0.56 - 11.19)	0.23
Insulin therapy	72 (10.8)	20 (9.3)	1.86 (0.38 - 9.09)	0.44
Visits to a usual healthcare provider over the last 12 months				
Not having a usual healthcare provider	287 (43.3)	65 (30.1)	1	
1 - 4 visits	128 (19.3)	42 (19.4)	1.42 (0.9 - 2.25)	0.13
≥ 5 visits	248 (37.4)	109 (50.5)	1.86 (1.38 - 2.87)	**< 0.001**

Variables with P-value < 0.25 in the bi-variable analysis were selected for multivariable analysis.

Barriers to self-care in diabetes

Table 4 highlights the three most prevalent self-reported barriers to DSC. In descending order, the most significant obstacles to adhering to DSC were perceived to be related to SMBG, foot care, and healthy diet adherence. Notably, Lack of provider recommendation was a prominent barrier across most DSC domains, except medication adherence. Statistically significant differences were observed in those with one versus two or more coexisting conditions for several barriers: provider recommendation for a healthy diet (31.8% vs 21.0%), physical limitations (43.8% vs 58.1%), medication affordability (28.2% vs 47.4%), and provider recommendation for footcare (59.3% vs 45.9%).

Table 4. Barriers to DSC adherence by coexisting conditions

The most common barriers to DSC adherence	N	One coexisting condition *n (%)*	Two or more coexisting conditions *n (%)*	Total	p-value
Healthy diet	**879**	**129 (61.4)**	**419 (62.6)**	**548 (62.3)**	0.81
Feeling hungry when following a healthy diet	548	57 (44.2)	201 (48.0)	258 (47.1)	0.48
Not desiring a prescribed healthy diet	548	33 (25.6)	135 (32.2)	168 (30.7)	0.16
Lack of recommendation from health providers	548	41 (31.8)	88 (21.0)	129 (23.5)	**0.02**
Physical activities	**879**	**105 (50.0)**	**372 (55.6)**	**477 (54.3)**	0.18
Physical limitation due to other health problems	477	46 (43.8)	216 (58.1)	262 (54.9)	**0.01**
Not having time for physical activities	477	32 (30.5)	95 (25.5)	127 (26.6)	0.32
Lack of recommendation from health providers	477	13 (12.4)	52 (14.0)	65 (13.6)	0.75
Blood glucose self-monitoring	**879**	**164 (78.1)**	**505 (75.5**	**669 (76.1)**	0.46
Affordability for a home glucometer	669	78 (47.6)	221 (43.8)	299 (44.7)	0.42
Lack of skills in blood glucose testing at home	669	79 (48.2)	223 (44.2)	302 (45.1)	0.42
Lack of recommendation from health providers	669	74 (45.1)	229 (45.3)	303 (45.3)	1.0
Treatment adherence	**879**	**39 (18.6)**	**135 (20.2)**	**174 (19.8)**	0.69
Affordability for prescribed medication	174	11 (28.2)	64 (47.4)	75 (43.1)	**0.04**
Usually forgetting to take medication	174	6 (15.4)	30 (22.2)	36 (20.7)	0.5
Not remembering the prescription	174	4 (10.3)	19 (14.1)	23 (13.2)	0.79
Foot care	**879**	**140 (66.7)**	**449 (67.1)**	**589 (67.0)**	0.93
Not think it is important for diabetes control	589	73 (52.1)	271 (60.4)	344 (58.4)	0.09
Lack of recommendation from health providers	589	83 (59.3)	206 (45.9)	289 (49).1	**0.007**
Lack of regular foot examinations by health providers	589	61 (43.6)	198 (44.1)	259 (44.0)	0.92

4. DISCUSSION

This study provides important insights into the challenges and barriers faced by patients with T2DM and multiple comorbidities in managing self-care practices in primary care settings in Central Vietnam. The high prevalence of multimorbidity, with an average of 2.9 comorbid conditions, underscores the complexity of managing diabetes in this population [22]. Our findings further prove the inadequate DSC among individuals with T2DM in LMICs [7], [23], [24]. Consistent with previous studies [7], [23], [25], we observed that medication adherence was the most prevalent self-care practice, followed by dietary adherence while self-monitoring of blood glucose (SMBG) and foot care showed the lowest compliance rates. This global trend underscores the need for tailored interventions to address the multifaceted nature of self-care and support patients in managing their diabetes comprehensively.

Furthermore, this study contributes to the limited research on the impact of comorbidities and complications on diabetes self-care in the Asia Pacific. Our findings align with previous literature highlighting the complex interplay between diabetic comorbidities/complications and diabetes care [3]. The significant effects of hypercholesterolemia, peripheral artery disease, coronary artery disease, and diabetic foot disorders on self-care practices suggest that these conditions may necessitate more personalised interventions to support patients in managing their diabetes effectively [26]. The moderate effect sizes observed suggest that while these comorbidities do not overwhelmingly dominate DSC practices, they present significant challenges that patients must navigate in managing their diabetes. The findings related to coronary artery disease and nephropathy further illustrate the complexity of managing diabetes in the presence of comorbid conditions. The dual effects of coronary artery disease, which was positively associated with SMBG but negatively associated with medication adherence, suggest that patients may prioritise blood glucose monitoring due to heightened cardiovascular concerns, but they struggle with the complexities of managing multiple medications [27]. This points to the broader issue of polypharmacy in multimorbid patients, where the cognitive and logistical challenges of adhering to numerous medications can lead to reduced overall adherence. Simplifying treatment regimens and providing personalised patient education could help minimise this burden and improve medication adherence across this population.

Our diabetic participants showed inferior foot care practices compared to the findings of the Chinese study (51.6%) [28] but relatively consistent with the Indian study (17.6%) [19]. Lack of awareness and practice of both patients and healthcare providers on foot care in diabetes management was identified in the literature and our study [20, 21]. The observation that individuals with diabetic foot disorders exhibit a greater focus on foot care than those with other chronic conditions highlights the impact of experiencing foot complications on patient awareness. However, this should not be the only catalyst for better foot care practices; proactive education and interventions are crucial for all individuals with diabetes to understand the importance of foot health and adopt appropriate self-care behaviours. This includes routine foot examinations and increased awareness among patients and healthcare providers to prevent foot ulceration and other complications. Furthermore, patients with nephropathy are often more aware of their heightened risk for foot complications, resulting in better foot care practices. However, it does not appear to extend to other crucial areas of diabetes self-care, suggesting that educational efforts focusing on a single aspect of care, like foot care, may not be enough to address the full spectrum of self-care requirements [29]. To enhance diabetes management, educational programs could consider emphasising the interconnectedness of self-care behaviours rather than focusing on isolated aspects of self-care like foot care or medication adherence. Future research should investigate the dynamic relationship between self-care behaviour and self-efficacy domains. By understanding how these factors mutually influence each other, we can design tailored educational programs that empower patients to manage various aspects of their diabetes care effectively.

Regarding SMBG, previous studies in Ethiopia [18] and China [28] showed similar poor adherence to SMBG (84% and 74.1%, respectively). Moreover, diabetic retinopathy was observed to have a negative impact on SMBG practice. Kassahun T et al. [18] identified several barriers to effective SMBG, including insufficient guidance and advice from healthcare professionals, knowledge gaps among patients, and inadequate access to necessary supplies. SMBG empowers PWDs to be more active in diabetes management, but cost-effectiveness remains debated. The International Diabetes Federation recommends incorporating SMBG in health education for non-insulin-treated

people with T2DM only when patients and healthcare providers have the knowledge, skills, and willingness to involve SMBG in diabetes care plans [30]. Vietnamese guidelines recommend SMBG 2-3 times per week at meals or bedtime for PWDs treated with oral medication except for insulin or sulfonylurea and four times per day for insulin or sulfonylurea-treated people [31]. Due to the low number of PWDs having insulin regimens managed at commune health centres (CHCs), inadequate capacity and lack of affordability and public health insurance coverage for SMBG prevent widespread SMBG provision at the CHCs in Vietnam, especially in remote areas [13]. Given these significant issues, consensus on SMBG in diabetes management and cost-effective SMBG interventions in PHC settings with proper reimbursement mechanisms are necessary to promote SMBG recommendations among primary care providers.

Consistent with previous studies, occupation, BMI, diabetes duration, complications/ comorbidities, and healthcare utilisation are significantly related to DSC practice [7]. Obese individuals seem to become conscious and aware of their health, master the basic skills to manage diabetes and adjust their lifestyle. Dixon JB et al. [32] showed that higher BMI levels increased engagement in self-care, particularly weight management, but posed challenges in achieving weight loss goals. Therefore, early comprehensive care, behavioural interventions, and intensive health education on DSC should target newly diagnosed and high-risk individuals to prevent complications. Social and family support and having a personal glucose meter were associated with better adherence to DSC. A family-oriented self-management program in Thailand showed promise in enhancing support, self-efficacy, and self-care, facilitating optimal HbA1c control and diabetes management [33].

While awareness of HbA1c level was beneficial for glycaemic control, our study highlights the prevailing ignorance of the role of HbA1c in diabetes management (88.4%), emphasising the need for enhanced self-efficacy and awareness through various methods such as consultations, structured educational programs, patient clubs, and mHealth. Additionally, the unavailable storage of HbA1c results in the Vietnamese Electronic Medical Record (EMR) systems hindered data collection efforts. Integrating an optional module for a personalised care plan within the Personal Health Record (PHR) application, first introduced by the Ministry of Health in 2019, would facilitate better tracking of DSC behaviours, HbA1c levels, and other clinical indicators, promoting better diabetes management. Interactive EMR-PHR collaboration is crucial.

The limitations of the PHC system in Vietnam, particularly the weak coordination between PHC providers and higher-level care, exacerbate these challenges. This is consistent with global observations in other LMICs, where the lack of integration between healthcare tiers hampers effective chronic disease management, including diabetes [34]. Improving PHC provider capacity through advanced training in counselling skills and self-care management for PWDs is critical to overcoming these barriers [35]. By enhancing the skills of PHC workers, patients can receive more tailored support, which is crucial for promoting sustainable self-care practices, especially in rural or underserved areas where healthcare resources are limited [36]. Moreover, the findings underscore the importance of implementing a multidisciplinary, team-based approach to diabetes management, a proven effective model in reducing self-care barriers [35]. Still underutilised in Vietnam, this integrated care model could significantly improve patient outcomes by providing more comprehensive support for managing multimorbidity. Therefore, it is recommended that future studies explore the feasibility and impact of team-based care interventions in PHC settings, particularly for diabetes care, as a means to improve coordination and support for self-care.

There are several limitations to the current study. Since it is a cross-sectional descriptive study based on a self-reported questionnaire, it might be limited by recall bias. Although PWDs were asked to provide the HbA1c level figures, collecting the figures and thoroughly assessing the glycaemic control status in the entire study sample was impossible. Some critical aspects of DSC, including diabetes-related literacy, self-efficacy, social and family support, and treatment costs for diabetes, were not assessed.

5. CONCLUSIONS

This study highlights the challenges multimorbid patients with T2DM face in managing self-care practices in primary care settings in Central Vietnam. Comorbidities like hypercholesterolemia, peripheral artery disease, coronary artery disease, and diabetic foot disorders significantly impact key self-care behaviours, emphasising the need for tailored, condition-specific interventions. Strengthening PHC capacity and adopting a multidisciplinary, team-based approach could improve patient outcomes

by providing comprehensive support for self-care practices. Further research should explore the interconnectedness between self-care behaviours and self-efficacy, examining how these domains reinforce one another to design tailored educational programs that empower patients to manage multiple aspects of diabetes care more effectively.

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