Original Research Article

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20172184

A community based study to assess the validity of Indian diabetic risk score, among urban population of North Central India

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Received: 13 April 2017 Accepted: 08 May 2017

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ABSTRACT

Background: The prevalence of diabetes mellitus is growing rapidly worldwide and India has earned the dubious distinction of being the diabetic capital of the world and had 69.2 million (8.7%) people living with diabetes. Unfortunately over half of these people remain undiagnosed as diabetes. IDRS is a cost effective and simple tool for screening of undiagnosed diabetic individuals in the community. The objective of the study was to estimate prevalence of undiagnosed high risk subjects of diabetes mellitus to validate IDRS as effective tool for diagnosis of diabetes in urban areas of Gwalior City.

Methods: In community based cross-sectional observational study house to house survey was conducted and face to face interview had done by predesigned questionnaire, which was based on IDRS variables for those persons of age more than 20 and not known to diabetes previously.

Results: In present study 55 (8.94%) out of 615 respondents were diagnosed as a newly diabetic cases. We found that at IDRS score of \geq 60 has a sensitivity of 45.5% and specificity of 88.0%.

Conclusions: This study provides a use of Indian diabetes risk score for identifying undiagnosed high risk for patients with diabetes in Indian population and could make screening programmes more cost effective.

Keywords: Diabetes, IDRS, Sensitivity, Specificity

INTRODUCTION

Socioeconomic development, technological advancements and changes in lifestyles, behavioural patterns, and demographic profile (increasing aging population) lead to major health transition to rapid increase in burden of noncommunicable disease like diabetes. The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.7% in 2015.

The Prevalence of diabetes mellitus is growing rapidly worldwide and India has earned the dubious distinction of being the diabetic capital of the world with the rise in staggering burden and its consequences, people with type 2 diabetes, the form that comprises some 90% of total diabetic cases. The most disturbing trend is the shift in the age of onset of diabetes to a younger age in the recent

years; Indians succumb to diabetes 5-10 years earlier than their western counterparts, this leads to considerable loss of productive years, adversely affecting nation's health and economy.³ In India more than 50% of people are unaware of their status which increases the risk of development of diabetes and its complication in them.^{4,5} In view of the above global situation WHO issues a call for action on diabetes, with the theme for the World Health Day 2016 was based on diabetes i.e. 'Beat Diabetes'. Hence, it is necessary to detect the large pool of undiagnosed diabetic subjects in India and could be able to offer early therapy to these individuals. The WHO collaborating centre for diabetes in India, Diabetes Research Centre (DRC) and MV Hospital Royapuram has taken major step in its diabetes prevention initiatives and announced in 2005 a simplified risk score for screening of undiagnosed diabetic was called as IDSR.6

IDRS consists of four simple parameters like age, waist circumference, family history of diabetes and physical activity. MDRF - IDRS not only predicted diabetes but also predicted metabolic syndrome, even in subjects who had normal glucose tolerance. However, the MDRF – IDRS needs to be validated in other populations. This study aims at the validation of the MDRF - IDRS through a population based study with prime objective to find out the sensitivity and specificity of Indian Diabetic Risk Score (IDRS) as screening tool done at urban locality of Gwalior city in North West of India.

METHODS

The study was conducted at urban locality of Gwalior city on adults aged 20 years or more. Study locality is one of a field practice areas of community medicine department of Gajra Medical College, Gwalior. The Gwalior Municipal Corporation has a population of 1069276 and consists of 66 wards. The study was community based, descriptive and cross sectional conducted in the three wards numbered - 55, 58 and 47 and those were selected with convenient random sampling, which includes, Amkho, Shivajinagar, Guda Gudi Ka Naka, and Lakkad Khana areas respectively in the catchment area of Community Medicine Department, G. R. Medical College, Gwalior (M.P.). The population of study area is 11200.9 The reference population consisted of age above 20 years was 6832 that was approximately 61% of study population. 10 Based on the nationwide prevalence of diabetes in India the sample size was calculated by taking 9% of reference population above 20 years of age, so the 9% of 6832 sample size comes out to be approximate 615.11

House to house survey has been conducted and face to face interview was done by predesigned questionnaire (schedule), which was based on IDRS variables. The selection of households was done by systematic random sampling with interval of every 3rd house in the total approximate house of 2000. First house selected randomly and then one subject from every 3rd house, till the desired sample size was achieved. We took all the measure to avoid duplication in study. Study was done after ethical approval obtained from Institutional ethical committee of the Gajra Raja Medical College, Gwalior. Total duration of study was 15 months from March 2015 to June 2016.

Anthropometric measurements and physical examination

Standard instruments and procedure were used for anthropometric measurements according to the WHO. ¹² Waist circumference was measured (in cm) using a non-stretchable tailor's tape at a point mid-way between tip of iliac crest and last costal margin in the back and at the umbilicus at the front, hip circumference was measured

over the greater trochanters, after explaining the purpose of study.

Investigation based survey

After obtaining proper consent from the participants in preliminary phase we screened the probable hyperglycemic and normoglycemic participants by a glucose meter (or glucometer) named Accu-Chek is a medical device for determining the approximate concentration of glucose in the blood.¹³ A small drop of blood, obtained by pricking the tip of left hand middle finger with a lancet, is placed on a disposable test strip that the gluco-meter reads and displays the level in units of mg/dl. If we found the blood glucose level more than 140 mg/dl then we had taken into account as hyperglycemic and these individuals' blood glucose level were also confirmed with oral glucose tolerance test (OGTT) then blood sample was taken to measure postprandial blood sugar and fasting blood sugar measurement. Results found out through IDRS as well as glucometer will be cross examined by blood glucose measurement and confirmed as diabetic as following.

- Post prandial blood glucose test -plasma glucose is measured after two hour of meal and was found blood sugar level ≥11.1 mmol/L (200 mg/dl) or more.¹⁴
- 2. Fasting blood glucose measurement done, if fasted overnight for at least 8 hours and was found blood sugar level. ≥7.0 mmol/L (126 mg/dl) or more. 14

Indian diabetes risk score (Table 1) is a simplified risk score for identifying undiagnosed diabetic subjects using four simple parameters like age, waist circumference, family history of diabetes and physical activity¹⁵. It is based on multiple logistic regression model using four simple questions,

- 1. What is your age?
- 2. Do you have family history of diabetes? If yes, does your father or mother or both have diabetes?
- 3. Do you exercise regularly? How physically demanding is your work/occupation?
- 4. Waist circumference using an inch tape, first two is non-modifiable and last two are modifiable risk factors.

Physical activity intensity levels were defined according to consensus physical activity guidelines for Asian Indians where as low-intensity physical activity elicits a slight or no increase in breathing rate and (e.g. strolling <3 km/h), moderate-intensity physical activity elicits a moderate, noticeable increase in depth and rate of breathing, (e.g. purposeful walking 3–6 km/h for an hour or equivalent and vigorous-intensity physical activity elicits a noticeable increase in depth and rate of breathing, (e.g. walking a more than 6 kilometre in one hour or one hour jogging, cycling etc).¹⁶

Table 1: IDRS and its variables.

IDRS score pattern*6					
Demographic variables			Score		
		<35	0		
Age (in years) ⁶		35-49	20		
		≥50	30		
	Male	< 90 cm (36")	0		
		≥ 90-99 cm (36"-39")	10		
Waist circumference (cm) ⁶		≥ 100 cm(40")	20		
waist circumference (cm)	Female	< 80 cm (32")	0		
		\geq 80-89 cm (32"-35")	10		
		≥ 90 cm(36")	20		
	Vigorous exercise [regular] or strenuous [manual] labour at home/work				
Physical activity	Moderate exercise[regular] or moderate physical activity home/work				
(Annexure – I) ⁶	Mild exercise[regular] or mild physical activity at home/work		20		
	No exercise and sedentary activities at home/work				
	No family history		0		
Family history ⁶	Either parents		10		
	Both parents	20			
*www.drmohansdiabetes.com					
Interpretation of IDRS score					
IDRS score	Risk of type 2 diab	petes mellitus			
<30	Low risk				
30-<60	Moderate risk				
≥60	High risk for diabetes and CVD				

RESULTS

Out of 615 study subjects 55 (8.9%) had newly diagnosed type 2 diabetes mellitus and majority of the diagnosed diabetes 2 was 25 (26.1%) in group who had IDRS more

than the cut off value of 60 while participants those who had IDRS score has less than 30 and in between 30 to less than 60, diabetic were found 1.6% and 8.2% respectively and this was found highly significant statistically (p <0.003 and p <0.001) with the OR=5.57 and OR=21.9 (Table 2).

Table 2: Distribution of participants according to IDRS score and prevalence of diabetic percentage.

Sr. no.	IDRS Score	Number of participants [n=615] No. (%)	Number of Diabetic (n=55)No.(%))	Odds Ratio (95%CI)	p value
1	≤30	190(30.9)	3(1.6)	Reference	
2	30-<60	329(53.5)	27(8.2)	5.57(1.7;18.6)	0.003*
3	≥60	96(15.6)	25(26.1)	21.9(6.4;74.9)	0.001*

^{*}Highly significant.

Table 3: Proportion of participants according to IDRS score and sensitivity and specificity.

IDRS	Participants proportion (n=615) no. (%)	Number of diabetics no (%)	Sensitivity	Specificity	Adjusted odd ratio (95% CI)	p value
≥0	615(100)	55(8.9)	100	0	Reference	NA
≥10	549(89.26)	55(10.0)	100	11.8	1.1(0.7;1.7	0.531#
≥20	478(77.7)	53(11.1)	96.4	24.3	1.2(0.9;1.6)	0.229#
≥30	425(69.10)	52(12.20	94.5	33.7	1.3(1.0;1.6)	0.049**
≥40	302(49.10)	47(15.6)	85.5	55.1	1.4(1.1;1.7)	0.001**
≥50	227(36.91)	41(18.1)	74.5	67.6	1.5(1.2;1.8	0.001**
≥60	96(15.60)	25(26.0)	45.5	88.0	1.6(1.3;1.9)	0.001**
≥70	32(5.20)	9(28.1)	14.5	96.84	1.6(1.4;1.9)	0.001**
≥80	10(1.62)	4(40.0)	7.27	99.0	1.7(1.4;2.0)	0.001**
≥90	1(0.16)	1(100)	1.81	100	1.7(1.4;2.0)	0.001**

^{**} Highly significant, * Significant, # Not significant.

Table 3 shows sensitivity and specificity of Indian Diabetes Risk Score in undiagnosed diabetes subjects, in the study population. We found that IDRS score more than or equal to 60 has the best sensitivity (45.5%) and specificity (88%) for detecting diabetes mellitus in the community.

Higher IDRS scores increased the specificity but the sensitivity dramatically decreased and the adjusted OR also increased with increasing IDRS score and it was also found significant statistically (p <0.01). Conversely, lower IDRS values increased the sensitivity but the specificity drastically decreased but it has not found statistically significant (p =0.229). Our study thus confirms and validated the Chennai Urban Rural Epidemiology Study (CURES) data and confirms the same IDRS score of \geq 60 as being the best cut point for identifying undiagnosed diabetes. ¹⁴

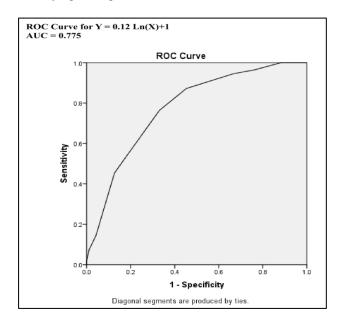


Figure 1: ROC curve.

In the present study, the area under the ROC curve (Figure 1) was 0.77 in urban area. This shows that the score has better diagnostic accuracy in study area. As a screening tool without compromising in sensitivity we can get optimal specificity at the cut of value of IDRS score 60 and above. In the study as the risk score are increases, shows decreasing number of subjects but percentage of number of diabetic increasing (Table2). Most of participants were having IDRS ≤30 and little less than one six were found to have IDRS Score ≥60. Most of the diabetic subjects were found in high risk group. This Table 2 reflects that in urban population of Gwalior city most of the population is in group of mild risk of diabetes but chances of developing diabetic increases as the risk score of IDRS increases. Table3 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 (MDRF-IDRS) increases more than 50 the sensitivity decreases sharply for further increase of specificity with both FPG and PPBG. At cut off 10, the MDRF-IDRS is 100% sensitive but specificity is 11.8%. Similarly at 90 the MDRF-IDRS is 100% specific but 1.81% sensitive. In this study, the area under the ROC curve (Figure 1) was 0.775 and this represents the category of moderate to good diagnostic accuracy in urban area.

DISCUSSION

The results of our study indicate that a simple diabetes risk score, the MDRF - IDRS developed by Mohan et al has a high degree of sensitivity and specificity, accuracy for detecting undiagnosed diabetic cases in a community. Tour study shows that if the MDRF − IDRS is applied in urban population and a score ≥ 60 is used for screening the new diabetic subjects' then we found 26.1% new diabetic cases in comparison to 5.8% only in the population group where score was less than 60.

In this present study (Table 2), most (53.5%) of participants were having IDRS in between 30-<60 (i.e. moderate risk group), of these 8.2% were have diabetes, whereas one third (i.e.30.9%) 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. 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. ^{18,19}

The study shows that IDRS has sensitivity 45.5% and specificity 88% when the score was 60 and above. The corresponding figures in the original CURES study by Mohan et al reported in an IDRS value 60 and above had the optimum sensitivity 72.5% and specificity 60.1% for determining diabetes.⁶ Another study conducted by Adhikari et al reported in their study for IDRS score 60 and above sensitivity 62.2% and specificity 73.7% for predicting diabetes in community.⁵ Vikram Shanbhogue et al in their study reported that the IDRS score used to predict risk of developing diabetes in general population has sensitivity of 72.5% and specificity of 61.3%.²⁰ Prevalence of most risk factors was very high among people with IDRS >60, it retrospectively proved that if prevalence of risk factors is not reversed, one is likely to get diabetes. The MDRF -IDRS could be administered easily, even in an epidemiological setting by a non-physician since it just involves collection of data on age, family history, physical activity and a single measurement of waist circumference. Its ease of administration and its accuracy makes it a useful screening test or diabetes. 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%.²¹

CONCLUSION

This study provides a use of Indian Diabetes Risk Score for identifying undiagnosed high risk for diabetic subjects in Indian population. The sheer simplicity of the MDRF – IDRS developed by Mohan et al, where only 3 questions and a simple waist measurement is included, make it much more attractive, and in our experience, a very useful tool and validates its sensitivity, specificity and accuracy in an independent urban population study by us in North Central India. 6

States have already initiated some of the activities for prevention and control of non-communicable diseases (NCDs) especially cancer, diabetes, CVDs and stroke through National program for prevention and control of cancer, diabetes, cardio-vascular disease and stroke (NPCDCS) and this simple IDRS tool may be used as a supplemented tool for community mass screening and these intervention can be carried out to early diagnosis. ²² IDRS has the following merits: its use is simple; scores are easily obtainable and have been drawn from high risk population. In addition the score is developed from representative sample of a large metropolitan city of India, the demographic of which is similar to rest of the India.

Recommendations

According to the present study findings the sensitivity of IDRS score of ≥ 30 has been reported to be as high as 94.5% and so IDRS with high positive rate can help in cost effective screening for diabetes as it uses simple, safe and inexpensive measures. Moreover it would help to do selective mass screening for undiagnosed diabetes instead of universal screening.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Agarwal AK, Ahirwar G, Marskole P, Bhagwat AK. A community based study to assess the validity of Indian diabetic risk score, among urban population of North Central India. Int J Community Med Public Health 2017;4:2101-6.