Annals of Global Health
© 2015 The Authors. Published by Elsevier Inc.
on behalf of Icahn School of Medicine at Mount Sinai

VOL. 81, NO. 6, 2015
ISSN 2214-9996
http://dx.doi.org/10.1016/j.aogh.2015.10.003

REVIEW

Diabetes Care in Iran: Where We Stand and Where We Are Headed

Sina Noshad, MD, MPH, Mohsen Afarideh, MD, MPH, Behnam Heidari, MD, MPH, Jeffrey I. Mechanick, MD, FACP, FACE, FACN, Alireza Esteghamati, MD

Tehran, Iran, and New York, NY

Abstract

BACKGROUND The prevalence of diabetes has steadily increased in Iran from the time of the first published nationally representative survey in 1999 and despite efforts and strategies to reduce disease burden.

OBJECTIVES The aim of the present review was to describe the current status of diabetes care in Iran.

METHODS A selective review of the relevant literature, focusing on properly conducted studies, describing past and present diabetes care strategies, policies, and outcomes in Iran was performed.

FINDINGS The quality of diabetes care has gradually improved as suggested by a reduction in the proportion of undiagnosed patients and an increase in affordability of diabetes medications. The National Program for Prevention and Control of Diabetes has proven successful at identifying high-risk individuals, particularly in rural and remote-access areas. Unfortunately, the rising tide of diabetes is outpacing these efforts by a considerable margin.

CONCLUSIONS Substantial opportunities and challenges in the areas of prevention, diagnosis, and management of diabetes exist in Iran that need to be addressed to further improve the quality of care and clinical outcomes.

KEY WORDS diabetes, diabetes epidemiology, health care policies, Iran, population surveillance, quality of care, type 2 diabetes

INTRODUCTION

Over the past 4 decades, the prevalence pattern of various diseases and their respective causes of death have significantly changed in Iran. A developing country, Iran is located in a predominantly flat terrain with a mostly subtropical climate throughout the year. Iran has undergone a rapid rise in urbanization and industrialization that is in line with drastic cultural and socioeconomic transitions over the past few decades. This rapid transition has been accompanied by changes in nutritional habits and physical activity, whereby sedentary lifestyles and frequent consumption of fast foods have grown into a major part of daily habitual behaviors.[1,2] At present, Iran's population is young:

The authors have no conflicts of interest to declare.
From the Endocrinology and Metabolism Research Center, Vali-Asr Hospital, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran (SN, MA, BH, AE); Division of Endocrinology, Diabetes, and Bone Disease, Icahn School of Medicine at Mount Sinai, New York, New York (JIM). Address correspondence to A.E. (esteghamati@tums.ac.ir).

Annals of Global Health, VOL. 81, NO. 6, 2015
November–December 2015: 839–850

Individuals under the age of 35 years make up about 64% of the population.[3] However, increased life expectancy, coupled with decreased birth rates, are transforming the population pyramid and graying of the population.[4] As a result of these lifestyle and demographic changes, noncommunicable diseases (NCDs), such as cardiovascular disease, cancer, motor vehicle injuries, and diabetes are the main causes of morbidity and mortality.[5-7] Diabetes is a major public health concern in Iran given its high prevalence rate, increasing incidence rate, and overall economic burden.[8] The International Diabetes Federation Atlas for Diabetes shows that the Middle East and North Africa region of the world has the highest prevalence of diabetes and is ranked second worldwide in terms of projections of diabetes increase by 2030.[9]

Reports on the quality of care in diabetes from developing countries are not widely available. For instance, in the United States, under the Catalyst to Better Diabetes Care Act of 2009, the Centers for Disease Control and Prevention is required to publish a biannual "Diabetes Report Card."[10] But in Iran, there are significant knowledge gaps with respect to key indicators of diabetes control, making the presentation of a nationwide picture of diabetes care an unattainable goal, at least for now. With that said, this review will briefly depict the current status of diabetes care in Iran using the available resources and published literature. In lieu of conducting an exhaustive systematic review of the articles published, more recent, properly performed, and representative studies in the area of diabetes care in Iran are selected. These references and the interpretations that follow may provide useful insights into the problem at hand, namely depicting a realistic image of the current status of diabetes care with a focus on epidemiology and control, prevention, and policies in place to reduce the burden of disease.

EPIDEMIOLOGY OF DIABETES AND ITS COMPLICATIONS

Prevalence and Incidence. In a national survey conducted in 2011, 11.4% (95% confidence interval, 9.86-12.89) of Iranian adults aged 25 to 70 years had diabetes (defined here as type 1 [T1D] and type 2 [T2D] combined; also defined as fasting plasma glucose concentrations ≥126 mg/dL).[11] At present, data describing specific prevalence rates of T1D and T2D, or all forms of prediabetes are not available. In about one-fourth of the population with diabetes (specifically, 2.71% of the adult population), individuals were not previously diagnosed with diabetes and were unaware of their status. The prevalence of diabetes was higher in women (12.86%) than in men (9.90%), and in urban (12.69%) than in rural (7.62%) residents. Furthermore, trend analyses showed that there was a 35% increase in the diabetes prevalence rate among Iranian adults from 2005 to 2011.[11] The prevalence of one form of prediabetes—impaired fasting glucose (fasting plasma glucose concentrations 100-125 mg/dL)—was considerably high (14.60%).[11] Although no nationwide report on the prevalence of another form of prediabetes—impaired glucose tolerance—is available, a 2008 study conducted in Tehran (the capital city of Iran) estimated the prevalence of isolated impaired glucose tolerance among adults aged 20 years and older to be 5.4% and 7.6% in men and women, respectively.[12] The incidence rate of diabetes in Iranian population is assessed in other studies with an annual incidence rate estimated to be about 1% of the total population.[13-22]

Significant knowledge gaps with respect to the prevalence of diabetes complications exist. Most published studies in this venue are clinic-based samples of small sizes and often are confined to a single region so nationally representative estimates are not available.[23] Cardiovascular diseases are regarded as the main cause of morbidity and mortality in patients with diabetes.[24] Results from one study demonstrated that the incidence rates of cardiovascular and coronary heart diseases are about 25 and 23 per 1000 person-years, respectively.[25] The data on the prevalence of diabetic foot among patients with diabetes is also scarce.[26,27] In one study, the prevalence of diabetic foot amputation was 0.7% among 4150 patients with T2D.[23] Among Iranian patients with diabetes, the prevalence of diabetic retinopathy is about 30% to 40%[28-30] and diabetic nephropathy about 16% to 87%.[27,31-33] Among patients with T2D, the prevalence of microalbuminuria (25.9%) is estimated to be higher than macroalbuminuria (14.5%).[29] A retrospective cohort of 1000 patients with T2D demonstrated that over a period of 10 years, 10.9% developed peripheral neuropathy.[34] The 10-year incidence rates for diabetic foot ulcer, diabetic nephropathy, and ophthalmologic complications including retinopathy were 8%, 4.6%, and 9.1%, respectively.[34] Selected studies on the prevalence of diabetes complications are summarized in Table 1.

Burden and Costs. Diabetes is a leading cause of mortality and high economic costs in Iran. The

Table 1. Select Studies on Prevalence of Micro- and Macrovascular Complications in Iranian Patients with Diabetes*

	Year	Complication	Sample Size (n)	Prevalence (%)	Region
		Macrovascular			
Faghih-Imani et al.[35]	2004	Myocardial infarction	500	6.3	Isfahan
Janghorbani et al.[36]	2001–2004	Coronary heart disease	1566	28	Isfahan
Alavi et al.[26]	2007	Diabetic foot	247	4	Kerman
		Microvascular			
Javadi et al.[28]	2007	Retinopathy	634	37	Tehran
Sobhani et al.[33*]	2014	Peripheral neuropathy	5540	53	Multicenter
Manaviat et al.[29]	2000–2001	Microalbuminuria	553	25.9	Yazd
		Macroalbuminuria		14.5	

* Meta-analysis of 21 studies.

population attributable fraction of death due to diabetes (ie, the proportional reduction in mortality that would occur if, under a hypothetical scenario, diabetes was eliminated) is estimated to be 17.3% and 17.8% in men and women, respectively.[25] Iranian patients with T2D die about 7 to 10 years sooner than those without diabetes.[37]

Several studies have evaluated health-related quality of life (HRQoL) among Iranian patients with diabetes.[38,39] A recent systematic review of 46 studies conducted in 20 of 31 provinces of Iran[38] demonstrated significantly worse HRQoL in patients with diabetes. Determinants of HRQoL were similar to those identified in the other countries. Among Iranian patients with diabetes, the presence of diabetes-related complications, greater age, female gender, lower socioeconomic status, being unmarried, higher hemoglobin A1c (A1C) levels, higher blood pressure, higher lipid levels, and greater diabetes duration are associated with poorer HRQoL.[38]

A study conducted with Iranian patients in 2009 found that total costs associated with T2D amounted to approximately US$3.78 billion annually.[40] This included $2.05 billion in direct and about $1.73 billion in indirect costs.[40] Direct costs of T2D were estimated to be about 8.7% of the total health expenditure in Iran.[40] Moreover, management of diabetes complications comprises the largest share of direct costs.[8] It has been concluded that the direct and indirect annual health care costs for an Iranian patient with diabetes is about 2.5 times higher than a healthy Iranian citizen.[8]

PRESENT STATUS OF DIABETES CARE

There are 3 discrete yet interconnected and concurrent goals in controlling diabetes in Iran:

1. Reducing blood glucose to the recommended targets through lifestyle and pharmacotherapy;
2. Assessment and reduction of related cardiometabolic risk factors (eg, overweight/obesity, hypertension, and dyslipidemia); and
3. Scheduled regular screening for micro- and macrovascular complications with prompt management of incident cases.

By examining the current status of goal-directed intervention, diabetes care in Iran can be characterized. Unfortunately, only a few studies to date have adequately explored this strategy and discrete tactics, and besides, the key representative surveys with findings generalizable to the population at a national level remain sparse. As a result, the current understanding of the quality of care is incomplete, although the inclusion of previously unpublished data of the fourth round of the SuRFNCD (Surveillance of Noncommunicable Diseases) can at least in part address this shortcoming. Inaugurated in 2005, SuRFNCD is a periodical, nationally representative survey of risk factors of NCDs, including prediabetes and diabetes. The survey adopts the framework laid out by the World Health Organization's STEPS (Step-wise approach to Surveillance). Although much more compendious, SuRFNCD can be compared in methodology and scope to the US NHANES (National Health and Nutrition Examination Survey). In the latest round of the survey conducted in 2011 (SuRFNCD-2011), A1C was measured in a randomly chosen proportion of the sample allowing evaluation of glycemic control status for the first time on this large scale.[11]

The findings from the nationwide SuRFNCD survey and also large community and clinic-based cohorts are presented in Table 2. As shown, the percentage of patients reaching treatment targets for hyperglycemia, hyperlipidemia, and hypertension

Annals of Global Health, VOL. 81, NO. 6, 2015
November–December 2015: 839–850

Table 2. Percentage of Patients with Diabetes Achieving Target Levels of A1C, HDL, and LDL Cholesterol, Triglycerides, and Blood Pressure

	Target	SuRFNCD-2011*	Mashhad†	TLGS‡
A1C	<7.0%	56.7	25.0	n/a
HDL cholesterol	>40 mg/dL in men	36.9	13.1	50.45 M
	>50 mg/dL in women			37.50 F
LDL cholesterol	<100 mg/dL	39.9	n/a	40.36 M
				36.32 F
Triglycerides	<150 mg/dL	37.2	36.9	49.40 M
				41.93 F
Systolic blood pressure	<130 mm Hg	46.8	n/a	n/a
Diastolic blood pressure	<80 mm Hg	49.6	n/a	n/a
Hypertension control	Systolic blood pressure <130 mm Hg	33.7	21.0	37.36 M
	Diastolic blood pressure <80 mm Hg			40.43 F

SuRFNCD, Surveillance of Risk Factors of Non-Communicable Diseases; TLGS, Tehran Lipid and Glucose Study; A1C, hemoglobin A1c; HDL, high-density lipoprotein; LDL, low-density lipoprotein; n/a, not available

* Data from SurFNCD-2011, Center for Disease Control of Iran. Targets were defined based on the latest revision of Iran's National Diabetes Program. Data comprised of 865 patients with diabetes across urban and rural counties of the country.

† From a clinic-based sample of 752 patients with diabetes from Mashhad (the most populated city in the country, after Tehran).[41]

‡ From a community-based sample of 710 patients with diabetes from Tehran (the capital of Iran).[42] Figures are reported separately for males and females as presented in the original manuscript. Herein, data from the latest follow-up round of the cohort (Phase 4, 2008-2011) are reported.

are comparable between SuRFNCD and the TLGS (Tehran Lipid and Glucose Study) cohort.[42] On the other hand, in the clinic-based sample of Mashhad (the second most populous city in Iran and a provincial capital), lower proportions of patients with diabetes achieved treatment targets, which could be attributed to the longer duration of diabetes (27.7% with durations >10 years) in this patient group.[41] Based on the SuRFNCD-2011 results, in nearly half of the patients with diabetes, the target A1C is not achieved (unpublished data). For hyperlipidemia and hypertension, rates of achieving treatment targets are lower and around 30% to 40%. The TLGS cohort also reported the trends in prevalence of medication use among patients with diabetes. Over a follow-up period of more than a decade (1999-2011), use of antihyperglycemic medications has nearly doubled (from 33.4% to 60.5%).[42] The use of antihyperlipidemic (from 10.2% to 30.3%) and antihypertensive medications (from 26.6% to 37.1%) also substantially increased.[42]

Medication adherence is affected by numerous factors relating to the patient, physician, and health care system and is an essential part of reaching treatment goals in patients with diabetes.[43,44] At the patient level, medication nonadherence appears to be a major obstacle. A systematic review of studies investigating diabetes and cardiovascular medications reported adherence rates of 63% to 86% and 39% to 60% for oral hypoglycemic medications and cardiovascular medications, respectively.[45] Common reasons for nonadherence, as reported by the patients, are forgetfulness and concerns about adverse effects.[45] These negative factors may dominate the beliefs and attitudes of Iranian patients toward diabetes medications despite high levels of education, positive beliefs about medication efficacy, and greater knowledge about the disease process.[45] Among Iranian patients with diabetes, poor adherence with a prescribed insulin regimen is a frequent theme. In a study of 400 patients with T2D, 77% reported unwillingness to insulin therapy.[46] In this study, the most common self-reported reasons for insulin refusals or adherence issues were "fear of injection," "hardship from insulin injection," and "high cost of insulin therapy."[46]

Access to medications in Iran appears to be high; essential medications are readily accessible and are covered by insurance.[47,48] At present, insulin pens manufactured by international pharmaceutical companies are imported and are widely available with the Iran Health Insurance Organization reimbursing 90% of the costs. If these reimbursements were not in place, given the plummeted value of the Rial against US dollar over the past decade, the out-of-pocket expenditures related to insulin therapy would have skyrocketed, rendering this option unaffordable for the vast majority of Iranian patients. A 2010 randomized controlled trial in Iran revealed that use of pen-prepared insulin analogs even in patients switching from isophane plus regular insulin regimens is associated with improved glycemic control in terms of A1C reduction, lower rates of hypoglycemic episodes, and improved

QoL.[49] Yet it wasn't until October 2013 that state subsidized reimbursement of insulin pens came into effect in Iran. Nevertheless, commercially available newer generation antihyperglycemic medications (eg, glucagon-like peptide-1 receptor agonists) that are incorporated into diabetes management clinical practice guidelines are still not covered by insurance. The high cost of these medications, despite their accessibility, further limits the physician's armamentarium for diabetes management.

Another issue related to the health care system is the tremendous mismatch between supply and demand for endocrinology care. A report by the president of the Iran Endocrine Society indicated that in 2008, there were 146 registered endocrinologists treating adults in Iran.[50] The report suggested that assuming one endocrinologist is needed per hospital unit with more than 100 beds, the country would need at least 700 endocrinologists just to provide adequate inpatient and outpatient hospital care.[50] However, there were only 20 endocrinologists trained annually by the 7 accredited programs across the country.[50] This translated into a projection of 226 practicing endocrinologists by 2011, provided no one had left practice. But, based on the most recent published prevalence rate of diabetes in 2011 (4.52 million adults with diabetes),[11] there were approximately 20,000 patients with diabetes per endocrinologist. This simplistic computation most likely represents an underestimation of the current situation because a proportion of endocrinologists solely perform research and/or administrative work, some only practice part time, and many clinical endocrinologists have in fact retired or otherwise left practice. Although the endocrinology care supply–demand mismatch is not unique to Iran, the extent of the problem is still quite profound.

To provide a comparative perspective, in 2015, on the supply side, there are 6872 board-certified endocrinologists in the United States.[51] Considering the approximately 29.1 million patients with diabetes in the United States,[52] the patient-to-endocrinologist ratio would be 4235:1; about 5 times lower than the 20,000 estimate for Iran. The implications of this mismatch on diabetes care are deeply rooted. Private practices and hospital endocrinology and diabetes clinics often are overcrowded or stretched to capacity leading to prolonged waiting times,[53] and reduced face-to-face patient–physician communication time. The limited time available to each patient often translates into a simple laboratory test–prescription exchange and leaves unaddressed many humanistic aspects related to effective care for diabetes (eg, patient education, individualized treatment, provision of diabetes self-management, and collaborative communication with other subspecialties for prevention and management of complications). The paucity of subspecialty diabetes care places a substantial burden on primary care physicians (PCPs) and general internal medicine specialists. Diabetes care has become increasingly complex, and nonendocrinologists often find it difficult to keep up with the fast-paced advances and changes in clinical care and guidelines. Although no study to date has comparatively evaluated the quality of diabetes management by endocrinologists versus PCPs or internists in Iran, evidence elsewhere suggests that improved treatment outcomes result when care is offered or provisioned by endocrinologists.[54-56]

The issue of "clinical inertia," that is, reluctance, refrain, or delay in stepwise intensification of diabetes treatment despite poor glycemic control,[57] appears to be prevalent in primary care settings.[58] Clinical inertia of the physician along with unwillingness to undergo insulin therapy by the patient leads to underutilization of insulin for patients with diabetes. A time-series analysis of diabetes medication utilization in Iran between 2000 and 2012 demonstrated that although overall utilization of diabetes medications has increased by about 7-fold over the period, the share of insulin has remained relatively constant, comprising 17% of the total diabetes medication utilization.[48] This rate is significantly lower than in many developed countries where the share of insulin surpasses 30% to 40% of total diabetes medication use.[48] A survey of 69 Iranian PCPs, specialists, and subspecialists other than endocrinology involved in the care of diabetes demonstrated that knowledge, attitude, and practice of physicians were unsatisfactory.[59] Only 36.2% of the surveyed physicians had satisfactory practice scores in terms of diabetes complications prevention.[59] Surprisingly, practice skill sets showed a declining propensity with the years of internal medicine specialty training.[59] In another study of Iranian PCPs, the most common educational resources used for diabetes educations were domestic journals, reference texts, and congress proceedings, in descending order.[60] Of note, only 62% of the physicians used any of the listed sources to gain knowledge and even in this subset, increased knowledge did not change clinical behavior.[60] Furthermore, very few (5%) Iranian PCPs cited their peers as a source for getting information about state-of-the-art diabetes care.[60] These findings expose problems with the knowledge base, attitudes,

Annals of Global Health, VOL. 81, NO. 6, 2015
November–December 2015: 839–850

and behaviors of PCPs, while also highlighting the absence of sustained communication between diabetes experts and PCPs for transmitting firsthand clinical knowledge and expertise of diabetes management in Iran.[61] This is in sharp contrast to infrastructures elsewhere in which subspecialists provide high-quality education for generalists.

The American Diabetes Association currently recommends that A1C measurements be conducted at least semiannually in patients with adequate glycemic control and quarterly for those not meeting glycemic targets and for whom the therapeutic regimen has changed.[62] In a follow-up study conducted alongside the first SuRFNCD in 2005 (SuRFNCD-2005), known patients with diabetes and other family members with diabetes in the same household were interviewed.[63] The findings showed that only 6.3% of the sample had an A1C measurement over the past year. The rates for lipid measurements, eye examination, and foot examination performed at least once in the preceding year were only 24.6%, 39.80%, and 17.3%, respectively.[63]

POLICIES AND PROGRAMS FOR DIABETES CARE MANAGEMENT AND PREVENTION

Background. In line with earnest global efforts to reduce the burden of diabetes, the World Health Organization (WHO) advocates national preventative and control enterprises of NCDs by its attending members.[64] The National Committee for Diabetes, a subdivision of Iran's Ministry of Health, issued the development of necessary policies and programs for the prevention and control of diabetes, based on a series of studies that independently confirmed the alarming prevalence rates of diabetes and prediabetes across the country. The historical timeline of a consolidated diabetes preventive action commenced with a 1992 government initiative in selected regions of the country. However, some major errors (including a nonstandard method of screening, high costs of screening and surveillance for each patient, lack of adequate equipment in the health network system to implement the program, and underestimated prevalence of diabetes in the rural areas) hindered the extrapolation of the survey results to the general population of Iran. This led to a premature ending of the program in 1993.[65] The official pilot phase of the National Program for Prevention and Control of Diabetes (NPPCD) originally ran from 1999 to 2001 under the supervision of 17 major medical universities across the country. The target population for the pilot screening and program implementation primarily included individuals >30 years of age, as well as pregnant women.[66-68] However, concrete efforts to establish a comprehensive national diabetes program did not materialize until 2004, when merging the Iranian Primary Health Care (IPHC) system into the body of the NPCCD generated the first systematic evaluation of the target population (NPPCD-2004).[67,69] The integrated IPHC-NPPCD-2004 involved primary health care workers known as *Behvarz* in rural settings. The main objectives were to actively detect and screen the pregnant and at-risk rural population aged >30 years.[65,66] However, collaboration difficulties between health and treatment operational deputies in NPPCD-2004 led to malfunctioning referral units due to an ambiguous follow-up criteria and to problems with timely control of complications.[65] Provisional arrangements to address shortcomings in the rural phase culminated in the development of the revised program: 2 urban phases of NPPCD-2010 initially screening the inhabitants in 6 major metropolitan areas with a population of >1 million (phase I, incorporating 7 provincial medical universities). By the end of the phase II in 2012, a population of just over 20 million was covered by 16 provincial faculties participating in the national diabetes program. A major methodological difference from NPPCD-2004 (rural) to NPPCD-2010 (urban) was the passive and opportunistic screening of high-risk individuals in the latter. Additionally, introduction of the referral feedback loop from academic specialized centers back to the lowest levels of IPHC helped maintain the continuum of care for patients with prediabetes and diabetes in NPPCD-2010. The graphical representation of 3 levels of NPPCD-2010 urban specialized care program is schematically illustrated in Figure 1. Enrolled patients from NPPCD-2010 have since undergone annual assessments of micro- and macrovascular complication of diabetes.[70]

Missions and Accomplishments. The main objectives and strategies of NPPCD are depicted in Table 3. In the NPPCD series, objectives and strategies were largely consistent with those outlined by the World Diabetes Program in 1989[71] and the WHO Global Action Plan for Prevention and Control of NCDs.[72] However, NPPCD codification of potential private-sector health-promoting and collaborative roles marginalized nonformal sectors and nongovernmental organizations.[73]

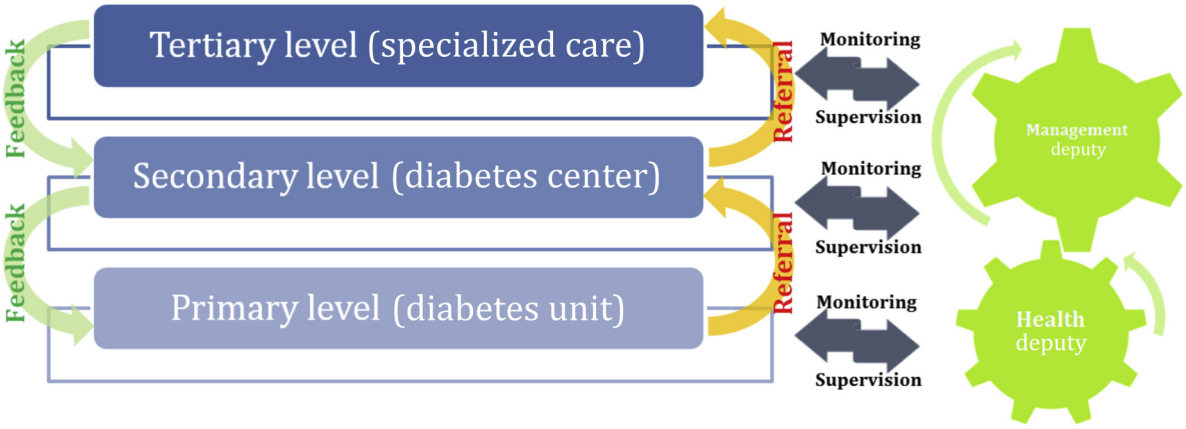

Figure 1. Three levels of diabetes care in the enhanced hierarchical model of the urban phase for the National Program on Prevention and Control of Diabetes (NPPCD-2010). The introduction of feedback loops in cooperation with the collaborating health and management deputies was a major leap forward from the rural phase of the program (NPPCD-2004) to the urban phase (NPPCD-2010), providing sustained and superior care to the diabetes patients in the latter. Primary level (diabetes unit): *family physician, urban health and management center, private clinic*; secondary level (diabetes center): *public/private hospital, specialty polyclinic*; Tertiary level (specialized care): *specialty and subspecialty hospitals*.

Specifically, the ratio of private key stakeholders outside the health system increased in the urban phase, but the public and health care internal stakeholders were the only fiscal agents solicited for their input in the formulation and decision making of the program.

As the results from NPPCD-2004 and NPPCD-2010 attest, treatment of diabetes in Iran has been more effective in rural than urban areas,[74] with IPHC-worker (*Behvarz*) density being associated with lower blood glucose concentrations. As such, integration of IPHC with the rural NPPCD-2004 suggests that IPHC, given the sufficient number of health workers for each district and borough and a program with well-defined guidelines and individual follow-up of patients, can be effective in diabetes management.[75] Better control of T2D in rural regions is noted despite the generally lower socioeconomic status in rural areas. Local health care workers (or Behvarz) with prespecified roles in rural health care houses actively examine rural people by performing monthly follow-up checks of their current diabetes status, keep record of their adherence to medications, and visit their respective PCPs or specialists periodically or if patients display signs of uncontrolled hyperglycemia. Behvarz are trained to follow their patients in designated areas and they are available to assist rural patients.[74]

As of yet, there are very few urban trained community health care professionals engaged in diabetes prevention programs and patients' medication adherence issues, so the supervision of diabetes control is heavily dependent on physicians. Thus, in urban areas, the absence of such rigorous follow-up might be the reason for lower effectiveness of the program, despite seemingly easier access to physicians.[75] Standardization of diabetes care programs, including offering incentives to providers and patients who achieve superior diabetes-related outcomes, are short-term strategies to hone diabetes management in urban areas. Nevertheless, the successful experience of the program in rural areas of the country suggests that the current health care framework should be capable of accommodating the urban phase of NPPCD (NPPCD-2010), particularly in older individuals as part of an overall strategy of screening high-risk individuals.

CONCLUSION

In this review, we discussed the current status of diabetes prevalence, trends, drivers for success and shortcomings, and established policies and programs for diabetes management and prevention in Iran (Table 4). Evidence suggests that the quality of care for diabetes in Iran is improving. The rate of cases with undiagnosed diabetes has dropped nearly 50% over the past decade, decreasing from 45.7% to 24.7% (2005-2011).[11] Accordingly, over a period of 13 years (2000-2012) the use of diabetes

Annals of Global Health, VOL. 81, NO. 6, 2015
November–December 2015: 839–850

Table 3. Levels of Common Strategies, Objectives, and Endpoint Expected Outcomes in the National Program on Prevention and Control of Diabetes (NPPCD)

Common Strategies	Preventive Care Objectives
Both NPPCD-2004 and NPPCD-2010 I. Ensuring the formal support of health decision/policymakers and providing adequate monetary resources. II. Education and notification. III. Active patient detection and early diagnosis of diabetes. IV. Promoting the standard of care for diabetes and prediabetes by determining the minimum acceptable health care standards and allocating required facilities.	Primary Prevention • Reducing the incidence of T2D in patients with prediabetes. ■ Improving the lifestyle of individuals at high risk for diabetes and/or prediabetes. ■ Identifying individuals at high risk for diabetes according to national guidelines. ■ Active surveillance and care of high-risk individuals according to national guidelines. ■ Promotion and/or dissemination of the required level of knowledge for health care system authorities and professionals and other sectors of society regarding diabetes and its predisposing factors; plus how to prevent/control detriments associated with diabetes.
Added in NPPCD-2010 V. Reinforcing the continuity of and functionality of referral system in the care of diabetes and hypertension. VI. Screening and early management of chronic diabetes complications in the population under the coverage of program. VII. Obtaining the support of society in informing and empowering patients with diabetes and hypertension and their families. VIII. Active and timely management of diabetes and hypertension to control/prevent the associated complications and disabilities. IX. Reinforcing intra- and intersectorial coordination in providing desired levels of service to referred patients with diabetes. X. Empowering a diabetes management team at various organizational levels.	Secondary Prevention • Preventing, reducing, and delaying the short- and long-term complications of diabetes ■ Early detection of T2D by screening high-risk individuals and pregnant women using national guidelines. ■ Active surveillance and timely management of identified patients to control and prevent diabetes from progression, using the national guidelines. ■ Increasing the awareness and knowledge of diabetes and its complications, how to control and prevent the complications, and management and the purpose of management in patients with diabetes, their families, their respective health care professionals, and other involved public sectors. ■ Increasing the awareness and knowledge of avoidable/modifiable cardiovascular risk factors and their associated adverse outcomes and how to control and/or prevent these risk factors including, tobacco smoking, high blood pressure, adverse lipid profile, sedentary lifestyle, and obesity in affected patients with diabetes, their families, and respective health care professionals.
XI. Reinforcing the surveillance, monitoring, and evaluation systems in the care of diabetes and hypertension. XII. Supporting the translation of conducted research to applicable practice guidelines. XIII. Developing reference laboratories for qualitative control of program-related tests. XIV. Providing medications, equipment, and materials required for the proper control, monitoring, and self-monitoring of diabetes. XV. Endorsing international contributions for the sustainable implementation of the program.	Tertiary Prevention • Reducing and delaying the incidence of disabilities, handicaps, and premature deaths due to diabetes complications and reducing the years of life lost in the population with diabetes. ■ Screening of patients with T2D for early and timely detection of macro- and microvascular (nephropathy, retinopathy, neuropathy, and limb amputation) complications in the primary stages according to the national guidelines. ■ Timely management of macro- and microvascular diabetes complications. ■ Prevention and active surveillance of patients according to the national guidelines.
Expected endpoint outcomes • Reducing economic burden due to diabetes and its complications. • Reducing disabilities due to diabetes and its complications. • Reducing premature mortality due to diabetes and its complications. • Improving quality of life and increasing the life span of patients with diabetes.	

T2D, type 2 diabetes

Table 4. Current Status of Diabetes Care in Iran at a Glance

- Diabetes prevalence rate in Iran has been continuously high (11.4% of the adult population in 2011).
- Diabetes prevalence rate in Iran is still rising (35% increase 2005-2011).
- About 50% of patients with diabetes have a poor glycemic control, with the rates for hypertension and dyslipidemia control being even lower, at 30% to 40%.
- There is an enormous mismatch between supply and demand of the endocrinology care.
- Burden of diabetes care in Iran is mainly on the shoulders of general practitioners, internists, and primary care physicians who have a suboptimal understanding of diabetes management.
- Diabetes medication use has sharply increased, yet it remains lower than the standard expected global rate, particularly in the case of insulin
- Lack of proper and adequate packages of insurance coverage for insulin pens before 2013, patient reluctance, and physician inertia toward insulin therapy, are the main reasons for a subpar rate of insulin utilization in Iran.
- In Iran, programs specifically dedicated to the care of people with diabetes have been around since 1990s, however, the first consolidated national program for control and prevention of diabetes came into effect in the year 2004.
- National diabetes program struggles to meet preset urban targets due to low number of urban health care professionals, lack of rigorous follow-up, and high demand for patient-oriented "self-care" to reach the proper glycemic control.
- National Diabetes Program is more effective in diabetes control and prevention among rural community dwellers, largely owing to established roots of the *Behvarz* primary health care program.

medications has increased by 7.5-fold in Iran.[48] Community-based cohorts of patients with diabetes have demonstrated improved rates of achieving treatment targets.[42] Valuable policymaking efforts have contributed to enhancements in diabetes care. The NPPCD has made great strides toward providing care for patients with diabetes and has been particularly successful in rural areas.

Unfortunately, the status quo is far from satisfactory, as it appears that the health care system infrastructure is not wholly prepared for the rising tide of diabetes in Iran. The weighed prevalence of prediabetes, diabetes, and diabetes complications is in an upward trend in Iran. Between 1999 and 2007, the prevalence of diabetes among Iranian adults nearly doubled[48] and trend analysis of later data showed that this pattern has remained uninterrupted.[11] From 2005 to 2011, the prevalence rate of diabetes increased by 35%, totaling to approximately 4.5 million adults with diabetes.[11] Despite tremendous advances in terms of medication use, low utilization of diabetes medications in Iran remains a considerable problem.[48] A figure of $865 as the average per capita indirect cost-of-illness for diabetes corresponds to 19% of the nation's per capita income.[40] Projections for the prevalence and burden of diabetes in the next 15 years are even more dismaying. It is estimated that by the year 2030, 9.2 million Iranian individuals will have diabetes.[76] Accordingly, direct and indirect costs will nearly triple from 2009, surpassing $9 billion in 2030.[76]

Part of the shortcomings in diabetes management and prevention in Iran are understandably pertinent to economic and financial restrictions in developing countries. Inadequate funding to conduct expensive parts of the NPCCD program, unavailability of proper and consistent health insurance coverage for advanced technology diagnostics and therapeutics, disparities in sustained access to therapeutic facilities, and subpar standards of laboratory reporting in rural health care centers are just a small sample of the most important barriers to proper care. Allocation of increased budgeted funds, for example from taxes imposed on carbohydrate-rich products and provision of adequate medical facilities, are among feasible solutions to overcome these challenges.[73] Additionally, the status of diabetes insurance and expenditure reimbursements should be revisited. Limiting the out-of-pocket costs associated with diabetes care via increasing the share of government subsidized insurance premiums especially for the lower-income strata of society is recommended. Finally, the role of media outlets (as the primary routes for increasing public awareness) along with nongovernmental organizations, which disseminate knowledge and provide education to patients with diabetes, should be encouraged. A list of suggestions for improving diabetes care in Iran is presented in Table 5.

In 2010, the rate of insurance coverage in Iran was 84%.[77] With the commencement of the so-called "health-sector evolution" by Iran's Ministry of Health in May 2014, this rate has increased to about 95%.[78] A study of the effects of health insurance patterns on the quality of care suggested that health care systems with universal insurance

Annals of Global Health, VOL. 81, NO. 6, 2015
November–December 2015: 839–850

Table 5. Suggested Solutions for Improving Diabetes Care in Iran

Item	Content
1	Allocate increased budgeted funds for improvement in diabetes care from taxes imposed on carbohydrate-rich products.
2	Assign subsidies to reduce high costs associated with the efficient self-monitoring of patients (eg, glucometer).
3	Offer incentive packages to health insurance companies for supporting the coverage of advanced technology diagnostics and proprietary items (eg, different types of insulin, premium quality syringes).
4	Donate technical support and devices to laboratories that adhere to calibrated and standard measurement and reporting of glycemic indices, particularly in rural remote-access areas.
5	Reduce the corporate tax for domestic companies that produce quality diabetes medications and diagnostics.
6	Facilitate installment plans for companies manufacturing quality products related to care of patients with diabetes.
7	Promote annual events to increase awareness and fiscal support for the nationwide control and preventative diabetes action plan.
8	Enhance diabetes knowledge and awareness through funding necessary materials and modalities (eg, TV programs, pamphlets, booklets).
9	Support and fund nongovernmental organizations that offer education to patients with diabetes.
10	Take advantage of the continuing medical education platform (already in place) to provide state-of-the-art and high-quality education by subspecialists to primary care physicians who care for patients with diabetes, through symposiums, meetings, and workshops.

such as that of the United Kingdom's National Health Service, function better in terms of diabetes care than market-based systems like the US system before the Affordable Care Act (ACA).[79] Furthermore, a recently published study on the effect of the ACA revealed that the expansion of coverage to uninsured people with diabetes is likely to increase their access to medical care and consequently culminate in improved management of diabetes.[80] Similarly, although it is too early to discern clear-cut outcomes, it is anticipated that the universal access model introduced in 2014 in Iran would ultimately benefit patients with diabetes by facilitating insurance reimbursements and making their access to medical care more affordable.

REFERENCES

1. Ghassemi H, Harrison G, Mohammad K. An accelerated nutrition transition in Iran. Public Health Nutr 2002;5:149–55.
2. Esteghamati A, Khalilzadeh O, Rashidi A, Kamgar M, Meysamie A, Abbasi M. Physical activity in Iran: results of the third national surveillance of risk factors of noncommunicable diseases (SuRFNCD-2007). J Phys Activ Health 2011;8:27e35.
3. Statistical Center of Iran. Atlas of Selected Results of the 2011 National Population and Housing Census. 2011. Available at: http://www.amar.org.ir/Portals/1/Iran/Atlas_Census_2011.pdf. Accessed September 12, 2015.
4. Kiani S, Bayanzadeh M, Tavallaee M, et al. The Iranian population is graying: are we ready? Arch Iran Med 2010;13:333–9.
5. Forouzanfar MH, Sepanlou SG, Shahraz S, et al. Evaluating causes of death and morbidity in Iran, global burden of diseases, injuries, and risk factors study 2010. Arch Iran Med 2014;17:304–20.
6. Khosravi A, Taylor R, Naghavi M, et al. Mortality in the Islamic Republic of Iran, 1964–2004. Bull World Health Organ 2007;85:607–14.
7. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006;3:e442.
8. Esteghamati A, Khalilzadeh O, Anvari M, et al. The economic costs of diabetes: a population-based study in Tehran, Iran. Diabetologia 2009;52:1520–7.
9. Whiting DR, Guariguata L, Weil C, et al. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes Res Clin Pract 2011;94:311–21.
10. Centers for Disease Control and Prevention. Diabetes Report Card 2012. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2012.
11. Esteghamati A, Etemad K, Koohpayehzadeh J, et al. Trends in the prevalence of diabetes and impaired fasting glucose in association with obesity in Iran: 2005-2011. Diabetes Res Clin Pract 2014;103:319–27.
12. Hadaegh F, Bozorgmanesh MR, Ghasemi A, et al. High prevalence of undiagnosed diabetes and abnormal glucose tolerance in the Iranian urban population: Tehran Lipid and Glucose

Study. BMC Public Health 2008;8:176.
13. Ramezankhani A, Pournik O, Shahrabi J, et al. Applying decision tree for identification of a low risk population for type 2 diabetes. Tehran Lipid and Glucose Study. Diabetes Res Clin Pract 2014;105:391–8.
14. Talaei M, Sadeghi M, Marshall T, et al. Anthropometric indices predicting incident type 2 diabetes in an Iranian population: the Isfahan Cohort Study. Diabetes Metab 2013;39:424–31.
15. Janghorbani M, Adineh H, Amini M. Finnish Diabetes Risk Score to predict type 2 diabetes in the Isfahan diabetes prevention study. Diabetes Res Clin Pract 2013;102:202–9.
16. Janghorbani M, Amini M. Incidence of type 2 diabetes by HbA1c and OGTT: the Isfahan Diabetes Prevention Study. Acta Diabetol 2012;49(suppl 1):S73–9.
17. Janghorbani M, Amini M. Associations of hip circumference and height with incidence of type 2 diabetes: the Isfahan diabetes prevention study. Acta Diabetol 2012;49(suppl 1):S107–14.
18. Harati H, Hadaegh F, Saadat N, et al. Population-based incidence of Type 2 diabetes and its associated risk factors: results from a six-year cohort study in Iran. BMC Public Health 2009;9:186.
19. Hadaegh F, Ghasemi A, Padyab M, et al. The metabolic syndrome and incident diabetes: Assessment of alternative definitions of the metabolic syndrome in an Iranian urban population. Diabetes Res Clin Pract 2008;80:328–34.
20. Bozorgmanesh M, Hadaegh F, Ghaffari S, et al. A simple risk score effectively predicted type 2 diabetes in Iranian adult population: population-based cohort study. Eur J Public Health 2011;21:554–9.
21. Hadaegh F, Hatami M, Tohidi M, et al. Lipid ratios and appropriate cut off values for prediction of diabetes: a cohort of Iranian men and women. Lipids Health Dis 2010;9:85.
22. Hosseinpanah F, Rambod M, Azizi F. Population attributable risk for diabetes associated with excess weight in Tehranian adults: a population-based cohort study. BMC Public Health 2007;7:328.
23. Amini M, Parvaresh E. Prevalence of macro- and microvascular complications among patients with type 2 diabetes in Iran: a systematic review. Diabetes Res Clin Pract 2009;83:18–25.
24. American Diabetes Association. Cardiovascular disease and risk management. Diabetes Care 2015;38:S49–57.
25. Bozorgmanesh M, Hadaegh F, Sheikholeslami F, et al. Cardiovascular risk and all–cause mortality attributable to diabetes: Tehran lipid and glucose study. J Endocrinol Invest 2012;35:14–20.
26. Alavi, A., Sanjari M., Haghdoost A., Sibbald R. G. "Diabetic foot ulcers in Kerman, Iran: prospective, descriptive review. Wound Repair Regen 2007;15:A47.
27. Khazai MH, Khazai B, Zargaran Z, et al. Diabetic complications and risk factors in recently diagnosed type II diabetes: a case-control study. ARYA Atheroscler 2006;2(2):79–83.
28. Javadi MA, Katibeh M, Rafati N, et al. Prevalence of diabetic retinopathy in Tehran province: a population-based study. BMC Ophthalmol 2009;9:12.
29. Manaviat MR, Afkhami M, Shoja MR. Retinopathy and microalbuminuria in type II diabetic patients. BMC Ophthalmol 2004;4:9.
30. Hosseini R. Prevalence and risk factors of diabetic retinopathy in patients referred to diabetes clinic of Kamkar Hospital in Qom. Qom Univ Med Sci J 2012;5(4):40–6.
31. Habibi Moeini A, Navaei L, Azizi F. Micro-and macrovascular diabetic complications in NIDDM: a population-based, case-control study. Iran Endo Metab J 1999;1:38–47.
32. Janghorbani M, Rezvanian H, Kachooei A, et al. Peripheral neuropathy in type 2 diabetes mellitus in Isfahan, Iran: prevalence and risk factors. Acta Neurol Scand 2006;114:384–91.
33. Sobhani S, Asayesh H, Sharifi F, et al. Prevalence of diabetic peripheral neuropathy in Iran: a systematic review and meta-analysis. J Diabetes Metab Disord 2014;13:97.
34. Farshchi A, Esteghamati A, Sari AA, et al. The cost of diabetes chronic complications among Iranian people with type 2 diabetes mellitus. J Diabetes Metab Disord 2014;13:42.
35. Faghih-Imani E, Amini M, Adibi P. Silent ischemia in type I diabetic patients: a study of EKG changes. ARYA Atheroscler 2010;1.
36. Janghorbani M, Amini M, Tavassoli A. Coronary heart disease in type 2 diabetes mellitus in Isfahan, Iran: prevalence and risk factors. Acta Cardiol 2006;61:13–20.
37. Bozorgmanesh M, Hadaegh F, Sheikholeslami F, et al. Shadow of diabetes over cardiovascular disease: comparative quantification of population-attributable all-cause and cardiovascular mortality. Cardiovasc Diabetol 2012;11:69.
38. Kiadaliri AA, Najafi B, Mirmalek-Sani M. Quality of life in people with diabetes: a systematic review of studies in Iran. J Diabetes Metab Disord 2013;12:54.
39. Javanbakht M, Abolhasani F, Mashayekhi A, et al. Health related quality of life in patients with type 2 diabetes mellitus in Iran: a national survey. PLoS One 2012;7:e44526.
40. Javanbakht M, Baradaran HR, Mashayekhi A, et al. Cost-of-illness analysis of type 2 diabetes mellitus in Iran. PLoS One 2011;6:e26864.
41. Bonakdaran S, Ebrahimzadeh S, Noghabi SH. Cardiovascular disease and risk factors in patients with type 2 diabetes mellitus in Mashhad, Islamic Republic of Iran. East Mediterr Health J 2011;17:640–6.
42. Jahangiri-Noudeh Y, Akbarpour S, Lotfaliany M, et al. Trends in cardiovascular disease risk factors in people with and without diabetes mellitus: a Middle Eastern cohort study. PLoS One 2014;9:e112639.
43. Balkrishnan R, Rajagopalan R, Camacho FT, et al. Predictors of medication adherence and associated health care costs in an older population with type 2 diabetes mellitus: a longitudinal cohort study. Clin Ther 2003;25:2958–71.
44. Farsaei S, Sabzghabaee AM, Zargarzadeh AH, et al. Adherence to glyburide and metformin and associated factors in type 2 diabetes in Isfahan, Iran. Iran J Pharm Res 2011;10:933–9.
45. Sarayani A, Jahangard-Rafsanjani Z, Hadjibabaie M, et al. A comprehensive review of adherence to diabetes and cardiovascular medications in Iran; implications for practice and research. J Diabetes Metab Disord 2013;12:57.
46. Ghadiri-Anari A, Fazaelipoor Z, Mohammadi SM. Insulin refusal in Iranian patients with poorly controlled type 2 diabetes mellitus. Acta Med Iran 2013;51:567–71.
47. Cheraghali AM, Nikfar S, Behmanesh Y, et al. Evaluation of availability, accessibility and prescribing pattern of medicines in the Islamic Republic of Iran. East Mediterr Health J 2004;10:406–15.
48. Sarayani A, Rashidian A, Gholami K. Low utilisation of diabetes medicines in Iran, despite their affordability (2000–2012): a time-series and benchmarking study. BMJ Open 2014;4:e005859.
49. Esteghamati A, Rajabian R, Amini M, et al. The safety and efficacy of biphasic insulin aspart 30 (BIAsp 30) in Iranians with type 2 diabetes: an open-label, non-randomised, multi-centre observational study-the Iran subgroup of the IMPROVE™ study. Endokrynol Pol 2010;61:364–70.
50. Azizi F. Sub-specialty training of endocrinologyin the Islamic Republic of Iran: estimating the need for endocrinologist training. J Med Educ 2009;12:105–8.

51. (ABIM) ABoIM. Number of Candidates Certified. 2015. Available at: http://www.abim.org/pdf/data-candidates-certified/State-Number-of-Certificates-Issued.pdf. Accessed August 28, 2015.
52. Centers for Disease Control and Prevention. National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services; 2014.
53. Aeenparast A, Farzadi F, Maftoon F. Waiting time for specialist consultation in Tehran. Arch Iran Med 2012;15:756–8.
54. Ho M, Marger M, Beart J, et al. Is the quality of diabetes care better in a diabetes clinic or in a general medicine clinic? Diabetes Care 1997;20:472–5.
55. Phillips LS, Ziemer DC, Doyle JP, et al. An endocrinologist-supported intervention aimed at providers improves diabetes management in a primary care site: improving primary care of African Americans with diabetes (IPCAAD) 7. Diabetes Care 2005;28:2352–60.
56. Leinung M, Matthew C, Gianoukakis M, et al. Comparison of diabetes care provided by an endocrinology clinic and a primary-care clinic. Endocr Pract 2000;6:361–6.
57. Khunti K, Wolden ML, Thorsted BL, et al. Clinical inertia in people with type 2 diabetes: a retrospective cohort study of more than 80,000 people. Diabetes Care 2013;36:3411–7.
58. Ziemer DC, Miller CD, Rhee MK, et al. Clinical inertia contributes to poor diabetes control in a primary care setting. Diabetes Educ 2005;31:564–71.
59. Peimani M, Tabatabaei-Malazy O, Heshmat H, et al. Knowledge, attitude and practice of physicians in the field of diabetes and its complications: a pilot study. J Diabetes Metab Disord 2010;9:10.
60. Tabatabaei-Malazy O, Nedjat S, Majdzadeh R. Which information resources are used by general practitioners for updating knowledge regarding diabetes? Arch Iran Med 2012;15:223–7.
61. Student R, Mojtaba M, Khamseh ME. General practitioners' knowledge and clinical practice in management of people with type 2 diabetes in Iran: the impact of continuous medical education programs. Arch Iran Med 2015;18:582.
62. American Diabetes Association. Glycemic targets. Diabetes Care 2015;38:S33–40.
63. Delavari A, Alikhani S, Nili S, et al. Quality of care of diabetes mellitus type II patients in Iran. Arch Iran Med 2009;12:492–5.
64. World Health Organization. 2008-2013 action plan for the global strategy for the prevention and control of noncommunicable diseases prevent and control cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. Geneva, Switzerland: WHO; 2009.
65. Delavari A, Mahdavihazavei A, Norouzinezhad A, et al. The national program for prevention and control of diabetes. Tehran: Seda Publication Center; 2004.
66. Azizi F, Gouya MM, Vazirian P, Dolatshahi P, Habibian S. The diabetes prevention and control programme of the Islamic Republic of Iran. East Mediterr Health J. 2003. 9, 1114-21.
67. Alavi Nia M, Ghotbi M, Kermanchi J, Mahdavi Hazaveh A, Nasli Esfahani A, Yarahmadi S. National program for prevention and control diabetes type II in urban areas. Tehran, Iran: Department of Endocrinology and Metabolism, Center for Non-Communicable Disease Control, Office of hospital administration and clinical service excellence, Treatment Deputy, Ministry of Health and Medical Education; 2012.
68. Azizi F, Guoya MM, Vazirian P, Dolatshahi P, Habibian S. Screening for type 2 diabetes in the Iranian national programme: a preliminary report. East Mediterr Health J 2003; 9: 1122–27.
69. Ravaghi H, Sajadi HS, Ghotbi M, et al. Evaluation of an urban phase of the Specialized Care Program for Diabetes in Iran: providers' perspectives. Int J Prev Med 2014;5:1013.
70. Alavinia SM, Ghotbi M, Mahdavi-Hezaveh A, Kermanchi J, Nasli-Esfahani E, Yarahmadi S. National comprehensive program for prevention and control of diabetes mellitus Type II in urban areas. Tehran, Iran: Ministry of Health and Medical Education; 2012.
71. World Health Organization. Guidelines for the development of a national programme for diabetes mellitus. Geneva, Switzerland: World Health Organization; 1991.
72. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva, Switzerland: World Health Organization; 2013.
73. Faraji O, Etemad K, Sari AA, et al. Policies and programs for prevention and control of diabetes in Iran: a document analysis. Glob J Health Sci 2015;7:187.
74. Mirzazadeh A, Baradaran HR, Haghdoost AA, et al. Related factors to disparity of diabetes care in Iran. Med Sci Rev 2009;15:PH32–6.
75. Farzadfar F, Murray CJ, Gakidou E, et al. Effectiveness of diabetes and hypertension management by rural primary health-care workers (Behvarz workers) in Iran: a nationally representative observational study. Lancet 2012;379:47–54.
76. Javanbakht M, Mashayekhi A, Baradaran HR, et al. Projection of diabetes population size and associated economic burden through 2030 in Iran: evidence from micro-simulation Markov model and Bayesian meta-analysis. PLoS One 2015;10:e0132505.
77. Rashidian A, Khosravi A, Khabiri R, et al. Islamic Republic of Iran's Multiple Indicator Demographic and Healh Survey (IrMIDHS) 2010. Tehran, Iran: Ministry of Health and Medical Education; 2012.
78. Ministry of Health and Medical Education. Health Sector Evolution. 2014. Available at: http://tahavol.behdasht.gov.ir/index.aspx?siteid=426&fkeyid=&siteid=426&pageid=52663. Accessed July 6, 2015.
79. Mainous AG, Diaz VA, Saxena S, et al. Diabetes management in the USA and England: comparative analysis of national surveys. J R Soc Med 2006;99:463–9.
80. Brown DS. Impact of the Affordable Care Act on access to care for US adults with diabetes, 2011-2012. Prev Chronic Dis 2015;12:1–11.