Research Article

Opportunistic screening for diabetes mellitus among adults attending a primary health center in Puducherry

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Abstract

Background: More than half of cases with diabetes mellitus in India remain undiagnosed. Considering factors on yield and availability of resources, population-based screening is not recommended in low- and middle-income countries. Evidences on feasibility of opportunistic screening for diabetes mellitus and follow-up in rural settings are scarce.

Objective: To estimate the proportion of undiagnosed diabetes mellitus among individuals aged 30 years or more attending a primary health center, and to identify factors influencing yield of such an opportunistic screening.

Materials and Methods: Individuals aged 30 years and above attending a rural health center were screened for diabetes mellitus (using random blood sugar test) and for noncommunicable diseases risk factors. People who had random blood sugar level 140 mg% or more were advised to come for the follow-up visit to confirm the diagnosis. Study participants with fasting blood sugar level of ≥126 mg/dL (7.0 mmol/L) and/or 2-h postprandial blood sugar level of ≥200 mg/dL (11.1 mmol/L) were diagnosed as having diabetes mellitus.

Result: Of 400 eligible participants, 81 (21.3%) had a random blood sugar level of 140 mg% or more. A total of 18 participants (4.5%) were newly diagnosed with diabetes mellitus. Overall, the number needed to screen a case of diabetes mellitus was 22. The number needed to screen was least among males (12) and highest among females (43).

Conclusion: In primary care settings where more than half of the cases were unidentified in the community, opportunistic screening can be a feasible strategy to find out missed cases.

KEY WORDS: Diabetes mellitus, opportunistic screening, noncommunicable diseases, number needed to screen, rural, primary care

Introduction

Diabetes mellitus is one of the most common noncommunicable diseases (NCDs) worldwide and is one of the major global risks for mortality, especially due to cardiovascular diseases.[1,2] The number of people with diabetes mellitus has risen sharply in recent years and has reached epidemic proportions, particularly in developing countries such as India.[3] In India, as per the 2011 estimates reported by the Indian Council of Medical Research (ICMR), 62.4 and 77.2 million people have diabetes mellitus and prediabetes, respectively. By 2030, almost 87 million people in India have been predicted to have diabetes mellitus.[4] Diabetes mellitus is frequently not diagnosed until complications appear, and approximately half of all subjects with diabetes mellitus remain undiagnosed. Between 30% and 80% of people in India are not diagnosed and are left untreated.[5] Around 20%–30% of individuals with diabetes mellitus are identified after developing macro- or microvascular complications.[6] This appears to be due to the combination of poor public

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awareness and limited opportunities for diagnosis.[7,8] People diagnosed by means of opportunity screening had good prognosis compared to those who are diagnosed by clinical onset of symptoms. Individuals with diabetes mellitus who present earlier had fewer incidences of macro- and microvascular complications and mortality. Hence, it is important to detect diabetes mellitus early by screening to prevent its micro- and macrovascular complications.[9,10]

Experiences from a few population-based screening have shown that population-based screening will result in low yield thereby resulting in a higher cost.[11,12] Moreover, population-based screening would be difficult in middle- or low-income countries where logistics and human workforce are far from requirements to implement even routine health-care activities. One of the key strategies under the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) in India is opportunistic screening of persons above 30 years of age at the point of primary contact with any health-care facility.[13] Thus, this study was undertaken with the objective to identify the magnitude of undiagnosed diabetes mellitus and its selected risk factors among individuals aged 30 years and more attending the rural health center (RHC) of Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, India. This study also aimed to report number needed to screen (NNTS) for diagnosis of diabetes mellitus across various subgroups of the population.

Materials and Methods

Study Design and Setting

This cross-sectional study was carried out at an OPD of the RHC in Puducherry, India. This RHC is situated at Ramanathapuram village, about 14 km from Puducherry town, and caters to 9101 residents in four villages. The average OPD attendance per day of this RHC is approximately 50, and the number of people attending the OPD of the age ≥30 years per day is approximately 35. There was no diabetes mellitus screening program existing before this study. Around 200 people were registered as having diabetes mellitus in the chronic disease clinic of this RHC.

Study Population and Study Duration

Individuals (patients and adults who accompanied them) aged 30 years and above attending the RHC between September 3, 2013, and September 21, 2013, constituted the study population. Patients with known diabetes mellitus were excluded from the study.

Procedure

Information on sociodemographic variables such as age, gender, and behavioral risk factors such as tobacco and alcohol use was collected using a structured interview schedule. Anthropometric measurements such as height, weight, and waist circumference were also measured as per the standard criteria.[14] Weight and height were measured using SECA scale. The height was recorded in centimeters with least count of 0.1 cm. Weight was measured in kilograms with accuracy of 100 g. Waist circumference was measured as the smallest horizontal girth between the costal margins and the iliac crests at minimal respiration using nonstretchable measuring tape. On the basis of the body mass index (BMI), study populations were categorized as per the following criteria: underweight (<18.5 kg/m^2), normal (18.5–22.99 kg/m^2), overweight (23–24.99 kg/m^2), and obese (≥25 kg/m^2).[15] Abdominal obesity was defined as waist circumference of ≥90 cm for men and ≥80 cm for women.

Eligible individuals were subjected to a random blood sugar (RBS) screening by glucometer (FreeStyle, Optium H). Individuals who had RBS level of ≥140 mg/dL were subjected to fasting blood sugar (FBS) and postprandial blood sugar (PPBS) estimation by auto analyzer method (ChemWell Chemistry Analyzer, P-2900 series, version 6.3).

Subjects whose RBS was ≥140 mg/dL based on the glucometer reading were counseled regarding necessity of undergoing definitive tests for diabetes mellitus and were instructed to come to the health center the next day in fasting status for testing FBS and 2-h PPBS [Figure 1].[16] Patients with newly diagnosed diabetes mellitus were provided proper counseling regarding diet and exercise, and were registered in the chronic disease clinic for further management.

Study subjects were diagnosed as having diabetes mellitus and hypertension based on ICMR criteria and JNC-7 guidelines, respectively, and managed accordingly.[16,17] Study subjects with FBS of ≥126 mg/dL (7.0 mmol/L) and/or 2-h PPBS of ≥200 mg/dL (11.1 mmol/L) were diagnosed as having diabetes mellitus. FBS between 110 and 125 mg/dL and/or PPPG between 140 and 199 mg/dL was considered as prediabetes. For those whose FBS and 2-h PPBS were not available were considered as loss to follow-up.[16] Individuals who had systolic blood pressure of ≥140 and/or diastolic blood pressure of ≥90 mmHg were considered as having hypertension.[17]

Data Entry and Statistical Analysis

Data were entered in Epi software, version 3.1, and were analyzed using SPSS software, version 17.0. Newly diagnosed diabetes mellitus resulting from the present opportunistic screening study is presented as percentages with 95% confidence intervals (CIs). The NNTS to identify one case of diabetes mellitus among those who did not know their diabetic status previously was calculated. This was calculated for various subgroups of the study population.

Results

A total of 400 individuals completed the interview and underwent RBS screening. Mean age (SD) of participants was 51 ± 13.4 years. Of 400 subjects, 256 (64%) were females

Table 1: Sociodemographic, behavioral, and clinical characteristics of the study participants at a rural primary health center, Puducherry (*N* = 400)

Characteristics	*n* (%)
Age (years)	
30–39	96 (24.0)
40–49	91 (22.8)
50–59	86 (21.4)
60–69	76 (19.0)
70	51 (12.8)
Gender	
Male	144 (36)
Female	256 (64)
Tobacco use	
Yes	84 (21)
No	316 (79)
Alcohol use	
Yes	67 (16.8)
No	333 (83.2)
BMI status	
Underweight	56 (14)
Normal	147 (36.8)
Overweight	130 (32.4)
Obese	67 (16.8)
Waist circumference	
Normal	219 (54.8)
Obese	181 (45.2)
Hypertension	
Yes	179 (44.8)
No	221 (55.2)

BMI, body mass index.

and 32% were aged 60 years and above. Behavioral and clinical characteristics of the study subjects are shown in Table 1.

Of the total, 84 (21%) subjects were current tobacco users in any form. The median duration of tobacco use was 23.5 years (interquartile range 6–40 years). Majority (i.e., 53.6%) of the tobacco users were females. Participants had predominantly (60.7%) used smokeless form of tobacco. Cigarette, beedi, and both were reportedly used by 13.1%, 22.6%, and 3.6% subjects, respectively. Totally, 16.8% of the screened people were currently consuming alcoholic drinks. A majority of them were males in the age category of 50–59 years.

Of these 400 individuals screened for RBS, 81 (20.3%) had their RBS of ≥140 mg%. Of these 81 individuals, only 44 were turned out for confirmatory test. Among those who turned out for the follow-up visit, 21 (47.7%) had normal blood sugar, 5 (11.4%) had impaired blood sugar, and 18 (40.9%) were newly diagnosed to have diabetes mellitus [Figure 1]. The characteristics of participants who did not come for confirmatory test were similar to those of participants who underwent confirmatory test.

The overall prevalence of undiagnosed diabetes mellitus among the screened people was 4.5% (95%CI: 2.7%–7.0%). The NNTS to identify one person with undiagnosed diabetes mellitus was 22. The prevalence of undiagnosed diabetes mellitus was stratified based on age category, gender, BMI, abdominal obesity and blood pressure. Within these subgroups, being a male and obese person had less NNTS for diabetes mellitus. The NNTS to identify one male person with undiagnosed diabetes mellitus was 12 but among females it was 43. The NNTS did not vary much within the subgroups except gender [Table 2].

Discussion

In this study, about 4.5% subjects were newly diagnosed to have diabetes mellitus. If this opportunistic screening was not performed, these 4.5% cases would have been left undetected or detected at the late stage of illness. Undiagnosed diabetes mellitus would lead to a huge economic loss due to macro- and microvascular complications and premature mortality. Identifying people at increased risk for undiagnosed diabetes mellitus or glucose intolerance, followed by blood glucose testing to establish diagnosis, is considered to be an appropriate way of dealing with this problem.[18] These findings provided a rationale for opportunistic screening. Evidences from countries such as the United Kingdom has shown that opportunistic screening among people aged 40 years or more without any risk factors in every 5 years once, or yearly once for people with one of the risk factors for NCDs, will identify all missed cases in the community.[19]

The proportion of undiagnosed diabetes mellitus (4.5%) is lower when compared to the Screening India's Twin Epidemic (SITE) study in 10 most populous states in India, which reported prevalence of undiagnosed diabetes mellitus to be 7.2%.[20] Similarly, a study on opportunistic screening for type 2 diabetes mellitus among pharmacy clients in Thailand by Dhippayom et al.[21] during 2012 showed the prevalence of undiagnosed diabetes mellitus as 12.7%. The lower proportion of newly diagnosed diabetes mellitus in this study is probably due to selection of lower age criteria (>30 years), difference in lost to follow-up, and screening strategies (cutoff 140 mg% random capillary blood glucose used for initial screening). Diabetes mellitus risk prediction followed by target screening with blood sugar in other studies could have increased the proportion of diabetes mellitus among the screened individual.

This study showed that the NNTS to identify one undiagnosed diabetes mellitus individual was 22. This is less compared to other studies reported from developed countries, which had ranged from 52 to 164.[22,23] Screening among elderly (≥60 years), males, extremes of nutritional status (chronic energy deficiency and obese) had identified more number of new diabetics with lesser number of people screened. The prevalence of diabetes mellitus was less in the younger age group compared to older age group. The NNTS was more for females than for males and this can be attributed to the fact that a larger proportion of males had impaired blood sugar during the initial blood sugar examination.

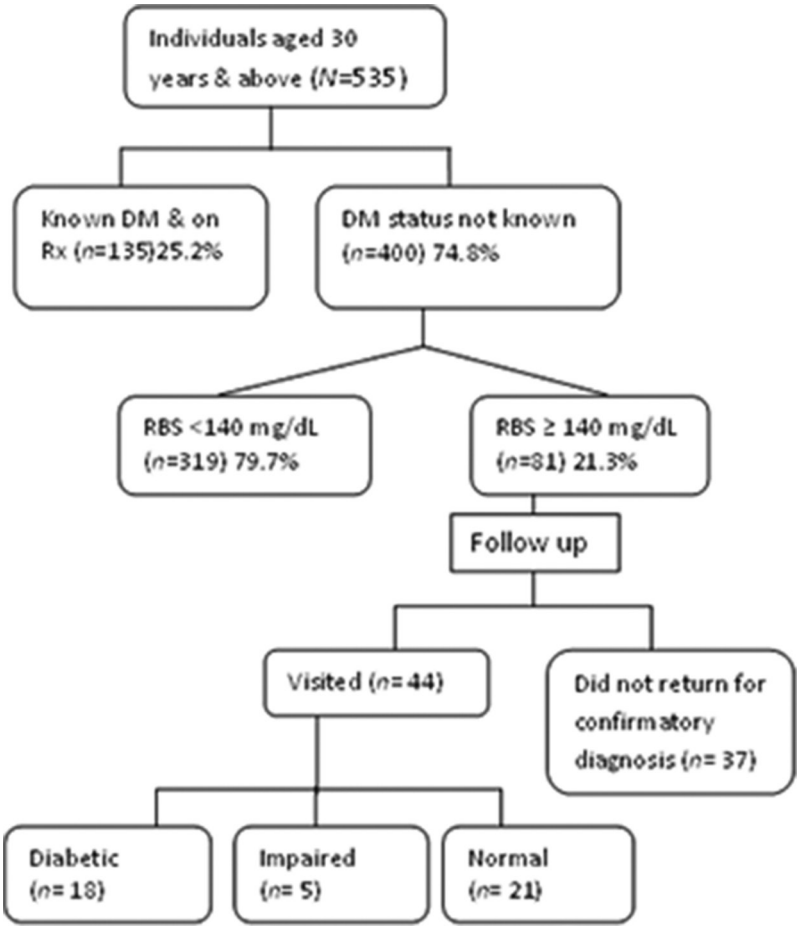

Figure 1: Flow diagram of study participants.

Recently published operational guidelines on NPCDCS focus on opportunistic screening as main strategy for early detection of diabetes mellitus.[24] To facilitate this opportunistic screening auxiliary nurse midwives are planned to be trained and provided with basic equipment from subcenter onwards. Despite its importance, literature on this strategy, especially in primary care settings from developing countries, is scarce.

This study opportunistic screening was performed with existing human workforce and limited resources available at an RHC. It shows the feasibility on this strategy toward early diagnosis of diabetes mellitus. Hence, health-care providers at primary care settings should be sensitized on practicing opportunistic screening in outpatient management. In resource-poor settings, target groups such as elderly, male, and thin/obese individuals should get priority in screening for diabetes mellitus. Because this study was carried out in a primary care setting, same-day-test strategies such as HbA1c were not feasible to confirm diabetic status in our study.

Loss to follow-up in this study was 47%. However, as characteristics of participants who attended follow-up blood sugar estimations were not statistically different from those who did not attend, our finding of 4.5% would presumably remain the same. However, the fact remains that more number of new cases of diabetes mellitus could have been detected, if those lose to follow-up could be contacted.

Opportunistic screening for diabetes mellitus is feasible with existing resources in rural health-care settings in identifying missed cases of diabetes mellitus, thereby applicable to resource-poor primary health care settings in India.

Conclusion

In primary care settings where more than half of the cases were unidentified in the community, opportunistic screening can be a feasible strategy to find out missed cases.

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Table 2: Proportion of undiagnosed diabetes and the NNTS among various subgroups in a rural primary health center, Puducherry

Characteristics	Total number screened	RBS ≥ 140 mg%, *n* (%)	LFU, *n* (%)	New DM, *n* (%)	NNTS (DM)
Overall	400	81 (20.3)	37 (45.7)	18 (4.5)	22
Age category					
30–40	118	20 (16.9)	11 (55)	4 (3.4)	30
41–60	185	38 (20.5)	18 (47.4)	9 (4.9)	21
>60	97	23 (23.7)	8 (34.8)	5 (5.1)	19
Gender					
Male	144	36 (25)	14 (38.9)	12 (8.3)	12
Female	256	45 (17.6)	23 (51.1)	6 (2.3)	43
BMI status					
Underweight	56	12 (21.4)	4 (33.3)	3 (5.4)	19
Normal	147	25 (17)	12 (48)	6 (4.1)	25
Overweight	130	27 (20.8)	14 (51.9)	5 (3.8)	26
Obese	67	17 (25.4)	7 (41.1)	4 (5.9)	17
Waist circumference					
Obese	181	39 (21.5)	17 (43.6)	8 (4.4)	23
Normal	219	42 (19.2)	20 (47.6)	10 (4.6)	22
Hypertension					
Present	179	40 (22.3)	15 (37.5)	8 (4.4)	22
Absent	221	41 (18.6)	22 (53.7)	10 (4.5)	22
Tobacco use					
Tobacco user	84	15 (17.9)	8 (53.3)	4 (4.8)	21
Non-tobacco user	316	66 (20.9)	29 (43.9)	14 (4.4)	23

RBS, random blood sugar; LFU, loss to follow-up; DM, diabetes mellitus; NNTS, number needed to screen.

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