Original Research Article

A community-based study to assess the sensitivity and specificity of Indian Diabetes Risk Score, among urban Population of District Bareilly, Uttar Pradesh, India

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Abstract

Background and Objective: Diabetes mellitus is a major public health problem in India and mostly remains unobserved. Indian diabetes risk score (IDRS) is a cost effective and simple tool for screening of undiagnosed diabetic individuals in the community. There is also various socio demographic and anthropometric factors associated with the risk of occurring diabetes. The objectives of the study were to assess the sensitivity and specificity of IDRS method as a screening tool in community as well as to determine the association of IDRS with socio demographic factors.**Material and Methods:** This cross sectional study was conducted for a one year period from February 2014 to February 2015 among adults aged 30 years and above residing in select areas of Bareilly City. Simple random sampling technique was adopted to achieve the desired sample size. House to house survey was done for collecting data. Data was tabulated and subjected to statistical analysis.**Results:** Out of 640 study subjects, Prevalence of Diabetes Mellitus was found to be 15.2%. Of these, almost half 7.1% were newly diagnosed and 22.7% were found to have high IDRS score. By applying IDRS, at score > 60, 30% sensitivity and 98% specificity was observed. Statistically significant associations of IDRS with age and gender were found. **Conclusion:** This study emphasises on the utilization of Indian diabetes risk score for identifying undiagnosed high risk for patients with diabetes in Indian urban population at community level as it is cost effective.

Keywords: IDRS, Sociodemographic,Sensitivity, Specificity.

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Introduction

World Health Organization (WHO) in 2016 observes that 422 million adults are suffering from diabetes, representing one in every eleven adults is affected by diabetes.[1] WHO in 2016 reports an general prevalence of diabetes in India is 7.8%[2]. Indian population is progressively vulnerable to diabetes. There are now an projected seventy million population with diabetes in India[3,4].Fluctuating the pattern of epidemiology of diabetes and meeting of rural-urban difference of occurrence of the development of diabetes put the health-care system doubtful. Country carry high economic load due to diabetes.Primary health-care consultants in low-income nations do not have access to the basic skills needed to diagnose diabetes at primary level and to assist people with diabetes appropriately to deal their disease. Only one in three low- and middle-income nationsobserves that the most basic skills for diabetes diagnosis and administration are usually available in primary health-care facilities[1].Many patients of diabetes can be cured at primary care level by efficiently applying routine modification after recognition of under risk population. Later, to mediate, one requires a cost-effective rationally accessible tool to evaluate the risk of people, pertaining to diabetes; so that the health promotional procedures can be applied to high-risk individuals at the initial stage to lessen the burden.Most of individual with diabetes live in a low and middle-income nations and will bear the greatest growth in cases of diabetes over the next 22 years[5]. According to WHO there is anseeming epidemic of diabetes which is powerfully related to lifestyle and economic change. India has currently witnessed this demographic transition with a decrease in crude birth rate and growth in life expectancy.[6,7]As most of the population affected with diabetes are in the age group of 40-60 years, this loadexecutes a heavy human, social and economic costs on a country. Primary and secondary preventive procedures in the form of lifestyle modification and early stage diagnosis by screening would play an important role in prevention of diabetes and its difficulties.[8] There is a need of a simple screening tool for detecting undiagnosed individuals with diabetes at a community level. The Indian Diabetes Risk Score was derived from the Chennai Urban Rural Epidemiology Study (CURES) by V. Mohan et al [4].The aims and objectives of the study were to study the sensitivity and specificity of IDRS method as a screening tool in community as well as to determine the association of IDRS with socio demographic factors.

Materials and methods

Study design

Cross-sectional community-based study.

Study Unit

The study subjects consisted of males and females in the age group of 30 years and above belonging to Bareilly city.

Sampling frame

The sampling frame consisted of urban wards (slum and non-slum locality) of Bareilly City. All men and women aged 30 years and above in selected localities were included in the sampling frame of our study.

Sample size

The study conducted by Anjana et al. (2011)[11] "Prevalence of diabetes and pre-diabetes in urban and rural India. The study revealed that overall prevalence of diabetes in Chandigarh was 13.6%, 10.4% in Tamil Nadu, 8.4% in Maharashtra and in Jharkhand 5.3%. In Chandigarh, a city of North India, the prevalence was 14.2% in urban areas and in the rural areas, the prevalence was 8.3%. So, Chandigarh was considered for calculating the sample size. Using the formula 4pq/d2 i.e. p is 14.2%, d is 20% relative error so 580 sample size came out, than adding 10% non-respondent i.e 58, 638 came out taking round figure, sample size came out to be 640.

Methodology

The present study was carried out in areas covered under Urban Health Training Centre of SRMS Bareilly situated at Rampur Garden. UHTC covered both slum area and non-slum areas.1 Slum area was selected and 1 Non-slum area was selected through simple random sampling for obtaining desired sample size. House to house survey was conducted and face to face interview was done by using predesigned questionnaire (schedule), which was based on IDRS variables[4]. Information about the purpose of study was given to all study subjects and a verbal consent was taken from them, before taking socio demographic information using pre-tested interview schedule. Houses were selected using simple random sampling. All eligible individuals in the visited house were included in the study. The subjects were briefed about the procedure of investigation and advised to remain fasting till their blood sample for blood sugar examination was collected. Kuppuswamy'sscale[9] used to calculate socioeconomic status.

Inclusion criteria

All individuals 30 years of age and above irrespective of disease status were screened for diabetes.

Exclusion criteria

Type 1 diabetes patients, Pregnant females, those who were seriously ill, Non-cooperative subjects.

Indian Diabetes Risk Score

IDRS was developed by Mohan et al and its parameters comprise of two modifiable (waist circumference, physical activity) and two non-modifiable risk factors (age, family history) for diabetes.As per the previous studies, Indian diabetic risk score >60 as found to be highly sensitive and specific for predicting diabetes hence we have used scores more than 60 as a cut-off for diabetes (Table 1)[4]

Table 1: Indian diabetes risk score

Particulars	Score
Age in years	
< 35	0
35-49	20
>50	30
Abdominal obesity	
Waist <80 cm(F): <90 cm(M)	0
Waist 80-89 cm(F): 90-99 cm(M)	10
Waist >90 cm(F): >100 cm(M)	20
Physical activity	
Exercise regular + strenuous work	0
Exercise regular or strenuous work	20
No exercise regular and sedentary work	30
Family history	
No family history	0
Either parents	10
Both parents	20
Minimum score	0

Ethical consideration

The study was approved by the Institutional Research Committee (IRC) & the Institutional Ethics Committee (ERC).

Statistical analysis

The data thus collected were entered and analyzed in Microsoft Office Excel. Socio-demographic characteristics were tabulated as descriptive statistics, explained by frequency and percentages. Using Chi square test for association and the effectiveness of IDRS scoring method in predicting diabetes Mellitus, various diagnostic parameters like sensitivity, specificity, PPV, NPV and Receiver operator characteristic (ROC) curve were calculated.

Results

Out of 640 study subjects, found that most of the subjects were of 30-39 years age group i.e. (29.7%). Females were (51.09%) and most the subjects (62.7%) were from nuclear family and (83.8%) were married. The overall prevalence of Diabetes Mellitus in the present study was found to be 15.2%. Of these, almost half 7.1% were newly diagnosed while the remaining were known diabetics. 9.5% of the study population wasfound to have Impaired Fasting glucose.

Table 2: Distribution of Diabetes Mellitus according to IDRS Score

IDRS	Diabetics (%)	Impaired Fasting(%)	Non- diabetic(%)	Total(%)
≤20	2 (1.7%)	3 (2.4%)	119 (95.6%)	124(19.3%)
30-50	52(14.0%)	37 (10%)	282 (76.0%)	371(57.9%)
≥60	43(29.6%)	21 (14.4%)	81 (55.9%)	145(22.7%)
Total	97	61	482	640

Table 2 shows as the IDRS score increases the prevalence of diabetes mellitus increases. The prevalence of DM was found maximum in subjects having IDRS score ≥60 score as compared to having low score. The minimum prevalence 1.7% was shown in those were having ≤20 score.Likewise, same scenario was seen in IFG those having ≥60 score prevalence was came out to be 14.4% followed by

10.0% among those who were having 30-50 score and the minimum prevalence 2.4% shown in those who were having ≤20 score.(Table 2)

Table 3: Association of socio demographic variables with respect to score of IDRS (n=640)

Variables		Low		Moderate		High		ChiSquare	P value
		N	(%)	N	(%)	N	(%)		
Age	30-39	84	31.7	68	29.6	38	26.2	45.58	0.000
	40-49	54	20.4	48	20.9	43	29.7		
	50-59	46	17.4	43	18.7	28	19.3		
	60-69	72	27.2	68	29.6	17	11.7		
	≥70	9	3.4	3	1.3	19	13.1		
Gender	Male	114	43.0	146	63.5	53	36.6	32.07	0.00
	Female	151	57.0	84	36.5	92	63.4		
Religion	Hindu	250	94.3	212	92.2	133	91.7	1.32	0.514
	Muslim	15	5.7	18	7.8	12	8.3		
SES	I	26	9.8	32	13.9	18	12.4	11.75	0.162
	II	54	20.4	36	15.7	32	22.1		
	III	67	25.3	57	24.8	41	28.3		
	IV	89	33.6	91	39.6	40	27.6		
	V	29	10.9	14	6.1	14	9.7		

The present study showed significant association between IDRS and socio demographic variables like age and gender whereas no significant association between IDRS and religion &socio-economic status. Present study found that females (63.4%) and 36.6% male belonged to high score whereas 43.0% males reported as low score. As far as religion is concerned, out of total 545 Hindu participants, 250 individuals having low score was foundwhile Muslims reported as having low score in only 15 out of 45 Muslim participants. (table 3)

Table 4: Distribution of Diabetes Mellitus patients according to Indian Diabetes Risk Score

IDRS Test	Diabetes Mellitus		
	Present	Absent	Total
IDRS Test positive score ≥ 60	43	102	145
IDRS Test negative <60	54	441	495
Total	97	543	640

Table 4 shows that 145 individual's shows Indian diabetes Risk Score (IDRS) test positive, out of that 43 having Diabetes Mellitus. Similarly, 495 individuals found IDRS negative and out of that 54 were having Diabetes.Overall in 640 individuals, 97 were diagnosed as disease and 543 were not having disease.(table 4)

Table 5: Sensitivity and specificity of IDRS test

IDRS	Sensitivity	Specificity	PPV	NPV	FP (100- specificity)
>10	90.1	41.2	79.8	31.1	58.8
>20	83.1	55.2	84.3	49.4	44.8
>30	77.8	59.8	85.5	45.8	40.2
>40	55.7	77.3	90.0	37.9	22.7
>50	41.1	93.2	95.8	32.5	6.8
>60	29.9	98.1	96.4	31.5	1.9
>70	8.1	99.2	96.6	25.6	0.8
>80	0.5	100	100	23.5	0

Table 5 shows that as the IDRS score is increasing, the sensitivity is decreasing and specificity is increasing. In this study as the cut-off of the Indian diabetic risk score increases more than 60 the sensitivity decreases sharply for further increase of specificity. At cut off 10, the Indian diabetic risk scorewas 90.1% sensitive but specificity is 41.2%. Similarly, at cut off 80 the Indian diabetic risk score is 100% specific but 0.5% sensitive. (Table 5)

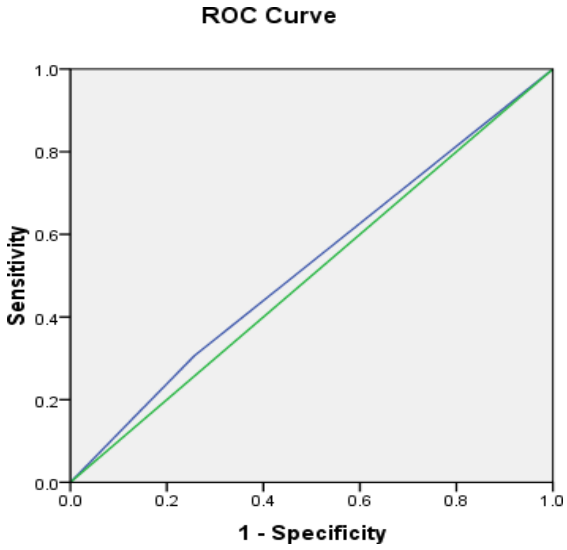

Fig 1: Receiver operator characteristic curve for different values of cut off of Indian Diabetic risk score.

Figure 1 illustrates that the receiver operator characteristic (ROC) curve for the application of IDRS inobserving DM at dissimilar cut off points, area under curve (AUC) was 0.53.

Discussion

The results of our study indicate that a simple diabetes risk score, the IDRS developed by Mohan et al has a high degree of sensitivity and specificity, accuracy for detecting undiagnosed diabetic cases in a community [4].

In present study, attempt to validate IDRS for screening of individuals for diabetes.IDRS methods are non- offensive method and cost effective for implementing at community level.Present study demonstrates that if the IDRS is applied in urban population and a score ≥ 60 is used for screening the new diabetic subjects. In present study as the IDRS Score increases the prevalence of diabetes mellitus increases. The prevalence of DM was found maximum in subjects having IDRS score ≥60 score as compared to having low score. The minimum prevalence 1.7% was shown in those were having ≤20 score.Likewise, same scenario was seen in IFG those having ≥60 score prevalence was came out to be 14.4% followed by 10.0% among those who were having 30-50 score and the minimum prevalence 2.4% shown in those who were having ≤20 score. Furthermore, Agrawal et al reported that the most of participants were having IDRS in between 30-<60,whereas one third were had low risk and had 1.6% diabetic among them. Lesser (15.6%)participants were found to have IDRS Score ≥60 but were found more percentage (26.1%) of diabetes. (10)These finding were similar with the study conducted by Arun et al, where 14.9% was also were in high risk IDRS category and with Nandeshwar et al, where was 28.40% to moderate risk and of these, 8.40% diabetic were present in moderate risk group.[11,12]. In present study evaluated 30% sensitivity and 98% specificity of IDRS, when score greater than 60. In consistent with present study,Mohan et al found that those had ≥60 had the optimum sensitivity 72.5% and specificity 60.1% for determining undiagnosed diabetes. Whereas similar study conducted by Adhikari et al showed 62.2% sensitivity and 73% specificity for predicting risk of diabetes in community. [4,13] A study done by Agrawal et al found alike findings with present study that is 45.5% sensitivity and 88% specificity.(10) Study conducted in 2012 by Taksande et al observed results high as compared to present study.(14)Results are

97.5% sensitivity and 81.9% specificity. In addition, Dudeja et al also calculated contrary results such as 95% sensitivity and 29% specificity on score above 60.[15]This cross-sectional study was carried on the socio-demographic and anthropometric factors influencing diabetes mellitus. With regard to gender, while present study showed the prevalence of diabetes mellitus in males was high in comparison to females but there was no such great difference in impaired fasting glucose in males and females the study by Patel et alfound males to be 62% of the total which is higher than present study.[16]Patil et al reported that out of 140 diabetic patients studied females were predominant 78 (55.71%). [17]However, in present study found that approximately above sixty three percent females belonged to high score whereas 43.0% males reported as low score. Present study results contrasts with study done by Acharya et al where no significant differences were found.[18]There was no significant association found between religion and IDRS score.Majority of study subjects were Hindus in present study. This finding consistent with the study by Acharya et al[18]Considered the association of socio economic status (SES) and IDRS score, it was found that as SES increased, percent of individuals having high IDRS scores also increased.

Many studies like Ramchandaran, Taksandeand Agrawal et al supported present study outcomes. [14,19] India has a population of nearly one billion with nearly 41 million people already having diabetes of whom almost half do not even know that they have diabetes, IDRS could thus be used as a good screening tool prior to doing blood sugar testing in our population. This could help reduce the costs of screening for diabetes by nearly 50%[20].

Conclusion

Present study favours the IDRS method as screening of diabetes at community level as it is cost effective as well as time utilizationmethod. IDRS is very useful for detection of those diabetic cases who remain left behind due to lack of proper investigations.

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