Utility of the diabetes risk score to detect impaired fasting glucose

Bernhard Kulzer, Norbert Hermanns, Thomas Kubiak & Thomas Haak

Research Institute of the Diabetes Academy Mergentheim, (FIDAM), Germany

contact: kulzer@diabetes-zentrum.de

ABSTRACT: Utility of the diabetes risk score to detect impaired fasting glucose

Kulzer B, Hermanns N, Kubiak T & Haak, T
Research Institute of the Diabetes Academy Mergentheim, (FIDAM), Germany

Introduction: One major problem in diabetes prevention is the identification of persons at risk who will profit from preventive steps. We assessed the utility of the diabetes risk score by Lindström and Tuomilehto to identify persons with impaired fasting glucose and undetected diabetes.
Methods: We invited employees of a big industrial company and employees of the community to complete a questionnaire designed to assess their diabetes risk. According to the recommendation, persons with a risk score > 9 were invited to determine their fasting blood glucose.
Results: From a total of approx. 10.000 persons, who were invited to participate in the screening performed by the risk questionnaire, 845 persons completed this questionnaire (approx. 8.4%). From these persons, 454 had a risk score >9. Fasting blood glucose could be obtained from 391 (90%). From these, 53 persons (13.5%) fulfilled criteria for impaired fasting glucose and 26 persons fulfilled criteria for diabetes (6.6%) Sensitivity, specificity, positive and negative predictive values of the diabetes risk score to predict current impaired fasting blood glucose or diabetes are shown in table 1. The area under ROC was .686.
Conclusions: The rate of participants completing the questionnaire was rather low. If an elevated risk score was identified, attrition rate to measuring fasting blood glucose was high. The diabetes risk score was designed to predict the risk of diabetes in the future. The screening abilities of this risk score to identify persons with present impaired fasting glucose or diabetes was rather modest in our sample, as indicated by the area under ROC. The suggested cut-off for screening (Score > 9) will lead to a great number of negative test results. At the cost of sensitivity, a higher cut-off score of >=13 or => 16 could be more appropriate to avoid unnecessary blood glucose testing.

Introduction: One major problem in diabetes prevention is to identify persons at risk who will profit from preventive steps. We assessed the utility of the diabetes risk score by Lindström and Tuomilehto to identify persons with impaired fasting glucose and undetected diabetes.

Methods: We invited employees of a big industrial company and employees of the community to complete a questionnaire designed to assess their diabetes risk. According to the recommendation, persons with a risk score > 9 were invited to determine their fasting blood glucose.

Results: From a total of approx. 10.000 persons, who were invited to participate in the screening performed by the risk questionnaire, 845 persons completed this questionnaire (see table 1). From these persons, 454 had a risk score >9. Fasting blood glucose could be obtained from 391. From these, 53 persons (13.5%) fulfilled criteria for impaired fasting glucose and 26 persons fulfilled criteria for diabetes (6.6%) (see figure 1). Sensitivity, specificity, positive and negative predictive values of the diabetes risk score to predict current impaired fasting blood glucose or diabetes are shown in figure 2. The area under the ROC was .686. We performed a factor analysis (Varimax rotation) and obtained a three factor solution explaining 56% of variance (see table 2). The first factor referred to body weight, the third factor referred to life style and the second factor contained age and signs of meta-bolic syndrome. A multivariate stepwise logistic regression analysis identified three items with the highest potential to identify IFG (see table 3). Using only these three items (age, BMI and history of high blood glucose) enhanced screening performance as indicated in a greater area under the ROC (see figure 3).

Conclusions: The rate of participants completing the questionnaire was rather low. If an elevated risk score was identified, attrition rate for measuring fasting blood glucose was high (86%). The diabetes risk score was designed to predict the risk of diabetes in the future. The screening abilities of this risk score to identify persons with present impaired fasting glucose or diabetes was rather modest in our sample, as indicated by the area under the ROC. The suggested cut-off for screening (Score > 9) will lead to a great number of negative test results. At the cost of sensitivity, a higher cut-off score of >=13 or >= 16 could be more appropriate to avoid unnecessary blood glucose testing. A short version using only three of the eight items of the diabetes risk score resulted in a higher screening performance to identify IFG.

table 1: Sample description (n = 845)

Characteristic	%	Characteristic	%
Age (yrs.):		Vegetables/berries	
<45	19.1	daily	39.0
45-54	30.3	not daily	61.0
54-64	26.7		
>64	20.9		
BMI (kg/m²)		Hypertension drugs	
<25	25.2	yes	38,7
25-30	50.1	no	61.3
>30	24.7		
waist circumference (cm)		Family history	
<94 (<80)	15.5	no	29.8
95-102 (80-88)	42.7	grandparent	15.9
>102 (>88)	41.8	parents	54.3
Physical activity		History of high BG	
yes	60.9	yes	23.1
no	39.1	no	76.8

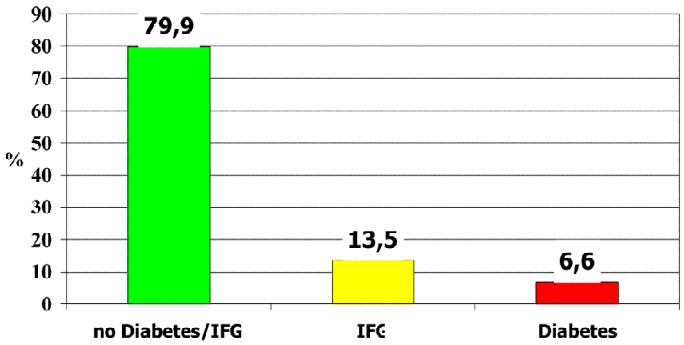
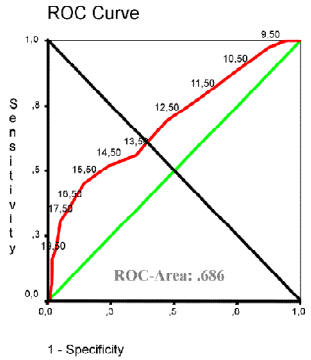


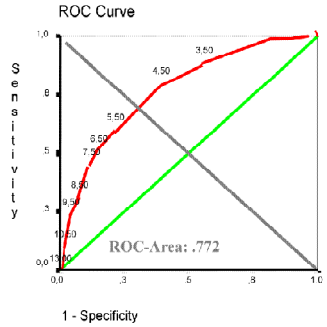
figure 1: Results of fasting blood glucose testing



Cut – off	Sensi-tivity	Speci-ficity
>10	.88	.26
>11	.78	.39
>12	.69	.53
>13	.56	.63
>14	.52	.74
>15	.45	.86
>16	.36	.92

Score 13: ppv=.27; npv=.87

figure 2: ROC analysis of the total risk score



Cut – off	Sensi-tivität	Spezi-fität
>2	.99	.12
>3	.99	.18
>4	.88	.45
>5	.80	.62
>6	.60	.79
>7	.51	.85
>8	.45	.90

Score 5: ppv=.32; npv=.93

figure 3: ROC analysis of the three item solution

table 2: Results of factor analysis

Item	Factor 1	Factor 2	Factor 3
Waist	.89		
BMI	.89		
Hypertension drugs		.61	
History of high BG		.61	
Family history		.58	
Age		.55	
Physical activity			.65
Vegetables/berries			.65

table 3: Results of stepwise logistic regression analysis

step	Item	R^2	DR^2
1	History of high BG	.13	-
2	History of high BG Age	.22	.09
3	History of high BG Age BMI	.25	.03