Establishment of Health Clinics as Mass Screening and Referral Systems for Chronic Non-communicable Diseases in Primary Health Care

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ABSTRACT

Background: This study aimed to establish a comprehensive screening and referral system for chronic non-communicable diseases (CNCD) in the routine primary health care, and to determine the prevalence of diabetes, pre-diabetes, metabolic syndrome, and dyslipidemia in adult population invited by public announcement to the Health clinics in Isfahan, Iran.

Methods: This survey was conducted from March 2010, and the current paper presents data obtained until November 2011. To provide health services for prevention and control of CNCDs, with priority of type2 diabetes mellitus, Health clinics were established in different parts of Isfahan city with a population of approximately 2,100,000 in Iran. The general populations aged 30 years and above were invited to the Health clinics by public announcement.

Results: A total of 198972 participants were screened. The mean age of participants was 47.8 years (48.5 men, 47.3 women), with a range of 1 to 95 years old and standard deviation of 12.3 years (12.7 men, 12.1 women). Overall, 22% of participants had impaired fasting glucose, 25% had hypercholesterolemia, 31% had hypertriglyceridemia, and 20% had metabolic syndrome.

Conclusion: The high prevalence of dysglycemia and diabetes in our survey may serve as confirmatory evidence about the importance of mass screening and early diagnosis of CNCDs' risk factors. Our model of establishing Health clinics, as a comprehensive referral system in the routine primary health care can be adopted by Middle Eastern countries, where CNCDs notably diabetes are an emerging health problem.

Keywords: Screening, diabetes, metabolic syndrome, prevention.

Original Article

INTRODUCTION

Chronic non-communicable diseases (CNCDs) are global public health and socioeconomic problems, with an escalating trend in developing countries. Pre-diabetes and type 2 diabetes mellitus (T2DM) are considered as substantial universal health problems of enormous proportions. According to the World Health

Organization (WHO) data, more than 220 million people worldwide are suffering from diabetes.[1] The global prevalence of T2DM is estimated to rise from 171 million in 2000 to 366 million in 2030.[2,3] The Middle Eastern populations are expected to have the world's highest increases in the absolute burden of T2DM in the next two decades.[4]

Usually T2DM is not diagnosed until the complications appear, and about one-third of the diabetic patients are undiagnosed. However, the effectiveness of early identification of pre-diabetes and diabetes through mass screening of asymptomatic persons still remains controversial.[5] However, mass screening is supported by the high prevalence of undiagnosed diabetes, and consequently, a large number of cases with complications at diagnosis are present.[2,6] T2DM may occur nine to twelve years before its clinical diagnosis.[7,8] Therefore, among the recently diagnosed patients, 20% have retinopathy and 10% have nephropathy.[7,9]

Diabetes and its microvascular and macrovascular complications impose a remarkable economic burden on patients, families, societies, and national healthcare systems.[10] Some experts have suggested that the most cost-effective prevention is screening adults, especially between the ages of 30 and 45 years, along with repeated screening every three to five years.[7,11,12] Alternatively, others have considered targeting diabetes screening at hypertensive persons to be more cost-effective than universal screening. They suggested that targeted screening of persons with age between 55 and 75 years would be the most cost-effective strategy.[13]

Considering the high prevalence of obesity,[14] metabolic syndrome,[15] and diabetes[16] in Iran, mass screening may help in identifying the 'at-risk' population. This study aims to establish a comprehensive screening and referral system for CNCDS in the routine primary health care, and to determine the prevalence of diabetes, pre-diabetes, metabolic syndrome, and dyslipidemia in the adult population invited by public announcement to the health clinics in Isfahan, Iran.

METHODS

Study population

On account of the lack of pre-defined settings for the prevention and control of CNCDs and their risk factors in the existing health system in Iran, from 2004, a wide-ranging program was designed by the Provincial Health Office affiliated to the Isfahan University of Medical Sciences in Isfahan, Iran. This city with a population of approximately 2,100,000 is located in central Iran. To provide health services for the prevention and control of CNCDs, with priority of T2DM, health clinics were established in different parts of the city. For training the health professionals working in these clinics, educational materials were prepared by experts. The personnel of each clinic comprised of a general practitioner, a nurse, a dietitcian, a psychologist, a physical education expert, and an expert on medical records. Except for the physician and nurse, the other staff worked every other day in each clinic. A laboratory with standard equipment was established in each clinic; all laboratories were under the quality control of the Provincial Central Laboratory, which met the standards of the National Reference Laboratory, a WHO collaborating center in Tehran.

Through public–private partnership, and the help of health charities, the number of health clinics in Isfahan has actually reached to seven public, eight private, and five charity ones. Similar services are provided in all clinics.

This survey was conducted from March 2010 (beginning of Iranian New Year), and the current article presents data obtained until November 2011.

The general population aged 30 years and above was invited to the health clinics by public announcement.

Data collection

The Ethics Committee and the Advisory Board of the Provincial Health Office approved the study. Our team obtained a written informed consent from all the participants.

Strict training modules were designed and used to train interviewers and other staff. A quality assurance program was implemented to ensure the quality of data collection and laboratory examinations.

A questionnaire consisting of demographic characteristics, family history, and past medical history (including history of abortion, stillbirth,

previous child with birth weight more than 4 kg, gestational diabetic mellitus for women) was completed.

A trained team conducted the physical examination under standard protocol by using calibrated instruments. Height and weight were measured to ± 0.2cm and ± 0.2kg, respectively, with subjects being barefoot and lightly dressed. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Waist circumference (WC) was measured with a non-elastic tape at a point midway between the lower border of the rib cage and the iliac crest at the end of normal expiration. Hip circumference (HiC) was measured at the widest part of the hip at the level of the greater trochanter to the nearest half-centimeter. Next, the waist-to-hip ratio (WHR) was computed by dividing the WC by the HiC.

Blood pressure (BP) was measured using mercury sphygmomanometers after five minutes of rest, in the sitting position. The subjects were seated with the heart, cuff, and zero-indicator on the manometer at the level of the observer's eye.

Trained laboratory technicians obtained fasting (12 hours) venous blood samples, which were centrifuged for 10 minutes at 3000 rpm, within 30 minutes of venipuncture. Fasting plasma glucose (FPG) was measured by the glucose oxidase/peroxidase-4-aminophenazone-phenol (GOD-PAP) method;[17] lipid profile, blood urea nitrogen (BUN), and creatinine were measured by auto-analyzers. Uniform testing kits (Pars Azmoun Company, Iran) were used to test all blood samples.

Definition of risk factors

The classification of diabetes was considered according to the criteria of the American Diabetes Association (ADA), in 2009,[18] that is, diabetes (FPG ≥ 126 mg/dL), impaired fasting glucose (FPG = 100-125 mg/dL), and normal (FPG ≤ 100 mg/dL). A person was considered to be overweight when the BMI was between 25.0 kg/m^2 and 29.9 kg/m^2 and he/she was considered obese when the BMI was at least 3.0 kg/m^2.[19] High blood pressure was defined as a systolic and/or diastolic blood pressure equal to or more than 140 and 90 mmHg, respectively. Hypercholesterolemia was defined as plasma cholesterol levels above 200 mg/dl. Participants were categorized to be with hypertriglyceridemia when their triglyceride plasma levels were more than 150 mg/dl. Low-density, lipoprotein cholesterol (LDL) levels above 130 mg/dL were considered as high, while high-density lipoprotein cholesterol (HDL) more than 50 mg/dL and 40 mg/dL were considered to be low in women and men, respectively. Renal impairment was defined as a blood creatinine level of ≥ 1.2 in women and ≥ 1.4 in men. The metabolic syndrome was defined in accordance with the National Cholesterol Education Program Adult Treatment Program III (NCEP ATP III).[20,21]

Statistical analysis

Data were analyzed by the SPSS statistical software version 11.5 (SPSS Inc., Chicago, IL, USA). A *P*-value of less than 0.05 was considered as statistically significant.

RESULTS

A total of 198,972 participants were screened. The mean age of the participants was 47.8 years (48.5 men, 47.3 women), with a range of one to 95 years and a standard deviation of 12.3 years (12.7 men, 12.1 women).

In terms of hypertension, 19% of the total screened individuals were known cases of hypertension, and 20% of the screened population were found to have high blood pressure. They were not aware of this condition [Table 1].

The results of the diabetes screening tests are categorized as normal, known case, new disease, and predisposed, one who has at least one risk factor [Table 2].

The frequency of various risk factors in individuals predisposed to diabetes is presented in Table 3.

The frequency of some generally known risk factors associated with diabetes mellitus is presented in Table 4.

Table 1: Prevalence of high blood pressure

	Men n (%)	Women n (%)	Total n (%)
Normal	27815 (57)	50787 (64)	78602 (61)
Known case	7737 (16)	16670 (21)	24407 (19)
New disease	13412 (27)	12421 (15)	25833 (20)
Total	48964 (100)	79878 (100)	128842 (100)

DISCUSSION

In this large study, we found alarming prevalence rates of dysglycemia and other risk factors of CNCDs. This study, which to the best of our knowledge, is the first of its kind in the low- and middle-income countries, provides evidence-based data on the importance of mass screening for identifying the 'at-risk' population. These findings may serve as up-to-date data on the necessity of orienting health systems in developing countries, to help in the prevention and early control of modifiable factors related to the clustering of risk factors. This is of special concern to the Middle Eastern countries. This may be accounted for by the rapid epidemiological, demographic, and nutritional transition in the Iranian community.

Diabetes has become a global concern. Many studies in different countries have estimated the prevalence of this disease. Most of them, like our study, have reported an excess of the previous estimation; the prevalence of diabetes in adults worldwide is estimated to rise from 4.0% in 1995 to 5.4% by 2025, with more than 75% of people with diabetes living in developing countries.[22]

In the United States, between 1992 and 2002, 9.3 % of the people suffered from diabetes (2.8% of them was undiagnosed), while 26% had impaired fasting glucose (IFG).[23] A similar study conducted in Australia on 11,247 participants aged ≥ 25 years resulted in 7.4% and an additional 16.4% having IFG.[24] A study on 5,844 Koreans, made an estimate of 7.6%, of whom 3.3% were newly diagnosed people.[25] A large study in China reported a prevalence of 5.2 and 5.8% among men and women, respectively.[26] In our study, the prevalence of diabetes was seen more in women as well. Maybe it was due to the different lifestyles led by men and women, with less physical activity in women, who were working indoors most of the time. Moreover, 16% of the women versus 12% of the men were obese, which might justify the higher prevalence of diabetes among women.

As King *et al*. predicted, diabetes in developing countries is much higher than in the developed countries.[22] The highest is reported in India with 12.1 and 14% for diabetes and IGF, respectively.[27] A study in Turkey showed a similar prevalence of 11% for diabetes in individuals aged above 35 years, in both genders.[28] Furthermore, a high rate of diabetes is reported in the neighboring countries of Oman and Bahrain.[29,30] Our findings are consistent with other studies in developing countries.

Diabetes occurs at a high rate among Iranians.

Table 2: Prevalence of dysglycemia

	Men n (%)	Women n (%)	Total n (%)
Normal	12924 (17)	5696 (5)	18620 (10)
Known case	8492 (11)	14233 (13)	22725 (12)
New disease	2153 (2)	1269 (2)	3422 (2)
Predisposed	52292 (70)	86111 (80)	138410 (76)
Total	75861 (100)	107309 (100)	183177 (100)

Table 3: Frequency of risk factors in individuals predisposed to diabetes

	Men (n = 42593) n (%)	Women (n = 62015) n (%)	Total (n = 104572) n (%)
Impaired fasting blood glucose	9202 (22)	13442 (22)	22644 (22)
Hypercholesterolemia	9784 (23)	16760 (27)	26508 (25)
Hypertriglyceridemia	14980(35)	17972 (29)	32952 (31)
Kidney dysfunction	14 (0.03)	5 (0.008)	19 (0.01)
Metabolic syndrome	8613 (20)	12619 (20)	21232 (20)
Gestational diabetes mellitus	-	1217 (2)	1217 (1)

Table 4: The frequency of some risk factors associated with diabetes mellitus

	Men (n = 50178) n (%)	Women (n = 85628) n (%)	Total (n = 135806) n (%)
Smoking	11400 (23%)	853 (1%)	12253 (9%)
Family history of diabetes	20048 (40%)	35689 (42%)	55737 (41%)
History of abortion or neonate ≥ 4 kg	-	20695 (24%)	20695 (15%)
Overweight	12673 (25%)	14402 (17%)	27075 (20%)
Obesity	6057 (12%)	13989 (16%)	20046 (15%)

In accordance with the preliminary report of the National Diabetes Prevention Program that began in 1996, the prevalence of diabetes was reported to be 3.6% (4.3% in women and 2.6% in men) in the general population of Iranians, aged 30 years and above.[31] A cross-sectional study on the over 20-year-old population, in Central Iran, in 2007, showed that 5.4% of the men and 7.1% of the women had diabetes.[32] A nationwide survey on 70,981 Iranians, aged 25 to 64 years, reported the prevalence of diabetes as being 7.7%, with a higher prevalence in women than in men (8.3 vs. 7.3%, respectively) and about half of them were undiagnosed.[33] In 2007, the prevalence of Iranian diabetic patients rose to 8.7% (9.2% in women and 7.5% in men).[16] We acknowledge that our results were based on voluntary referral of individuals to our health centers, whereas, the aforementioned studies were randomly selected from the population.

In our survey, the newly diagnosed patients with diabetes had a higher prevalence of obesity, dyslipidemia, and hypertension. These problems were more common in women and participants of older age. Our findings were consistent with a study in the North-East of Iran, in which some sociodemographic factors like urbanization and increasing age of population were associated with a higher prevalence of diabetes.[34] Some other studies found the association of diabetes with some traditional cardiovascular risk factors including age, obesity, lipid disorders, high blood pressure, prior family history, and smoking.[27,35-38] Among these risk factors, lipid disorders especially low HDL cholesterol and high triglycerides were more prevalent,[38] which increased cardiovascular diseases in these patients.[39]

In our survey, 31% (35% men, 29% women) of the participants had hypertriglyceridemia; the corresponding figure was 25% (23% men, 27 % women) for hypercholesterolemia. These findings were lower than the prevalence reported in the Taiwanese and Turkish populations. In a study conducted among 2695 individuals in a medical center in Taiwan, the prevalence of hypercholesterolemia was 53.3% in men and 48.2% in women. Likewise, hypertriglyceridemia was found in 29.3% of the men and 13.7% of the women.[39] In a study on 4089 Turkish adults, 37.5% had high cholesterol and 30.4% had high triglycerides, with a predominance of men over women.[40]

Among hypertensive persons, 51% were unaware of their condition. These findings were more than in some other reports. Sonkodi *et al*. found, in the working population in Hungary, that 22.6% of the participants had hypertension and 40% of them were new cases.[41] Erem *et al*., reported a higher prevalence in their study among Turkish adults with the number at 44.0% (46.1% in women and 41.6% in men), and only 41% of them were aware of their disease.[42] In the National Health Survey of Mexico, in 2000, the prevalence of hypertension was 30.05% (34.2% in men and 26.3% in women, which increased to 30.2% in 2004).[44]

In our survey, 21% of women and only 16% of men stated having prior blood pressure. After measuring, however, new hypertensive cases were discovered in 27% of the men and 15% of the women. Furthermore, 64% of women versus 57% of men had normal blood pressure. It might be because women's further attention to their health draws them to medical care center more frequently than men.

The prevalence of the metabolic syndrome is considerably high among diabetic patients, for instance, in a study in Spain, the metabolic syndrome was documented in 71.5% of 1259 diabetic patients.[45] Moreover, the metabolic syndrome increased the risk of developing T2DM and cardiovascular diseases.[46,47]

We found that 20% of our study participants fulfilled the criteria of the metabolic syndrome. This prevalence increased with age and had no significant difference in terms of gender. The metabolic syndrome is highly prevalent in industrialized[48,49] and developing countries.[50,51] As the lifestyle change is still a matter of utmost importance in the incidence of diabetes and other CNCDs,[52] we suggest that in the low- and middle income countries, preventive educational and screening programs should be intensified.

CONCLUSION

The high prevalence of dysglycemia and diabetes in our survey may serve as confirmatory evidence of the importance of mass screening and

early diagnosis of CNCDs' risk factors. Our model of establishing health clinics, as a comprehensive referral system, in the routine primary health care, can be adopted by Middle Eastern countries, where CNCDs, notably diabetes, are emerging health problems.

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