Original Article

Human resources, patient load, and infrastructure at institutions providing diabetic care in India: The India 11-city 9-state study

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ABSTRACT

Background: There is a lack of information on the practice patterns and available human resources and services for screening for eye complications among persons with diabetes in India. **Objectives:** The study was undertaken to document existing health care infrastructure and practice patterns for managing diabetes and screening for eye complications. **Methods:** This cross-sectional, hospital-based survey was conducted in 11 cities where public and private diabetic care providers were identified. Both multispecialty and standalone diabetic care facilities were included. A semi-structured questionnaire was administered to senior representative(s) of each institution to evaluate parameters using the World Health Organization health systems framework. **Results:** We interviewed physicians in 73 hospitals (61.6% multispecialty hospitals; 38.4% standalone clinics). Less than a third reported having skilled personnel for direct ophthalmoscopy. About 74% had provision for glycated hemoglobin testing. Only a third had adequate vision charts. Printed protocols on management of diabetes were available only in 31.5% of the facilities. Only one in four facilities had a system for tracking diabetics. Half the facilities reported having access to records from the treating ophthalmologists. Direct observation of the services provided showed that reported figures in relation to availability of patient support services were overestimated by around 10%. Three fourths of the information sheets and half the glycemia monitoring cards contained information on the eye complications and the need for a regular eye examination. **Conclusions:** The study highlighted existing gaps in service provision at diabetic care centers in India.

Key words: Diabetes, health care facilities, human resources, India, referrals

Introduction

Diabetes mellitus (DM) is one of the most common noncommunicable disorders,[1] affecting an estimated 382 million people worldwide.[2] India has the second highest number of people with diabetes,[3] which is estimated to increase from 65 million in 2013, to 109 million by 2025.[2] The prevalence of diabetes is estimated to be 4 times higher in urban areas compared to rural areas in India.[4]

With such a high prevalence of diabetes in India, it is imperative that the healthcare sector is equipped to deliver quality care for patients with diabetes and its management. However, that is not the case. Numerous health care

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Access this article online	
Quick Response Code:	Website: www.ijem.in
	DOI: 10.4103/2230-8210.179769

Cite this article as: Anchala R, Gudlavalleti AS, Gudlavalleti MV, Singh V, Shukla R, Jotheeswaran AT, *et al*. Human resources, patient load, and infrastructure at institutions providing diabetic care in India: The India 11-city 9-state study. Indian J Endocr Metab 2016;20:11-8.

providers, working without national guidelines or protocols for services including standards for health facilities, personnel and treatment protocols, makes it difficult to ensure good quality diabetic care in the country.[5]

In such a situation, it is necessary to study the existing health care infrastructure and practice patterns for managing diabetes and screening for eye complications and identify gaps so that appropriate remedial measures can be instituted. The paper presents results on the current status of available infrastructure and human resources for diabetic care from India 11 city study which was conducted in 2013–2014 in 11 of the largest cities across 9 states in India.

Methods

The study was a cross-sectional, hospital based survey, and was conducted in 11 cities across 9 states in India. All cities in India were ranked in descending order of population size (2011 census) and the 10 most populated cities were selected. As only one city (Kolkata) was in Eastern India another was added – Bhubaneshwar, making a total of 11. Sampling was done using a two stage process wherein cities were first stratified based on their population (> or <7 million). The 11 cities were Ahmedabad, Bengaluru, Bhubaneshwar, Chennai, Delhi, Hyderabad, Jaipur, Kolkata, Mumbai, Pune, and Surat.

In each city, public and private providers for diabetic care services were identified. The other variable in selecting diabetic care institutions was the size of the facility. We choose multispecialty hospitals (100 or more bedded hospital with three or more specialties providing services under one roof), polyclinics (with two or more specialties providing services under one roof), and standalone diabetes clinics (physician/endocrinologist run facilities providing only medical care for diabetes patients).

A semi-structured questionnaire was administered to senior representative(s) of each institution to evaluate different characteristics of each institution, using the World Health Organization health systems framework.[6]

Stata 12 SE for Windows (Stata Corp., Texas, USA) was used for statistical analysis. Frequencies of the variables were tabulated. *t*-test was used for continuous variables and Chi-square was used for categorical variables. Results were adjusted for the type of city (large cities [having a population of 7 million and above] or small cities), type of facility (multispecialty or standalone diabetic facility), sector (public funded or private-funded, including both the not-for-profit and for-profit sector), and whether the institution had teaching facilities.

Results

We interviewed physicians in 73 hospitals, 61.6% ($n = 45$) of which were multispecialty hospitals and 38.4% ($n = 28$) were standalone diabetic clinics [Table 1]. 37% ($n = 27$) of the hospitals were in the public-funded sector, whereas 63% ($n = 46$) were in the private-funded sector, a major proportion of which ($n = 38$) were not-for-profit organizations. About 53.4% of the facilities ($n = 39$) were in the larger cities and 39.7% ($n = 29$) were teaching hospitals. Institutes in larger cities were more likely to be standalone diabetic clinics than institutes in smaller cities (67.4% vs. 32.6%; $P = 0.04$) (adjusted for specialty, sector, teaching/nonteaching).

Public-funded institutions were more likely to have multiple specialties (odds ratio: 8.9 [95% CI: 2.4–40.2]; $P < 0.001$) and were more likely to be teaching hospitals (odds ratio: 8.5 [95% CI: 2.6–29.3]; $P < 0.001$). About 61.6% ($n = 45$) of the facilities had their own eye unit/department, and 13.7% ($n = 10$) had worked collaboratively with an ophthalmologist. Multispecialty hospitals were more likely to have an eye unit/tie up with an ophthalmologist compared to standalone diabetic clinics (95.1% (39) vs. 50% [16]; $P < 0.001$).

The healthcare personnel mix at the different facilities showed that there was a mean of 1.8 ± 2.7 (standard deviation [SD]) endocrinologists per hospital and 5.3 ± 8.1 (SD) general physicians working in the 73 institutions [Table 2]. Compared to standalone diabetic institutions, multispecialty institutions had significantly more endocrinologists (2.4 ± 3.3 standalone diabetic care clinics vs. 1.0 ± 1.4 in multispecialty; $P = 0.03$) and general physicians (8.1 ± 9.9 vs. 1.6 ± 1.7; $P < 0.001$). It was observed that there the mean number of endocrinologists per facility were significantly higher in larger cities compared to the smaller cities (2.3 ± 3.2 vs. 1.0 ± 1.6; $P = 0.04$).

Table 1: Profile of diabetic care facilities included in the study

	Characteristics	*N* (73)	%
Type of facility	Multispecialty facilities	45	61.6
	Standalone diabetic facilities	28	38.4
Sector	Public-funded	27	37.0
	Private funded	46	63.0
	Private: Not for profit	38	52.0
	Private for profit	8	11.0
Type of city	Large (≥7 million population)	39	53.4
	Small (<7 million population)	34	46.6
Teaching status	Teaching institution	29	39.7
	Non-teaching institution	44	60.3
Access to eye care facilities	In-house ophthalmologist available	45	61.6
	Tie up with an ophthalmologist available	10	13.7
	No direct linkage with an ophthalmologist	18	24.7

Public-funded institutions had a greater number of general physicians than private institutions (7.8 ± 11.5 public-funded vs. 3.7 ± 4.8 private-funded; $P = 0.04$). Teaching institutions also had more general physicians than nonteaching institutions, (9.5 ± 11.3 teaching vs. 2.5 ± 2.7 nonteaching; $P < 0.001$). Similar was the case with multispecialty compared to standalone diabetic care facilities (8.1 ± 9.9 physicians vs. 1.6 ± 1.7 physicians; $P < 0.001$). In standalone diabetic care clinics ($n = 28$), the mean number of general physicians was significantly higher than of endocrinologists (5.7 ± 9.3 vs. 2.6 ± 3.2; $P = 0.04$).

A nutritionist/dietician was available, most of the time in 60.3% ($n = 44$) of facilities and a counsellor was present in 39.7% ($n = 29$). There was a significant difference in the availability of a regular counsellor between the public funded and private funded facilities (χ^2 - 5.48; $P = 0.02$). Less than a third of the surveyed hospitals reported having personnel skilled to perform direct ophthalmoscopy, and this pattern was similar to private and public funded facilities.

Almost three quarters of the facilities (74%; $n = 54$) were able to provide glycated hemoglobin (HbA1c) testing [Table 3], with better provision in private-funded facilities than public-funded institutions (84.8% vs. 55.6%, respectively; $P = 0.006$). The majority of service providers had facilities for measuring blood glucose (87.7%, $n = 64$) and lipids (82.2%, $n = 60$), and to assess renal function (84.9%, $n = 62$). Most also had a dedicated pharmacy stocking drugs for diabetes, with significant differences between public-funded and private facilities (100% vs. 76.1%, respectively, $P = 0.006$).

All institutions had functioning equipment for measuring blood pressure and weighing scales [Table 3]. However, a lower proportion had a functioning direct ophthalmoscope (56.1%, $n = 41$) and adequate visual acuity charts (31.5%). Only 17.8% ($n = 13$) had a functional fundus/retinal camera.

The number of persons with diabetes (PWD) registered at the study institutions in 2011 and 2012 showed the work load to be similar in each year [Table 4]. The mean number of PWD attending in 2011 and 2012 were 10,944 ± 14,289 (SD) and 12,337 ± 18,029 (SD) per hospital, respectively. Teaching hospitals saw more than twice the number of new PWD than nonteaching facilities. A mean patient load of 3273 ± 4742 (SD) newly registered PWD per facility, was seen in 2011, whereas a mean patient load of 3114 ± 4548 (SD) newly registered PWD per facility was seen in 2012. In 2011 and 2012, teaching hospitals recorded significantly higher numbers of new PWD (2011: 5202 ± 6335 vs. 2010 ± 2787 [$P = 0.02$]; 2012: 5054 ± 5764 vs. 2030.5 ± 3413.4 [$P = 0.02$]). Multispecialty hospitals saw significantly more PWDs in 2012 than standalone diabetic care facilities (17270 ± 22541 vs. 6647 ± 7929; $P = 0.03$). The mean number of patients presenting for follow-up evaluation for diabetes at each facility was 5.5 ± 6.3 (SD) patients per week.

The majority of institutions stated that they received regular referrals from ophthalmologists (83.6%; $n = 61$). This did not differ by type of facility.

Two-thirds (67.1%) of the respondents stated that they knew about the National Program for Prevention and Control of Diabetes, Cancer and Stroke (NPCDCS). However, only 5% ($n = 4$) reported that they had received any support from the government under the NPCDCS.

Printed protocols on management of diabetes were available in 31.5% (23) of the facilities [Table 5]. The availability of such protocols was significantly higher in standalone diabetic care clinics compared to multispecialty facilities (χ^2 - 4.67; $P = 0.03$) and in the larger cities compared to the smaller cities (χ^2 - 11.9; $P = 0.001$). Printed protocols on detection

Table 2: Human resources availability reported by the institutions

Human resources	Mean±SD		
	Public-funded (*n*=27)	Private-funded (*n*=46)	All
Endocrinologists	2.0±2.5	1.6±2.8	1.8±2.7
General physicians	7.8±11.5	3.7±4.8	5.3±8.1
Nutritionist	55.6% (15)	63.0% (29)	60.3% (44)
Counselor	22.2% (6)	50.0% (23)	39.7% (29)
	χ^2=5.48; *P*=0.02		
Staff skilled in direct ophthalmoscopy	29.6% (8)	30.4% (14)	30.1% (22)

SD: Standard deviation

Table 3: Services and equipment available at the institutions

	Public funded (*n*=27)		Private-funded (*n*=46)		All (*n*=73)	
	N	%	*N*	%	*N*	%
Service						
HbA1c testing available	15	55.5	39	84.8	54	74
	χ^2=7.55; *P*=0.006					
Blood sugar testing available	25	92.6	39	84.8	64	87.7
Lipid testing available	21	77.8	39	84.8	60	82.2
Renal function testing available	23	85.1	39	84.8	62	84.9
Pharmacy for diabetes available	27	100.0	35	76.1	62	84.9
	χ^2=7.60; *P*=0.006					
Functional equipment						
BP apparatus available	27	100.0	46	100.0	73	100
Direct ophthalmoscope available	12	44.4	29	63.0	41	56.1
Fundus/retinal camera available	3	11.1	10	21.7	13	17.8
Visual acuity charts available	5	18.5	18	39.1	23	31.5
Weighing scale available	27	100.0	46	100.0	73	100

HbA1c: Glycated hemoglobin, BP: Blood Pressure

Table 4: Reported workload at the responding institutions

Characteristics	Public funded	Private funded	All
No. of persons with diabetes seen per week	4.6±3.9 (*n*=25)	6.0±7.3 (*n*=43)	5.5±6.3 (1-50) (*n*=68)
New diabetics seen in 2011	3764±5376 (*n*=16)	3028±4464 (*n*=32)	3273±4742 (19-21,900) (*n*=48)
Old + new diabetics seen in 2011	14,248±18,829 (*n*=18)	9142±11,009 (*n*=33)	10944±14289 (29-65,957) (*n*=51)
New diabetics seen in 2012	3033±4125 (*n*=18)	3156±4808 (*n*=35)	3114±4548 (25-21,900) (*n*=53)
Old + new Diabetics seen in 2012	16140±24723 (*n*=19)	10385±13396 (*n*=37)	12337±18,029 (169-84,439) (*n*=56)

n=No. of institutes which provided data

Table 5: Reported practice patterns at diabetic care facilities

Reported practice pattern	*N*	%	χ^2; *P*
Printed protocols on managing diabetes readily available in clinic (73)	23	31.5	
Standalone diabetic care clinics (28)	13	46.6	
Multispecialty hospitals (45)	10	22.2	χ^2=4.67; *P*=0.03
Large cities (42)	20	47.6	
Small cities (31)	3	9.7	χ^2=11.9; *P*=0.001
Printed protocols on detection of complications readily available in clinic (73)	15	20.5	No significant associations
Information sheets on diabetes available for distribution in clinic (73)	49	67.1	
Standalone diabetic care clinics (28)	25	89.3	
Multispecialty hospitals (45)	24	53.3	χ^2=10.11; *P*=0.001
Public-funded (27)	9	33.3	
Private-funded (46)	40	87.0	χ^2=22.17; *P*<0.001
Information sheets on diabetes contain advice on eye complications in diabetes (49)	39	79.6	No significant associations
Customized diet cards given to persons with diabetes (73)	47	64.3	
Standalone diabetic care clinics (28)	23	82.1	
Multispecialty hospitals (45)	24	53.3	χ^2=6.25; *P*=0.012
Each diabetic given a card to monitor glycemic status (73)	45	61.6	
Standalone diabetic care clinics (28)	23	82.1	
Multispecialty hospitals (45)	22	48.9	χ^2=8.07; *P*=0.004
Public-funded (27)	12	44.4	
Private-funded (46)	33	71.7	χ^2=5.36; *P*=0.021
Glycemic status monitoring card mentions need for eye examinations (45)	20	44.4	No significant associations
Standardized set of procedures established for assessment of diabetics (73)	50	68.5	No significant associations
Reminders sent to registered persons with diabetes for follow up (73)	20	27.4	
Standalone diabetic care clinics (28)	14	50.0	
Multispecialty hospitals (45)	6	13.3	χ^2=11.67; *P*=0.001
Teaching facilities (29)	4	13.8	
Non-teaching facilities (44)	16	36.4	χ^2=4.48; *P*=0.034
Access to records from ophthalmologists for individual persons with diabetes (73)	40	54.8	
Public-funded (27)	17	63.0	
Private-funded (46)	16	34.8	χ^2=5.45; *P*=0.02
Large cities (42)	25	59.5	
Small cities (31)	8	25.8	χ^2=8.19; *P*=0.004
Diabetic care clinics maintain records pertaining to eyes/vision of individual diabetics (73)	27	37.0	No significant associations
Referrals received from ophthalmologists every week (73)	56	76.7	No significant associations
Registered diabetics regularly referred to ophthalmologists (73)	63	86.3	
Large cities (42)	40	95.2	
Small cities (31)	23	74.2	χ^2=6.68; *P*=0.01
Physicians suggesting annual eye examination to registered diabetics (73)	58	79.4	
Suggest eye examination as soon as person with diabetes registered (73)	63	86.3	

and management of complication of diabetes were reported to be available in a fifth of the institutions but there were no significant differences observed in this regard [Table 5]. Information sheets on diabetes for distribution to PWD were reported to be available in the clinics by 67.1% (49) of the responding institutions, with significant differences between standalone diabetic care clinics compared to multispecialty hospitals (χ^2 - 10.11; $P = 0.001$) and private-funded compared to public-funded facilities (χ^2 - 22.17; $P < 0.001$). 79.6% of hospitals reporting availability of information sheets stated that eye complications were mentioned in the information sheets. Customized diet sheets were reported to be available by 64.3% (47) facilities with significant differences being observed between standalone diabetic care facilities and multispecialty hospitals (χ^2 - 6.25; $P = 0.012$). Cards to help PWD monitor their diabetic status were reported by

61.6% (45) facilities with significant differences between standalone diabetic care units and multispecialty units (χ^2 - 8.07; P = 0.004) and private-funded compared to public-funded institutions (χ^2 - 5.36; P = 0.021). 44.4% of such monitoring cards were reported to include information on the need for regular eye examinations. 68.5% facilities stated that they had established a standard set of procedures to assess PWD. Only 1 in 4 hospitals/clinics mentioned that they had a system for tracking PWD through a short messaging service to remind them of follow-up visits, with significant differences being reported by standalone compared to multispecialty facilities (χ^2 - 11.67; P = 0.001) and nonteaching facilities compared to teaching facilities (χ^2 - 4.48; P = 0.034).

Only half the facilities reported that they had access to records from the treating ophthalmologists. This was significantly better in public compared to private funded facilities (χ^2 - 5.45; P = 0.02) and in the larger cities compared to the smaller cities (χ^2 - 8.19; P = 0.004). The reported referral network between the diabetic care physicians and the treating ophthalmologists was good.

The interview team also personally observed the available facilities in the diabetic care institutions [Table 6]. It was observed that the reported figures with regard to the availability of printed protocols was a slight overestimate compared to the actual availability. The same was the case with regard to patient information sheets, customized diet cards, and glycemic monitoring cards. The difference between the observed and reported proportions was about 10% on each of the items observed.

Three-fourths of the information sheets and half the glycemia monitoring cards contained information on the eye complications and the need for a regular eye examination.

Retinal examination on the first visit of a person with diabetes to a diabetic care facility was mentioned to be the practice followed by 20.5% (15) of the responding facilities. 45.2% (33) stated that they referred a person with diabetes for a retinal examination at the very first visit to their clinic. Only 10% of the retinal examinations were reported to be done by physicians. About 4.1% facilities reported that they referred for a retinal examination only if they suspected an eye problem. In-house retinal photography/digital imaging were not very common in diabetic care facilities with only 6.8% (5) reporting that such a practice was followed.

The 73 responding diabetic care facilities stated that the most common risk factors for diabetic retinopathy observed by them in their clientele were poor glycemic control (79.4%), duration of diabetes (60.3%), concomitant hypertension (58.9%), and high lipids (35.6%).

Table 6: Observed practice patterns at diabetic care facilities

Observed practice patterns at clinic visit	*N*	%	χ^2; *P*
Printed protocols available in clinic on management of diabetes (73)	15	20.5	
Standalone diabetic care clinics (28)	10	35.7	
Multispecialty hospitals (45)	5	11.1	χ^2=6.4; *P*=0.011
Large cities (42)	13	30.9	
Small cities (31)	2	6.4	χ^2=6.56; *P*=0.01
Printed protocols available in clinic on detection of complications of diabetes (73)	8	11.0	
Standalone diabetic care clinics (28)	6	21.4	
Multispecialty hospitals (45)	2	4.4	χ^2=5.10; *P*=0.024
Public-funded (27)	0	0	
Private-funded (46)	8	17.4	χ^2=5.27;p=0.022
Information sheets for persons with diabetes available in clinic (73)	40	54.8	
Standalone diabetic care clinics (28)	20	71.4	
Multispecialty hospitals (45)	20	44.4	χ^2=5.07; *P*=0.024
Public-funded (27)	8	29.6	
Private-funded (46)	32	69.6	χ^2= 10.95; *P*=0.001
Information sheets for persons with diabetes mention eye complications (40)	29	72.5	
Prototype of individualized diet card for persons with diabetes available in clinic (73)	35	47.9	
Standalone diabetic care clinics (28)	18	64.3	
Multispecialty hospitals (45)	17	37.8	χ^2=4.86; *P*=0.03
Public-funded (27)	8	29.6	
Private-funded (46)	27	58.7	χ^2=5.76; *P*=0.02
Prototype of glycemic monitoring card for persons with diabetes available in clinic (73)	35	47.9	
Standalone diabetic care clinics (28)	19	67.9	
Multispecialty hospitals (45)	16	35.6	χ^2=7.22; *P*=0.007
Public-funded (27)	6	22.2	
Private-funded (46)	29	63.0	χ^2= 11.36; *P*=0.001
Glycemic monitoring cards include advice on need for eye examination (35)	19	54.3	

Discussion

We interviewed individuals in 73 hospitals across 9 states. We observed that public-funded hospitals were more likely to be teaching hospitals and were also more likely to have multiple specialties which reflect the situation in the country as government institutions are more likely to provide postgraduate medical education (courses recognized by the Medical Council of India [MCI]) than private institutes.[7]

The number of endocrinologists was significantly higher in multispecialty hospitals and in larger cities. This documents the fact that specialists tend to aggregate in facilities with better infrastructure.

We observed that general physicians were generally managing diabetic care, which is consistent with what has been reported from India earlier. In a pan Indian study, 70% of diabetics were diagnosed by general physicians rather than specialized endocrinologists or diabetologists.[8]

Lifestyle modification including diet management is known to prevent the incidence of DM,[9] and also helps reduce HbA1c levels.[10] This would thus help reduce microvascular complications of diabetes.[11] Unfortunately physicians and nurses tend to spend less time in counseling for management of type 2 DM in low middle income countries like India.[12] We observed that about a quarter of the facilities ($n = 18$) neither had a nutritionist or a counselor. In the absence of such personnel, effective management of the glycemic state is compromised. Thus there is an urgent need for specialized nutritionists and counselors to be trained and employed so that they can advise and motivate patients to modify their lifestyle and comply with their treatment.

Teaching institutes, public-funded institutes, and multispecialty hospitals tended to have a significantly greater number of general physicians and residents. Again this reflects inequitable distribution of health care delivery and human resources in the country.

Monitoring of the glycemic state was regularly undertaken either by HbA1c testing or blood glucose testing especially in private-funded institutions. Blood glucose monitoring was the more common modality practiced in India diabetic care facilities. Testing for HbA1c has been included in the criteria for diagnosing DM by the American Diabetes Association in 2010,[13] in addition to the criteria pertaining to blood glucose. A study observed significant differences in the prevalence of diabetes when calculated via Oral glucose tolerance test (OGTT) and HbA1c levels across different countries including the UK, Australia, India, Kenya, and Denmark.[14] In the Indian and the Danish subset, HbA1c testing was more sensitive than OGTT,[14] whereas the opposite was true for individuals living in the UK and in Australia. In India, the prevalence of diabetes was 12.9% via HbA1c testing and 10.2% via OGTT. Thus, in India, which is home to the second largest population of diabetics,[15] increasing the sensitivity of detection by increasing HbA1c testing, would be very helpful.

Treating hyperlipidemia and proteinuria in diabetics is a very important aspect of management of diabetes, to reduce the risk of complications like diabetic retinopathy. Hyperlipidemia raises the risk of complications such as coronary artery disease, stroke, and diabetic retinopathy.[16,17] The ADA has recommended that the first priority of lipid lowering be a low density lipoprotein (LDL) level <100 mg/dL.[18] In our study, it was observed that more than 80% of institutions assessed possessed the capability of testing for lipids.

Diabetic kidney disease is one of the most common causes of end stage renal disease.[19] It is present in approximately 40% of patients with type 2 diabetes.[19] Hence, it is very important to be able to test for basic renal functions such as urine protein, urine, and serum creatinine. Approximately, 85% of institutions in the present study had the capability to perform renal function tests.

Thus, a majority of institutions could perform the basic, necessary tests to diagnose and manage diabetes. However, public-funded institutions would need to consider introducing tests for HbA1c to detect diabetes among their client population.

A majority of institutes also had a pharmacy attached, which distributed drugs for diabetes. All public-funded institutions had this facility, whereas 76.1% of the private institutions did. Having attached pharmacies would not just be convenient for the PWD, but would also play an additional complementary role as the pharmacists can be effective "counselors." Studies have shown that counseling by pharmacists reduces the level of postprandial blood glucose, triglycerides and LDL.[20]

All institutions assessed had a functional Sphygmomanometer. This is important as 30–35% PWD in India have concomitant hypertension.[21] Thus, it is important to be able to detect hypertension at the earliest, and provide adequate monitoring and care for the same. Although more than half the institutions had a functional direct ophthalmoscope, only 17.8% had a functional fundus camera. Use of a fundus camera is far more superior

for screening compared to direct ophthalmoscopy.[22,23] The cost of a fundus camera may be a factor that could limit its use for screening purposes, but this can be made cost-efficient by coupling it with tele-ophthalmology facilities.[24,25]

Majority of the institutions stated that they received regular referrals from ophthalmologists. This is a positive finding as effective management of the glycemic status is critical to preventing blindness due to diabetic retinopathy.

The present study has few limitations. Only hospitals in urban areas were interviewed. Thus, the results cannot be generalized to the rural areas. The selection of hospitals/institutions was not randomized and hence the results may not be entirely representative of the situation of institutions across these cities. Since history was elicited using a questionnaire, recall bias cannot be ruled out.

Conclusion

Multispecialty and teaching institutions had a higher patient load as compared to other hospitals providing care for PWD. HbA1c testing was low in public-funded institutions as compared to private-funded ones. We observed significant differences in infrastructure among different facilities according to the sector (public-funded vs. private-funded institutions), type of facility (multispecialty vs. standalone diabetic care institutions), and teaching status (teaching vs. nonteaching institutions).

Reported and observed practice patterns at diabetic care facilities showed that there were significant differences with the type of facility. Overall, it was observed that standalone diabetic care centers and privately-funded institutions were better equipped to meet the needs of PWD.

The results from the present study will be used to develop a sustainable model for comprehensive diabetic care with an emphasis on prevention of blindness due to diabetic retinopathy. Such a model will be integrated into the existing district health systems. The study shows that the model will need interventions that include capacity building of diabetic care teams to augment efforts for screening for retinopathy at their clinics/hospitals and education of PWD and their care-givers/family members to inculcate lifestyle modification and improve compliance with prescribed medication.

Financial support and sponsorship

The study was supported by a grant from the Queen Elizabeth Diamond Jubilee Trust, London, UK.

Conflicts of interest

There are no conflicts of interest.

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