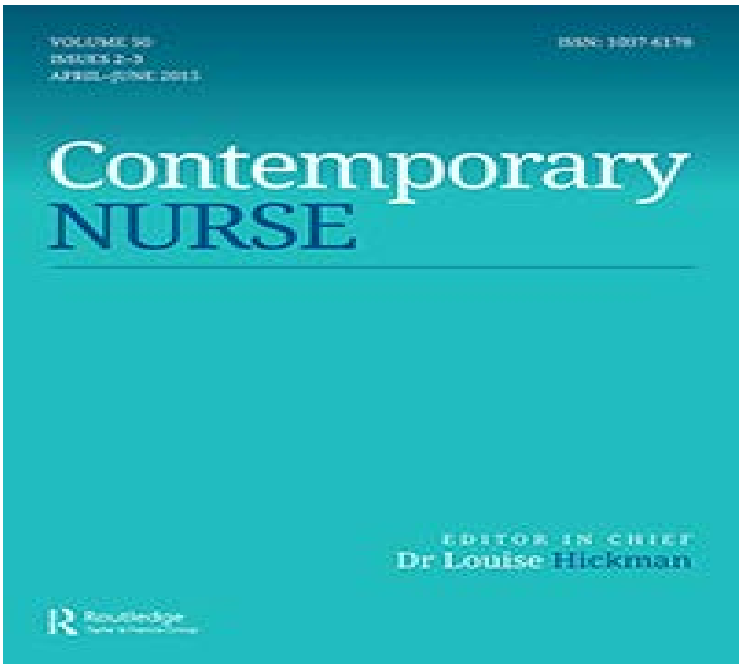

Contemporary
NURSE
EDITOR IN CHIEF
Dr Louise Hickman
Routledge

Coverage
Science Citation Index
Science Citation Index Expanded
Current Contents - Physical, Chemical & Earth Sciences

CONTACT DERMATITIS
Monthly ISSN: 0105-1873
WILEY-BLACKWELL, 111 RIVER ST, HOBOKEN, USA, NJ, 07030-5774
Coverage
Science Citation Index
Science Citation Index Expanded
Current Contents - Clinical Medicine
BIOSIS Previews

CONTACT LENS & ANTERIOR EYE
Bimonthly ISSN: 1367-0484
ELSEVIER SCIENCE BV, PO BOX 211, AMSTERDAM, NETHERLANDS, 1000 AE
Coverage
Science Citation Index Expanded
Current Contents - Clinical Medicine

CONTEMPORARY CLINICAL TRIALS
Bimonthly ISSN: 1551-7144
ELSEVIER SCIENCE INC, 360 PARK AVE SOUTH, NEW YORK, USA, NY, 10010-1710
Coverage
Science Citation Index
Science Citation Index Expanded
Current Contents - Clinical Medicine
Current Contents - Life Sciences
BIOSIS Previews

CONTEMPORARY NURSE
Bimonthly ISSN: 1037-6178
ROUTLEDGE JOURNALS, TAYLOR & FRANCIS LTD, 4 PARK SQUARE, MILTON PARK, ABINGDON, ENGLAND, OXFORDSHIRE, OX14 4RN
Coverage
Science Citation Index Expanded
Social Sciences Citation Index

CONTEMPORARY PHYSICS
Bimonthly ISSN: 0010-7514
TAYLOR & FRANCIS LTD, 4 PARK SQUARE, MILTON PARK, ABINGDON, ENGLAND, OXON, OX14 4RN
Coverage
Science Citation Index
Science Citation Index Expanded
Current Contents - Physical, Chemical & Earth Sciences

Editorial board

Editor-in-Chief:

LouiseHickman - Faculty of Health, University of Technology Sydney, Australia

Associate Editor:

StephenNeville - Department of Nursing, AucklandUniversity of Technology, New Zealand

Editorial Board:

Sharon Andrew - (Methods Editor) Faculty of Health, SocialCareandEducation, AngliaRuskinUniversity, UK

Victoria Bungay - Faculty of AppliedScience, School of Nursing, University of British Columbia, Canada

SallyBorbasi - Faculty of HealthSciences, AustralianCatholicUniversity, Australia

Myoung-AeChoe - College of Nursing, SeoulNationalUniversity, Seoul, Korea

Wendy Cross - School of NursingandMidwifery, MonashUniversity, Australia

PatriciaDavidson - Dean, Johns Hopkins University School of Nursing, USA andFaculty of Health, University of Technology Sydney, Australia

LynoreGeia - School of Nursing, MidwiferyandNutrition, James CookUniversity, Australia

AnnetteHuntington - School of HealthSciences, MasseyUniversity, New Zealand

Claire Hale - Faculty of MedicineandHealth, School of Healthcare, University of Leeds, UK

AnnetteHuntington - School of HealthSciences, MasseyUniversity, New Zealand

Debra Jackson - Faculty of Health, University of Technology Sydney, Australia

HesterKlopper - Faculty of CommunityandHealthSciences, University of the Western Cape, South Africa

Anne McMurray - School of NursingandMidwifery, Griffith University, Australia, andFaculty of HealthSciences, MurdochUniversity, Australia

Martin McNamara - UCD School of Nursing, MidwiferyandHealthSystems, Ireland

Afaf I Meleis - School of Nursing, University of Pennsylvania, USA

Phillip Newton – (Statistical Consultant) Faculty of Health, University of Technology Sydney, Australia

BevO'Connell - Faculty of Nursing, University of Manitoba, Canada

KathPeters - (BookReviews Editor) School of NursingandMidwifery, University of Western Sydney, Australia

Tamara Power - Faculty of Health, University of Technology Sydney, Australia

AnnieTopping - CentreforHealthandSocialCareResearch, University of Huddersfield, UK

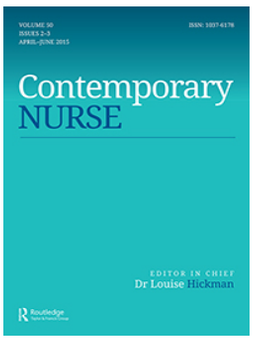
Kim Walker - Practice Development andResearch, StVincent'sPrivateHospital, Darlinghurst, Australia

Roianne West - School of NursingandMidwifery, Griffith Health, andTownsvilleHospitalandHealth Service, QueenslandHealth, Australia

Denise Wilson - NationalInstituteforPublicHealthandMentalHealthResearch, andFaculty of HealthandEnvironmentalSciences, AucklandUniversity of Technology, New Zealand

Thomas Wong - Faculty of HealthandSocialSciences, The Hong Kong PolytechnicUniversity, Hong Kong, China

DianneWynaden - School of NursingandMidwifery, CurtinUniversity of Technology, Australia



Contemporary Nurse

ISSN: 1037-6178 (Print) 1839-3535 (Online) Journal homepage: http://www.tandfonline.com/loi/rcnj20

Sensitivity of FRAMINGHAM, PROCAM and SCORE models in Turkish people with Type 2 diabetes: comparison of three cardiovascular risk calculations

Ayfer Bayındır Çevik, Şeyda Özcan & İlhan Satman

To cite this article: Ayfer Bayındır Çevik, Şeyda Özcan & İlhan Satman (2015) Sensitivity of FRAMINGHAM, PROCAM and SCORE models in Turkish people with Type 2 diabetes: comparison of three cardiovascular risk calculations, Contemporary Nurse, 50:2-3, 183-195, DOI: 10.1080/10376178.2015.1111153

To link to this article: http://dx.doi.org/10.1080/10376178.2015.1111153

Accepted author version posted online: 27 Oct 2015.
Published online: 19 Nov 2015.

Submit your article to this journal

Article views: 66

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
http://www.tandfonline.com/action/journalInformation?journalCode=rcnj20

Download by: [Recep Tayyip Erdogan University] **Date:** 29 February 2016, At: 04:59

Contemporary Nurse, 2015
Vol. 50, Nos. 2–3, 183–195, http://dx.doi.org/10.1080/10376178.2015.1111153

Routledge
Taylor & Francis Group

Sensitivity of FRAMINGHAM, PROCAM and SCORE models in Turkish people with Type 2 diabetes: comparison of three cardiovascular risk calculations

Ayfer Bayındır Çevik[a*], Şeyda Özcan[b] and İlhan Satman[c]

[a]*School of Health, Department of Nursing, Recep Tayyip Erdoğan University, Rize, Turkey;* [b]*School of Nursing, Koc University, Istanbul, Turkey;* [c]*Istanbul Medical Faculty, Istanbul University, Istanbul, Turkey*

(*Received 10 September 2014; accepted 17 October 2015*)

Purpose: To determine the cardiovascular risk factors according to the Framingham, PROCAM and SCORE models, to evaluate the 10-year cardiovascular disease (CVD) risk factors, and to compare the suitability of different models in Turkish Type 2 diabetes patients.
Methods: Risk factors and the 10-year CVD risk in 265 patients were evaluated using three risk models. Measurements included blood pressure, weight, height, waist and hip circumferences. Cholesterol, triglycerides, fasting and postprandial plasma glucose and HbA_{1c} were measured. Low-, moderate- and high-risk groups were determined according to the three risk calculations.
Results: Hypertension, obesity and no exercise, dyslipidemia and high HbA_{1c} in women, and excessive cigarette/alcohol consumption, increased weight, dyslipidemia and high HbA1c in men were crucial. Men were in the moderate-risk group according to three risk models. Women were in the medium-risk group according to the Framingham and PROCAM risks and in the low-risk group according to the SCORE.
Conclusion: Results estimating the 10-year CVD according to the three risk models were inconsistent. More sensitive CVD risk calculators are needed.
Discussion and practice implications: Our results could guide diabetes specialists in identifying gender-specific risks and designing preventive interventions.

Keywords: cardiovascular disease risk; Framingham; nursing; PROCAM; SCORE; Type 2 diabetes

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Diabetes is usually accepted as a "risk equivalent" of cardiovascular disease (CVD) risk as increased prevalence of diabetes has been linked to increases in CVD rates (American Diabetes Association [ADA], 2011; Finnish Diabetes Association, 2011). Cardiovascular diseases are associated with 75% of deaths in patients with diabetes (Conti, Mineli, & Gensini, 2007). Diabetes and CVDs are among the leading causes of mortality and morbidity in Turkey (Onat, 2009a; Satman et al., 2013). Although the prevalence and burden of CVD in people with diabetes is high, many individuals with diabetes who are at high risk for CVD are not recognized in the Turkish population (Onat, 2009a; Satman et al., 2013).

*Corresponding author. Email: ayferbayindir@hotmail.com.tr

© 2015 Taylor & Francis

In the Turkish Adults Risk Factors (TARF, 2009) study and the Turkey Diabetes Epidemiology Project (TURDEP-II, 2013), increased rate of diabetes in adults was shown. Therefore, it is likely that the diabetes-related CVD risks have enormously increased in the Turkish population (Onat, 2009b). Determining the risk factors for CVD in people newly diagnosed with diabetes is important for initiating protective interventions (Charles et al., 2012; Hobbs, Jukema, Da Silva, McCormack, & Catapano, 2010).

In patients with diabetes, several CVD risk factors including age, gender, smoking, obesity, hypertension, dyslipidemia, insufficient exercise and familial CVD history are often found (Cederholm & Nilsson, 2011). Synergistic effect of multiple risk factors is greater than the effect of each individual risk factor to increase the total risk of CVD. Therefore, calculation of the total CVD risk is more important than determining the risk factors one by one (Cooney, Dudina, & Graham, 2009). There are several CVD risk prediction models including Framingham, ASSIGN (the assessment of cardiovascular risk according to the Scottish Intercollegiate Guidelines Network), SCORE (Systematic Coronary Risk Evaluation Score), PROCAM (Prospective Cardiovascular Münster Score) and UKPDS (United Kingdom Prospective Diabetes Study) (Abbasi et al., 2012; Van Dieren, Beulens, Kengne, & Peelen, 2012). However, only a minority of studies have validated this large number of clinical prediction models in patients with diabetes (Van Dieren et al., 2012). Several prediction models are incorporated in guidelines for the management of Type 2 diabetes and prevention of cardiovascular complications. Assessment of the impact on diabetes treatment and complications has been conducted for only one prediction model (Coleman, Stevens, Retnakaran, & Holman, 2007).

The use of risk scores in clinical practice is highly variable and often fails to meet expectations (Aspelund, Thorgeirsson, Sigurdsson, & Gudnason, 2007). The impact of applying these risk scores during clinical practice is almost completely unknown, although their use is recommended in various national guidelines. The validation and impact of most prediction models has not been assessed, and there is a great need for such studies (Van Dieren et al., 2012).

In order for nurses to take precautions prior to the development of cardiovascular complications in people with diabetes, major risks of people with diabetes should be determined by calculating their CVD risks and people with diabetes should be assigned to risk groups. To achieve this, nurses should calculate CVD risks of people with diabetes during routine follow-up care (Bayındır Çevik, Özcan, & Aygün, 2010). Life style changes, education programs and interventions that will be recommended to people with diabetes will change accordingly.

The Turkish adaptation of the Framingham risk calculation was conducted by the Turkish Cardiology Association. Similar studies assessing CVD risks via the PROCAM and SCORE models in a Turkish population could not be found. The aims of this study were to determine the dominant risk factors for CVD in Turkish people with Type 2 diabetes according to the Framingham, PROCAM and SCORE models and the 10-year CVD risk factors; to evaluate risk models according to gender and age, to compare the risk models with regard to their compliance with Type 2 diabetes and their suitability of different risk models for people with Type 2 diabetes.

Methods

Study design and sample

Patients with Type 2 diabetes who were followed-up in the Diabetes Outpatient Clinic, Istanbul Medical Faculty, Istanbul University were included in this exploratory, cross-sectional study. Sample size ($n = 265$) was determined by taking the number of patients who attended in the clinic in the past year and conducting a power analysis with a 95% confidence interval. Inclusion criteria were to be between 30 and 74 years old and not to have a CVD. Patients who met the inclusion criteria were chosen randomly.

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Measures and definitions

Information on socio-demographic characteristics, smoking and alcohol habits, exercise habits, duration of diabetes diagnosis and medication use were obtained from the participants via face-to-face interviews. In the study, the age variable was classified under four categories: 30–40 years of age, 41–50 years of age, 51–60 years of age and 60 and above. The relationship between age groups and 10-year CVD risks was investigated. Weight and height, hip and waist circumferences, systolic blood pressure (sBP) and diastolic blood pressure (dBP) were measured, and the body mass index (BMI) was calculated [BMI = weight (kg)/height (m^2)].

Glycated hemoglobin (HbA_{1c}) was determined using the ROCHE Hitachi Modular P system and the turbidimetric inhibition immunoassay TINIA method. The normal reference interval was taken as 4.6–5.6%. Serum levels of total, HDL and LDL-cholesterol and triglycerides, and urine levels of albumin excretion were measured using the same laboratory equipment.

Cardiovascular risk scoring models

The Framingham, PROCAM and SCORE risk models were used for cardiovascular risk scoring (www.framinghamheartstudy.org 2013, www.chd-taskforce.de/procam 2013 and www.escardio.org 2013). These models were chosen because they have been used in long-term or cohort studies with large sample sizes including patients with diabetes.

The Framingham risk scoring is suitable for the 10-year CVD risk evaluation of patients with diabetes aged between 30 and 74 years. Risk calculation in the Framingham model is made using LDL-cholesterol levels, HDL-cholesterol, age, sBP, existence of diabetes and smoking. Total score gives the definitive risk of CVD. Among the percentages pertaining to the total risk scores, <10% indicated low risk; 10–19% medium level risk and ≥20% indicated high risk. Relative risk levels are calculated by comparing the risk levels of individuals in the same age (www.framinghamheartstudy.org 2013).

The risk calculator of PROCAM was developed to assess the risk for acute coronary syndrome (ACS) development risk of men with diabetes aged between 35 and 65 years. A rough estimate was also given in determining the ACS risk in women with diabetes (Assmann, Schulte, & Cullen, 2002; www.chd-taskforce.de/procam 2013). In the model, risk factors are scored according to increasing age, LDL-cholesterol, HDL-cholesterol, triglycerides, fasting plasma glucose (FPG), sBP, antihypertensive drug use, familial cardiac disease history, the presence of diabetes and smoking. The total score determines the likelihood of ACS development (Buyken, Von Eckardstein, Schulte, Culle, & Assmann, 2007). Among the percentages pertaining to the total risk scores, <10% indicated low risk, 10–19% medium level risk and ≥20% indicated high risk (www.chd-taskforce.de/procam 2013).

The SCORE model is suitable for the risk evaluation the patients aged between 40 and 65 years. Ten-year coronary event development estimations can be done by scoring according to the total cholesterol level, sBP, age and by taking smoking status as a basis. For low- and high-risk levels, two tables have been used. A scoring system for diabetes risk factors is not included in the SCORE model (www.escardio.org 2013). On the other hand, it is already known that patients with diabetes have a high risk of developing CVDs (Thor, Gudmundur, Gunnar, & Vilmundur, 2007). Therefore, a high-risk table was used for patients with diabetes. In this study, the cutpoint of all risk factors was found by selecting risk factors that were on the SCORE risk scoring table and were possessed by the participant. The color and score belonging to the value gave the 10-year coronary event development risk (www.escardio.org/ 2013). Among the percentages pertaining to the total risk scores, <1% indicated low risk, 2–4% medium level risk and ≥5% indicated high risk. The risk of nonfatal CVDs was evaluated

through the SCORE model (Gonzalez-Velazquez & Mendez, 2007; Thor et al., 2007). The PROCAM model was used due to clinical requirements. PROCAM evaluates the ACS risk (Buyken et al., 2007), whereas Framingham and SCORE evaluate the CVD risk (Aspelund et al., 2007; Gonzalez-Velazquez & Mendez, 2007).

Ethical considerations

The study was approved by the ethics committee of the Istanbul University, Istanbul School of Medicine. The study was performed in accordance with the 2008 Helsinki Declaration.

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Data analysis

The cardiovascular risk calculations were conducted by considering the appropriate age groups. In this context, the cardiovascular risks of patients were calculated using the Framingham, the PROCAM and the SCORE risk model. Patients with missing data were excluded in risk calculation of each model. Statistical analyses were performed using SPSS 16.0 software. A p value of <0.05 was accepted as significant. In the Framingham and SCORE models, risk factors were scored separately for men and women (www.framinghamheartstudy.org 2013 and www.escardio.org 2013). In the PROCAM model, the same scoring system for both genders was used (www.chd-taskforce.de/procam 2013). In all models, 10-year coronary heart disease risk scores were calculated, and coronary heart disease risk percentages were classified as low, medium and high (www.framinghamheartstudy.org 2013, www.chd-taskforce.de/procam 2013 and www.escardio.org 2013).

Models were calculated using the same predictors and coefficients as when they were originally developed and validated (Siontis, Tzoulaki, Siontis, & Ioannidis, 2012). The Framingham and PROCAM calculations were performed using the Microsoft Office Excel program, SCORE calculation was done by using a premade risk calculator according to their scoring guidelines. The risk percentages were classified as low–medium–high risks, and the absolute risk was evaluated in each model.

Descriptive statistics were reported in frequencies, means and standard deviations. Pearson's χ^2, Mann–Whitney U and Fisher's exact tests were used for evaluating demographic characteristics, risk factors and 10-year risks according to gender. Pearson's χ^2 analysis was used for evaluating the relationship between 10-year risks and age groups. The χ^2 test was conducted, and linear-by-linear association value was considered when the values that were expected to be less than 5 in a column were 25% and above. The Kruskal–Wallis test was used for evaluating the relationship between CVD risks and alcohol and exercise habits.

Results

Demographics characteristics

The sample consisted of 265 participants; 180 women (67.9%) and 85 men (32.1%). Among the study group, 48.3% ($n = 128$) consisted of people with diabetes who were aged between 51 and 60 years. It was determined that the men participants had a higher rate of high school and college education ($p < .001$), a higher rate of employment ($p < .001$) and better economic status compared to the women ($p = .008$ (Table 1).

Table 1. Demographic characteristics.

	Total ($n = 265$)	Men ($n = 85$)	Women ($n = 180$)	
	n (%)	*n* (%)	*n* (%)	*p*
Age groups (years)				
30–40	8 (3.0)	1 (1.2)	7 (3.9)	0.251
41–50	56 (21.1)	14 (16.7)	42 (23.2)	
51–60	128 (48.3)	47 (56.0)	81 (44.8)	
60–74	73 (27.5)	22 (26.2)	51 (28.2)	
Educational status				
Primary school	127 (47.9)	31 (36.5)	96 (53.3)	<0.001
Secondary school	46 (17.4)	7 (8.2)	39 (21.7)	
High school	47 (17.7)	23 (27.1)	24 (13.3)	
University	45 (17.0)	24 (28.2)	21 (11.7)	
Occupation				
Housewife	148 (55.8)	0 (0.0)	148 (82.2)	<0.001
Retiree	95 (43.9)	69 (81.3)	26 (14.4)	
Civil servant	18 (6.8)	12 (14.1)	6 (3.3)	
Other (laborer and freelance)	4 (1.5)	4 (4.7)	0 (0.0)	
Economic status				
Good	30 (11.3)	15 (17.6)	15 (8.3)	0.008
Medium	224 (84.5)	70 (82.4)	154 (85.6)	
Poor	11 (4.2)	0 (0.0)	11 (6.1)	

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Aim 1: determining the prevalence of CVD risk factors according to the Framingham, PROCAM and SCORE models

Average time of diabetes diagnosis was 10.9 years (±6.8). The average duration of pharmacological treatment was 8.3 years (±5.7). The rate of men who are smokers and quit smoking ($p < .001$), the average number of cigarettes smoke by men in a day ($p < .05$), the rate of alcohol use in men ($p < .001$) and men's exercise rates ($p = .001$) was found to be higher than in women. The rate of hypertension in patients was 43.4%. The rates of hypertension ($p < .001$) and antihypertensive drug use ($p = .049$) in women were found to be higher than in men. The rate of presence at least one chronic complication of diabetes ($p = .001$), the mean BMI ($p < .001$), obesity rate ($p < .001$) and HDL-cholesterol levels ($p < .001$) were higher in women than in men (Table 2).

Aim 2: evaluating the 10-year CVD risks according to gender and age

According to Framingham, in terms of 10-year CVD risk, no significant difference was determined between men and women ($p = .977$). According to PROCAM, men were in a higher risk group than women ($p = .005$). Men were more likely than women to have medium and high level risks for SCORE ($p < .001$). For PROCAM ($p = .001$) and SCORE ($p < .001$), men's 10-year risk calculations were detected to be higher than those of women (Table 3). When the increase in CVD risk was evaluated according to age groups, it was found that lower age groups were in low-risk groups and higher age groups were in high-risk groups in all three models ($p < .05$) (Table 4).

Aim 3: comparing the risk models with regard to their compliance with Type 2 diabetes

Both women and men reside in the medium-risk level in each model. However, in PROCAM ($p = .001$) and SCORE ($p = .001$), the risk percentages of men were meaningfully different from women (Table 5).

Table 2. CVD risk factors and metabolic control parameters in people with Type II diabetes.

	Total ($n = 265$)	Men ($n = 85$)	Women ($n = 180$)	
	n (%)	*n* (%)	*n* (%)	*p*
Duration of diabetes diagnose(year)[a]	10.9 (±6.8)	10.8 (±6.6)	11.1 (±6.9)	0.845
Duration of pharmacological treatment(year)[a]				
OAD	130 (52.2)	48 (60.0)	82 (48.5)	0.231
Insulin	35 (14.1)	10 (12.5)	25 (14.8)	
OAD + insulin	84 (33.7)	22 (27.5)	62 (36.7)	
Nondiabetic drugs				
Antihypertensive	157 (59.2)	43 (50.6)	114 (63.3)	0.049
Statin	94 (35.5)	32 (34.0)	62 (34.4)	0.611
Antitrombosit	122 (46.0)	42 (34.4)	80 (44.4)	0.449
People with diabetes-related complications	148 (56.1)	35 (41.2)	113 (63.1)	0.001
Chronic complications				
Retinoathy	58 (21.9)	19 (22.3)	39 (21.7)	1.000
Nephropathy	16 (6.0)	7 (8.2)	9 (5.0)	0.302
Neuropathy	79 (29.8)	23 (27.1)	56 (31.1)	0.501
Diabetic foot	10 (3.8)	3 (3.5)	7 (3.98)	1.000
Hypertension	115 (43.4)	23 (27.1)	92 (51.1)	<0.001
Smoking				
Smoker	30 (11.3)	12 (14.1)	18 (10.0)	<0.001
Ex-smoker	62 (23.4)	33 (38.8)	29 (16.1)	
Never smoked	173 (65.3)	40 (47.1)	133 (73.9)	
Alcohol use				
Drinker	43.8 (±24.7)	45.5 (±25.4)	43.2 (±24.6)	0.676
Ex-drinker	8.3 (±5.7)	8.6 (±5.6)	8.1 (±5.8)	0.357
Never drunk	157 (59.2)	43 (50.6)	114 (63.3)	0.049
Exercise				
Yes	58 (21.9)	29 (34.1)	29 (16.1)	0.001
Sometimes	103 (38.9)	21 (24.7)	82 (45.6)	
No	104 (39.3)	35 (41.2)	69 (38.3)	
BMI (kg/m^2)[a]	30.0 (±5.1)	28.3 (±4.5)	30.8 (±5.2)	<0.001
BMI categories				
Normal (18.5–24.9 kg/m^2)	37 (14.0)	19 (22.3)	18 (10.0)	<0.001
Overweight (25–29.9 kg/m^2)	109 (41.1)	43 (50.6)	66 (36.7)	
Obese (≥30kg/m^2)	119 (44.9)	23 (27.1)	96 (53.3)	
WHR	0.90 (±0.06)	0.92 (±0.06)	0.89 (±0.05)	<0.001
sBP (mmHg)	128.0 (±17.0)	128.8 (±13.5)	127.7 (±18.4)	0.379
dBP (mmHg)	77.7 (±10.6)	78.4 (±9.7)	77.4 (±11.0)	0.556
FBG (mg/dL)	157.8 (57.9)	153.7 (47.9)	159.7 (62.0)	0.874
PBG (mg/dL)	193.8 (64.8)	186.0 (58.3)	197.4 (67.5)	0.285
HbA_{1c} (%)	7.9 (4.2)	8.2 (7.0)	7.7 (1.5)	0.170
Total cholesterol (mg/dL)	189.3 (41.9)	180.1 (42.6)	193.7 (40.9)	0.006
HDL-cholesterol (mg/dL)	47.5 (16.1)	44.5 (20.0)	48.9 (13.7)	<0.001
LDL-cholesterol (mg/dL)	113.4 (35.5)	107.3 (34.1)	116.2 (35.8)	0.057
Trigliserides (mg/dL)	167.3 (98.5)	163.4 (94.1)	169.1 (100.7)	0.627
Microalbuminuria (mg)	29.21 (47.4)	29.76 (24.0)	28.89 (57.5)	0.106

OAD, oral antidiabetic; WHR, waist and hip ratio; BMI, body mass index; sBP, systolic blood pressure; dBP, diastolic blood pressure; FG, fasting glucose; PBG, postprandial blood glucose; HbA_{1c}, hemoglobin A_{1c}.
[a]Mean (SD).

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Table 3. Grouping of 10-year risks according to the models.

	Total ($n = 265$)	Men ($n = 85$)	Women ($n = 180$)	
Framingham	*n* (%)	*n* (%)	*n* (%)	*p*
Low (<10%)	80 (30.2)	26 (30.6)	54 (30.0)	0.977
Medium (10–19%)	111(41.9)	36 (42.4)	75 (41.7)	
High (≥20%)	74 (27.9)	23 (27.1)	51 (28.3)	
	Total ($n = 239$)	Men ($n = 76$)	Women ($n = 163$)	
PROCAM	*n* (%)	*n* (%)	*n* (%)	
Low (<10%)	123 (51.5)	28 (36.8)	95 (58.3)	0.005
Medium (10–20%)	62 (25.9)	23 (30.3)	39 (23.9)	
High (>20%)	54 (22.6)	25 (32.9)	29 (17.8)	
	Total ($n = 236$)	Men ($n = 76$)	Women ($n = 160$)	
SCORE	*n* (%)	*n* (%)	*n* (%)	
Low (≤1%)	132 (55.9)	15 (19.7)	117 (73.1)	<0.001
Medium (2–4%)	84 (35.6)	43 (56.6)	41 (25.6)	
High (≥5%)	20 (8.5)	18 (23.7)	2 (13)	

Table 4. Age grouping of 10-year risks according to the models.

	Total[a]	30–40 years	41–50 years	51–60 years	60 years over	*p*
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	
Framingham						
Low (<10%)	80 (30.2)	1 (1.3)	28 (35.0)	46 (57.5)	5 (6.3)	0.000
Medium (10–19%)	111 (41.9)	4 (3.6)	23 (20.7)	62 (55.9)	22 (19.8)	
High (≥20%)	74 (27.9)	3 (4.1)	5 (6.8)	20 (27.0)	46 (62.2)	
PROCAM						
Low (<10%)	123 (51.5)	6 (4.9)	43 (35.0)	54 (43.9)	20 (16.3)	0.000
Medium (10–20%)	62 (25.9)	2 (3.2)	9 (14.5)	29 (46.8)	22 (35.5)	
High (>20%)	54 (22.6)	0 (0.0)	3 (5.6)	21 (38.9)	30 (55.6)	
SCORE						
Low (≤1%)	132 (55.9)	5 (3.8)	40(30.3)	52 (39.4)	35 (26.5)	0.006[b]
Medium (2–4%)	84 (35.6)	3 (3.6)	15 (17.9)	54 (64.3)	12 (14.3)	
High (≥5%)	20 (8.5)	0 (0.0)	0 (0.0)	8 (40.0)	12 (20.3)	

[a]Column percent, all others are row percent.
[b]Chi square test, linear by linear association, others are Pearson χ^2 results.

Table 5. Comparison of 10-year CVD risks according to the risk models in people with diabetes.

		Men	Women	*p*
Framingham	*X* (±SD)	16.2 (8.9)	14.7 (7.7)	0.287
10-Year risk degree	*n*	85	180	
PROCAM	*X* (±SD)	16.1 (12.0)	11.6 (10.8)	0.001
10-Year risk degree	*n*	76	163	
SCORE	*X* (±SD)	3.4 (2.3)	1.2 (0.9)	<0.001
10-Year risk degree	*n*	76	160	

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Table 6. The relationship between CVD risks and alcohol and exercise habits.

	Framingham ($n = 265$)	PROCAM ($n = 239$)	SCORE ($n = 236$)
	$X \pm SD$	$X \pm SD$	$X \pm SD$
Alcohol use			
User	20.7 (11.3)	26.1 (10.6)	3.6 (1.9)
Ex-used	19.5 (8.7)	13.3 (9.7)	2.8 (1.0)
Never used	14.8 (7.8)	12.3 (11.1)	1.8 (1.8)
p	0.101	0.002	0.001
Exercising habits			
Yes	15.7 (7.4)	15.1 (10.7)	2.5 (2.4)
Sometimes	15.2 (8.1)	13.3 (11.1)	1.9 (1.7)
No	14.8 (8.5)	11.6 (11.9)	1.5 (1.5)
p	0.549	0.016	0.005

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

In addition, study findings showed significant relation between risk scores and alcohol use. According to PROCAM ($p = .002$) and SCORE ($p = .001$), the risk scores of alcohol users were higher than nondrinkers and those who have never drunk. According to PROCAM ($p = .016$) and SCORE ($p = .005$), the risk scores of those who exercise were higher (Table 6).

Discussion

In the study, women with hypertension, obesity, the absence of exercise habits, dyslipidemia and high HbA_{1c} had higher levels of CVD risk, whereas men with excessive smoking and alcohol consumption, increased weight, dyslipidemia, and high HbA_{1c} values had higher levels of CVD risk. It was also found that the Framingham model yielded higher risk calculations in Turkish women with diabetes compared to the PROCAM and SCORE models.

Demographic and CVD risk factors

The demographic characteristics of the participants were similar to those of the TARF and TURDEP-II (2013) participants (Onat, 2009a; Satman et al., 2013). In the Turkish society, the population with diabetes was determined to be mostly in the middle age group and above, and predominantly female. The female diabetes population was found to be less educated, less employed and economically in worse status when compared to males.

Results from this study were similar to those reported by Lahoz-Rallo et al. (2007) and the TARF study (Onat, 2009c). Specifically, rates of diabetes complications in both studies were greater in women than in men. Hypertension and antihypertensive medication use in women was significantly higher than in men in our study.

These results can be attributed to the dominance of diabetes in women. Antihypertensive, statin and aspirin treatments were ranked as the first three most frequently used nondiabetic medications. According to Hoorn's (2003) as cited in Becker et al. (2003) study, antihypertensive medication use in patients was determined to be 78%. According to Lahoz-Rallo et al.'s (2007) study, 45.9% of patients received antihypertensive medication, 36.4% aspirin and 35.4% statin. In both studies, similarly with our study, antihypertensive, aspirin and statin medication use ranked first in the nondiabetic medications.

In this study, 53.3% of women and 27.1% men were obese, similar to the TARF (2009) study reporting higher rate of obesity in women (46.6%) than in men (15.9%). The TURDEP-II data

showed that the obesity rate in women was 40.3% and 25.1% in men. In Mokdad et al.'s (2003) study, the relationship between diabetes and obesity was evaluated in patients whose BMI was ≥30 kg/m^2, and it was found that the participants had hypertension, hypercholesterolemia and deteriorated health. In Wilsgaard and Arnesen's (2007) study, it was found that an increase of 3 kg/m^2 in BMI increases CVD risks by 0.66 points in women and 0.45 points in men. In the TARF study (2009), each unit of increase in the BMI increased CVD risk by 9% (Onat & Sansoy, 2009).

It has been reported that central obesity is one of the most important factors in terms of CVD risk and increased values of CVD risk have been as waist circumference ≥102 cm in men and ≥88 cm in women (Redberg et al., 2009; Rydén et al., 2007). In the TARF (2009) study, the rate of waist circumference in men was determined to increase CVD risk significantly compared to women (Onat & Sansoy, 2009). In this study, the BMI rate was in average for both genders but the rate of obesity in men was higher than in women.

Prevention of obesity, especially central obesity, and its treatment are basic principles of CVD prevention (Hartiala et al., 2012). One of the leading arteriosclerosis risk factors is arterial hypertension (Onat, 2009d). The American Heart Association (AHA) and ADA (2011) suggest the sBP value to be ≤130 mmHg and dBP value ≤80 mmHg for patients (ADA, 2011; Smith et al., 2011). The sBP and dBP values of our sample were among the suggested values.

The ADA (2011) states that HbA_{1c} should be kept at <7% and LDL-cholesterol at <100 mg/dL in patients with diabetes. Lipid levels in this study were not under control in spite of statin treatments, with the exception of total cholesterol levels. The average HDL-cholesterol levels for women were lower, whereas serum levels of triglycerides, HbA_{1c} and LDL-cholesterol levels were higher than the suggested values (ADA, 2010; Greenland et al., 2010). Although the relationship between postprandial plasma glucose (PPG) and 10-year CVD risk could not be determined in our study, PPG averages were found to be high.

This data showed that the predisposing risk factors for CVD were higher in women than in men. Similarly, Juutilainen et al. (2004) inferred that diabetes had a significantly stronger effect on CVD risk factors in women than in men. In other studies, similar results were found (Onat, 2009d; Satman et al., 2013). In this study, cigarette and alcohol use in women was lower than in men. Less cigarette and alcohol consumption in women is a factor reducing CVD risk. Alcohol use was not included in the PROCAM and SCORE calculations. Nevertheless, patients who have increased alcohol consumption had increased PROCAM ($p = .002$) and SCORE ($p = .001$) risk. Lower alcohol consumption is a preservative factor against CVDs since it increases HDL cholesterol and diminishes plaque accumulation in the vessels (Rydén et al., 2007). However, excessive alcohol consumption can damage the heart in due course and lead to high blood pressure, alcohol cardiomyopathy and congestive heart failure (Eidelman, Vignola, & Hennekens, 2002). In our study, lower alcohol consumption was determined to reduce CVD risks according to PROCAM and SCORE (Tables 2 and 5).

When exercise status was examined according to PROCAM and SCORE, it was observed that patients who had high risks did more exercise (Table 5). This result marks that patients who have high risks give more importance to exercise. Increasing exercise in diabetes management is one of the prominent goals (Shicheng & Yarnell, 2004).

The 10-year CVD risk

The Framingham model yielded moderate-risk levels for females, whereas the PROCAM and SCORE models yielded low-risk levels. According to SCORE, a higher rate of males was in the moderate-risk group. A higher rate of participants was in the low-risk group according to

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

PROCAM and SCORE, and in the medium-risk group according to Framingham. There was no significant difference in Framingham risk levels according to gender.

It is important to determine CVD risk factors that change with age and to determine the increase in risks (Ünal et al., 2013). The Framingham risk model is appropriate for calculating risks in the 30–74 age group, while the PROCAM risk model is appropriate for the 35–65 age group and the SCORE risk model is appropriate for the 40–65 age group (www.framinghamheartstudy.org 2013, www.chd-taskforce.de/procam 2013, www.escardio.org 2013). Risk calculations of the study group were conducted considering people in these age groups. In the present study, it was found that lower age groups had low risk and higher age groups had high risk in all the three models. Studies reporting the generalizability of Framingham-derived scores in 112 different population groups revealed a tendency to overestimate CVD risk in the low-risk groups and to underestimate CVD risk in the high-risk groups. The risk scores discriminated between female patients who were in the low- and high-risk groups compared to males (Brindle, Beswick, Fahey, & Ebrahim, 2006). Similarly, the UKPDS study indicated that the Framingham model is efficient for determining moderate level-risk estimates in people newly diagnosed with diabetes; however, it is not efficient for determining high-risk estimates (Bayındır Çevik et al., 2010; Guzder, Gatling, Mullee, Mehta, & Byrne, 2005). The Framingham model predicted high-risk estimates in the Chinese population and successfully predicted 5-year moderate-risk estimates in patients with diabetes (Yang et al., 2008). These results are consistent with our findings. On the other hand, it was shown that the CVD rates in the South European populations were much lower than those determined by Framingham. Therefore, the Framingham model yields higher risk estimates (Menotti, Lanti, Puddi, & Kromhout, 2000). Guzder et al. (2005) reported that the Framingham and UKPDS models were effective in determining the CVD risk in people newly diagnosed with Type 2 diabetes and that the Framingham model could estimate cardiovascular event risk and that the UKPDS yielded a ratio of 32%. Coleman et al. (2007) found that the Framingham, SCORE and DECODE (Diabetes Epidemiology: Collaborative analysis of Diagnostic criteria in Europe) models were unable to provide risk estimates for people newly diagnosed with Type 2 diabetes. In Van der Heijden, Ortegon, Niessen, Nijpels, and Dekker's (2009) study, it was found that the Framingham gave higher risk levels than SCORE. Similarly, in the present study, it was determined that the Framingham and PROCAM risk models yielded higher prevalence rates for the high-risk groups with advanced age compared to the SCORE risk model. The SCORE yielded lower mortality rates and lower CVD risk levels, especially in women (Werner-Hense et al., 2008). The UKPDS (2007) as cited in Van der Heijden et al. (2009) study, which was conducted with people newly diagnosed with Type 2 diabetes, showed that the SCORE model yields realistic results only for males and the Framingham model only for females (Kirk et al., 2007). Various studies conducted with different populations including this study, support these findings.

Our study shows that while diabetes is seen more frequently in women, it constitutes a larger threat to the cardiovascular health of men, increasing the intensity of the already existing CVD problems in men. The results of a study by Hoorn (2009) as cited in Van der Heijden et al. (2009) also support the findings of our study, stating that while CVD risks are higher in women with diabetes when compared to healthy women, the CVD risk of men with diabetes is larger than women with diabetes.

In order to plan interventions aimed at reducing the risk of cardiovascular disease, nurses should assess CVD risks of people with diabetes during routine follow-up care. Risk reduction programs should be provided for people with diabetes in accordance with the dominant risks determined during the risk calculation process and with the degree of risks (Bayındır Çevik, Özcan, & Satman, 2015). Therefore, nurses should evaluate the appropriateness of a program

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

for a specific population by using different risk models during clinical practice. Calculation of CVD risks by using risk models is important in terms of taking evidence-based precautions.

This study has some limitations. The study needs a long-term follow-up to determine which method has the best predicting power among three different risk models. Authors recommend the analysis of concordance in predicting the risk level with the observation of actual events over a long-term follow-up period in future studies.

Conclusion

A major strength of the study is comparing three CVD risk prediction models in an understudied population which is an innovative application. Testing the clinically applicability of CVD risk calculations is another major strength of the study. These tree risk calculation tools aiming to predict the cardiovascular disease risk were tested and compared first time in a group of Turkish patients with diabetes. Results estimating the 10-year risk factors for CVD according to the three models were inconsistent. More sensitive CVD risk calculators comprising of the risk factors should be developed. New CVD risk calculators should comprise of the risk factors such as alcohol consumption and exercise habits that are not included in the three risk models applied in the study. Nevertheless, nurses using these models may help increase awareness regarding risks and risk levels in people with diabetes as well as CVD awareness, facilitating cardiological follow-up of people with diabetes.

Acknowledgement

We sincerely thank the patients who accepted to participate in the study.

ORCID

Ayfer Bayındır Çevik http://orcid.org/0000-0002-8667-4094

References

Abbasi, A., Peelen, L. M., Corpeleijn, E., van der Schouw, Y. T., Stolk, R. P., Spijkerman, A. M., … Beulens, J. W. (2012). Prediction models for risk of developing type 2 diabetes: Systematic literature research and independent external validation study. *Journal of British Medicine*, *345*, e5900.

American Diabetes Association. (2011). Standards of medical care in diabetes – 2011. *Diabetes Care*, *34*(1), 11–61.

Aspelund, T., Thorgeirsson, G., Sigurdsson, G., & Gudnason, V. (2007). Estimation of 10-year risk of fatal cardiovascular disease and coronary heart disease in Iceland with results comparable with those of the Systematic Coronary Risk Evaluation Project. *European Journal Cardiovascular Preventive Rehabilitation*, *14*, 761–768.

Assmann, G., Schulte, H., & Cullen, P. (2002). New and classical risk factors—the Münster Heart Study (PROCAM). *Circulation*, *10*(5), 310–315.

Bayındır Çevik, A., Özcan, Ş., & Aygün, M. (2010). Tip 2 diyabetliler için kardiyovasküler hastalık riskinin hesaplanmasının önemi ve risk tahmin modelleri [Cardiovascular disease risk estimate for Type 2 diabetes to the importance and prediction models risk]. *Diyabet Forumu* [*Diabetes Forum*], *6*(4), 21–29.

Bayındır Çevik, A., Özcan, Ş., & Satman, İ. (2015). Reducing the modifiable risks of cardiovascular disease in Turkish patients with type 2 diabetes: The effectiveness of training. *Clinical Nursing Research*, *24*(3), 299–317.

Becker, A., Bos, G., de Vegt, F., Kostense, P. J., Dekker, J. M., Nijpels, G., … Stehouwer, C. D. (2003). Cardiovascular events in type 2 diabetes: Comparison with non-diabetic individuals without and with prior cardiovascular disease 10-year follow-up of Hoorn study. *European Heart Journal*, *24*(15), 1406–1413.

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Brindle, P., Beswick, A., Fahey, T., & Ebrahim, S. (2006). Accuracy and impact of risk assessment in the primary prevention of cardiovascular disease: A systematic review. *Heart*, *92*, 1752–1759.
Buyken, A. E., Von Eckardstein, A., Schulte, H., Culle, P., & Assmann, G. (2007). Type 2 diabetes mellitus and risk of coronary heart disease: Results of the 10-year follow-up of the PROCAM study. *European Journal of Cardiovascular Prevention & Rehabilitation*, *14*(2), 230–236.
Cederholm, J., & Nilsson, P. M. (2011). A review of risk factors and cardiovascular disease in diabetes care-2011. *European Journal of Cardiovascular Medicine*, *1*, 21–25.
Charles, M., Simmons, R. K., Williams, K. M., Roglic, G., Sharp, S. J., Kinmonth, A. L., … Griffin, S. J. (2012). Cardiovascular risk reduction following diagnosis of diabetes by screening: 1-year results from the ADDITION-Cambridge trial cohort. *British Journal of General Practice*, *62*(599), e396–402.
Coleman, R. L., Stevens, R. J., Retnakaran, R., & Holman, R. R. (2007). Framingham, SCORE and DECODE risk equations do not provide reliable cardiovascular risk estimates in type 2 diabetes, cardiovascular and metabolic risk brief report. *Diabetes Care*, *30*(5), 1292–1293.
Conti, A. A., Mineli, M., & Gensini, F. G. (2007). Global management of high risk patients: Iterated primary cardiovascular prevention in diabetics. *International Congress Series*, *10*(20), 10–20.
Cooney, M. T., Dudina, A. L., & Graham, I. M. (2009). Value and limitations of existing scores for the assessment of cardiovascular risk. *Journal of American College of Cardiology*, *54*(14), 1209–1227.
Eidelman, R. S., Vignola, P., & Hennekens, C. H. (2002). Alcohol consumption and coronary heart disease: A causal and protective factor. *Seminars in Vascular Medicine*, *2*(2), 253–256.
Finnish Diabetes Association. (2011). *DEHCO development programme for the prevention of Type 2 diabetes in Finland 2000–2010*. High Risk Strategy. p. 38. Retrieved May 25, 2014, from http://www.diabetes.fi/sivu
Gonzalez-Velazquez, F., & Mendez, G. F. (2007). Cardiovascular risk stratification by means of the SCORE system in health care workers in Veracruz Mexico. *International Journal of Cardiology*, *121*(1), 81–83.
Greenland, P., Alpert, J. S., Beller, G. A., Benjamin, E. J., Budoff, M. J., Fayad, Z. A., … Wenger, N. K. (2010). ACCF/AHA Guideline for assessment of cardiovascular risk in asymptomatic adults. A report of the American Colllege of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Journal of American College of Cardiology*, *56*(25), e50–e103.
Guzder, R. N., Gatling, W., Mullee, M. A., Mehta, R. L., & Byrne, C. D. (2005). Prognostic value of the Framingham cardiovascular risk equation and the UKPDS risk engine for coronary heart disease in newly diagnosed Type 2 diabetes: results from a United Kingdom study. *Diabetic Medicine*, *22*(5), 554–562.
Hartiala, O., Magnussen, C. G., Kajander, S., Knuuti, J., Ukkonen, H., Saraste, A., … Raitakari, O. T. (2012). Adolescence risk factors are predictive of coronary artery calcification at middle age. The cardiovascular risk in young Finns Study. *Journal of the American College of Cardiology*, *60*(15), 1364–1370.
Hobbs, F. D., Jukema, J. W., Da Silva, P. M., McCormack, T., & Catapano, A. L. (2010). Barriers to cardiovascular disease risk scoring and primary prevention in Europe. *Journal of the Association of Physicians*, *103*(1), 727–739.
Juutilainen, A., Kortelainen, S., Lehto, S., Rönnemaa, T., Pyörälä, K., & Laakso, M. (2004). Gender difference in the impact of type 2 diabetes on coronary heart disease risk. *Diabetes Care*, *27*(12), 2898–2904.
Kirk, J. K., Bertoni, A. G., Case, D., Bell, R. A., Goff, D. C., & Narayan, K. M. (2007). Predicted risk of coronary heart disease among persons with type 2 diabetes. *Coronary Artery Disease*, *18*(8), 595–600.
Lahoz-Rallo, B., Blanco-Gonzalez, M., Casas-Ciria, I., Marín-Andrade, J. A., Mendez-Segovia, J. C., Moratalla-Rodriguez, G., … Quintero-Dominguez, R. (2007). Cardiovascular disease risk in subjects with type 2 diabetes mellitus in a population in Southern Spain. *Diabetes Research and Clinical Practice*, *76*, 436–444.
Menotti, A., Lanti, M., Puddi, P. E., & Kromhout, D. (2000). Coronary heart disease incidence in northern and southern European populations: a reanalysis of the seven countries study for European coronary risk chart. *Heart*, *84*, 238–244.
Mokdad, A. H., Ford, E. S., Bowman, B. A., Dietz, W. H., Vinicor, F., Bales, V. S., & Marks, J. S. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors. *Journal of the American Medical Association*, *289*(1), 76–79.
Onat, A. (2009a). TARF. *Kardiyovasküler hastalık riski prevalansı, yeni koroner olaylar ve ölüm oranları* [The prevalence of cardiovascular disease risk, new coronary experiences and death rate]. *TARF 2009*. 19–26. Retrieved June 3, 2013, from http://tekharf.org
Onat, A. (2009b). TARF: *Türk erişkinlerinde diyabet ve prediyabet* [Diabetes and prediabetes in Turkish Adults]. *TARF 2009*. 140–148. Retrieved June 3, 2014, from http://tekharf.org
Onat, A. (2009c). *Toplumumuzda kan basıncı ve hipertansiyon* [In our society, blood pressure and hypertension]. *TARF 2009*. 74–89. Retrieved May 7, 2014, from http://tekharf.org.

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016

Onat, A. (2009d). *Türk halkında lipid, lipoprotein ve apolipoproteinler* [In Turkish society lipids, lipoproteins, and apolipoproteins]. *TARF 2009*. 39–56. Retrieved May 7, 2014, from http://tekharf.org.

Onat, A., & Sansoy, V. (2009). *Türk toplumunda obezite, abdominal obezite ve belirleyicileri ve sonuçları* [In Turkish society, obesity, abdominal obesity and determinants and consequences]. *TARF 2009*. 106–117. Retrieved May 7, 2014, from http://tekharf.org

Redberg, R. F., Benjamin, E. J., Bittner, V., Braun, L. T., Goff, D. C., Havas, S., … Swegler, E. W. (2009). ACCF/AHA 2009 performance measures for primary prevention of cardiovascular disease in adults: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Performance Measures. *Journal of American College of Cardiology*, *54*(14), 1364–1405.

Rydén, L., Standl, E., Bartnik, M., Van den Berghe, G., Betteridge, J., de Boer, M. J., … Wood, D. (2007). Guidelines on diabetes, pre-diabetes, and cardiovascular diseases: Executive summary. *European Heart Journal*, *28*, 88–136.

Satman, I., Tütüncü, Y., Kalaca, S., Gedik, S., Dinççağ, N., Karşıdağ, K., … Tuomilehto, J. (2013). Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. *European Journal of Epidemiology*, *28*(2), 169–180.

Shicheng, Y., & Yarnell, J. W. G. (2004). Exercise for the prevention of cardiovascular disease: How vigorous and how often? Cardiovascular reviews and report. *Cardiovascular Reviews and Reports*, *25*, 274–276.

Siontis, G. C., Tzoulaki, I., Siontis, K. C., & Ioannidis, J. P. (2012). Comparisons of established risk prediction models for cardiovascular disease: Systematic review. *British Medical Association*, *344*(1), e3318.

Smith, S. C., Benjamin, E. J., Bonow, R. O., Braun, L. T., Creager, M. A., Franklin, B. A., … Taubert, K. A. (2011). AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update. *Journal of the American College of Cardiology*, *58*(23), 2432–2446.

Thor, A., Gudmundur, T., Gunnar, S., & Vilmundur, G. (2007). Estimation of 10-year risk of fatal cardiovascular disease and coronary heart disease in Iceland with results comparable with those of the Systematic Coronary Risk Evaluation Project. *European Journal of Cardiovascular Prevention & Rehabilitation*, *14*(6), 761–768.

Ünal, B., Sözmen, K., Uçku, R., Ergör, G., Soysal, A., Baydur, H., … Tuncel, P. (2013). High prevalence of cardiovascular risk factors in a Western urban Turkish population: A community-based study. *The Anatolian Journal of Cardiology*, *13*(1), 9–17.

Van der Heijden, A. A., Ortegon, M., Niessen, L. W., Nijpels, G., & Dekker, J. M. (2009). Prediction of coronary heart disease risk in a general, pre-diabetic, and diabetic population during 10 years of follow-up: accuracy of the FRAMİNGHAM, SCORE, and UKPDS risk functions: The Hoorn Study. *Diabetes Care*, *32*(11), 2094–2098.

Van Dieren, S. W., Beulens, J. W. J., Kengne, A. P., & Peelen, L. M. (2012). Predictions models for the risk of cardiovascular disease in patient with type 2 diabetes: A systematic review. *Heart*, *98*(5), 360–369.

Werner-Hense, H., Koesters, E., Wellman, J., Meisinger, C., Völzke, H., & Keil, U. (2008). Evaluation of a recalibrated systematic coronary risk evaluation cardiovascular risk chart: Results from Systematic Coronary Risk Evaluation Germany. *European Journal of Cardiovascular Prevention and Rehabilitation*, *15*(4), 409–415.

Wilsgaard, T., & Arnesen, E. (2007). Body mass index and coronary heart disease risk score: The Tromso Study, 1979 to 2001. *Annals of Epidemiology*, *17*(2), 100–105.

Yang, X., So, W. Y., Kong, A. P., Ma, R. C., Ko, G. T., Ho, C. S., & Lam, C. W. (2008). Development and validation of a total coronary heart disease risk score in type 2 diabetes mellitus. *American Journal of Cardiology*, *101*(5), 596–601.

Downloaded by [Recep Tayyip Erdogan University] at 04:59 29 February 2016