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Screening for diabetes complications and associated factors in primary care in Galle, Sri Lanka

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Abstract

Introduction

Diabetes (DM) and its complications show an increasing trend and pose a huge burden on the health system. Thus, early detection of complications is essential. Primary care institutions treat and follow up patients with diabetes in their territories. The aim of the study was to assess awareness, practices, and service-related factors associated with screening for diabetes complications among patients attending the medical clinics of primary care level hospitals in the Galle district.

Methods

A descriptive cross-sectional study was conducted at three Divisional Hospitals in Galle District, among patients attending medical clinics. Data was collected through an interviewer-administered questionnaire designed to assess awareness and screening practices for diabetes complications, screening done for diabetes complications, and associated factors were analyzed.

Results

Four hundred patients with diabetes participated in the study. The majority (more than 95%) were aware of common organs affected by DM and were aware of investigations and their availability at primary care institutions (more than 85.0%). Adherence to recommended screening tests and frequency was very low (ranging from 3% to 16%) and nearly half of the patients never had any form of screening. Older age was associated with better retinopathy screening {OR = 0.61 95% CI (0.41-0.91)} while having co-morbidities was associated with better screening for retinopathy {OR = 1.67 95% CI (1.02-2.71)} and ischemic heart disease.{OR = 2.03 95% CI (1.22-3.40)}. A better awareness was associated with better screening for DM complications.

Conclusions

In conclusion, awareness about screening for diabetes complications was satisfactory among the study sample. However, the screening practices were sub-optimal as the recommended screening protocols have not been followed. Better screening was associated with better awareness, older age, having comorbidities, and being employed.

The study recommends increasing awareness among patients with diabetes on complications and screening for complications and establishing a mechanism to streamline complication screening in patients with diabetes

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Introduction

Diabetes Mellitus (DM) is a "syndrome of chronic hyperglycemia due to relative insulin deficiency, resistance, or both".[1] Throughout the past decades, the disease burden due to Diabetes Mellitus has increased to a level that causes a significant effect on human well-being, health, and socio-economic aspects of the world. The International Federation of Diabetes (IFD) estimated that 451 million suffered from DM in 2017 and this will increase up to 693 in 2045.[2] In Sri Lanka, the prevalence of diabetes among individuals more than 20 years of age is 10.3%.[3]

Complications of diabetes mellitus can be broadly classified as microvascular and macrovascular complications. Macrovascular complications are coronary heart disease, stroke and peripheral vascular disease, and microvascular complications are end-stage renal disease, retinopathy, and neuropathy. These complications lead to a higher portion of diabetes-related deaths around the globe.[4]

Nearly half of people with DM have macrovascular complications and 28% have microvascular complications in developed countries[5] and a higher prevalence of microvascular complications was also noted in the local context.[6] These complications account for large costs in providing healthcare for people with DM.[7]

Due to the high prevalence and the economic burden, early detection and proper treatment of diabetes complications is crucial in the management of diabetes mellitus. Several global and local protocols have been made for screening diabetes complications.

The World Health Organization (WHO) recommends annual screening of cardiovascular risk using different modalities to detect cardiovascular complications (CAD and stroke)(8). And the Ministry of Health and the College of Endocrinologists in Sri Lanka have recommended cardiovascular risk assessment for all diabetic patients at the diagnosis and then annually. Similarly, microvascular complications (nephropathy, retinopathy and neuropathy) were recommended to be screened at the diagnosis and followed up annually in different global and local protocols and guidelines for screening for diabetes complications. [8–12]

Despite the availability of guidelines and different treatment modalities, there is a lack of screening coverage for diabetic screening at local, regional, and global levels.[13–15] A study conducted to assess the screening for diabetes complications among 147 inward diabetic patients at the National Hospital Sri Lanka, revealed that 32.7%, 43.5%, and 61.2% of diabetes patients have been screened annually for neuropathy, nephropathy, and retinopathy respectively.[15]

Utilization and participation in screening depend on several factors at different levels such as individual, social, economic, and health systems.[13] Male sex, people with higher education and income, people living with a spouse, and people who have more health concerns and better knowledge of screening were found to have good screening practices for diabetes complications.[13,14] Further, higher screening was seen among patients residing in cities and belonging to communities with more health resources and better financial support.[13]

Therefore, it has been evident that screening for diabetes complications is yet to be understood in different contexts. Factors associated with the screening practices are of different dimensions ranging from individual to community levels. These areas need to be uncovered to achieve higher screening coverage and thus to achieve a reduction in diabetes complications. And through which the disease burden and economic cost can be minimized.

The current study aimed to assess screening practices at the primary care level and to assess patients' awareness of screening and screening methods. The study will also assess service-related factors like availability and accessibility for screening. Therefore, the study will provide rich information to policymakers in planning further improvements in infrastructure, health education, and promotional interventions.

On the other hand, data collected by the current study can be utilized as baseline data in improving screening practices at primary care level hospitals.

Methods

A (descriptive) cross-sectional study was conducted to assess the awareness, practices and service-related factors associated with screening for diabetes complications. The study was carried out at the medical clinics of three selected primary care level hospitals in Galle district, namely Divisional Hospital Arachchikanda, Imaduwa and Thalapitiya. Patients attending medical clinics of the selected primary care hospitals were considered as the study population.

A convenient sample of patients attending medical clinics at selected hospitals were extracted including patients diagnosed with diabetes for more than one year duration and excluding those who diagnosed for less than one year duration.

The sample size was determined using the formula for the sample size calculation in cross-sectional studies aiming to assess the prevalence of health-related events[16]. The estimated prevalence was considered as 50% based on a previous study conducted at a tertiary care hospital in Sri Lanka. That study has concluded that screening for DM complications in patients admitted to a tertiary care hospital ranged from 32.7% to 61.2% for different complications[15]. Desired alpha and beta errors were set at 95% and 80% respectively and estimated precision was kept at 5%.

An interviewer-administered pre-tested questionnaire was used to collect data on socio-demographic characteristics, awareness of DM, its complications, and screening for complications (Annexure I). Questions were asked on DM and its complications and screening. A data record sheet was used to capture data on screening practices at the clinic (Annexure II). Data on the screening test and timing was captured by asking the patients and looking at the clinic records as well. A checklist was used to capture service-related data such as the availability and accessibility of screening services for primary care hospitals (Annexure III).

Knowing confidently of organs affected (Kidney, Heart, Brain and Eyes) was defined as good awareness of complications. Having strong positive perceptions (answering confidently yes for awareness questions 2,4,5,6 and 7) on the screening test was considered as good awareness on screening. Having undergone screening with correct test at correct frequency was considered as the "recommended screening practice" and having undergone correct screening test without correct frequency was considered as having "any screening".

Socio-demographic factors, awareness, and screening practices were described using descriptive statistics as frequencies, mean, or median. Measures of dispersion were used appropriately to infer summary measures to the population. The Chi-Square test was used to check associations between selected factors and screening practices while taking 0.05 as the cut off p-value.

Ethical approval for the study was obtained from the Ethical Review Committee, Faculty of Medicine, University of Ruhuna (Registration no. - 2022/P/079). Administrative approval was obtained from the Regional Director of Health Services – Galle district and from the medical officer in charge at the selected hospitals. Informed written consent was obtained from all participants prior to data collection. Participants identified with problems were referred to Teaching Hospital Karapitiya.

The study was conducted while adhering to the World Medical Association Declaration of Helsinki on ethical principles for medical research involving human subjects.

Results

Four hundred and three participants (response rate 98.3%) have participated in the study. The mean age of the sample was 63.2 years (SD = 11.2) and the median value for that was 64 years (IQR = 16) and nearly 60.0 % of participants were more than 60 years of age. A vast majority of participants were Sinhala in nationality (94.5%) and Buddhists (94.3%)in their religion. Table 1 summarizes the socio-demographic and health-related characteristics of the study sample.

A vast majority of participants were able to confidently say that diabetes can affect their kidneys, eyes, and heart. However, 45.9% and 30.8% were uncertain whether diabetes is affecting their blood vessels and nerves. On the other hand, the majority confidently says that assessment of organs affected is important and early detection of complications leads to a better quality of life. However nearly half of the participants were aware that they are assessed, and tests had been done for complications at the clinic. Table 2 summarizes awareness on organs affected and screening for diabetes complications.

Table 1. Socio-demographic and health-related characteristics

Characteristics	Frequency	Percent
Marital status		
Unmarried	16	4.0
Married	387	96.0
Highest educational qualification		
No school education	8	2.0
Grade 1-5	74	18.4
Grade 6-11	138	34.2
Passed G.C.E (Ordinary level)	131	32.5
Passed G.C.E. (Advanced level)	52	12.9
Employment status		
Government	33	8.2
Private	39	9.7
Self-employed	15	3.7
Un-employed	316	78.4
Monthly income group		
Less than 10,000 LKR	269	66.7
10000-20000 LKR	81	20.1
20000-30000 LKR	37	9.2
30000-40000 LKR	10	2.5
More than 40000 LKR	6	1.5
Co-morbid condition		
Hypertension	275	68.2
Dyslipidaemia	255	63.3
Family history of diabetes		
Farther	50	12.4
Mother	112	27.7

Around 40 -50 % of participants had at least one screening for nephropathy, retinopathy and ischemic heart disease. However only four percent of participants were screened for nephropathy as recommended in guidelines and those who had recommended screening for retinopathy and ischemic heart disease were 1.5% and 0.8% respectively. Table 3

Age more than 60 years showed a significant association with having any form of retinopathy screening. Having co-morbidities was significantly associated with having been screened for retinopathy and ischemic heart disease. However apart from the association of the employed state with lower ischemic heart disease screening none of the socio-demographic factors and

health-related factors were not associated with the screening for complications of diabetes mellitus. Table 4 summarizes associations between socio-demographic and health-related factors and screening practices for nephropathy, retinopathy, and ischemic heart disease.

Table 2. Awareness on organs affected and screening for diabetes complications

	Yes No. (%)	No No. (%)	Don't know No. (%)
Diabetes can affect the following organs			
Kidney	399 (99.0%)	3 (0.7%)	1 (0.3%)
Eye	400 (99.3)	1 (0.2%)	2 (0.5)
Heart	376 (93.3%)	7 (1.7%)	20 (5.0%)
Blood vessels	195 (48.4%)	23 (5.7%)	185 (45.9%)
Nerves	263 (65.3%)	16 (4.0%)	124 (30.8%)
Do you think that assessment of affected organs is important?	349 (86.6%)	17 (4.2%)	37 (9.2%)
Do you think that well controlled diabetes can reduce the risk of having complications?	354 (87.8%)	26 (6.5%)	23 (5.7%)
Do you think that at clinic you are assessed for complications?	182 (45.2%)	140 (34.7%)	81 (20.1%)
Do you know the tests that has been done to assess the complications?	169 (41.9%)	98 (24.3%)	136 (33.8%)
Do you believe that early detection of complications will help you to have a good quality of life?	394 (97.8%)	5(1.2%)	4 (1.0%)

Having a better knowledge of commonly affected organs by diabetes showed a statistically significant association with nephropathy, retinopathy, and ischemic heart disease screening. Similarly, being aware of screening for complications at clinics (aware of screening and referring or doing relevant tests at clinics) was significantly associated with better screening for diabetic nephropathy, retinopathy, and ischemic heart disease. At the same time, those who are aware that well-controlled diabetes can reduce the risk of having complications have better screening. Table 5 summarizes associations between knowledge and awareness and screening practices for nephropathy, retinopathy, and ischemic heart disease.

Table 3. Screening tests and adherence to recommendation for screening for diabetes complications

	Never	Any screening	Recommended screening
Nephropathy screening			
Serum creatinine	227 (56.7%)	157 (39.0%)	16 (4.0%)
Estimated GFR/ e-GFR	274 (68.0%)	111 (27.5%)	16 (4.0%)
Urine albumin creatine ratio	390 (96.8%)	10 (2.5%)	3 (0.7%)
Retinopathy screening			
Participate a screening test for assess your vision	178 (44.2%)	217 (53.8%)	6 (1.5%)
Get a referral for an Ophthalmologist	206 (51.1%)	189 (46.9%)	6 (1.5%)
Ischaemic heart disease screening			
ECG	224 (55.6%)	173 (42.9%)	3 (0.8%)
Echocardiography	319 (79.2%)	82 (20.3%)	0 (0.0%)
Exercise treadmill test	375 (93.1%)	28 (6.9%)	0 (0.0%)

Discussion

The mean age of the study participants was 63.2 years (SD = 11.2) and the median value for that was 64 years (IQR = 16). Most of the participants (60.5%) we more than 60 years of age. The commonest type of diabetes is type II diabetes which is an adult-onset disease.[1] The study population was patients with diabetes attending medical clinics at primary care-level hospitals. Thus, it is explainable that the study sample is more towards the elderly and that results highlight that the sample represents the study population.

A vast majority of the study sample was Sinhalese by the nation and Buddhist by religion. According to the census and statistics department data 2012, Galle district has a majority of Sinhalese population with a sizable Muslim and Tamil population (Department of Census and Statistics Sri Lanka, 2012). However, the draining area for DH Arachchikanda and Thalapitiya has a reasonable

Muslim population and Tamil population is less in that area. (Department of Census and Statistics Sri Lanka, 2012). This can be the reason for high Sinhala/ Buddhist percentage with low Muslim/ Islam percentage and very low Tamil in the study sample.

Table 4. Associations between socio-demographic and health-related factors and screening practices for nephropathy, retinopathy, and ischemic heart disease

	Nephropathy screening OR (95%CI)	Retinopathy screening OR (95%CI)	Ischemic heart disease screening OR (95%CI)
Age 60 years or less	0.74 (0.49 -1.10)	0.61* (0.41-0.91)	0.84 (0.56-1.26)
Living with spouse	1.26 (0.48 -3.31)	1.61 (0.62-4.18)	1.28 (0.49-3.38)
Education Below GCE (O/L)	0.99 (0.67 -1.47)	1.01 (0.68-1.49)	0.88 (0.59-1.30)
Employed	0.86 (0.53 -1.40)	0.68 (0.42-1.10)	0.52* (0.32-0.84)
Income Up to 10,000	0.96 (0.64 -1.46)	0.75 (0.49-1.15)	0.76 (0.52-1.20)
Having Co-morbidities	1.38 (0.84 -2.26)	1.67* (1.02-2.71)	2.03* (1.22-3.40)
Having Family history of diabetes	1.07 (0.71 -1.62)	0.98 (0.65-1.48)	1.24 (0.82-1.87)
* p-value less than 0.05			

Majority of the study sample was unemployed because most of them were more than 60 years of age and either retired or not physically fit to be employed. Therefore, their monthly income was low nearly two third of participants had monthly income less than 10,000 LKR. Having either lower or upper secondary education for nearly two third of participants might have also contributed to this scenario as they were not able to get a pensionable employment due to lack of educational qualifications.

Hypertension and Dyslipidemia were higher among the participants (68.2% and 63.8% respectively) as co-morbid conditions going hand in hand with diabetes. However, STEPS survey has concluded that the island-wide prevalence of hypertension and dyslipidemia was 34.8% and 48.7% respectively (Ministry of Health Nutrition and Indigenous Medicine, 2017). Like diabetes, these co-morbidities are also diseases of older age (Adam Feather et al., 2020). Therefore, it explains the higher prevalence of those co-morbidities in the study sample.

Awareness on complications of diabetes and its prevention was higher among the participants. A vast majority of participants were aware that diabetes affects the kidney, eye and heart (99.0%, 99.3% and 93.3% respectively). More than 80% of participants stated that screening for affected organs is important in diabetes management and well-controlled diabetes will reduce organ damage. There was no local evidence on awareness on diabetes complications and screening for complications. However, study conducted in rural setting of India also reported higher awareness of diabetes complications and its screening among patients with diabetes (Lingam et al., 2018). Another study conducted in South Korea has also concluded a higher awareness of complications among patients with diabetes (Han et al., 2016).

A reasonable number of participants had undergone screening for diabetic nephropathy and retinopathy at least one time in the course of their disease (44.2% and 55.8% respectively). However, only a minute portion of the study sample has undergone screening according to the recommendations. Even though screening tests indicated for ischemic heart disease and stroke have been conducted, they were not done according to the recommendation and seem ad-hoc in the manner of investigation. These screening practices are suboptimal when compared to a previous study conducted at NHSL 2012 where it was noted that 43.5%and 61.2% of diabetes patients have been screened annually nephropathy and retinopathy respectively (G.N.D Perera et al., 2015). Suboptimal retinopathy screening was also highlighted in a study conducted at a rural setup in India. There it was highlighted that 47.5% had not had an eye examination within the previous year and 35.6% of them had never had an eye examination for screening for diabetic retinopathy (Lingam et al., 2018). Further, a study conducted in South Korea also pointed to a lower prevalence of diabetes complication screening among both male and female diabetic patients (Han et al., 2016).

Age more than 60 years was found to be associated with better retinopathy screening. This can be due to multiple reasons. First, health-seeking and health concerns are higher during the older age, and it has been evident that screening is higher in people with more health concerns (Han et al., 2016). Second, there might be other eye diseases associated with older age like cataract, glaucoma and dry eyes etc. Therefore, while seeking healthcare services for those conditions these patients can be subjected to opportunistic screening as well. Both factors can contribute to higher retinopathy screening among older age. Similarly, when people having multiple co-existing conditions their health concerns and contact with the healthcare system is improved. Therefore, they will have more opportunities for screening. Thus, participants to the study with co-morbidities (either hypertension or dyslipidemia) had

better screening for retinopathy and ischemic heart disease. At the same time investigations indicated in hypertension and dyslipidemia management (ECG, Echocardiograpy, lipid profile etc.) are used as screening tests for ischemic heart disease.

Table 5. Associations between knowledge and awareness and screening practices for nephropathy, retinopathy, and ischemic heart disease

	Nephropathy screening OR (95%CI)	Retinopathy screening OR (95%CI)	Ischemic heart disease screening OR (95%CI)
Know organs affected by Diabetes	3.70* (2.44-5.62)	3.36* (1.20-5.14)	1.98* (1.30-2.90)
Do you think that the assessment of affected organs is important?	1.18 (0.66-2.10)	1.43 (0.80-2.54)	2.11* (1.13-3.92)
Do you think that well-controlled diabetes can reduce the risk of having complications?	2.72* (1.37-5.93)	2.96* (1.58-5.60)	1.98* (1.04-3.76)
Do you think that at the clinic you are assessed for complications?	6.05* (3.90-9.39)	2.90* (1.92-4.38)	1.98* (1.33-2.95)
Do you know the tests that have been done to assess the complications?	6.38* (4.12-9.89)	3.36* (2.18-5.16)	2.25* (1.50-3.37)
Do you believe that early detection of complications will help you to have a good quality of life?	6.53 (0.81-52.67)	1.60 (0.42-6.04)	1.01 (0.27-3.81)
* p-value less than 0.05			

Awareness of the affected organs and better perception on screening showed a strong positive association with better screening for nephropathy, retinopathy and ischemic heart disease screening. Though better knowledge of diabetes complications known to be associated with participation to screening in previous studies as well (Lingam et al., 2018), it should be interpreted cautiously. Because both current and previous study were cross-sectional studies where the temporal relationship between two associated factors cannot be established. Thus, it is impossible to determine whether participants got screened due to improved awareness or got improved awareness due to screening.

In conclusion, awareness about screening for diabetes complications was satisfactory among the study sample. Though participants had a satisfactory awareness the screening practices were sub-optimal as the recommended screening protocols have not been followed. Better screening was associated with good awareness, older age, having comorbidities, and being employed.

The study recommends increasing awareness among patients with diabetes on complications and screening for complications and establishing a mechanism to streamline complication screening in patients with diabetes.

The study has a few limitations. One such limitation is the study was conducted only in primary care institutions in the public sector. However, a significant number of patients are followed up at private sector hospitals and by general practitioners. Therefore, that group of patients was not captured in the study and thus it affects the external validity of the study. Another major limitation is the inability to establish the temporality of associations due to the cross-sectional design of the study. Even with above limitations the study was able the capture reasonable information on screening practices, awareness and associated factors regarding diabetes and its complications.

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