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ECONOMICS AND POLICY IN DIABETES (AA BAIG AND N LAITEERAPONG, SECTION EDITORS)

Diabetes in the Middle East: Government Health Care Policies and Strategies that Address the Growing Diabetes Prevalence in the Middle East

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Abstract

Purpose of review Diabetes is a primary public health concern and a challenge for health decision makers in this century. Though the number of people with diabetes is increasing all over the globe, the very high prevalence of diabetes in many Middle East countries has made this region one of the global diabetes hot spots. Due to rapid socioeconomic growth, lifestyle changes and increasing obesity prevalence, the number of people with diabetes is expected to double by 2045 in this region. This high prevalence of diabetes imposes a substantial socioeconomic impact on the individual and governments in this region. The governments in the Middle East have devised many policies, programs, and strategies to address the growing prevalence of diabetes. In this article, we aim to review such policies, programs, and the magnitude of diabetes in this part of the world.

Recent findings Faced with a challenge on a high scale, most governments in the Middle East are making progress in responding to diabetes.

Summary Diabetes is a chronic and costly disease; however, it can be prevented. The alarm of the rising tide of diabetes has not yet been successfully translated into action in the Middle East. The governments in the region need to devise more intense, broader policies and preventive measure programs based on local sociocultural practices to effectively combat the situation. Further improvements of the primary health care system and cross-governmental approaches are needed in the region to keep the growing epidemic of diabetes under control.

Keywords Diabetes · Middle East region · Policy · Diabetes prevention

Introduction

Diabetes mellitus is one of the greatest health care problems and challenges to human health in this century [1]. Worldwide, the total number of people with diabetes is projected to increase from 171 million in 2000 to 366 million in 2030 [2]; however, according to the International Diabetes Federation (IDF), these projections were met early in 2011 [3]. Currently, 425 million people are living with diabetes, and the number is predicted to increase by 48% and reach 629 million in 2045 [4••]. The Middle East (ME) region is not immune from this increasing prevalence. Latest IDF report shows the Middle East North African region has the second highest age-adjusted diabetes prevalence in the world, and close to 49% of the people in these countries are still undiagnosed [4••].

The increasing prevalence of diabetes and numerous people living with diabetes and its complications with increased life expectancy is bringing a new socioeconomic challenge to individuals, society, and government. In addition, a number of countries in this region face war, political instability, climate change, forced migration, and social instability, presenting a significant challenge to the delivery of health care and social services [5]. The majority of the people and countries in the

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ME share many similarities including language and religion; however, heterogeneity exists in ME countries in terms of culture, ethnicity, level of development, income, urbanization, and level of health care, which may explain variations in epidemiology, quality of care, and the health and economic outcome of diabetes [5, 6••, 7, 8•]. The growing burden of diabetes and complexity in these countries are challenging health decision-makers in this region [9]. For this review, we have included 15 countries in the ME region (Table 1).

Diabetes Prevalence

Some ME countries have the highest prevalence of type 2 diabetes in the world. Rapid economic and lifestyle changes have brought a sharp increase in diabetes and obesity rates in ME countries [1, 6••, 10, 11]. Approximately 25.8 million people are living with diabetes in these countries (Table 1), and the number is expected to double by 2045. Many countries in this region have a higher prevalence (Table 1) of diabetes than the world average (8.8%). When broken down by country, the Kingdom of Saudi Arabia (KSA) has the highest age-adjusted prevalence of diabetes (17.7%), followed by the United Arab Emirates (UAE, 17.3%), Egypt (17.3%), Bahrain (16.5%), Qatar (16.5%), Kuwait (15.8%), Sudan (15.7%), Lebanon (12.7%), Oman (12.6%), Jordan (11.8%), Libya (10.4%), Iran (9.6%), and Iraq (8.8%). Only Syria (8.2%) and Yemen (5.4%) have a lesser prevalence than the world average. This low prevalence of diabetes in Yemen and Syria could be an underestimation due to poor epidemiological surveys as a result of political instability and the war in these countries [12••]. Available data from the UAE and Kuwait show that the prevalence of diabetes and obesity is also high among the expatriate population [13, 14] which suggests the environmental influences on health.

Reason for Increasing Prevalence

Diabetes is a multifactorial condition. Available literature shows a family history of diabetes, physical inactivity, high prevalence of impaired glucose tolerance (IGT), ethnicity, genetic predisposition, environment, increasing age, obesity, higher waist-to-hip ratio, urbanization, multiple pregnancies, low level of education, lack of health education and awareness, access to cheap migrant labor, smoking, higher per capita GDP income, and high energy consumption are important factors for the increasing prevalence of diabetes in the ME [8•, 9, 12••, 15–19].

Table 1 Overview of prevalence, undiagnosed diabetes, and expenditure In Middle Eastern countries

Country	Adults with diabetes (20–79) in 1000s	Diabetes (20–79) national prevalence (%)	Diabetes age-adjusted (20–79) comparative prevalence (%)	Adults with undiagnosed diabetes (20–79) in 1000s	Mean diabetes-related expenditure per person (20–79) with diabetes (USD)	Mean diabetes-related expenditure per person (20–79) with diabetes (ID)
Bahrain	165.3	16.2	16.5	62.9	1170	3237
Egypt	8222.60	15.1	17.3	4367	268	897
Islamic Republic of Iran	4985.50	8.9	9.6	1748.50	533	1643
Iraq	1411.50	7.5	8.8	664.1	544	1242
Jordan	408.1	9.5	11.8	156.3	619	1376
Kuwait	441.00	15.1	15.8	74.1	1960	3281
Lebanon	585.4	14.6	12.7	251.4	774	1343
Libya	442.5	11.2	10.4	190.1	579	1255
Oman	367.7	10.7	12.6	161	1035	2211
Qatar	259.2	14.1	16.5	98.7	3062	4464
Saudi Arabia	3852.00	18.5	17.7	1516.50	1661	3571
Sudan	2247.00	10.9	15.7	965.2	225	488
Syrian Arab Republic	705.7	7.1	8.2	303.1	122	690
United Arab Emirates	1185.50	15.6	17.3	482.5	2269	482.5
Yemen	530.5	3.8	5.4	118	156	396
Overall	25,809.5	11.92	13.08	11,159	998.4	1771

ID international dollar

(With permission from: International Diabetes Federation. IDF Diabetes Atlas, 8th edn. Brussels, Belgium: International Diabetes Federation, 2017. http://www.diabetesatlas.org) [4••]

Table 2: Prevalence of obesity, overweight, and physical inactivity in the ME region

Country	Prevalence of obesity	Prevalence of overweight	Prevalence of physical inactivity
Bahrain	34.10%	70.30%	N/A
Egypt	27.70%	60.00%	31.00%
Islamic Republic of Iran	24.90%	60.50%	31.90%
Iraq	21.20%	53.20%	46.30%
Jordan	28.10%	62.30%	12.10%
Kuwait	38.30%	73.70%	53.60%
Lebanon	30.80%	67.30%	39.10%
Libya	31.90%	67.00%	36.60%
Oman	26.50%	60.60%	N/A
Qatar	41.00%	76.60%	33.30%
Saudi Arabia	33.70%	68.20%	58.50%
Sudan	6.60%	25.00%	N/A
Syrian Arab Republic	21.60%	55.00%	N/A
United Arab Emirates	34.50%	70.60%	30.20%
Yemen	14.20%	40.60%	NA

N/A not available

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The prevalence of obesity in the ME region is higher than the Caribbean and European region [12••]. World Health Organization (WHO) data (Table 2) show a higher prevalence of obesity and physical inactivity in these countries. Qatar has the highest prevalence of obesity (41%) and overweight (71.6%) in this region, followed by Kuwait, Bahrain, and the UAE. Along with economic and lifestyle changes, environmental changes such as automotive transportation, freely accessible water and air conditioning, and sedentary office work have ultimately led to obesogenic urbanization, which promotes weight gain within the home or workplace [20].

Undiagnosed Diabetes

Almost 11.1 million people in the ME are still undiagnosed. Age-specific data are limited in this part of the world. Available data from Oman show that the proportion of undiagnosed diabetes is higher in younger people [18], and this could be due to lack of routine screening at a younger age, lack of awareness, barriers to accessing health care services, and the level of education [12••, 15]. As patients with undiagnosed diabetes are at risk of presenting late to health care systems with diabetes complications and poor health outcomes, it is crucial for all ME countries to diagnose diabetes at the earlier stage of the disease. In addition to the high prevalence of diabetes, increasing obesity and impaired glucose tolerance [4••] is expected to increase the number of people with diabetes in the future without effective preventive strategies [12••].

Childhood Obesity

Another crucial area of concern is increasing prevalence of childhood obesity and type 2 diabetes in the ME, making it an emerging public health problem [21•, 22, 23]. A school-based adolescent study in Saudi Arabia showed the prevalence of overweight was 19.5% in males and 20.8% in females, while that of obesity was 24.1% in males and 14% in females [24]. Another report from Qatar shows that 18.8% of boys and 15.5% girls less than 20 years of age are obese [25]. Some of the documented factors for increasing prevalence of obesity among children are unhealthy school canteen meals, sedentary lifestyles, inadequate physical activity, and insufficient education regarding the role of fitness and exercises among children [26]. With a high prevalence of adult obesity, parents with obese or overweight children often failed to recognize their child's obesity or overweight problem; many of them tend to underestimate their obese child's weight [27]. Childhood obesity is a critical public health priority in this region as most of these obese children and adolescents may grow to be obese adults, an important reason for the increase in the prevalence of early-onset type 2 diabetes. There is an urgent

need for collaboration between different stakeholders such as health care agencies, food industry, schools, parents, and community leaders to address the increasing prevalence of childhood obesity [28].

Quality of Care

When diabetes is uncontrolled, it has severe consequences for health and well-being, and increases both the direct and indirect costs of diabetes. Therefore, it is important to continuously assess and improve the care of patients with diabetes as good glycemic control significantly reduces diabetes complications, which in turn reduces the cost burden of diabetes [29]. The investment in health care systems and progress in health services have led to improvement in key health indicators such as an increase in life expectancy, reduced infant mortality, and reduction in mortality due to infectious diseases [30]. However, unhealthy lifestyle changes and lack of focus on preventive care lead to higher morbidity and mortality due to noncommunicable diseases, including diabetes [30, 31].

Many countries have adopted national treatment guidelines (Table 3) for treating diabetes. However, there is limited information on the extent of implementation and efficacy of such programs and guidelines [12••, 32]. Studies found management of diabetes is suboptimal at all levels of the health care system, primary, secondary and tertiary care, with less than 50% of patients with diabetes reaching target levels of glycemic control [8•, 18, 32–34•]. There is an urgent need for improved diabetes care; otherwise, diabetes and its complications will soon consume most of a country's national health care budget.

Barriers to diabetes care related to organizations, patients, and providers have been identified in this region. Many doctors are expatriates; therefore, language barriers and poor knowledge of local culture and its impact on diabetes are significant obstacles for diabetes care [35, 36]. Increasing the awareness of local culture and providing appropriate training for health-care providers in communication skills are critical to overcoming these barriers [35]. Lack of social support and a healthy environment, knowledge gaps in diabetes self-management, poor compliance with diet, physical activity recommendations and medication, and poor attitudes toward the disease prevent patients from achieving optimal glycemic control [17•]. Health care providers should be aware of these factors and provide appropriate education, devise intervention strategies based on gender, age, and local sociocultural practices, and provide opportunities within daily life to promote active behavior changes to address the modifiable factors and improve the outcome of diabetes management [37•]. The role of primary care in the management of diabetes should be strengthened, and greater emphasis should be placed on educating patients, which helps them in managing their condition. Combined with the structured delivery of care, measurable quality standards, and clear guidelines for referral to specialist centers, the majority of people with type 2 diabetes can be managed in community settings by a multidisciplinary approach at a primary care level [36].

Complication Rate

National-level data on diabetes-related complications are limited in this region. Available literature shows that the complications are high in these countries [8•, 16•, 38]. Despite the high rate of diabetes complications, the proportion of patients receiving annual screening for complications in the ME is relatively low [33]. For example, a study from a diabetes and endocrine center in Bahrain showed that only 22% of diabetes patients underwent foot inspection, 42% underwent retinal screening, and 23% had microalbuminuria screening [38]. In Oman, 47.3% of lower limb amputations are related to diabetes, and given that diabetes-related foot amputations are mostly preventable, there is room for improvement in the delivery of diabetic foot care [39]. Lack of screening and late diagnosis of diabetes complications are a significant cause of higher morbidity and cost in the region.

Economic Impact/Cost of Diabetes

Diabetes is a costly disease. For example, in the US, lifetime health care costs are 2.3 times higher for people with diabetes compared to the average population [40]. The economic and health impacts of diabetes are often underestimated [41]. Diabetes and its complications bring about substantial financial loss to people with diabetes, society, health systems, and national economies through direct medical costs and indirect costs such as lost productivity caused by morbidity, disability, premature mortality, earlier retirement, and increased requirements for social support [6••, 16•, 42•].

Costs of diabetes vary between countries in the ME (Table 1). Local studies reported that direct diabetes treatment costs reach USD 1605 in the UAE [43•] and USD 175 in Sudan [44] per person with diabetes. This variation of the expenses is due to relative income levels in each country. The primary cost drivers are hospital care and outpatient care. In Kuwait, 40.6% of hospitalized patients had diabetes and those with diabetes were hospitalized 2 to 3 times more than people without diabetes [45]. As an increasing number of younger patients receive a diagnosis of diabetes in this area, the lifetime costs of diabetes will soar, and the costs of health care will weigh heavily on government budgets in the region. Abu Dhabi's spending on the treatment of diabetes is expected to quadruple between 2010 and 2030. Kuwait spent around

Table 3 Overview of Middle East countries response to diabetes

The national response to diabetes	Operational policy/strategy/action plan for diabetes	Operational policy/strategy/action plan to reduce overweight and obesity	Operational policy/strategy/action plan to reduce physical inactivity	Evidence-based national diabetes guidelines/protocols/standards	National diabetes registry	Recent national risk factor survey in which blood glucose was measured
Bahrain	Yes	Yes	Yes	Available and partially implemented	Yes	No
Egypt	No	No	No	Available and partially implemented	No	Yes
Islamic Republic of Iran	Yes	No	Yes	Available and fully implemented	Yes	Yes
Iraq	Yes	No	Yes	Available and fully implemented	Yes	No
Jordan	Yes	Yes	Yes	Available and fully implemented	Yes	No
Kuwait	Yes	No	No	Available and fully implemented	Yes	Yes
Lebanon	Yes	No	Yes	Available and partially implemented	No	No
Libya	No	No	No	Not available	No	No
Oman	No	No	No	Available and fully implemented	Yes	No
Qatar	Yes	Yes	Yes	Available and fully implemented	Yes	Yes
Saudi Arabia	Yes	Yes	Yes	Available and fully implemented	Yes	Yes
Sudan	No	No	No	Available and partially implemented	No	No
Syrian Arab Republic	No	No	No	Available but not implemented	No	No
United Arab Emirates	Yes	Yes	Yes	Available and fully implemented	No	No
Yemen	No	No	No	Not available	No	No

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16% of its health expenditure on diabetes alone in 2010, and this number might increase by 150% in 2030.

Diabetes in Women

High prevalence of obesity, physical inactivity, gestational diabetes mellitus (GDM) [46, 47], and multiple pregnancies are important risk factors for diabetes among women in this part of the world. GDM also carries a risk of developing diabetes later in life for the offspring, so it is a significant health issue. Despite the magnitude of the problem, studies focusing on women in this region are limited [48, 49]. Addressing women's health is necessary, which will benefit everyone. Improving women's health matters to women, to their families, communities, and societies at large. The WHO says that it is an urgent priority and requires major social and political attention. Increased access to training, education, and participatory leadership around a clear and coherent agenda for action with involvement and full participation of women and women's organizations will be critical in making progress.

Diabetes Policies and Programs in the Middle East Region

Governments in the ME appeared to have identified the threat of diabetes and started to respond with various policies, initiatives, and programs. The WHO's country profile gives (Table 3) an overview of each country's response to diabetes. Six out of 15 countries in this region still do not have national operational action policy for diabetes. Many countries still do not have a national strategy to reduce overweight, obesity, and physical inactivity, which are important risk factors for diabetes. Most counties have fully implemented national diabetes treatment guidelines.

Some countries are implementing the WHO's "best buys"—such as reducing salt quantity in food, raising taxes on tobacco and alcohol, or promoting public awareness of diet and physical activity. A few have implemented broader health care strategies to tackle diabetes and launched initiatives to target specific aspects of disease management or prevention. Some are setting up diabetes registries. Countries like Oman and the UAE have initiated screening. A few have partnered with experts in the field of diabetes, such as the Kuwait-Scotland eHealth Innovation Network. A pilot project such as the Nizwa healthy lifestyles project in Oman involved various stakeholders including ministries such as education, social development, regional municipalities, and sports. It also involved other organizations like the Oman Woman Association, Royal Oman Police, the WHO, academic institutions, private companies, and sports club in Nizwa Wilayat district. The project showed almost 50% of participants

reported to have changed their lifestyle due to interventions [50•]. Awareness of physical inactivity as a risk factor and participation in leisure-time physical activity has increased from 2001 to 2010 [50•].

In Iran, The National Committee for Diabetes, which is a subdivision of Iran's Ministry of Health, has initiated several policies and programs for the prevention and control of diabetes. The historical timeline of a consolidated action commenced in 1992 with a pilot project for prevention and control of diabetes in selected regions of the country. However, it had a premature ending in 1993. The national diabetes prevention and control program started again in 1999 with pilot implementation in 17 medical universities. After the pilot implementation, the program was launched in two phases, the rural phase in 2004 and urban phase in 2010 [51••]. The National Program for Prevention and Control of Diabetes in Iran has helped in identifying high-risk individuals, particularly in rural and remote areas, which helped in reducing people with undiagnosed diabetes and improved the quality of diabetes care [52]. Valuable policy-making efforts have contributed to enhancements in diabetes care in Iran, particularly in rural areas [10]. Despite the attention to the diabetes problem and the beginning of the program many years ago, the prevalence of diabetes is still 9.6% in Iran. This indicates policymakers need to focus more on the diabetes prevention strategies and reducing risk factors in the society.

In the KSA, over the last few years, The Ministry of Health (MOH) has started several initiatives to control the diabetes epidemic, including a national awareness program for diabetes. It has established more than 20 specialized centers for treating people with diabetes across Saudi Arabia's regions and governorates [6••]. A center for noncommunicable diseases (NCDs) has been established and many programs for diabetes prevention, healthy diet, and physical activity have been initiated [53]. The Saudi MOH and WHO both created The Cooperation Strategy for 2006–2011 that recommended the Saudi health system should prioritize the promotion of a healthy lifestyle, especially among young people. Later, another initiative was developed by the MOH focusing primarily on the promotion of a healthy lifestyle within the specific context of Saudi values and practices. In September 2012, the Saudi MOH, in collaboration with the WHO's Eastern Mediterranean Regional Office (EMRO), organized an international conference. The partnership resulted in the Riyadh Declaration that included ten recommendations to combat NCDs including diabetes at the regional level [54]. The MOH has approved a ten-year (2010–2020) national executive plan for controlling diabetes. Though the Saudi government has developed and implemented several policies to tackle diabetes, the effectiveness has not yet been evaluated [6••].

Kuwait established a diabetes resource center to provide structured education to patients and also training to educators and nutritionist. The Kuwait National Program for Healthy Living [20] is an initiative with a clear goal and objectives to promote the health and well-being for individuals residing in the country. It focuses more specifically on obesity in general and diabetes in particular due to the high prevalence of these conditions in Kuwait. Oman has established clear strategies to combat diabetes. The national diabetes program was set up in 1991. Oman's Health Vision 2050, as released by the sultanate's MOH in May 2014, states that "timely action will be taken to inform and educate the people so that they adopt a healthy lifestyle and food habits." Health Vision 2050 acts as a basis for shorter-term plans, such as the ninth five-year Health Development Plan 2016–2020, which includes targeted measures to realize the country's vision. The IDF has praised [55••] the efforts of Oman as it has a fully implemented framework for the monitoring and surveillance of diabetes.

The UAE has the Early Action in Diabetes Policy [56] with a clear road map. After successful implementation, policymakers expect a 3% reduction in the prevalence of diabetes of people between the age of 20 and 79 years and 2% reduction in the prevalence of obesity among children. The government also aims to screen at least 80% of high-risk patients in primary health care centers by 2021, a 100% national diabetes registry by the end of 2018, and 100% coverage of schools to raise awareness of child obesity by 2018. In Qatar, the Supreme Council of Health, the body responsible for public health in the state, established the National Diabetes Strategy Committee in 2013 to tackle the disease. It has recently launched the National Health Strategy 2018–2022, which aims to increase physical activity and reduce obesity rates and smoking prevalence [25]. According to the latest IDF global diabetes scorecard for member states [55••], Syria faces considerable challenges to respond to the diabetes epidemic due to local crisis and war. Jordan is providing services for the treatment of diabetes, but needs progress concerning monitoring and surveillance. Egypt needs to work more on national plans and preventive policies. Iraq needs to make progress in preventive strategies to respond to the diabetes challenge.

Impact of Policies

For most countries, the extent and timing of program implementation are not clear, and in a few countries, the content of the program too [32]. Though there are policies in place, there are no clear key indicators of diabetes control, making it difficult to understand the impact of a national picture of diabetes care programs. Despite the implementation of some policies and initiatives to tackle diabetes in the ME, policymakers must step up their efforts and take concerted action to control the disease in these countries since there is a clear and urgent need to combat diabetes in the ME region.

Discussion

Governments and policymakers in the ME need to prioritize diabetes prevention strategies as the prevalence of diabetes and health system costs are increasing in this region. Ideally, these intervention strategies should be combined or backed by representative national epidemiological data [11, 24], which will help policymakers to understand the actual burden of diabetes and its complications. However, there is a considerable lack of data in the region, such that nationally representative and accurate estimates of the prevalence of diabetes and complications are limited. Most studies in this part of the world are confined to a single clinic-based study with a small sample or a single region. There is an urgent need to improve research infrastructure; lack of investment in research reduces the capacity of the counties to respond effectively to the challenge raised by diabetes. Not only investment in research, but overall health expenditure on diabetes is also low. It is less than what is needed in these countries [31]; World Bank data indicate that health care expenditure in the region ranged from 3.0% to 7.59% of GDP in 2015, which is far lower than the world average of 9.9 %.

The ME region is facing two significant problems; one is improving the quality of care for existing patients with diabetes, and another is the prevention of diabetes. Improving the quality of diabetes care will, in turn, reduce the complications, morbidity, and overall cost of diabetes. For better quality of diabetes management, the health care system needs to implement evidence-based clinical practice guidelines, with an emphasis on multidisciplinary diabetes care approaches and strengthening existing community health care systems [57]. To improve the quality of diabetes care, policymakers should believe and invest in and work to strengthen the primary health care system. Governments must be committed to increase resource allocation to diabetes care, improve diagnostic infrastructure, and provide continued education and training to enhance health care workers' skill sets and knowledge. Healthcare workers should provide comprehensive education to patients to adopt healthy lifestyle changes such as exercising regularly, eating healthily, avoiding or managing stress, maintaining sleep hygiene, and avoiding smoking for better treatment outcome. Stress is a known risk factor for diabetes and poor glycemic control, which is not well-studied in the ME. A study from Oman showed simple health education could improve patient's compliance among type 2 diabetes subjects [58]. An early intensive glycemic control is vital for a better long-term outcome. However, sometimes physicians are reluctant or refrain from stepwise intensification of diabetes treatment [59, 60] despite the suboptimal glycemic control. This along with patients' unwillingness to initiate insulin therapy [61] lead to underutilization of medications and suboptimal glycemic control. Education is a key to overcome this barrier. Reinforcing primary care services with the emphasis on cost-effective diabetes care and attaining equilibrium between curative and preventive care is essential to strengthen response against the growing diabetes impact in the ME.

Type 2 diabetes is preceded by a long period of a prediabetes state. One can mostly prevent or delay the onset of diabetes or its progression by implementing lifestyle changes which are free of cost and free of side effects. Therefore, identifying people at risk of diabetes is a public health priority [62••]. Prevention of diabetes and diabetes-related complications not only improves the well-being of an individual but also helps in avoiding the cost of diabetes. While a variety of factors have been shown to contribute to a high likelihood of diabetes, obesity is the principal risk factor, irrespective of age [63••]. Focusing on obesity to prevent diabetes is a good strategy because obesity is a modifiable factor and available literature shows that 5–7% weight loss is sufficient to prevent individuals with impaired glucose tolerance from developing type 2 diabetes [64, 65]. Systematic reviews [66, 67] evaluating the Diabetes Prevention Program (DPP) showed that intensive lifestyle interventions are successful at bringing clinically meaningful weight loss. In the region with a high prevalence of obesity and early-onset diabetes, these intensive lifestyle interventions will be beneficial.

The diabetes preventive measures must be based on evidence and offer high economic value [68], such as the WHO's "best buy" interventions, which are not only cost-effective but also feasible. A sustained and coordinated effort, including broad national policies based on local sociocultural factors, to address modifiable risk factors is needed to help people with diabetes control their disease well and reduce the increasing prevalence of diabetes in the ME [17•, 69]. Currently, limited data are available from the region with regard to the impact of both individual and population-wide interventions. Having a framework for understanding optimal spending for individual- versus population-level interventions can help stakeholders and provide essential insights on how budgets should be allocated to programs and how best to offer programs to different people [63••]. However, the literature shows that interaction between policymakers and researchers were limited. They are not frequently undertaking knowledge translation (KT) activities; also, policymakers rarely utilize research evidence in decision-making processes. These findings emphasize the complexity of policy-making and the need for well-informed, research-based, and structured policy decision-making [70•].

Taking a life-course perspective is essential for preventing type 2 diabetes, for which not only policymakers but the wider community has a role to play. Governments strive to implement policies and programs to address the key components of disease control; however, they are limited by the provision of funds and resources, which contributes to the level of success. There is significant scope for the religious side of the community to become more deeply involved in the fight against

diabetes in the region. Coordinated public health messaging delivered by religious leaders can reach significant proportions of the population and can be potent.

No single policy or intervention can prevent this increasing prevalence of diabetes. There is a need for a whole-of-government and whole-of-society approach, in which all sectors including agriculture, trade, finance, transport, education, media, and urban planning work symmetrically to strengthen the diabetes prevention programs to reduce the burden of diabetes in the ME region.

Conclusion

The majority of countries in the ME region are engaged in a multi-dimensional transition. The shift from rural to urban dominance, socioeconomic development, and sedentary lifestyles have led to rising rates of obesity, IGT, and diabetes, which constitute a real challenge in the region. To alleviate the burden of diabetes, preventive strategies are needed that are acceptable within the local sociocultural context, with cross-governmental approaches. Furthermore, people with diabetes must receive improved-quality diabetes care to reduce mortality, morbidity, and loss of economic productivity. The governments in the ME have devised many policies, programs, and strategies to address the growing prevalence and burden of diabetes in the region and keep the disease under control; however, more needs to be done to contain diabetes in this region.

Compliance with Ethical Standards

Conflict of Interest Noor Al Busaidi, Prakash Shanmugam, and Deepa Manoharan declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

1. Badran M, Laher I Type II diabetes mellitus in arabic-speaking countries. Int J Endocrinol 2012;Article ID 902873. 11 pages. https://doi.org/10.1155/2012/902873
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047–53. https://doi.org/10.2337/diacare.27.5.1047.
3. IDF atlas, 5th Edition, 2011. Available from http://www.diabetesatlas.org/resources/previous-editions.html
4. •• IDF diabetes atlas 8th edition, 2017, Available from http://www.diabetesatlas.org/resources/2017-atlas.html. **Data from IDF gives the magnitude of the problem.**
5. Sibai AM, Semaan A, Tabbara J, Rizk A. Aging and health in the Arab region: Challenges, opportunities and the way forward. Population Horizons. 2017;14(2):AOP. https://doi.org/10.1515/pophzn-2017-0007
6. •• Alharbi NS, Alotaibi M, de Lusignan S. An analysis of health policies designed to control and prevent diabetes in Saudi Arabia. Global J Health Sci. 2016;8(11). https://doi.org/10.5539/gjhs.v8n11p233. **An important article which analysis Saudi Arabia's diabetes polices**.
7. Elliott JA, Abdulhadi NN, Al-Maniri AA, Al-Shafaee MA, Wahlström R. Diabetes self-management and education of people living with diabetes: a survey in primary health care in Muscat Oman. Bullen C, ed. PLoS One. 2013;8(2):e57400. https://doi.org/10.1371/journal.pone.0057400.
8. • Zabetian A, Keli HM, Echouffo-Tcheugui JB, Venkat Narayan KM, Ali MK. Diabetes in the Middle East and North Africa. Diabetes Res Clin Pract. 2013;101(2):106–22. https://doi.org/10.1016/j.diabres.2013.03.010. **The review article gives an overview of risk factor and complications the MENA region**.
9. Boutayeb A, Lamlili MEN, Boutayeb W, Maamri A, et al. The rise of diabetes prevalence in the Arab region. Open Journal of Epidemiology. 2012;2:55–60. https://doi.org/10.4236/ojepi.2012.22009.
10. Noshad S, Afarideh M, Heidari B, Mechanick JI, Esteghamati A. Diabetes care in Iran: where we stand and where we are headed. Ann Glob Health. 2015;81(6):839–50. https://doi.org/10.1016/j.aogh.2015.10.003.
11. Karageorgi S, Alsmadi O, Behbehani K. Prevalence, trends, risk factors, and epidemiologic methods in Kuwait. J Obes. 2013;2013:378650, 14 pages. https://doi.org/10.1155/2013/378650.
12. •• Majeed A, El-Sayed AA, Khoja T, Alshamsan R, et al. Diabetes in the middle-east and north Africa: an update. Diabetes Res Clin Pract. 103(2):218–22. https://doi.org/10.1016/j.diabres.2013.11.008. **This review article discusses prevalence, quality of care in ME region**.
13. Sulaiman N, Elbadawi S, Hussein A, et al. Prevalence of overweight and obesity in United Arab Emirates Expatriates: the UAE National Diabetes and Lifestyle Study. Diabetol Metab Syndr. 2017;9:88. https://doi.org/10.1186/s13098-017-0287-0.
14. Channanath AM, Farran B, Behbehani K, Thanaraj TA. State of diabetes, hypertension, and comorbidity in Kuwait: showcasing the trends as seen in native versus expatriate populations. Diabetes Care. 2013;36(6):e75. https://doi.org/10.2337/dc12-2451.
15. Mabry RM, Morsi M, Owen N. Descriptive epidemiology of sitting time in omani men and women: a known risk factor for non-communicable diseases. Oman Medical Journal. 2017;32(3):233–9. https://doi.org/10.5001/omj.2017.43.
16. • Abu yassin B, Laher I. Diabetes epidemic sweeping the Arab world. World J Diabetes. 2016;7(8):165–74. https://doi.org/10.4239/wjd.v7.i8.165. **A recent article which describes lifestyle risk factors among Arabs**.
17. • Al neami YM, Coleman CL. Risk factors for and barriers to control type-2 diabetes among Saudi population. Global J Health Sci. 2016;8(9):10–9. https://doi.org/10.5539/gjhs.v8n9p10. **A recent study which describes barriers to diabetes control**.
18. Al Riyami A, Elaty MAA, Morsi M, Al Kharusi H, Al Shukaily W, Jaju S. Oman World Health Survey: Part 1 - methodology, sociodemographic profile, and epidemiology of non-

communicable diseases in Oman. Oman Medical Journal. 2012;27(5):425–43.
19. Sulaiman N, Mahmoud I, Hussein A, et al. Diabetes risk score in the United Arab Emirates: a screening tool for the early detection of type 2 diabetes mellitus. BMJ Open Diabetes Res Care. 2018;6: e000489. https://doi.org/10.1136/bmjdrc-2017-000489.
20. Behbehani K. Kuwait National Programme for healthy living: first 5-year plan (2013-2017). Med Princ Pract. 2014;23(Suppl 1):32–42. https://doi.org/10.1159/000358884.
21.• Al-Rubeaan K. National surveillance for type 1, type 2 diabetes and prediabetes among children and adolescents: a population-based study (SAUDI-DM). J Epidemiol Community Health. 2015;69(11):1045–51. https://doi.org/10.1136/jech-2015-205710. **The study explores the prevalence of diabetes among children and adolescents in Saudi Arabia which reflects many countries ME**.
22. Alhyas L, McKay A, Balasanthiran A, Majeed A. Prevalences of overweight, obesity, hyperglycemia, hypertension, and dyslipidemia in the Gulf: a systematic review. JRSM Short Reports. 2011;2(7):55. https://doi.org/10.1258/shorts.2011.011019.
23. Moussa M, Alsaeid M, Abdella N, et al. Prevalence of type 2 diabetes mellitus among Kuwaiti children and adolescents. Med Princ Pract. 2008;17:270–5. https://doi.org/10.1159/000129604.
24. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Alsulaiman NA, Musaiger AO. Prevalence of overweight, obesity, and abdominal obesity among urban Saudi adolescents: gender and regional variations. J Health Popul Nutr. 2014;32(4):634–45.
25. Qatar National Health Strategy 2018-2022. Available from https://www.moph.gov.qa/HSF/Documents/short%20report%20eng%2020.03.2018.pdf
26. Al Dhaifallah A, Mwanri L, Aljoudi A. Childhood obesity in Saudi Arabia: opportunities and challenges. Saudi Journal of Obesity. 2015;3(1):2–7. https://doi.org/10.4103/2347-2618.158684.
27. Aljunaibi A, Abdulle A, Nagelkerke N. Parental weight perceptions: a cause for concern in the prevention and management of childhood obesity in the United Arab Emirates. Schooling CM, ed. PLoS One. 2013;8(3):e59923. https://doi.org/10.1371/journal.pone.0059923.
28. Alaslani MH, Alasmari MAS, Almaghamsi AH, Mufti MI, et al. Obesity in children and its connection to diabetes in Saudi Arabia: review. Int J Med Res Prof. 2018;4(1):349–54. https://doi.org/10.21276/ijmrp.2018.4.1.074.
29. Al-Shafaee M, Al-Farsi Y, Al-Kaabi Y, Banerjee Y, Al-Zadjali N, Al-Zakwani I. Quality of diabetes care in primary health centres in north Al-Batinah of Oman. Open Cardiovasc Med J. 2014;8:48–54. https://doi.org/10.2174/1874192401408010048.
30. Khoja T, Rawaf S, Qidwai W, Rawaf D, Nanji K, Hamad A. Health care in Gulf Cooperation Council countries: a review of challenges and opportunities. Muacevic A, Adler JR, eds. Cureus. 2017;9(8): e1586. https://doi.org/10.7759/cureus.1586.
31. Al-Rubeaan K. The impact of diabetes mellitus on health and economy of Gulf Cooperation Council countries. Diabetes Manage. 2014;4:381–90.
32. Alhyas L, McKay A, Balasanthiran A, Majeed A. Quality of type 2 diabetes management in the states of the Co-Operation Council for the Arab States of the Gulf: a systematic review. Sesti G, ed. PLoS One. 2011;6(8):e22186. https://doi.org/10.1371/journal.pone.0022186.
33. Szabo SM, Osenenko KM, Qatami L, Korenblat Donato BM, et al. Quality of care for patients with type 2 diabetes mellitus in Dubai: a HEDIS-like assessment. Int J Endocrinol. 2015;2015:413276, 8 pages. https://doi.org/10.1155/2015/413276.
34.• Al-Sinani S, Al-Mamari A, Woodhouse N, et al. Quality of diabetes care at outpatient clinic, Sultan Qaboos University Hospital. Oman Medical Journal. 2015;30(1):48–54. https://doi.org/10.5001/omj.2015.09. **Gives an over of diabetes care quality in a teaching hospital**.
35. Noor Abdulhadi NM, Al-Shafaee MA, Wahlström R, Hjelm K. Doctors' and nurses' views on patient care for type 2 diabetes: an interview study in primary health care in Oman. Prim Health Care Res Dev. 2013;14(3):258–69. https://doi.org/10.1017/S146342361200062X.
36. Alhyas L, Nielsen JDJ, Dawoud D, Majeed A. Factors affecting the motivation of healthcare professionals providing care to Emiratis with type 2 diabetes. JRSM Short Reports. 2013;4(2):14. https://doi.org/10.1177/2042533313476419.
37.• P Mohammed, J. Alramadan, Afsana Afroz, Sultana Monira Hussain, Mohammed Ali Batais et al. Patient-related determinants of glycaemic control in people with type 2 diabetes in the Gulf Cooperation Council countries: a systematic review. J Diabetes Res. 2018;2018:Article ID 9389265, 14 pages https://doi.org/10.1155/2018/9389265. **A recent review describes modifiable and nonmodifiable risk factors for suboptimal glycemic control in GCC.**
38. Al-Baharna MM, Whitford DL. Clinical audit of diabetes care in the Bahrain Defence Forces Hospital. Sultan Qaboos Univ Med J. 2013;13(4):520–6.
39. Al-Busaidi IS, Abdulhadi NN, Coppell KJ. Care of patients with diabetic foot disease in Oman. Sultan Qaboos Univ Med J. 2016;16(3):e270–6. https://doi.org/10.18295/squmj.2016.16.03.002.
40. American Diabetes Association. The cost of diabetes. Available at: www.diabetes.org/advocacy/news-events/cost-of-diabetes.html
41. van Dieren S, Beulens JW, van der Schouw YT, Grobbee DE, Neal B. The global burden of diabetes and its complications: an emerging pandemic. Eur J Cardiovasc Prev Rehabil. 2010;17(Suppl 1):S1–8. https://doi.org/10.1097/01.hjr.0000368191.86614.5a.
42.• WHO global report on diabetes 2016, available at -http://apps.who.int/iris/handle/10665/204871, **WHO report discusses various aspects of global diabetes, including national policies, guidelines, and protocols.**
43.• Al-Maskari F, El-Sadig M, Nagelkerke N. Assessment of the direct medical costs of diabetes mellitus and its complications in the United Arab Emirates. BMC Public Health. 2010;10:679. https://doi.org/10.1186/1471-2458-10-679. **An article gives an idea about cots of diabetes in one of the countries in ME**.
44. Elrayah-Eliadarous H, Yassin K, Eltom M, Abdelrahman S, et al. Direct costs for care and glycaemic control in patients with type 2 diabetes in Sudan. Exp Clin Endocrinol Diabetes. 2010;118(4): 220–5. https://doi.org/10.1055/s-0029-1246216.
45. Afaf MS, Al-Adsani, Kholouda A. Abdulla Reasons for hospitalizations in adults with diabetes in Kuwait. International Journal of Diabetes Mellitus. 2015:65–9.
46. Mirghani Dirar A, Doupis J. Gestational diabetes from A to Z. World J Diabetes. 2017;8(12):489–511. https://doi.org/10.4239/wjd.v8.i12.489.
47. Alfadhli EM, Osman EN, Basri TH, et al. Gestational diabetes among Saudi women: prevalence, risk factors, and pregnancy outcomes. Annals of Saudi Medicine. 2015;35(3):222–30. https://doi.org/10.5144/0256-4947.2015.222.
48. Alshaikh MK, Filippidis FT, Al-Omar HA, Rawaf S, et al. The ticking time bomb in lifestyle-related diseases among women in the Gulf Cooperation Council countries; review of systematic reviews. BMC Public Health. 2017;17:536. https://doi.org/10.1186/s12889-017-4331-7.
49. World Health Organization. Women and health: today's evidence tomorrow's agenda, available at http://www.who.int/gender/women_health_report/full_report_20091104_en.pdf
50.• Ministry of Health Oman. Nizwa healthy lifestyle evaluation report. Muscat, Oman: Ministry of Health. 2012. Available online at http://www.emro.who.int/health-education/physical-activity-case-

studies/the-nizwa-healthy-lifestyles-project-oman.html. **A report which gives an idea about how cross-governmental approach can improve the lifestyle of the community**

51.•• Faraji O, Etemad K, Sari AA, Ravaghi H. Policies and programs for prevention and control of diabetes in Iran: a document analysis. Global J Health Sci. 2015;7(6):187–97. https://doi.org/10.5539/gjhs.v7n6p187. **A review article discusses Iran's diabetes program**.

52. Esteghamati A, Etemad K, Koohpayehzadeh J, Abbasi M, 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(2):319–27. https://doi.org/10.1016/j.diabres.2013.12.034.

53. WHO-Country Cooperation Strategy for WHO and Saudi Arabia 2012–2016, Available at http://apps.who.int/iris/bitstream/handle/10665/113227/CCS_Saudia_2013_EN_14914.pdf;jsessionid=C32B16EB15870EF067793554BFEAE5E9?sequence=1

54. WHO, the Riyadh declaration on September 12, 2012, available at http://www.emro.who.int/images/stories/ncd/documents/Riyadh_Declaration.Final_bilingual.pdf?ua=1

55.•• IDF global diabetes scorecard, available at https://www.idf.org/our-activities/advocacy-awareness/resources-and-tools/53-global-diabetes-scorecard.html. **IDF source which gives an overview of diabetes programs in each country**

56. Early Action in Diabetes: United Arab Emirates Policy Road-Map, available at http://earlyactionberlin.com/Country-Posters/AZ-Country-poster_UAE.pdf

57. Alyaarubi S. Diabetes care in Oman: obstacles and solutions. Sultan Qaboos Univ Med J. 2011;11(3):343–8.

58. Al-Sinani M, Min Y, Ghebremeskel K, Qazaq HS. Effectiveness of and adherence to dietary and lifestyle counselling: effect on metabolic control in type 2 diabetic Omani patients. Sultan Qaboos Univ Med J. 2010;10(3):341–9.

59. Khunti K, Wolden ML, Thorsted BL, Andersen M, Davies MJ. Clinical inertia in people with type 2 Diabetes: a retrospective cohort study of more than 80,000 people. Diabetes Care. 2013;36(11):3411–7. https://doi.org/10.2337/dc13-0331.

60. Ziemer DC, Miller CD, Rhee MK, et al. Clinical inertia contributes to poor diabetes control in a primary care setting. Diabetes Educ. 2005;31(4):564–71. https://doi.org/10.1177/0145721705279050.

61. Ghadiri-Anari A, Fazaelipoor Z, Mohammadi SM. Insulin refusal in Iranian patients with poorly controlled type 2 diabetes mellitus. Acta Med Iran. 2013;51(8):567–71.

62.•• Al-Shudifat A-E, Al-Shdaifat A, Al-Abdouh AA, et al. Diabetes risk score in a young student population in Jordan: a cross-sectional study. J Diabetes Res. 2017;2017:8290710. https://doi.org/10.1155/2017/8290710. **A recent article estimates diabetes risk factors among younger population and assesses the usefulness of Finnish diabetes risk score among them**.

63.•• Alva ML. A review of the impacts of different approaches for diabetes prevention and a framework for making investment decisions. Int J Environ Res Public Health. 2018;15(3):522. https://doi.org/10.3390/ijerph15030522. **A recent paper which discusses individual and population level interventions**.

64. Crandall JP, Knowler WC, Kahn SE, et al. The prevention of type 2 diabetes. Nat Clin Pract Endocrinol Metab. 2008;4(7):382–93. https://doi.org/10.1038/ncpendmet0843.

65. Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. Lancet. 2009;374(9702):1677–86. https://doi.org/10.1016/S0140-6736(09)61457-4.

66. Aziz Z, Absetz P, Oldroyd J, Pronk NP, Oldenburg B. A systematic review of real-world diabetes prevention programs: learnings from the last 15 years. Implement Sci. 2015;10:172. https://doi.org/10.1186/s13012-015-0354-6.

67. Dunkley AJ, Bodicoat DH, Greaves CJ, et al. Diabetes prevention in the real world: effectiveness of pragmatic lifestyle interventions for the prevention of type 2 diabetes and of the impact of adherence to guideline recommendations: a systematic review and meta-analysis. Diabetes Care. 2014;37(4):922–33. https://doi.org/10.2337/dc13-2195.

68. Woolf SH, Husten CG, Lewin LS, Marks JS, Fielding JE, Sanchez EJ. The economic argument for disease prevention: distinguishing between value and savings. Washington, DC: Partnership for Prevention; 2009. available at http://archive.dialogue4health.org/hcr/PDFs/7_09/Economic_Argument.pdf

69. Hamidi S. Health services financing and delivery: analysis of policy options for Dubai, United Arab Emirates. ClinicoEconomics and Outcomes Research: CEOR. 2015;7:133–43. https://doi.org/10.2147/CEOR.S75743.

70.• El-Jardali F, Ataya N, Jamal D, Jaafar M. A multi-faceted approach to promote knowledge translation platforms in eastern Mediterranean countries: climate for evidence-informed policy. Health Research Policy and Systems. 2012;10:15. https://doi.org/10.1186/1478-4505-10-15. **Discuss the engagement of knowledge transfer activities among policymakers and the need for evidence-based structured policy making**.

71. World Health Organization –country profiles. 2016. Available at http://www.who.int/diabetes/country-profiles/en/