# Current Status of Diabetes in Palestine: Epidemiology, Management, and Healthcare System

Nuha El Sharif and Asma Imam

## Contents



**Abstract**

This chapter reviews the epidemic of diabetes mellitus (DM) that is affecting the Palestinian population, the extent and magnitude of the problem, risk factors and complications, management protocols and compliance, and patients' quality of life (QoL). Moreover, the challenges and problems facing the Palestinian community in prevention and control of diabetes are discussed. The authors

N. El Sharif (✉) · A. Imam
Faculty of Public Health, Al Quds University, Jerusalem, Palestine
e-mail: nsharif@staff.alquds.edu; aimam@staff.alquds.edu



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focus on the published literature from the past two decades, and incorporate data from research studies in the field of diabetes and metabolic syndrome. It is worth noting here that most work done in Palestine in the field are evaluative studies, and that there are no prevention or intervention studies focused on diabetes prevention or control.

DM is considered the fourth leading cause of death in Palestine, with a prevalence of 9.1% in patients aged 20–79 years and is predicted to increase to 20.6% by 2020. Lifestyle changes and uncontrolled glycemic levels are associated with an increased risk of developing type 2 DM (T2DM) and its complications.

All Health-related quality of life (HRQoL) domains of Palestinian patients with DM are negatively affected by its incidence. Moreover, longer duration of DM (>10 years), presence of chronic diseases and comorbidities, and the existence of one or more DM complications negatively impact HRQoL.

T2DM patients' adherence to anti-diabetic medications in Palestine is sub-optimal compared to international studies. The overall adherence levels to the diabetic clinical guidelines are disappointingly suboptimal within the Palestinian Primary Healthcare Centers of both the Ministry of Health and the United Nations Relief and Work Agency (UNRWA).

**Keywords**

Epidemiology · Risk factors · Prevention · Complications · Management protocols · Compliance · Quality of life · Diabetes strategy · Challenges · Arabs · Palestine · Diabetes management · Medication adherence

## Introduction

Diabetes is one of the four priority non-communicable diseases (NCDs) identified by the World Health Organization (WHO) along with cardiovascular disease (CVD, which includes heart attack and stroke), cancer, and chronic respiratory disease. Diabetes is a group of disorders with common features, of which raised blood glucose is the most evident. It is a chronic disease which can cause substantial premature morbidity and mortality (WHO 2014).

Diabetes is subcategorized into diabetes type 1 or what was formerly called juvenile diabetes (T1DM), diabetes type 2 (T2DM), as well as specific types, e.g., drug-induced and gestational diabetes mellitus (GDM). It is a common, chronic, and a costly disease (IDF 2015). Many factors affect its prevalence and identification of those factors is necessary to facilitate change when facing health challenges. An increased number of early-onset DM is also responsible for the development of various diabetic complications due to longer disease duration that is largely due to better disease management (Hillier and Pedula 2003).

The diagnosis of diabetes is based on clinical symptoms and/or measurements of plasma glucose. Glycocylated hemoglobin A1c (HbA1c) is accepted as an additional diagnostic test for DM (WHO 2011a). The American Diabetes Association (ADA)

has also suggested a revision by incorporating impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) tests as indicators of increased risk of diabetes (American Diabetes Association 2010). The definition of gestational diabetes mellitus (GDM) is controversial although guidelines for its detection and diagnosis are available.

The etiology of DM is multifactorial and includes genetic factors coupled with environmental influences such as obesity associated with modern living standards, the steady stream of urban migration, and lifestyle changes. In the Arab region, rapid urbanization and lack of exercise are among other key determinants of this increase in T2DM (Laher 2014).

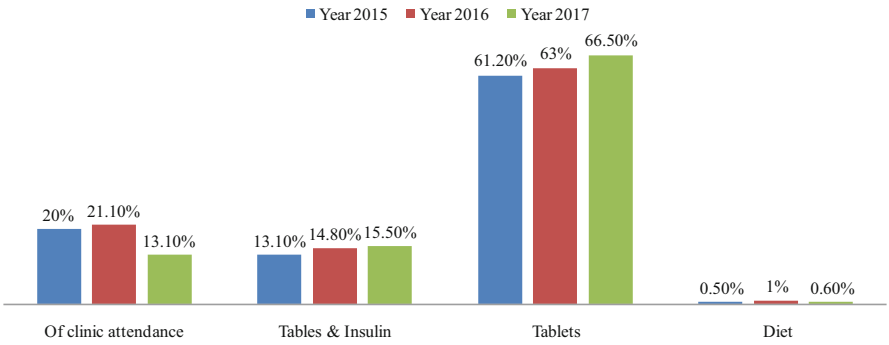
Developing T2DM and its complications can cause severe problems for affected individuals and their families, in addition to increasing the burden on health services. Primary prevention of T2DM is potentially feasible, but has yet to be implemented as a public health measure. The organization of services for the care of people with diabetes is complex, involving hospital-based diabetes teams, community services, those working in primary care, patients, and their families (McGill et al. 2017).

Much as in other developing countries, Palestine is also experiencing a rapid epidemiological transition which leads to a rapid change in lifestyles, nutritional behaviors, and environmental conditions. It was estimated that nearly two-thirds of elderly Palestinians complain from chronic diseases. However, there is insufficient or incomplete national data on the quantity, quality, and scope on the burden of chronic non-communicable diseases (NCDs) (Musleh et al. 2016).

Some studies were conducted on diabetes management in Palestine, with reports on self-management or management by healthcare providers and the type of the healthcare provided. Also, protocols used for diagnosis, treatment, and follow-up are areas of intense investigation. Another research interest is the quality of life (QoL) and satisfaction with services provided for diabetic patients' illness.

## Aim and Scope

This chapter reviews the most recent published studies in the area of epidemiology and management of diabetes in Palestine. Also, it highlights areas and suggests issues, in particularly in the domain of health services, where more information is needed. The chapter includes a review of the Palestinian health system; the extent and magnitude of DM; the epidemiology of DM in the following order: incidence and prevalence and controlling the modified risk factors (metabolic syndrome, overweight and obesity, diet and physical activity, and tobacco smoking); QoL of diabetic patients; and diabetes management (glycemic control and diabetes complications, medications adherence among patients with T2DM, and healthcare professionals adherence to Palestinian diabetes guidelines).

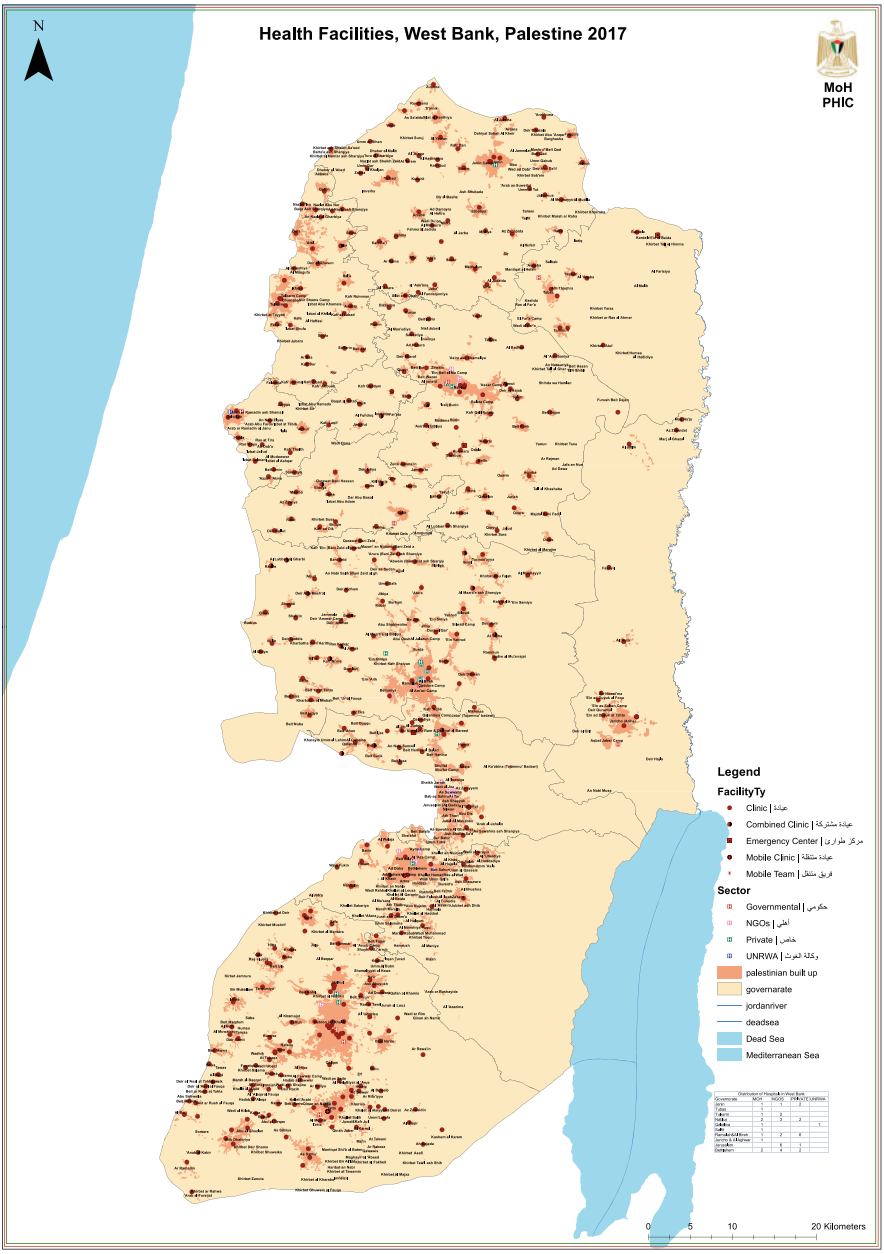



**Map 1** Healthcare facilities distribution in the West Bank – Palestine 2017. (Source: Palestinian Ministry of Health, Palestinian Health Information Center (PHIC))

## The Palestinian Healthcare System

The Palestinian Healthcare System is a mixture of governmental, nongovernmental (NGOs), United Nations Relief and Work Agency (UNRWA), Palestinian Military Medical Services (PMMS), and private (profit and nonprofit) services delivery. These health providers provide overlapping services, although none of these sectors deliver comprehensive health services. The Palestinian Ministry of Health (PMoH) endures the heaviest load of the health services responsibility. It provides primary healthcare (PHC) and secondary and tertiary healthcare for the entire population, and the UNRWA, which is the other healthcare provider in Palestine, provides services at the primary level of healthcare. There are 669 primary health clinics and 51 hospitals in the West Bank, including those of the UNRWA and nongovernmental organizations (see Map 1). There are 223 primary healthcare facilities and 28 hospitals in the Gaza Strip (WHO EMRO 2010) (see Map 2). However, specialized care is not available in the public health system, and patients in need are referred to private nongovernmental organization-managed hospitals in the West Bank, Gaza, or abroad; a significant portion is referred to Israeli hospitals. The cost of this referral is entirely covered by the national governmental insurance. This referral imposed a large burden on the Palestinian Healthcare System, which recently adapted a multifaceted performance improvement approach to reduce the cost of referrals (Bitar 2016). In East Jerusalem, the six Palestinian-operated hospitals – Maqassed Islamic Hospital, the Red Crescent Society (PRCS) maternity hospital, Augusta Victoria Hospital, St. John's Ophthalmic Hospital, St. Joseph's Hospital, and Princess Basma Rehabilitation Center – have served for decades as the main referral centers for the Palestinian population in the West Bank and Gaza Strip and the central medical training facilities for Palestinian health professionals. Egypt, Israel, and Jordan also provide important referral centers for treatment for Palestinians with either government insurance or private patients.

In its latest annual report, "Right to Health: Crossing barriers to access health in the occupied Palestinian territory," the World Health Organization (WHO 2016a)




**Map 2** Healthcare facilities distribution in Gaza Strip – Palestine 2010. (Source: World Health Organization, Jerusalem, Palestine)

draws attention to a concerning and continuing decline in the approval rates for patient permits to access healthcare outside of the West Bank and Gaza Strip.

Historical reliance on hospitals and referral centers that now require permits to access, especially those in occupied East Jerusalem, means that patients must navigate burdensome permit application processes and security procedures that result in delays and denial of care for thousands of Palestinian patients every year. In 2016, the permit approval rate for patients was the lowest recorded by WHO since it started monitoring in 2008, with two in every five patients encountering delays or denial of care.

## Extent and Magnitude of the Problem

The prevalence of T2DM is increasing in developing countries because of the ageing population, adopting a sedentary life, changing lifestyles, and the increase in the prevalence of several risk factors such as the metabolic syndrome factors, particularly obesity (Maruthur 2013). In addition, the noticeable increase in the incidence of childhood diabetes also contributes to the rise of diabetes incidence and prevalence (Cizza et al. 2012). There are a limited number of published studies on the incidence and prevalence of diabetes in Palestine, with the most recent data derived from projection models (Abu-Rmeileh et al. 2013). Similarly, there are a limited number investigations on the risk factors and complications for T1DM (Khdour and El Sharif 2007) and GDM (AlKasseh et al. 2014; Smak et al. 2014; Titi and El Sharif 2013). Most studies have focused on the risk factors for T2DM, which will be presented in the following sections.

### Prevalence and Incidence of T2DM in Palestine

The most recent findings rank T2DM as the fifth leading cause of disability in the Arab world which is a significant deterioration from being ranked 10th as recently as 1990 (Abuyassin and Laher 2016). This is very similar to the Palestinian case, where the Palestinian Ministry of Health (PMoH) ranked T2DM as the fourth leading cause of death and represented 8.9% of all deaths in 2014 (PMoH 2016a).

The incidence of T2DM in Palestine is not reported accurately. In the Palestinian national population-based survey (STEPwise 2010/2011) on risk factors of T2DM of adults aged 15–64, the annual incidence rate ranged from 150 to 220 per 100,000 population. However, the reported cases may represent half of actual cases, as there is currently no screening program in place for the early detection of diabetes. Another potential explanation is the underreporting of cases since there is no real-time electronic medical record system at the point of care (e-Health) for monitoring incidence, prevalence, and treatment outcomes in the PMOH primary healthcare clinics (Khader et al. 2013). Most diagnosed cases that are registered were insulin-resistant T2DM (WHO 2011a). In 2016, in the annual PMoH report, the newly reported DM cases in primary healthcare diabetes clinics in West Bank were 5,148 cases. The incidence in males was 174.6 per 100,000 population and 211.5 per 100,000 for females. However, the prevalence rate of T2DM was highly variable

in the various studies and reports. The International Diabetes Federation (IDF) reported the prevalence in diabetic patients aged 20–79 years in Palestine to be 9.1% (IDF 2015). In the national STEPwise survey, 8.5% were diabetics and 5.8% had impaired glucose levels (WHO 2011b), while insulin-dependent T1DM was about 5% of diagnosed cases (WHO 2016b). The rate of diabetes as reported by the United Nations Relief and Works Agency (UNRWA) was 5 million (or 11%) of the Palestinian-registered refugees living in Palestine and in the other Arab countries (Jordan, Lebanon, and Syria) aged 40 years and older (UNRWA 2014).

Data on T1DM in Palestine is very limited. No data is available for T2DM in children, and diabetes in childhood is entirely due to T1DM. In Saudi Arabia, the age-specific prevalence of T2DM in children less than 18 years old is 1 per 1000 (Zeitler et al. 2014). Similarly, the UNRWA annual report (2016) reported that T1DM is about 2.6% of patients diagnosed with diabetes (with an estimated prevalence of 1.5%), but accurate national incidence and prevalence rates are not available. In the STEPwise national survey (2010/2011), the mean fasting blood glucose, including those currently on medication for raised blood glucose, was 98 mg/dl. The percentage of patients with impaired fasting glycemia [IFG, defined as the percentage below plasma venous values of $\geq$6.1 mmol/L (110 mg/dl) and $<$7.0 mmol/L, and capillary whole blood values of $\geq$5.6 mmol/L (100 mg/dl) and $<$6.1 mmol/L (110 mg/dl)] was 5.8% (3.7–5.8%). The percentage with increased fasting blood glucose, defined as percentages below or currently on medication for raised blood glucose [plasma venous value $\geq$7.0 mmol/L (126 mg/dl), or capillary whole blood value $\geq$6.1 mmol/L (110 mg/dl)] was 8.5% (6.5–10.5%) (WHO 2011b).

In a recent modeling for diabetes projections, diabetes prevalence (for those aged 25 years or more) is predicted to reach 20.6% in 2020 and 21.5% in 2030, representing a predicted increase of 35% from 2000 to 2030. The estimated number of patients with diabetes is thus expected to reach 289,000 in 2020 and 444,000 in 2030. Prevalence in men increased from 9.1% to 16.9% and in women from 10.2% to 13.6% (Abu-Rmeileh et al. 2013).

## Controlling the Modified Risk Factors for Diabetes

Diabetes can be prevented with effective lifestyle changes, including maintaining a healthy diet, regular physical activity, normal body weight, and avoiding tobacco. However, these measures are not widely implemented by the public. According to STEPwise national survey (2010/2011), nine out of every ten Palestinians living in Palestine have at least one risk factor for NCDs, whether diabetes, heart disease, cerebrovascular disease, or cancer (WHO 2011b).

## Metabolic Syndrome (MetS)

MetS is also a constellation of abnormal cardiometabolic factors that increase the risk of CVD and T2DM. It is characterized as having three or more of the following: central obesity (large waist), high blood pressure, altered fasting blood glucose, and high cholesterol level (Kaur 2014). These factors are present in 20–40% of Palestinians. In Palestinians older than 20 years in the Jerusalem area, the prevalence of MetS was 33.6%, of which 27% had insulin resistance and 67% had high levels of central obesity (Abu Sham'a et al. 2009). In Gaza, those older than 20 years of age had prevalence rates of MetS of 23.0%, which was associated with physical inactivity (Sirdah et al. 2011). Therefore, obesity and physical inactivity are of great concern when setting policies for control of T2DM. A recent estimation model to prevent and control diabetes in Palestine showed that increases in obesity and smoking, the major lifestyle factors associated with diabetes, will affect T2DM over ten years (Abu-Rmeileh et al. 2013).

## Overweight and Obesity

The first line of therapy for the treatment of T2DM is weight loss with lifestyle modifications such as a healthy diet and increased exercise levels, as obesity increases the probability of developing diabetes and its complications (Masuo et al. 2010; Masuo et al. 2011). Not only does the total body fat matter but also the pattern of its distribution. Excess visceral fat, also referred to as central obesity, has a stronger association with chronic diseases than does subcutaneous fat, which is deposited mainly around the hips and buttocks (Segula 2014). Epidemiological studies across the world shows that body mass index (BMI) positively correlates with the chance of developing T2DM. The Health Professionals' Follow-up Study of 51,529 US male dentists, veterinarians, osteopaths, podiatrists, optometrists, and pharmacists aged 40–75 years reported that the risk of DM increased with greater levels of body mass index (Chan et al. 1994). The Nurses' Health Study of 113,861 US female nurses aged 30–55 years also reported similar results in women with a BMI of 22 or greater (Colditz et al. 1990). Therefore, examining the modifiable risk factors for DM, including obesity, is important because of its public health implications (CDC 2018a).

Treating long-term DM is costly, and the best approach to control diabetes is primary prevention. In some Arab countries where diabetes prevalence is relatively low, such as Sudan and Tunisia, the Relative Risk (RR) of developing T2DM was 1.74 (95%CI: 1.32–2.28) and 1.61 (95%CI: 1.34–1.93), respectively (Laher 2014). However, the prevalence of obesity in adults (15–100 years old) in other Arabian countries such as Kuwait (29.5–55%) and the United Arabs of Emirates (24.5–42%) were considered relatively high when compared to Palestine (19.6–37.9%) (Badran and Laher 2011). The situation in Palestine may be even worse than in Sudan and Tunisia, since obesity is relatively high in Palestine at about 25% of the adult population (Abu-Rmeileh et al. 2013). The national STEPwise survey reported 57.8% of adults aged 15–64 years as overweight and 26.8% as obese (WHO 2011b).

Obesity is becoming pandemic in Palestine, in particular among adult females over age 40 and is more preventable among those living in cities and refugee camps compared to those living in rural areas both in Gaza Strip and West Bank (see Table 1). The two major healthcare providers, i.e., PMoH and UNRWA, reported a high prevalence of obesity in diabetic patients, leading both agencies to include obesity in the national strategy to combat NCDs – particularly diabetes. The PMoH reported that over half of diabetic patients have obesity (PMoH 2005). The UNRWA reported that 90% of DM patients are obese or overweight. These "dangerous" rates require a long-term action plan which includes an emphasis on comprehensive medical treatment and lifestyle support for patients living with T1DM and updating technical instructions to introduce modern technologies and medicines for care of T2DM, expanding comprehensive prevention activities for at-risk populations, and developing partnerships with local, national, and international stakeholders (UNRWA 2014).

Therefore, obesity should be targeted to reduce the prevalence of T2DM. The EMRO-WHO targets a 35% reduction in obesity over 10 years, which could lower diabetes prevalence by 20.2%. In Palestine, a suggested policy scenario to control diabetes expects a decline in obesity by 10% in 10 years, which could produce a 5.3% reduction in diabetes prevalence (Abu-Rmeileh et al. 2013).

## Diet and Physical Activity

A healthy diet has an important role in preventing and managing diabetes complications (Ley et al. 2014). Changing dietary habits is an important strategy that targets diabetes prevention and control of its complications (Ley et al. 2014). Some food groups are associated with diabetes complications such diabetic retinopathy in patients with T2DM (Cundiff and Nigg 2013). For example, increased fruit intakes in ranges commonly consumed are associated with reduced incidence of diabetic retinopathy inpatients adhering to a low-fat energy-restricted diet (Tanaka et al. 2013a, b). Diabetic retinopathy, sight-threatening diabetic retinopathy, and microalbuminuria are also associated with a lower dietary-fiber intake (Ganesan et al. 2012). Understanding dietary patterns can be used to test the role of the overall diet on nutrition-related diseases. Most of these dietary patterns are characterized by high consumption of plant-based foods and low consumption of animal-based, high-fat, and processed food (Lazarou et al. 2012). Plant-based dietary patterns, which are rich in fruits, vegetables, and whole grains, are valuable in preventing various chronic diseases, whereas a diet high in red and processed meat, refined grains, and added sugar increases the risk of developing T2DM and the metabolic syndrome (Medina-Remon et al. 2018). Several of dietary patterns are beneficial both for the prevention and management of T2DM (Ley et al. 2014). The Mediterranean diet, which is a plant-based diet, significantly reduces the rate of T2DM (Georgoulis et al. 2014). There is a noticeable increase in the consumption of fast foods such as hamburgers, pizza, etc. in Palestine during the past decade (Abudayya et al. 2011). A recent study in Gaza showed that an "Asian-like" diet, which is characterized by a high intake of whole grains, potatoes, beans, legumes, vegetables,

**Table 1** Two-decade data on overweight and obesity in Palestine

| | Year | Population | Location[a] | Gender | Overweight | Obese |
|---|---|---|---|---|---|---|
| Abdul-Rahim et al. 2001 | 2001 | Urban population | WB | F | | 49 |
| | | | | M | | 3 |
| Abdeen et al. 2012 | 1999–2000 | 18–64 years | WB | F | 33.5 | 31.5 |
| | | | | M | 40.3 | 17.5 |
| Abdeen et al. 2003 | 2003 | Children <59 months | WB | Both | 14.9 | 5.9 |
| Al-Rifai & Roudi-Fahimi 2006 | 2006 | Rural | WB | F | | 37 |
| | | | | M | | 18 |
| Ellulu et al. 2014 | 2007 | Adults | WB | F | | 52.6 |
| | | | | M | | 28.7 |
| | | | GS | F | | 41.6 |
| | | | | M | | 34.1 |
| Kanoa et al. 2008 | 2008 | University students | GS | F | 17.3 | 3 |
| Husseini et al. 2009 | 2009 | Adults | All | F | | 71.3 |
| | | | | M | | 58.7 |
| Al Sabbah et al. 2009 | 2009 | Adolescents | WB | Both | 13.3 | 3.2 |
| Obaid et al. 2010 | 2010 | > = 60 years | Gaza | Both | 29.4 | 41.0 |
| Al-Sabbah 2012 | 2012 | University students | WB | Both | 20.1 | 4.6 |
| Musaiger et al. 2011 | 2011 | Adolescents | WB | F | 12.5 | 3.5 |
| | | | | M | 12.7 | 5 |
| Bayyari et al. 2013 | 2013 | University students | WB | F | 12.4 | 1.7 |
| Lubbad et al. 2011 | 2011 | University students | GS | F | 7.1 | 0 |
| | | | | M | 17.1 | 2.9 |
| Kishawi et al. 2014 | 2014 | 18–28 years | GS | Both | 31.3 | 15.6 |
| | | 29–39 years | | Both | 37.6 | 35.8 |
| | | 40–50 years | | Both | 32.4 | 56.8 |
| | | City | GS | Both | 26 | 31 |
| | | Rural | | Both | 47 | 20 |
| | | Refugee camps | | Both | 35.9 | 30.9 |
| Kishawi et al. 2016 | 2016 | 18–50 years | GS | F | 64.1 | – |
| Massad et al. 2018 | 2010 | Refugee camps | WB | F | 30% | 39% |

[a]*WB* West Bank including Jerusalem, *GS* Gaza Strip

tomatoes, and fruits, as well as a low intake of refined grains, sugar, sweets, and desserts, lowered the prevalence of T2DM complications, i.e., high blood pressure,

kidney injury, heart diseases, peripheral organ injury, and neurological complications (El Bilbeisi et al. 2017).

Regular physical activity helps to maintain weight loss and prevent weight regain, and also decreases the risk of developing T2DM. Regular exercise and fitness improve insulin sensitivity that persists for 72 h or longer after training (Way et al. 2016). Only about 19% of the adolescent population in Arab engages in physical activity (Abuyassin and Laher 2016). A limited number of studies examined the activity levels of the Palestinian community. The STEPwise national survey (2011/2012) reported that Palestinian men spent more time on physical activity than women. The percentage with low levels of activity (defined as <600 MET/metabolic equivalents-minutes per week) was 46.5% (33.8% in males versus 59.2% in females) (WHO 2011b). The community-based study of 30 diabetic women aged from 40 to 70 years in Gaza that included a health awareness and education program on changing lifestyle (diet and daily physical activity) produced a significant reduction in HbA1c mean after 3 months of intervention (9.16 (SD 1.15) before versus 8.033 (SD 1.21) after intervention) (Arafat et al. 2016).

## Tobacco Smoking

There is much evidence that smoking increases the risk of diabetes and its complications. Smokers are 30–40% more likely to develop T2DM than non-smokers (CDC 2018a). Smokers who are also diabetic are more likely than non-smokers to have difficulty with insulin dosing and with controlling their disease. The exact mechanism of how smoking increases the risk of diabetes and deteriorates glucose homeostasis has not been fully elucidated, but the available evidence indicates that smoking increases insulin resistance (CDC 2018a). Smoking makes glucose control more difficult, regardless of the type of diabetes. Moreover, smokers with diabetes have higher risks for serious complications (Seet et al. 2012).

Smoking prevalence in Palestine is very high, where 53.7% of men are smokers compared to 5.2% of women (Abu-Rmeileh et al. 2013). The STEPwise national survey reported that about 20% were current smokers (36% in men and 2.2% in women (WHO 2011b). The UNRWA reported that 20% of the refugee population with T2DM were also smokers (34.1% males and 11.3% females) (UNRWA 2014). Data on smoking in females may be underestimated. "Nirgelia" or water pipe smoking is not considered as tobacco smoking but a social habit which is common in females. However, other methods of tobacco smoking, such as cigarette or pipe smoking, by females is a stigma in Palestinian society. Therefore, the published smoking rates and its association with diabetes in Palestinian women should be treated with caution. The association between tobacco smoking, in particular water pipe "Nirgelia" smoking, and health effects (especially diabetes) has not been examined in Palestine. It is important to stress that use of the water pipe is not without health risk. In a review by Golbidi et al. (2018), the authors concluded that understanding the cellular redox balance in conditions such as diabetes and smoking

would help in providing a new treatment strategy that might minimize the side effects of treatments in these conditions.

## Quality of Life (QoL) in Patients with Diabetes

WHO defines QoL as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, and standards and concerns. It is a broad-ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, and their relationships to salient features of their environment" (Bowling 2003; WHO 1997). Health-related quality of life (HRQoL) is a multi-dimensional concept and its determinants have developed since the 1980s to include domains related to physical, mental, emotional, and social functioning (CDC 2018b). HRQoL has been used to differentiate the different patients or groups of patients, to predict individual outcomes, and to evaluate the effectiveness of therapeutic interventions (Guyatt et al. 1993). EQ-5D is a standardized measure of health status developed by the EuroQol Group in order to provide a simple, generic measure of health for clinical and economic appraisal (EuroQol Group 1990). The scale comprises five domains (mobility, self-care, usual activities, pain, and anxiety/depression).

Health-Related Quality of Life (HRQoL) is a relatively new research field in Palestine. In reviewing the literature, there are three published studies conducted on QoL in Palestinian patients with DM and one unpublished doctoral dissertation. These studies concluded that all domains of HRQoL (physical, emotional, and psychological) were negatively affected by diabetes (Abu Awad 2013, and Eljedi et al. 2006, Khatib et al. 2018). Studies by Zyoud et al. (2015) found the mean of European Quality of Life Scale (EQ-5D) score for diabetic patients in Palestine was 0.7 (SD 0.20), while studies by Khatib et al. (2018) reported that the mean EQ-5D score in hemodialysis patients with DM was 0.314 (SD 0.4). This low score may reflect the impact of complications resulting from both DM and hemodialysis. Data by Eljedi et al. (2006) suggest that all domains of World Health Organization Quality of Life-short version (WHOQOL-BREF) were substantially reduced in diabetic patients as compared to controls, with stronger effects on physical health (36.7 vs. 75.9 points in the 0–100 score) and psychological domains (34.8 vs. 70.0) and weaker effects in social relationships (52.4 vs. 71.4) and environment domains (23.4 vs. 36.2).

Moreover, longer duration of DM (>10 years) and existence of one or more DM complications negatively impact HRQOL (AbuAwad 2013). Patients with more chronic diseases and comorbidities have significant poorer HRQOL scores (Khatib et al. 2018). Moreover, patients who were on oral hypoglycemic agents (OHAs) had a better HRQOL score than patients treated with insulin, but this difference did not reach significant levels (AbuAwad 2013).

## Diabetes Management

"Disease Management" is the goal in caring for patients with DM and aims to eliminate symptoms and to prevent, or at least slow, the development of complications. Microvascular (i.e., eye and kidney disease) risk reduction is accomplished through control of hyperglycemia and blood pressure, while macrovascular (i.e., coronary, cerebrovascular, peripheral vascular) risk reduction occurs through control of lipids and hypertension, smoking cessation, and aspirin therapy and metabolic and neurologic risk reduction by control of hyperglycemia (Chawla et al. 2016).

A team-based management strategy is crucial in the treatment of diabetes – the disease should be managed by the patient, the physician, the nurse, the healthcare system, and the sociocultural environment as a whole. Defects in any of these components would lead to less than optimal results in the fight against diabetes The essential components of disease management are (1) identification of individuals or populations with diabetes (or a subset with certain risk factors); (2) use of guidelines or performance standards to manage those identified; (3) information systems to track and monitor interventions and patient-, practice-, or population-based outcomes; and (4) measurement and management of patient and population outcomes (Huber 2005). This approach to diabetes management involves lifestyle modifications, proper use of medication, appropriate self-monitoring of blood glucose (SMBG), regular monitoring for complications, and laboratory assessment which should be applied for diabetes management and control (WU et al. 2014). We next discuss diabetes management and its applications in Palestine.

## Managing Diabetes Through Lifestyle Modifications

The Palestinian healthcare system is mostly physician-centered and with a focus-prescribing medications. Dieticians are not part of the care team in the primary healthcare clinics, and nutrition counseling is performed mainly through the distribution of printed materials by either nurse/nurse educator or clinic physicians who usually have many other priorities in terms of urgent patient care (WHO 2016c).

There is substantial evidence that leading a healthy lifestyle, including following a healthy diet, achieving modest weight loss, and performing regular physical activity can maintain healthy blood glucose levels and reduce the risk of complications of T2DM (Klein et al. 2004). Intensive lifestyle interventions reduced a weight loss of more than 5%, which was maintained at the fourth year in the Look AHEAD (Action for Health in Diabetes) study (Wadden et al. 2011).

The PMoH constructed a national NCD center that is responsible for conducting health education and health promotion campaigns and maintaining a surveillance system in Palestine. Further, the PMoH NCD department, in collaboration with technical assistance from the WHO, has developed a national strategy for the prevention and management of NCDs. The results of the STEPwise survey on non-communicable disease risk factors (2010–2011) guided the PMoH in formulating the National Policy and Strategic Plan for Preventing and Management of NCDs

for 2010–2014 (PMoH 2010). In the Palestinian National Strategy 2017–2022, one of the main strategies is to promote the management of non-communicable diseases, preventive healthcare approaches, community health awareness, and gender-related programs (PMoH 2016b). However, the action plan for this strategy for 2017–2022 is still in preparation.

The Augusta Victoria Hospital (AVH) in East Jerusalem initiated a diabetes project in 2003 with the purpose of establishing a diabetes center at AVH. The aim was to create a center of excellence for the introduction of holistic approaches to diabetes care and prevention, thus challenging the biomedical approach that has dominated diabetes care in the Palestinian areas for decades. In this program, patients who have access to the center are assessed by a team of health professionals that include a diabetologist (who prescribes the proper treatment according to patient's condition and diabetes control), a dietitian (for individual nutrition assessment and counseling), and specialized diabetes care nurses. Healthy lifestyle strategies are discussed with all diabetics and their families. Group education sessions on topics related to diabetes self-management, complications, treatment, and control are held regularly. All necessary laboratory tests (mainly HbA1c and creatinine-albumin ratio) are performed on all diabetic patients (Khatib and El Sharif 2012). Due to the political situation that prevents Palestinians from accessing the center services in Jerusalem, AVH initiated in 2014 a new community health program targeting diabetes. Mobile units run by AVH medical specialists and nurses who travel daily to key locations in southern Palestine provide high-quality diabetic care to 154 communities. In cooperation with the Palestinian Ministry of Health, AVH staff treats patients seeking eye, foot, and diabetes care (LWF 2015). Abu Al-Halaweh et al. (2017) assessed the prevalence of microvascular and macrovascular complications of T2DM in 1308 patients examined by the AVH Mobile Diabetes Clinic. The mean HbA1c (tested in 1221 patients) was 9.21 (standard deviation = 2), and only 16.1% of patients had HbA1c <7%. The authors concluded from this survey and other surveys that were done on the same database of AVH that the provision of diabetes services, including diabetes medications, health education, monitoring, and supportive supervision, is still insufficient to improve diabetes control through diabetic patients' education and awareness (Abu Al-Halaweh et al. 2017).

The UNRWA conducted a clinical Audit of Diabetes in 2012 and in 2015 for Palestinian Refugees. The purpose of the audit was to evaluate the technical instructions on treatment and monitoring of diabetes (UNRWA 1997) and the health education program that was implemented in the PHC of the UNRWA to control diabetes and its complications. The results of the first and the second UNRWA clinical audits reported that around 90.0% of the patients registered in the non-communicable diseases (NCD) program were either obese (~ 64.0%) or overweight (~26.0%). The 2015 audit showed that low control rates and poor health lifestyle remained the major problem facing diabetes care in UNRWA. Control rates were only ~25%. Obesity and overweight remained prevalent (~91%). The program of controlling diabetes using lifestyle approaches was successful in only 2.5% of patients. Routine measuring of HbA1c was introduced in 2015, and the NCD

technical instructions was updated accordingly (UNRWA 2016). In addition, the UNRWA implemented a "Risk scoring" system, which is a risk assessment system for patients with NCD who are registered refugees at the UNRWA health centers. The presence of modifiable risk factors for NCD (such as smoking, hyperlipidemia, physical inactivity, blood pressure, blood sugar) and non-modifiable risk factors (such as age and family history of the disease) are recorded. The system helps health staff to manage patients according to their risk score and to refer them for specialist care as necessary. All patients registered with the NCD program in 2015 at an UNRWA health center were assessed using the risk scoring assessment system, and revealed that an average of ~25% of patients were considered to be at high risk (UNRWA 2016).

Registered Palestinian refugees in Syria, Jordan, Lebanon, Gaza, and the West Bank receive food aids containing grain, flour, and rice, i.e., "traditional food parcel delivery" ("in-kind" food aid). A recent study by Basu and colleagues (2018) indicates that a shift in the content of these food parcels to an alternative parcel with less grain and more fruits and vegetables affects the morbidity and mortality of several NCDs such as T2DM and hypertension. They showed a decreased incidence of T2DM by 0.18 per 1,000 person-years and by 0.02 per 1,000 person-years all-cause mortality (95% CI 0.01 decrease to 0.04 increase) for those receiving aid. The authors also reported that engaging in compensatory behavior by recipients of food aid through the additional consumption of as little as a 2% increase in refined grains, fats, and oils neutralized the positive effects of the fruit- and vegetable-rich parcels. The researchers therefore recommend offering a larger alternative parcel but this would require an increase in total food aid expenditure of 27%.

Most diabetes awareness campaigns in Palestine are always done in cooperation with the PMoH and the UNRWA. Juzoor for health and social development (Juzoor), which is a Palestinian nongovernmental organization, had two projects on diabetes in cooperation with the PMoH, UNRWA, AVH, and the DAN Church AID (DCA). The first project aims in implementing the Diabetes Comprehensive Care Model in the North of the West Bank (Qalqilya, Toulkarem, and Nablus) and was funded by the World Diabetes Foundation. It is a national community-based approach to diabetes care and prevention. One of its objectives was to raise awareness of preventive measures for diabetes and NCDs within the community (Juzoor 2018). In addition, in year 2017, they run a 1-year program on lifestyle modifications in Al-Jalazoon refugee camp in Ramallah governorate. The Diabetes Prevention Program (DPP) project was funded by Portland Trust. It targeted the Palestinian pre-diabetic refugee women. The intervention is composed of nutrition, physical education, and yoga sessions. The program showed an impact of the women's weight and HbA1c. The body Mass Index (BMI) decreased for a total of 100% of participants. HbA1c was reduced in a percentage of 67%, and none of the participants reached the diabetic stage. This program is extended for another 3 years 2018–2021 and will include 300 pre-diabetic refugee women in Al-Amary, Qalandia, Qadoura, Jalazoon, and Shufat refugee camps within the Ramallah governorate (Juzoor 2017).

## Medications Adherence Among Patients with T2DM

Adherence to prescribed medications is defined as the proportion of prescribed doses of medications actually taken by a patient over a specified period of time (Osterberg and Blaschke 2005). It is one of the key elements of healthcare quality, and it has significant economic and therapeutic consequences (Ho et al. 2006). Patient's adherence to anti-diabetic medications is important in preventing serious detrimental complications and minimizing utilization of healthcare resources. Thus, achieving glycemic control and preventing early diabetes complications depend on patient's adherence to therapies (Farsaei et al. 2011). Several factors can influence a patient's adherence to treatment plans, including provider-patient relationship, patient-centered factors, therapy-related factors, healthcare system factors, social and economic factors, and disease-related factors (Wong et al. 2011).

According to the PMoH reports (PMoH 2016a, 2017, 2018), Fig. 1 shows the trend of diabetes medications use between years 2015 and 2017. The figure shows that there is an increase in the percentage of patients using medications which might reflect better compliance, better diagnosis, better patients-physician communication, or better awareness.

Published studies on adherence to anti-diabetic medications in T2DM patients in Palestine are few and show that adherence was suboptimal compared to international studies. Elsous et al. (2017) report that 42% of the participants had a compliance that was medium to low adherence, while Sweileh et al. (2014) indicate that 42.7% of the study sample were considered non-adherent, and Jamous et al. (2011) suggest that 44.6% had a medium adherence and 16.9% had low adherence rates. The low-medium level of adherence to medications in these studies was attributed to the healthcare settings mainly related to provider-patient relationships and the socioeconomic status of patients. Moreover, the level of adherence to medications was associated with patient-specific factors, patient's disease-related knowledge, and their knowledge of the severity and seriousness of disease and the benefit and consequences of treatments. In the Gaza Strip specifically, an important consideration is the inconsistent availability of medications due to the political conditions.

It can be concluded that the Palestinian PMoH should further develop policies and take steps to boost the adherence to medications for type 2 DM, including measures that promote the provider-patient relationship, making the treatments accessible at the time of use and enhancing the self-management and self-monitoring of blood glucose. Moreover, healthcare providers should address the patient's beliefs through assessment and education on medications in the hope of improving adherence and consequently therapeutic outcomes. Medication adherence has important therapeutic and economic consequences (Ho et al. 2006; Sokol et al. 2005).

## Palestinian Diabetes Guidelines

Several international organizations have published guidelines for the care of patients with DM to help practitioners and patients choose appropriate care and improve treatment outcomes. Guidelines for the care of patients with DM help to improve

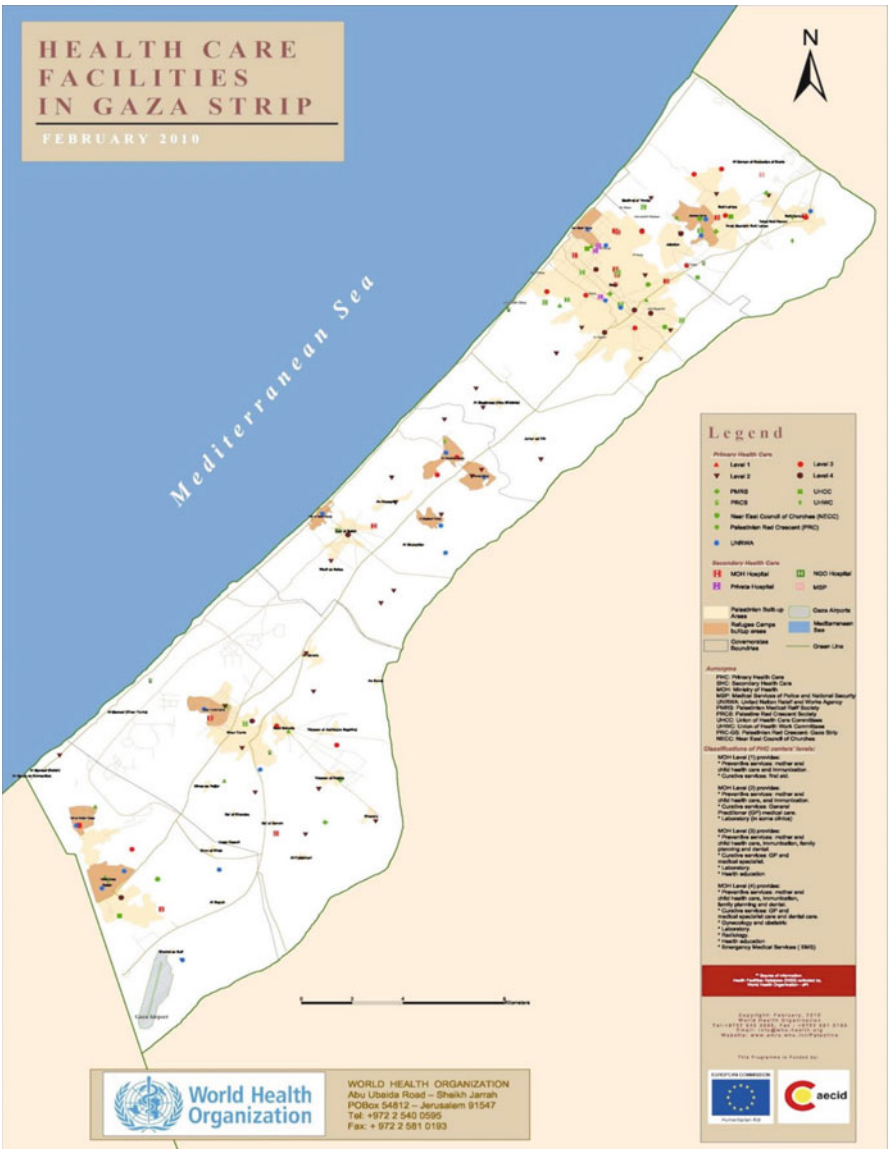



**Fig. 1** Trend on diabetes medications use at the PMoH primary healthcare clinics. (Source: PMoH annual Health reports, 2015, 2016, 2017)

clinical practice and patient care (Sharif et al. 2016). To improve the quality of care of diabetes patients, the Palestinian Ministry of Health (PMoH) and the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), the two major stakeholders in Palestine, have developed guidelines for the management of diabetes. The PMoH guide is devoted to the management

and care of DM, while the UNRWA provides technical instructions and management protocols on the prevention and control of non-communicable diseases. Both protocols are based on the World Health Organization (WHO) diabetes care guidelines of 2006, with some differences between the two protocols, and sometimes also from the WHO guidelines (WHO 2006). The PMoH guide was developed in 2008, in cooperation with WHO and the Austrian Development Cooperation. The PMoH adopted the *Quick reference guide for the management and care of diabetes mellitus*, also called the Quick Guide. The Quick Guide targets areas of screening, diagnosis, and treatment in order to standardize the care provided to patients withT1DM and T2DM (WHO 2006).

Technical guidelines on surveillance, monitoring and management of DM in UNRWA covers the following: diagnostic criteria for DM, case assessment (risk assessment and physical examination, basic investigations, and health status in terms of control and complications), management of DM (lifestyle modifications, insulin therapy, therapy by oral hypoglycemic agents (OHA), and combined insulin and OHA therapy), management of diabetic emergencies (hypoglycemia, hyperglycemia, and diabetic ketoacidosis), monitoring (control criteria, and follow-up), referral to specialists, self-care (enhancing self-reliance, teaching basic skills, and monitoring of glucose level), diagnosis, management, and monitoring of diabetes in pregnancy (pre-existing DM and preconception care of women with diabetes, and gestational DM), and surveillance (UNRWA 2009).

The following management standards for T2DM were developed by the MoH primary healthcare centers in 2012: screening and diabetes, early detection, diabetes diagnostic criteria, management of diabetes, complications monitoring, nutrition therapy and lifestyle changes, pharmacotherapy, diabetes self-management education and self-monitoring of blood glucose, testing (HbA1c, cholesterol, renal evaluation, and eye examination and foot examination), and referral criteria and indicators (screening indicators, clinical assessment indicators, treatment indicators, outcome indicators, chronic complications indicators) (USAID 2012).

The main roles of physicians include taking a medical history (personal, family, and past history, symptoms related to DM, frequency of acute complications, symptoms of chronic complications and medications use), physical examination (chest and heart, abdomen, mouth examination, skin, peripheral pulses, neurological foot examination), treatment and patient education (nutrition therapy and lifestyle changes, pharmacotherapy), and referral to other healthcare specialists (referral to ophthalmologist, nephrologist, etc.) (USAID 2012).

The roles of the nurses include the following: blood pressure, height, and weight measurement and recording, providing nursing care, and providing patient education regarding DM general information, diet, exercise, DM chronic complications, DM acute complications, patient's risk for having CVD, taking medications, self-monitoring of blood glucose, foot care, and tobacco use (USAID 2012).

A study by EL Sharif et al. (2015) in the West Bank analyzed the pattern of DM care by physicians and nurses in PHC clinics, and their self-reported compliance with the PMoH and UNRWA guidelines. Their study showed that only half of the physicians and one-third of nurses were familiar with local guidelines at their

disposal. Around half of the physicians and nurses did not adhere to Palestinian diabetes guidelines because of lack of interest, making it challenging to the healthcare services and proper diabetes management. In total, 46.0% of participants knew of the existence of Palestinian guidelines and about 60% believed these were partially used; 32.7% received training on implementation of the guidelines. The poor adherence to guidelines by physicians and nurses is related to time constraints and work overload, lack of the guideline trustworthiness, lack of incentives, lack of resources for laboratory testing, and lack of training on how to apply the guidelines (El Sharif et al. 2015; Radwan et al. 2017).

A recent study by Radwan et al. (2017) in Gaza to identify the predominant culture within the Palestinian Primary Healthcare Centers of the Ministry of Health (PHC-PMoH) and the Primary Healthcare Centers of the United Nations Relief and Works Agency for Palestine Refugees (PHC-UNRWA) used the competing values framework (CVF) and examining its influence on the adherence to the Clinical Practice Guideline (CPG) for DM. The overall adherence levels to the diabetic clinical guideline were disappointingly suboptimal within the PHC-PMoH and the PHC-UNRWA. The organizational culture had a marginal influence on the adherence to diabetes treatment guidelines. The lowest adherence was on the recommendation to perform screening for type 2 DM in all individuals at the age of $\geq$45 years in both PHC-PMoH and PHC-UNRWA. These findings were congruent with several systematic reviews which also indicated that most of the adherence-enhancing interventions had only modest-to-moderate effects (Bero et al. 1998; Grimshaw et al. 2004).

In conclusion, there is a great need to effectively consider the factors that are associated with successful implementation of clinical guidelines, including the availability and affordability of resources and updating and training on guidelines and the characteristics of the patients, providers, and healthcare organizations.

## Monitoring NCDs Including Diabetes by the PMoH and UNRWA

According to the Palestinian National Policy and Strategy for Prevention and Management, the burden of NCDs and the health outcomes of people with NCDs within the National Health Information system should be monitored. The PMoH is planning a legislative and regulatory policy framework to combat smoking, and promote a healthy diet and physical activity. In addition, the PMoH is working to strengthen health promotion and education programs in schools, the workplace, and at a community level. Such health promotion and education programs are aimed at preventing and decreasing levels of smoking, physical inactivity, obesity, and the consumption of foods rich in salt, sugar, and calories. In addition, the PMoH is working to strengthen the early detection of NCDs and their risk factors in an effort to reduce and prevent complications (PMoH 2010). At the PHC level, the PMoH is implementing the WHO Package of Essential Noncommunicable Disease Interventions for primary healthcare (PEN) approach to improve health outcomes and to reduce rising healthcare costs due to NCDs and their preventable complications (WHO 2010). In 2011, the WHO Package PEN led to introducing

evidence-based and cost-effective interventions for NCDs. The PEN interventions are for detection, prevention, treatment, and care of NCDs approach. From January 2013 to June 2013, a pilot project for the PEN approach was implemented in 14 primary care clinics in Salfit District, West Bank and assessment made after a 6-month pilot project. Patients who participated in this qualitative study perceived positive changes in the quality of NCD services since the introduction of the PEN – such as having a more thorough physical examination by a doctor, more time with the doctor, perceived improvement in prescription of drugs, and better organization of laboratory tests (Barghouthi et al. 2017).

The UNRWA began developing and piloting the use of electronic medical records (EMRs), named as "the classical e-health system, in its health centers, transitioning away from a time consuming, costly and labor-intensive imprecise paper-based system" for Palestinian refugees in 2009. One of these modules is the NCDs e-health (UNRWA 2015). In 2012, and due to continuous political conflicts and lack of justice especially in Palestine (which affects the population's physical, social and mental health), the UNRWA set a strategy that focuses on "improving the quality of healthcare delivered through a Family Health Team (FHT) model; improving the quality of medical consultations and care for NCDs; providing staff with training in family health; integrating Mental Health and Psychosocial Support (MHPSS) and protection into the day-to-day activities of health centers; engaging the community in health prevention and promotion activities; and improving hospitalization support to ensure financial protection for the most vulnerable." This strategy helped in supporting the e-health system, and strengthening the FHT primary healthcare model (UNRWA 2015). Following the FHT approach implementation in 2012, a new FHT-based e-health system was developed which led to better documentation and follow-up of referrals. It reduced patient waiting times and increased provider-patient contact time, thereby increasing opportunities for the delivery of important health education messages (UNRWA 2017).

## Prevention of Diabetes Complications Using the Glycemic Control (HbA1c)

Several factors have been suggested to be of importance for the development of short-term and long-term complications in diabetes such as metabolic syndrome factors (Wu et al. 2014). Some associations have asserted that the duration of diabetes and other metabolic syndrome factors are well-established risk factors, while others have been more controversial with partly contradictory findings in different studies (Wu et al. 2014). The importance of different risk factors also differs in patients with short- or long-term durations of diabetes (Karamanos et al. 2000). Chronic complications of diabetes include microvascular and macrovascular complications. Microvascular complications include retinopathy, nephropathy, and neuropathy. The risk of developing microvascular complications of diabetes depends on both the duration and the severity of hyperglycemia (The American Diabetes Association 2010).

The risk of diabetic complications is dependent on the degree of glycemic control in patients. The main goal of pharmacological treatment of DM is to achieve a target level of HbA1c, with an attempt to prevent the development of diabetes-related complications (WHO 2011b). As recommended by the 2009 consensus statement of the American Diabetes Association and the European Association for the Study of Diabetes, a HbA1c level of $\geq$7% calls for initiation, combination, or change of therapy with the aim of achieving an optimal glycemic control, i.e., HbA1c level below 7% (Nathan et al. 2009). Clinical trials such as the Diabetes Control and Complications Trial (DCCT) demonstrate that tight glycemic control achieved with intensive insulin regimens can reduce the risk of developing or progressing retinopathy, nephropathy, or neuropathy in patients with T1DM or T2DM. The Epidemiology of Diabetes Interventions and Complications (EDIC) trial, a follow-up to the DCCT, indicates that the previous degree and duration of glycemic exposure are also important determinants of risk of developing microvascular diabetic complications (American Association of Diabetes Educators 2002; Cundiff and Nigg 2005).

Studies in Palestine show poor glycemic control in diabetic patients, which is associated with several complications. A study in Gaza reports that good glycemic control is determined by the patients' age, high medication adherence, and better health literacy. Duration of DM (DM >7 years) was inversely related to good glycemic control (Radwan et al. 2018). In a community-based study in the Ramallah governorate, 35% of T1DM patients had HbA1c measurement over 8.5%. The prevalence of diabetic complications was as follows: retinopathy 36.4%, neuropathy 26.2%, and nephropathy 7.5%. The study results show a significant association between retinopathy and neuropathy with HbA1c and diabetes duration (Suman and El Sharif 2009). In patients with T2DM with a mean level of HbA1c of 8.27, rates of complications were as follows: 54% had hypertension, 6.7% had kidney problems, 28% had cardiac problems, and 62% had retinopathy (Suman and El Sharif 2009). Similarly, a hospital-based study showed that in patients with a mean HbA1c of 9.2%, the prevalence of microvascular complications was 16%, and myocardial infarction and stroke was 26% (Abu Al-Halaweh et al. 2017). However, other studies show lower prevalence of these complications. In a "Rapid Assessment of Avoidable Blindness (RAAB)" survey in Gaza, which included diabetic patients aged 50 years or more, the prevalence of blindness suggests that significant numbers of people (predominantly female) in Palestine do not have access to eye care services The prevalence of blindness was higher in Gaza (4.9%, 95%CI: 3.7–6.1%) than in the West Bank (2.5%, 95%CI: 1.9–3.1%) and greater in women (4.3%, 95%CI: 3.3–5.2%) than in men (2.2%, 95%CI:1.5–2.9%) (Chiang et al. 2010).

In conclusion, adherence to medication, patient literacy, and duration of diabetes are key factors for improving glycemic control and preventing diabetes-related complications. In Palestine, strategies have been suggested for improving the quality of diabetes education to make it more effective and enhancing glycemic control (UNRWA 2016; El Sharif et al. 2015), but these strategies are still not implemented.

## Challenges and Problems

**Political Situation & Access to Care**: Palestine is a country in conflict and under occupation. Israeli authorities restrict the free movement of Palestinians between the Gaza Strip and the West Bank, between East Jerusalem and the rest of the West Bank, and between rural areas and their traditional service centers. In the West Bank, movement restrictions are implemented through military orders, regulations, policies and practices, as well as physical obstacles such as the separation wall, countless barriers, gates and fences, and Israeli settlements and their separate system of road networks. Palestinian patients may travel to East Jerusalem only by permit and are restricted in their mode and point of entry at the 16 checkpoints around the city. Palestinians can also exit the West Bank directly via the Allenby Bridge, contingent on an Israeli permit, as well as a Palestinian passport or Jordanian travel document. In the Gaza Strip, there are just two exits for patients (at Rafah to Egypt), and at Erez (to Israel and for access to the West Bank, including East Jerusalem, or to Jordan).

**Political Situation and Quality of Services**: In the Gaza Strip, the long durable siege and the severe constrains executed by the Israeli occupation since 2006 (and before with the beginning of the second Intifada in 2000) severely impact the development of quality healthcare services in Gaza. This has been intensified by the internal Palestinian political separation and the economic crisis in Gaza. The health system had been impacted severely in the previous three wars (2008/2009, 2012 and 2014), the last of which severely affected the social and economic conditions of the Gaza Strip population and the health sector.

## Conclusions

DM is rapidly reaching epidemic proportions in Palestine. The levels of morbidity and mortality due to diabetes and its potential complications are enormous and pose significant healthcare burdens on individuals, families, and society. Of concerns are that diabetes is associated with a spectrum of complications and is occurring at a relatively younger age within the country. The steady migration of people from rural to urban areas and changes in the economic situation lead to lifestyle changes which impact susceptibility to DM. Despite the increased incidence in diabetes, there remains a paucity of studies investigating the prevalence and management of the disease, largely due to the political and socioeconomic vulnerability in the country. Given that the disease is now highly visible across all sections of Palestinian society, there is an urgent need for more research and intervention – at regional and national levels – to mitigate the potentially catastrophic increase in diabetes predicted to occur in the near future.

In addition, screening studies related to lifestyle choices, levels of physical activity, diet, and environmental factors as well as culturally sensitive community-based strategies aimed at prevention and management of obesity and its metabolic complications are crucial for effective strategies. Moreover, it is essential to stabilize

healthcare-based interventions and strategies to support patients with diabetes through improvement of follow-up, adherence to the national diabetes management guidelines, patients' adherence to medication use, and patients' education on diabetes complications.

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