

Original Research Article

A survey of factors influencing standards and outcomes of care for patients with diabetes mellitus attending the urban health centre and its community clinics in South India: a cross-sectional study

Ruby Angeline Pricilla¹, Falah Pulikkadan Muhammad², Priyadarshini Vijayakumar², Pavan Mukherjee³, Venkatesan Sankarapandian², Sajitha M. F. Rahman^{2*}

¹Department of Community Medicine, Christian Medical College, Vellore, Tamil Nadu, India

²Department of Family Medicine, Christian Medical College, Vellore, Tamil Nadu, India

³Low Cost Effective Care Unit, Christian Medical College, Vellore, Tamil Nadu, India

Received: 12 June 2025

Accepted: 08 September 2025

*Correspondence:

Dr. Sajitha M. F. Rahman,

E-mail: sajithaprveenmf@gmail.com

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ABSTRACT

Background: Diabetes mellitus is a rising health challenge in south-east Asia and India in particular. The World Health Organization advocates for effective management of diabetes at the primary and secondary care centres. The first contact and longitudinal care of patients with diabetes should be effective to improve their health outcomes. This study was undertaken to determine the standard and outcome of care and the factors influencing them among patients with diabetes attending the low-resourced urban health centre (UHC) and its community clinics (CCs) in south India.

Methods: A cross-sectional study was done among adults with diabetes for more than a year. A structured questionnaire was used to collect data from 100 participants at the UHC and 200 from the CCs.

Results: The mean standard of care score was significantly higher ($p=0.00001$) at the CCs than at the UHC. Overall, the glycemic control was poor. Participants who were male ($p=0.03$), belonging to religion other than Hindu ($p=0.03$), on oral drugs ($p=0.004$) and no complications ($p=0.02$) had better glycemic control at the UHC. At the CCs, those with $\leq$ six years of diabetes ($p=0.001$), with $\leq$ five clinic visits ($p=0.004$), on oral drugs ($p=0.01$) and without complications ($p=0.04$) had better glycemic control.

Conclusions: Better glycemic control was noted among patients with lesser duration of diabetes, those without complications and those on oral hypoglycemics alone. The spectrum of challenges in improving standard of care in low resourced communities is beyond the implementation of clinical guidelines alone.

Keywords: Clinical audit, General diabetes, Primary care, Quality in health care

INTRODUCTION

Diabetes Mellitus is a major global health emergency. In 2021, 536.6 million people were estimated to be living with diabetes in the world.¹ Diabetes resulted in 1.6 million deaths as the ninth leading cause of death globally.² The prevalence of diabetes is increasing most rapidly in low and middle income countries.³ India has 74.2 million people with diabetes estimated to rise to 124.9 million by 2045 second to China.¹ The average

monthly expenditure per person with diabetes in India was reported to be Rs. 1,098.25, which adds up to an annual expenditure of Rs.13,179 per person.⁴

Early diagnosis and effective management of diabetes is essential to prevent complications, hospitalizations and improve the health outcomes.⁵ Good glycemic control will bring down the direct and indirect costs of diabetes care and minimize the burden on families and health care systems.⁶ The role of physicians of first contact and

longitudinal care is of paramount importance in providing quality diabetes care at the primary and secondary health care system.⁷

The Institute of Medicine defines quality of health care as “the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge”.⁸ Quality of care includes patient-centred care focussing on the context and individual needs alongside interactions with health care professionals, timely appointment and less waiting time. Patient satisfaction and less waiting time are considered to be good indicators of quality of care.^{9,10}

The Urban health centre (UHC) in which the study was carried out provides primary and secondary level health care services to low-resourced urban communities. Diabetes care involves a major portion of the services of the UHC.^{11,12} In 2012 an audit of the care for patients with diabetes was done to assess the quality and the outcome of diabetes care.¹³ Subsequently, annual screening tests based on the Indian Council of Medical Research (ICMR) guidelines was made mandatory for patients with diabetes and documented in a separate diabetic follow-up card.^{14,15}

A structured program of weekly clinics (CCs) in the community was initiated in 2016 to improve accessibility and care of patients with chronic diseases in the community. In 2019, a nurse for diabetes care was recruited at the UHC to focus on health education for lifestyle changes, medication compliance, insulin technique, self-care and regular follow-up. Additionally, the nurse would screen patients for peripheral neuropathy, foot ulcers, deformities and review the annual screening tests.

This study was part of a broader evaluation to measure the impact on diabetes care at the UHC.¹⁶ This study has measured the standard and health outcomes of patients with diabetes who seek care at the UHC and its CCs. Study results can promote similar models of health care in low-resource settings in India to improve accessibility and standard of care for patients with diabetes.

Objectives

To assess the standard of care of patients with diabetes mellitus attending the urban health centre and the community clinics of the urban health centre.

To determine the outcome of care of patients with diabetes mellitus attending the urban health centre and the community clinics of the urban health centre.

To determine factors influencing the standard of care and outcome of care of patients with diabetes mellitus attending the urban health centre and the community clinics of the urban health centre.

METHODS

Study setting

The UHC and the CCs are one of the primary and secondary care services of a private academic medical college. The tertiary care hospital of the medical college is the referral unit for the UHC. A team of family physicians, community medicine physicians, post graduate trainees, junior medical officers and interns provide patient care at the UHC. Around 200 patients are seen daily in the out-patient department of which 50% are related to diabetes care.

The CCs are weekly clinics in seven low-resourced urban communities covering a population of 12000 of which 1000 of them have non-communicable disease. A team of a family physician or community medicine physician along with a post-graduate resident in family medicine, a community health nurse (CHN), a community health worker (CHW) and a social worker (SW) run the weekly clinics. The CHWs have the enumerated list of households in each community with data on the morbidities of individual family members and their source of health care services.

Study design

A cross-sectional study was conducted at the UHC and CCs to recruit eligible participants fulfilling the above criteria.

Inclusion criteria

All adults aged 18 years and above, with diabetes mellitus at least for a year and receiving care at the UHC or CCs for a minimum of one year were eligible to participate. Those who were acutely ill on the day of survey were excluded from the study.

Sample size and sampling method

Assuming that at least 50% of the participants would have had adequate standard of care and glycemic control; with a relative precision of 20%, the sample size required was 100 for each setting using the formula $4pq/d^2$. Hence 100 patients with diabetes from UHC and 200 patients from the CCs were enrolled in the study. Convenient sampling was done among patients who seek care at the UHC or at the CCs. There was no duplication of participants.

Study instrument and measurement

A structured questionnaire including demography, process indicators and outcome of care was used. Data was collected by the investigators by face-face interview during March-May 2022. Standard of care was calculated from the process indicators and had 12 questions each with a score of 0 or 1. Maximum possible score was 12 and minimum was 0.

Those scoring more than 9 ($\geq 80\%$) were considered to have good standard of care, 6-9 (50-79%) as average standard of care and less than 6 (50%) as poor standard of care. Glycemic and blood pressure control, lipid levels, renal parameters, presence of complications, hospitalizations and compliance with follow-up visits were used to determine the outcome of care. Data was entered using Epi-Data 3.1 software.

Statistical analysis

The data was analysed using SPSS version 23. Descriptive statistics was calculated including proportions for categorical variables and means (SD) for continuous variables. Measures of central tendency and SD was calculated for the aggregate scores on standard of care.

The association of good standard of care with demographic and other factors was calculated using Chi-square test. P value < 0.05 was considered to be significant.

Ethical aspect

This study was approved by the institutional review board and ethics committee vide IRB Min. No. 14502 (OBSERVE) dated 23.02.2022. All eligible participants were recruited after informed consent in compliance with Helsinki declaration.

RESULTS

Socio-demographic characteristics of participants at the UHC and CCs were similar.¹⁶ A higher proportion of the participants belonging to the Hindu religion ($p=0.005$) and those with middle school education $p=0.04$ were seen in the CCs and participants with more than 10 years of diabetes were seen ($p=0.02$) at the UHC (Table 1). Majority of the responders had only one co-morbidity and hypertension was the most common one at both settings. The mean (SD) number of clinic visits at the UHC was 5.10 (2.03) with a median of 5 and range of 0-12. At the CCs the mean (SD) number of clinic visits was 5.5 (1.85), median of 5 and a range of 2-11 visits.

Table 1: Baseline data of the participants (n=300).

Variables	UHC (n=100) N (%)	ORC (n=200) N (%)	P value
Age in years			
<45	18 (18)	37 (18.5)	0.91
45-60	51 (51)	98 (49.0)	0.74
>60	31 (31)	65 (32.5)	0.79
Gender			
Male	18 (18)	48 (24.0)	0.24
Female	82 (82)	152 (76.0)	
Religion			
Hindu	70 (70)	168 (84)	0.005
Others	30 (30)	32 (16)	
Education			
No education	29 (29)	51 (25.5)	0.52
Primary	34 (34)	62 (31.0)	0.60
Middle school	15 (15)	51 (25.5)	0.04
High school	21 (21)	35 (17.5)	0.47
College	1 (1)	1 (0.5)	0.62
Occupation			
Unemployed	65 (65)	129 (64.5)	0.93
Employed	35 (35)	71 (35.5)	
Duration of diabetes in years			
<5	28 (28)	58 (29.0)	0.86
5-10	38 (38)	99 (49.5)	0.06
>10	34 (34)	43 (21.5)	0.02
Diabetes treatment			
OAD	89 (89)	173 (86.5)	0.54
Insulin	11 (11)	27 (13.5)	
Co-morbidities			
Yes	68 (68)	137 (68.5)	0.93
Frequency of clinic visits			
≤ 5	63 (63)	114 (57.0)	0.32
>5	37 (37)	86 (43.0)	

Table 2: Standard of care indicators for diabetes mellitus at the UHC/ORC (n=300).

Standard of Care Indicators	UHC (n=100) N (%)	ORC (n=200) N (%)	Z-score	P value
Blood pressure recorded in the last 3 visits	88 (88)	194 (97)	3.09	0.002
Fasting and postprandial sugars done in the last 3 visits	97(97)	198 (99)	1.28	0.20
Annual BMI recorded	28 (28)	115 (57.5)	4.82	0.00001
Counselling done	70 (70)	193 (96.5)	6.58	0.00001
Annual fasting lipid profile done	48 (48)	127 (63.5)	2.57	0.01
Annual test for proteinuria done	59 (59)	138 (69)	1.72	0.08
Peripheral sensation recorded in the last year	40 (40)	161 (80.5)	7.03	0.00001
Peripheral pulses recorded in the last year	37 (37)	161 (80.5)	7.49	0.00001
Annual Foot examination done	38 (38)	159 (79.5)	7.14	0.00001
Annual Eye examination for retinopathy done	32 (32)	94 (47)	2.48	0.01
Creatinine done in the last year	73(73)	157 (78.5)	1.06	0.29
HBA1c (glycated hemoglobin) done in the last year	70 (70)	151 (75.5)	1.02	0.31

Table 3: Outcome of diabetic care at the UHC/ORC (n=300).

Variables	UHC (n=100) N (%)			ORC (n=200) N (%)		
Fasting Glucose (mg/dl)- Last 3 visits	(n=98)			(n=198)		
Ideal (≤ 110)	13 (13)	8 (8)	12(12)	36 (18)	42 (21)	42(21)
Satisfactory (111-125)	14 (14)	11 (11)	11 (11)	34 (17)	28 (14)	29(14.5)
Unsatisfactory (>125)	71 (71)	79 (79)	75 (75)	130 (65)	128 (64)	127 (63.5)
Glycated Hemoglobin [HBA1C (%)]	(n=70)			(n=151)		
Ideal (<7)	14 (20)			48 (31.8)		
Satisfactory (7- <8)	14 (20)			36 (23.8)		
Unsatisfactory (≥ 8)	42 (60)			67 (44.4)		
Blood pressure (mmHg)- last 3 visits						
Systolic BP	(n=94)	(n=93)	(n=90)	(n=200)	(n=199)	(n=194)
Ideal (<130)	48 (48)	40 (40)	43 (43)	69 (34.5)	74 (37)	77 (38.5)
Satisfactory (130-140)	32 (32)	41 (41)	35 (35)	95 (47.5)	96 (48)	91 (45.5)
Unsatisfactory (>140)	14 (14)	12 (12)	12 (12)	36 (18)	29(14.5)	26 (13.0)
Diastolic BP						
Ideal (<80)	29 (29)	20 (20)	25 (25)	62 (31)	47 (23.5)	55 (27.5)
Satisfactory (80-90)	61 (61)	66 (66)	62 (62)	131 (65.5)	144 (72)	131 (65.5)
Unsatisfactory (>90)	4 (4)	7 (7)	3 (3)	7 (3.5)	8 (4)	8 (4)
Body mass index (BMI-kg/m²)	(n=28)			(n=115)		
Ideal (20-23)	5 (17.9)			16 (13.9)		
Satisfactory (23.1-25)	1 (3.5)			21 (18.3)		
Unsatisfactory (>25)	22 (78.6)			78 (67.8)		
Low density lipoprotein (LDL) cholesterol (mg/dl)	(n=48)			(n=127)		
<100	25 (52.1)			51 (40.2)		
≥ 100	23 (47.9)			76 (59.8)		
Serum creatinine (mg/dl)	(n=73)			(n=157)		
<1.4	72 (98.6)			154 (98.1)		
1.4-2.0	1 (1.4)			1 (0.6)		
>2.0				2 (1.3)		
Urine protein/creatinine ratio (UP/UC)	(n=59)			(n=138)		
≤ 0.20	40 (67.8)			98 (71)		
>0.20	19 (32.2)			40 (29)		
Presence of complications	(n=100)			(n=200)		
Yes	26 (26)			51 (25.5)		
Admissions in the last one year	(n=100)			(n=200)		
Yes	11 (11)			14 (7)		

Table 4: Factors influencing glycemic control at the UHC (n=70).

Variables	Satisfactory HBA1C (<8) (n=28) N (%)	Unsatisfactory HBA1C (≥8) (n=42) N (%)	χ^2 value (p value)	Odds ratio (95% CI)
Age in years				
≤55	15 (40.5)	22 (59.5)	0.10	1.05
>55	13 (39.4)	20 (60.6)	(0.92)	(0.40-2.74)
Gender				
Male	8 (66.7)	4 (33.3)	4.29	3.80
Female	20 (34.5)	38 (65.5)	(0.03)	(1.02-14.18)
Religion				
Hindu	16 (32.0)	34 (68.0)	4.67	0.31
Others	12 (60.0)	8 (40.0)	(0.03)	(0.11-0.92)
Education				
≤Primary school	17 (37.8)	28 (62.2)	0.26	0.77
>Primary school	11 (44.0)	14 (56.0)	(0.61)	(0.29-2.09)
Occupation				
Unemployed	14 (31.8)	30 (68.2)	3.30	0.40
Employed	14 (53.8)	12 (46.2)	(0.07)	(0.15-1.09)
Duration of diabetes				
≤8 years	18 (50.0)	18 (50.0)	3.09	2.40
>8 years	10 (29.4)	24 (70.6)	(0.08)	(0.89-6.43)
Co-morbidities				
No	8 (36.4)	14 (63.6)	0.18	0.80
Yes	20 (41.7)	28 (58.3)	(0.67)	(0.28-2.27)
No of clinic visits				
≤5 times	20 (43.5)	26 (56.5)	0.68	1.54
>5 times	8 (33.3)	18 (66.7)	(0.41)	(0.55-4.31)
Diabetes treatment				
OAD	28 (46.7)	32 (53.3)	7.78	18.42
Insulin	0 (0)	10 (100)	(0.004)-(FE)	(1.03-328.50)
Complications				
No	23 (48.9)	24 (51.1)	4.76	3.45
Yes	5 (21.7)	18 (78.3)	(0.02)	(1.09-10.83)
Admissions in the past one year				
No	25 (41.0)	36 (59.0)	0.19	1.39
Yes	3 (33.3)	6 (66.7)	(0.66)	(0.32-6.08)
Standard of care				
Good	5 (23.8)	16 (76.2)	3.28	0.35
Average/poor	23 (46.9)	26 (53.1)	(0.07)	(0.11-1.12)

The standard of care was good at the UHC with regard to blood pressure (BP) and glucometer monitoring of sugars. It was average with regard to counselling, screening of proteinuria, creatinine and HBA1C. It was poor with regard to recording of body mass index (BMI) and screening of lipid profile, foot ulcers, neuropathy and retinopathy (Table 2). At the CCs, good standard of care was found for BP, monitoring of sugars, counselling, screening for peripheral neuropathy and pulses. It was average for recording of BMI and screening of lipid profile, renal parameters, foot examination for ulcers and HBA1C. It was poor with regard to screening for retinopathy. Overall, the standard of care at the CCs was

significantly better with regard to many process indicators.

At the UHC and in the CCs, no significant association of good standard of care with age, gender, education, occupation, duration of diabetes, presence of co-morbidities, number of clinics visits or type of treatment for diabetes was noted. However, a significant association of respondents from religion other than Hindu had good standard of care [$p=0.003$, OR (95% CI) =0.24 (0.09-0.64)] at the CCs.

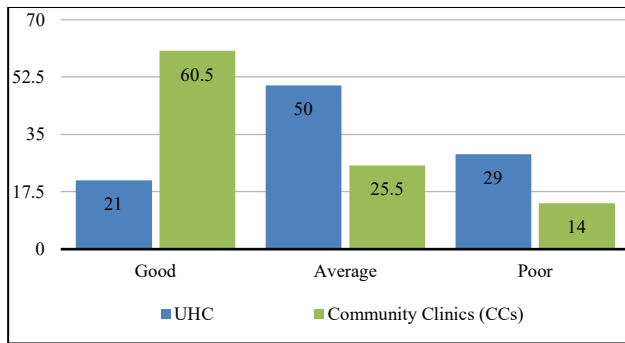


Figure 1: Standard of care score at the UHC/ORC (n=300).

Majority of the participants received average standard of care at the UHC. At the CCs about 2/3rd of the

respondents received good standard of care. The good standard of care was ($p < 0.001$) statistically better at the CCs as compared to the UHC. The mean (SD) standard of care score was 6.81 (2.87) at the UHC and 9.24 (2.95) at the CC and this was statistically significant ($p < 0.001$) (Figure 1).

The glycemic control was poor at both the settings (Table 3). Majority of the participants had BMI of >25 and either ideal or satisfactory BP in both the settings. About 50% of participants at the UHC and about 40% from the CCs had target low density lipids (LDL). Majority had serum creatinine <1.4 in both settings. Among those with UP/UC ratio >0.20 , 11 (57.9%) from the UHC and 34 (85%) from the CCs were on either ACE (angiotensin converting enzymes) inhibitors or ARBs (angiotensin receptor blocker).

Table 5: Factors influencing glycemic control at the ORC (n=151).

Variables	Satisfactory HBA1C (<8) (n=84) N (%)	Unsatisfactory HBA1C (≥ 8) (n=67) N (%)	χ^2 value (p value)	Odds ratio (95% CI)
Age in years				
≤ 55	43 (53.1)	38 (46.9)	0.46	0.80
> 55	41 (58.6)	29 (41.4)	(0.50)	(0.42-1.53)
Gender				
Male	21 (56.8)	16 (43.2)	0.03	1.06
Female	63 (55.3)	51 (44.7)	(0.87)	(0.50-2.25)
Religion				
Hindu	64 (53.3)	56 (46.7)	1.25	0.63
Others	20 (64.5)	11 (35.5)	(0.26)	(0.28-1.43)
Education				
$\leq$ Primary school	48 (59.3)	33 (40.7)	0.93	1.37
$>$ Primary school	36 (51.4)	34 (48.6)	(0.33)	(0.72-2.62)
Occupation				
Unemployed	56 (54.4)	47 (45.6)	0.21	0.85
Employed	28 (58.3)	20 (41.7)	(0.65)	(0.43-1.70)
Duration of diabetes				
≤ 6 years	57 (67.9)	27 (32.1)	11.47	3.13
> 6 years	27 (40.3)	40 (59.7)	(0.001)	(1.60-6.11)
Co-morbidities				
No	28 (59.6)	19 (40.4)	0.43	1.26
Yes	56 (53.8)	48 (46.2)	(0.51)	(0.63-2.54)
Number of clinic visits				
≤ 5 times	55 (66.3)	28 (33.7)	8.45	2.64
> 5 times	29 (42.6)	39 (57.4)	(0.004)	(1.36-5.12)
Diabetes treatment				
OAD	79 (59.4)	54 (40.6)	6.42	3.80
Insulin	5 (27.8)	13 (72.2)	(0.01)	(1.28-11.29)
Complications				
No	65 (60.7)	42 (39.3)	3.90	2.04
Yes	19 (43.2)	25 (56.8)	(0.04)	(1.00-4.15)
Admissions in the past one year				
No	76 (54.3)	64 (45.7)	1.41	0.45
Yes	8 (72.7)	3 (27.3)	(0.24)	(0.11-1.75)
Standard of care				
Good	67 (55.8)	53 (44.2)	0.01	1.04
Average/poor	17 (54.8)	14 (45.2)	(0.92)	(0.47-2.30)

Presence, type of complications and the number of hospitalizations was similar at both settings.

The association of glycemic control with the socio-demographics are reported in (Tables 4 and 5). Participants who were male, belonging to religion other than Hindu, on oral anti-diabetic drugs (OADs) and without complications had significantly better glycemic control at the UHC. At the CCs, those with less than or equal to six years duration of diabetes, with less than or equal to five clinic visits, on OADs and without complications had better glycemic control.

DISCUSSION

Our study has identified the trend in socio-demographics, standard and outcome of care at the UHC over the last decade. Majority of the participants of the audit in 2013 were more than 60 years, while 50% of the participants at the UHC and the CCs in this study are between 45-60 years. This reflects the increase in prevalence of diabetes in India from 7.1% in 2009 to 8.9% in 2019.¹⁷

Duration of diabetes of five to ten years in 40-50% and more than ten years in 20-30% of respondents represents the increasing burden of disease in our communities. Increased burden of diabetes is associated with rise in age-standardized mortality and disease-adjusted life years (DALY) in the lower-middle income regions.^{18,19}

Overall standard of diabetes care has improved with 70-75% of patients tested for creatinine and HBA1C, 50-60% tested for lipid profile and 40-70% had foot exam. The standard of diabetes care is significantly better at the CCs where the CHWs are the ground level workers. They identify non-compliant patients and follow with telephonic reminders or in-person home visits. The evidence for the role of CHW-based diabetes care in low-resourced communities is widely available.²⁰ About 11% from UHC and 14% from CCs were hospitalized over one year. A general practice study from England reports that 60% of their participants had one hospitalization over a four-year period.²¹

The outcome of diabetes care reported in this study is suboptimal. Only 25-30% of our participants had HBA1C<7 and 45-60% of them had HBA1C>8. WHO advocates accessible health care services and a balance between implementing standard guidelines and feasibility in low-resourced communities.²² About 65% of our participants being women who were unemployed, with less than primary school level of education, the standard for diabetes care is determined by the relevance of guidelines to the context of low-resourced communities.

Standard guideline-based treatment for diabetes was implemented in UHC and CCs with the recommended first and second choice of oral anti-diabetic drugs widely in use. However, the newer drugs like sodium glucose co-transporter 2 inhibitors, dipeptidyl peptidase 4 inhibitors,

glucagon like peptide 1 receptor agonists and insulin were not preferred due to cost, non-availability in the government health system and route of administration. One in ten people receive guideline-based diabetes treatment in low- and middle-income countries (LMICs).^{23,24}

Health outcomes are influenced by socio-demographic, cultural, and health seeking behaviour which needs specific interventions targeted for low-resourced communities.²⁵ Patient-centred approach to address the socio-demographic factors is needed to influence onset of co-morbidities and improve compliance. Health education on chronicity, long term impact, complications, life style changes and regular monitoring of diabetes care is fundamental to influence the health seeking behaviour of patients in low-resourced communities.

Strengths of this study are - our study was conducted in primary care clinics managed by a generalist team of family physicians and community medicine physicians. The primary care services at the UHC and the CCs are based in the community and is supported by the tertiary care system for referrals. The study instrument was based on the standard ICMR guidelines for patients with diabetes in-addition to the comprehensive demographic questionnaire. Adequate sample of patients were recruited with no refusal of consent. Our study results add to the existing gap in the evaluation of standard of diabetes care in primary care clinics and in the role of CHW-based diabetes care in low-resourced communities in India.

There are some limitations. The study was conducted in a private medical institution in India. The clinical services provided by the UHC and the CCs are subsidized for investigations, therapeutics and referrals to tertiary care. The findings are specific and influenced by subsidized care, with less probability of generalizability. Similar settings may be limited in other parts of the India and the applicability of similar standard of services in other primary and secondary care settings is questionable. Accessibility to health care services at both the UHC and CCs was significantly compromised due to pandemic related financial and travel restrictions or covid related health emergencies.

CONCLUSION

Our study confirms the challenges associated with diabetes care in low-resourced communities. A trend toward substantial increase of middle-aged participants with diabetes is noted. Improved standard of care in UHC and in CCs can be replicated in smaller health care systems. The role of CHW in low resource setting is evolving and worth exploring in similar settings. The socio-demographic factors that impact health seeking behaviour are beyond the reach of hospital-based interventions and may not be influenced by changing clinical guidelines alone. Specific community-based interventions are needed to customise treatment, improve

accessibility and decrease costs to improve health outcome of patients with diabetes.

ACKNOWLEDGEMENTS

Authors acknowledge all the team members of the urban health centre and community clinics who supported with the recruitment of participants and completion of data collection.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee vide IRB Min. No. 14502 (OBSERVE) dated 23.02.2022

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Cite this article as: Pricilla RA, Muhammad FP, Vijayakumar P, Mukherjee P, Sankarapandian V, Rahman SMF. A survey of factors influencing standards and outcomes of care for patients with diabetes mellitus attending the urban health centre and its community clinics in South India: a cross-sectional study. *Int J Community Med Public Health* 2025;12:4538-46.