

Literature review of type 2 diabetes mellitus among minority Muslim populations in Israel

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Bedouin populations of Israel. T2DM is a global health problem. The rapid rise in its prevalence in the Arab and Bedouin populations in Israel is responsible for their lower life expectancy compared to Israeli Jews. The increased prevalence of T2DM corresponds to increased rates of obesity in these populations. A major risk group is adult Arab women aged 55-64 years. In this group obesity reaches 70%. There are several genetic and nutritional explanations for this increase. We found high hospitalization rates for micro and macrovascular complications among diabetic patients of Arab and Bedouin origin. Despite the high prevalence of diabetes and its negative health implications, there is evidence that care and counseling relating to nutrition, physical activity and self-examination of the feet are unsatisfactory. Economic difficulties are frequently cited as the reason for inadequate medical care. Other proposed reasons include faith in traditional therapy and misconceptions about drugs and their side effects. In Israel, the quality indicators program is based on one of the world's leading information systems and deals with the management of chronic diseases such as diabetes. The program's baseline data pointed to health inequality between minority populations and the general population in several areas, including monitoring and control of diabetes. Based on these data, a pilot intervention program was planned, aimed at minority populations. This program led to a decrease in inequality and served as the basis for a broader, more comprehensive intervention that has entered the implementation stage. Interventions that were shown to be effective in other Arabic countries may serve as models for diabetes management in the Arab and Bedouin populations in Israel.

Key words: Type 2 diabetes mellitus; Pre-diabetes; Risk factors for diabetes; Muslims; Bedouins; Arabs; Ethnic differences

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Abstract

This review surveys the literature published on the characteristics and implications of pre-diabetes and type 2 diabetes mellitus (T2DM) for the Arab and

Core tip: Type 2 diabetes mellitus is a global health problem and its rapid rise in prevalence in the Arab and Bedouin populations in Israel is responsible for the lower life expectancy among Israeli Arabs compared to Israeli Jews. An important high-risk group is adult Arab women in the 55 to 64 year age range where obesity rates approach 70%. Our review found high hospitalization rates for micro and macrovascular complications among diabetic patients of Arab and Bedouin origin. There is evidence that care and counseling relating to nutrition, physical activity and self-examination of the feet are unsatisfactory in these populations. In Israel, data from the quality indicators program demonstrated inequality in health and served as the basis for an intervention program in minority populations to improve the monitoring and control of diabetics in these populations. Preliminary data indicated that this program has a significant potential to reduce health inequality between the Jewish and Arab populations.

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INTRODUCTION

Once considered a disease of western society, type 2 diabetes mellitus (T2DM) has now spread to every country in the world, with Asia accounting for 60% of the world's diabetic population^[1]. Obesity and T2DM have become a central medical problem among immigrants and minorities^[2].

There are three patterns of increase in diabetes prevalence: gradual, rapid and accelerated. The prevalence rates today are 4%-9% in Europeans and reach 14%-20% among Asian immigrants to India, Arabs, Chinese, individuals of African descent and Hispanics. Particularly high rates of diabetes, up to about 50%, are found in native populations in the United States, Canada, Australia and the Pacific region. Explanations for the increasing prevalence of diabetes in Europe include changes in lifestyle and obesity^[3]. Several hypotheses have been proposed over recent years to explain the rapid and accelerated rise in diabetes among developing nations. One of the explanations, known as the "thrifty phenotype" or "fetal origins of disease", assumes that malnutrition during pregnancy and infancy can lead to a process of adaptation and more "efficient" metabolic production that facilitates the anabolic processing of energy sources when the individual has an unrestricted intake of calories later on^[2,4]. Conversely, the "drifty genotype" hypothesis contends that the prevalence of thrifty genes is attributable to a genetic drift resulting from the disappearance of predative selection pressures^[5].

SETTING

According the Central Bureau of Statistics, the State of Israel had a population of 8102000 in March 2013, with close to 75% Jews, about 21% Arabs and about 4% others^[6].

Bedouins are one of the ethnic groups in Israeli society. They comprise 3.5% of the total population with about 280000 individuals, most living in the Negev region in southern Israel. They are Semitic tribes that originated in the Arabian Peninsula from where they began to disperse to the north to find areas worthy of grazing and living. They are Muslim Arabs that live in accordance with the unique customs of their society^[7].

The Bedouins in the Negev are at the bottom of the socioeconomic scale in Israel^[8]. Phenomena such as polygamy, in-marriage (marriage within one's own tribe or group as required by custom or law) and high birth rates (in 2009 the average Bedouin family numbered 6.8 children) are common in Bedouin society^[7].

These characteristics, intermingling with elements of modern life, have brought about a condition in which a significant proportion of their society is in a phase of "population in transition".

Today, about 61% of the Negev Bedouins live in permanent towns and 39% live in unauthorized villages. There is a large difference in living conditions between these two groups. The latter live in huts or tents without official supplies of water or electricity. Houses are heated in the winter primarily by burning wood over open fires. Cooking is done on gas stoves or open fires. The sanitation level is very low with no central sewerage or garbage removal. These conditions affect morbidity, adherence to treatment and access to healthcare services^[9].

Israel has a national health insurance law. In accordance with this law, the population receives medical care through non-profit medical organizations. The work principle of these medical organizations is based on the patient-oriented model based on primary care in the community by a team of doctors and nurses with specialist consultants, if required^[10]. Although the Arab and Bedouin populations of Israel live in the same geographical area as the Jews and have at their disposal the same broad basket of healthcare services, they are separate ethnic groups embracing a different lifestyle, nutritional habits and environmental exposures. Furthermore, in recent years, the Arab population of Israel has experienced a rapid change towards a westernized lifestyle.

We surveyed the literature on pre-diabetic states and T2DM and their consequences among the Arab and Bedouin populations of Israel. The search was conducted in the PubMed database using the search terms "nutrition and obesity", "diabetes" and "Arabs and Bedouins in Israel". Thirty six relevant articles were found, 30 in English and six in Hebrew.

ISRAELI ARABS

Genetic background, obesity and pre-diabetes in the Arab population of Israel

While the life expectancy of Israeli Arabs was lower

than Israeli Jews from 1975-2004, the gap decreased between 1975 and 1998. However, since 1998 the gap has increased again and the difference in 2004 was 3.2 years more for Israeli Jewish men and 4 years more for Israeli Jewish women. The main causes of death that lead to the gap in life expectancy are chronic diseases, especially ischemic heart disease and diabetes^[11]. The Arab community of Israel is characterized by a high rate of consanguinity. One study investigated the effect of consanguinity on multifactorial common adult morbidity, including T2DM. There was no significant difference in T2DM between patients with consanguinity and those without^[12]. Another study that investigated the existence of a direct genetic association that affects the development of diabetes demonstrated that distinct genetic backgrounds are responsible for the development of beta-cell dysfunction and insulin resistance among Arabs^[13]. Obesity comprises a central element in the development of T2DM and the risk of diabetes increases substantially with increased body mass index (BMI)^[14]. A study from central Israel showed that the mean BMI of 18-year-old Jews and Arabs is similar. This finding changes with age so that 52% of Arab women are classified as obese compared with 31% of Jewish women and 25% of Arab men compared to 23% of Jewish men. A central group pointed to in this study was Arab women aged 55-64 years where the rate of obesity reaches 70%^[16]. A study of randomly recruited healthy, overweight Arabs (BMI > 27) attending a primary healthcare clinic in Israel revealed that 27% of them had undiagnosed T2DM, 42% had impaired glucose tolerance (IGT), and only 31% had a normal OGCT. The metabolic syndrome was diagnosed in 48%^[17]. There is evidence from various populations that IGT and impaired fasting glucose (IFG) often are associated with different groups of patients^[18]. The study from Israel assessed insulin resistance and impaired pancreatic function among overweight Arab patients with IFG only, IGT only or IFG and IGT (combined glucose intolerance-CGT) compared to those with a normal response to glucose (NGT). Patients with IFG and CGT were more obese and had higher values of insulin resistance compared to those with IGT only or normal fasting glucose. There was no statistically significant difference in insulin resistance between patients with IGT only and those with NGT. Beta-cell function was depressed in patients with IGT only and CGT compared to those with IFG and NGT, while beta-cell function indices in patients with IFG were similar to those with NGT^[19].

DIABETES MELLITUS IN ISRAELI ARABS

Studies show that in recent decades the incidence rate of diabetes in the Israeli Arab population has increased by 9.1 per 1000 persons annually^[20]. A study of the urban Jewish and Arabs population from the central area of Israel found that the prevalence rates for adult-onset diabetes were 21% among Arabs and 12% among Jews.

The Arabs presented with diabetes at a younger age than the Jews and 25% of the Arab population was diagnosed with diabetes by age 57 compared to age 68 in the Jewish population^[21]. An alarmingly high prevalence of diabetes was found in Israeli Arab women over 50 years, reaching 50%^[22]. Another study found that the prevalence of diabetes among women younger than 65 years old was significantly higher compared to men. The mean age of diabetic women was 48.3 compared to 59.5 among men and women had a higher BMI (34.5 *vs* 30.04, respectively) at diagnosis. The age of diagnosis of diabetes correlated significantly with BMI^[14]. Despite the high prevalence of obesity, metabolic syndrome and overt diabetes among Arabs, there is evidence of inadequate care for diabetes in this population. More than a third of respondents reported that they did not receive any counseling on issues such as foot care or the effects of smoking on diabetes. Misconceptions, attributable to social norms, are common and more than a third forgo taking medications because they cannot afford them^[23]. Arab diabetics received less nutritional counseling (OR = 0.46), less counseling on physical activity (OR = 0.42) and less advice on self-testing of the feet than Jewish patients (OR = 0.55)^[24]. There is poor diabetes control and sub-optimal follow-up care among Arab patients with diabetes^[25].

The results of studies on the prevalence of obesity, pre-diabetes and diabetes type 2 in the Arab Israeli population are summarized in Table 1.

DIABETES AS A RISK FACTOR IN ISRAELI ARABS

In a five country observational study that determined the incidence of hypoglycemia during the holiday of Ramadan among Muslim subjects with T2DM treated with a sulphonylurea, the highest incidence of hypoglycemia was reported by patients from Israel (40%)^[26].

In a recent study among patients in hospitals that had predominantly Arab patients (more than 90%), the proportion of diabetics was 39%. There was a female preponderance among patients admitted with diabetes (52.9%), while only 45% of hospitalized patients without diabetes were women ($P = 0.0003$).

A difference was found in the reasons for hospitalization between patients with diabetes and those without. In the diabetic group, there were more hospitalizations (37% *vs* 27% respectively, $P < 0.001$) and urinary tract infections (7.7% *vs* 6.9%, respectively). The authors recommended that the prevention of cardiovascular disease and urinary tract infections among the diabetic population should be a priority, especially for Arab women over 40 who have a high risk for morbidity and a high rate of hospitalizations^[27].

A study that evaluated risk factors among Arab and Jewish patients who underwent rehabilitation for a first stroke revealed that a high percentage of Arab patients have hypertension and T2DM. The prevalence of diabetes

Table 1 Results of studies on the prevalence of obesity, pre-diabetes and diabetes type 2 in the Arab Israeli population

Ref.	Date	Subjects	Study results
Keinan-Boker <i>et al</i> ^[16]	2005	Representative sample of 3246 individuals from the general Israeli population	In the subgroup of older Arab women, aged 55-64 yr, obesity reached 70%
Abdul-Ghani <i>et al</i> ^[17]	2005	95 randomly recruited Arab subjects who were overweight and over the age of 40	27% had undiagnosed DM, 42% impaired fasting glucose or impaired glucose tolerance, 48% metabolic syndrome
Abdul-Ghani <i>et al</i> ^[14]	2005	7434 patients from an outpatient clinic in an Arab village	The prevalence of diabetes type 2 in Arab patients younger than the age of 65 was significantly higher among women than men. Diabetic women were younger than men at diagnosis (48 yr <i>vs</i> 59 yr) and had a higher BMI
Kalter-Leibovici <i>et al</i> ^[15]	2007	880 randomly selected Arab and Jewish patients	The prevalence of obesity was 52% in Arab women compared to 31% in Jewish women and 25% in Arab men compared to 23% in Jewish men
Idilbi <i>et al</i> ^[20]	2012	Review of official health statistics	The incidence rate of diabetes in the Israeli Arab population increased by 9.1 per 1000 persons annually. In contrast, it decreased among Jews
Kalter-Leibovici <i>et al</i> ^[21]	2012	1100 Arab and Jewish patients older than the age of 20	The prevalence of diabetes was 21% among Arabs and 12% among Jews. Arabs developed diabetes 11 years earlier than Jews

DM: Diabetes mellitus.

among Arabs was 51.4%, among non-immigrant Jews 38.5%, and among immigrant Jews 39.1% ($P < 0.001$)^[28]. In another study that evaluated ethnic disparities between patients with a first episode of primary intracerebral hemorrhage in northern Israel, the Arabs were found to be younger and to have a higher prevalence of diabetes^[29]. A national survey among 28 hospitals in Israel that assessed ethnic variations in acute ischemic stroke showed that the mean age of Arab patients was nine years younger than Jewish patients (63 ± 11 years *vs* 72 ± 12 years, respectively), Arabs were more likely to be obese (OR = 1.72) and to have diabetes (OR = 1.41)^[30]. A higher prevalence of diabetes among Arabs than Jews was also found in a study that compared ethnic differences in ischemic stroke in patients of working age (≤ 65 years)^[31].

In two studies that examined risk factors in hospitalized Arab and Jewish women with coronary heart disease who underwent cardiac catheterization, a higher prevalence of diabetes was found among the Arab women^[32,33].

These differences should be addressed when developing stroke and coronary artery disease preventative strategies, planning healthcare services and designing culturally relevant public education programs.

The results of studies on diabetes as a risk factor among Israeli Arabs appear in Table 2.

NUTRITION AND OBESITY AMONG BEDOUINS IN THE NEGEV

Similar to other Arab Israeli populations, the prevalence of obesity was also higher among Bedouins compared to Jews (27.9% *vs* 20%, respectively)^[34]. A study of Bedouin women of childbearing age found a high prevalence of obesity associated with nutritional deficits^[35]. In order to investigate possible dietary causes for the discrepancy in obesity rates between adult Jews and Bedouins, researchers from southern Israel compared eating patterns in the two populations. Bedouin men and women reported a lower intake of fat and protein and

a higher intake of carbohydrates than Jews^[34]. Another study demonstrated that the nutrition of Bedouin women who lead a semi-traditional lifestyle had a caloric value that was 50% higher than that of Jewish women. The mean BMI of the Bedouin women was 30^[36]. To evaluate the importance of modern food and drink in their daily diet, the nutrition of Bedouin women living in permanent towns and non-permanent settlements was compared. Residents in non-permanent settlements, where there are no means to preserve food, ate more traditional dairy products while those in permanent towns ate more meat. Both population groups based their two main meals on traditional food, but processed foods and drink were consumed as snacks. These processed products are calorie-rich and can be a factor in the rising rate of diabetes^[37].

T2DM AMONG BEDOUINS IN THE NEGEV

An epidemiological survey conducted among Bedouins about half a century ago reported that only a few patients had hypertension and diabetes and none had ischemic heart disease^[38,39]. Later, evidence accumulated that cardiovascular risk factors among the Bedouins were on the rise and that this increase was more pronounced among Bedouin living in settled settings compared to the traditional tribal groups. A study performed in 1990 demonstrated that among Bedouins who lived in permanent towns, 15% were obese and 23% were overweight compared to Bedouins who did not live in permanent towns, where there were no obese individuals and 23% were overweight. This difference was particularly apparent in the younger age group. No difference was found between the groups regarding fasting blood glucose^[40]. A study from 2005 found a difference in diabetes prevalence in urban compared to rural settlements (5.5% *vs* 3.9%, respectively, $P < 0.001$). In this study, diabetes control was less successful among Bedouin diabetes patients. Only 29.3% had their diabetes under control compared to 46.7% among non-Bedouin

Table 2 Results of studies on diabetes as a risk factor among Israeli Arabs and Bedouins

Ref.	Date	Subjects	Study results
Jabara <i>et al</i> ^[32]	2007	546 women (102 Arabs) after cardiac catheterization	Arab women had a higher prevalence rate for diabetes (61% <i>vs</i> 46% in Jews)
Salameh <i>et al</i> ^[33]	2008	40 Arab and 179 Jewish women hospitalized with coronary artery disease	More Arab patients had diabetes (73% <i>vs</i> 40%)
Telman <i>et al</i> ^[31]	2010	727 Arab and Jewish patients of working age (< 65 yr) with stroke	There was a higher prevalence of diabetes in the Arab patients
Telman <i>et al</i> ^[29]	2010	546 patients with a first episode of primary intracerebral hemorrhage	Diabetes was more frequent among the Arab patients.
Aravind <i>et al</i> ^[26]	2011	1378 Muslim patients from five countries who were treated with sulfonylurea during Ramadan	The highest percentage of hypoglycemia (40%) was reported in patients from Israel
Greenberg <i>et al</i> ^[28]	2011	2000 patients with a first stroke (237 Arabs)	A high percentage of Arabs had diabetes (51.4% <i>vs</i> 35.8% in Jews)
Gross <i>et al</i> ^[30]	2011	1540 patients with acute ischemic stroke, 169 Arabs	Arab patients were more likely to have diabetes (OR 1.41)
Chorny <i>et al</i> ^[46]	2011	523 diabetic patients (Jews and Bedouins) who were examined by an ophthalmologist	The prevalence of maculopathy and retinopathy was higher among the Bedouins (22% <i>vs</i> 13.4%)
Nseir <i>et al</i> ^[27]	2013	3784 patients from hospitals with predominantly Arab patients	39% of the hospitalized patients were diabetics. The diabetics had more hospitalizations due to atherosclerotic disease
Rabaei <i>et al</i> ^[45]	2014	220 patients admitted with diabetic ketoacidosis (19% Bedouins)	There was no difference in outcomes (in-hospital mortality, 30-d mortality) between Jews and Bedouins

diabetes patients^[41]. A study at the largest urban Bedouin outpatient clinic in 2002 revealed that the prevalence of diabetes was 7.3% among men and 9.9% among women. Women had significantly higher BMI levels than men but lower levels of HbA1c and microalbuminuria^[42]. Prescribed oral medicines were purchased by 69% of the women compared to 76% of the men. Insulin was purchased by 19% of the women compared to 15% of the men^[42]. The study from 2007 showed an age-adjusted prevalence rate for diabetes of 12% in the Bedouin urban population compared to 8% among Jews. The prevalence rate was especially notable among Bedouins in the 40-49 year age group where it was three times higher than in the Jewish population of the same age. The adherence rate to diabetes treatment was 27% among the Bedouins compared to 42% in the Jewish population. The Bedouin population was also less compliant with follow-up blood tests: 22% of the Bedouin patients had no HbA1C measurements over the course of the previous year, compared to 13% of the Jews. The rates of controlled diabetic patients were lower among the Bedouins than the Jews (29.5% *vs* 57%, respectively)^[43]. The results of studies on the prevalence of obesity and diabetes type 2 among Bedouins in the Negev are summarized in Table 3.

A recent study evaluated the reasons for non-treatment of cardiovascular disease and its risk factors in the Bedouin population. Structured interviews on knowledge and attitudes relating to chronic diseases and their treatment were conducted among patients with T2DM, hypertension and lipid metabolic disorders. Ninety-nine high and 101 low-adherent patients were interviewed. More patients in the low-adherence group believed that traditional folk treatment was an alternative to prescription drugs for the treatment of T2DM, hypertension and hyperlipidemia and 10% took traditional drugs only. Patients in the group that was classified as undertreated believed that adverse drug effects were more harmful than

the disease itself (65% *vs* 47%, respectively) and this was also the reason for the cessation of treatment among 47% who were classified as low-adherent^[44].

In a retrospective analysis of the clinical characteristics and outcomes of diabetic ketoacidosis in the Jewish and Bedouin populations that included patients with both type 1 and type 2 diabetes, no differences were found for in-hospital mortality, 30 d mortality or complication rates in Jewish and Bedouin patients^[45]. Damage to the eye as a result of microvascular injury is a common complication in diabetes patients. Among diabetic patients referred to ophthalmologists in southern Israel, significantly more diabetic complications (damage to the retina and the macula) were found among the Bedouins than among the Jews (22% *vs* 13.4%, respectively), although the Bedouin patients were younger than the Jews (average age 58.6 ± 12 years *vs* 64 ± 10.3 years). The predicting factors for diabetic eye complications among Bedouins were the duration of the diabetes, high levels of HbA1c, insulin treatment and smoking^[46]. The results of studies on diabetes as a risk factor among Israeli Arabs appear in Table 2.

THE PROGRAM FOR HEALTH QUALITY INDICATORS AND ITS EFFECT ON THE CONTROL OF DIABETES IN MINORITY POPULATIONS

Health quality indicators were introduced at the inception of the process of departmentalization of clinics and was part of the process of assessment of the clinics. The first indicator that was chosen in this process was the rate of influenza inoculation in the target population. Over the years the number of indicators increased so that today there are 70 indicators in 11 primary areas. A significant

Table 3 Results of studies on the prevalence of obesity and diabetes type 2 among Bedouins in the Negev

Ref.	Date	Subjects	Study results
Ben Assa ^[38]	1961	2000 examined Bedouins	10 diabetic patients
Fraser <i>et al</i> ^[40]	1990	Tribal and settled Bedouin males	Among settled Bedouins, 15% were obese and 35% were overweight. Among tribal Bedouins, none were obese and 23% were overweight
Abou-Rbiah <i>et al</i> ^[42]	2002	3115 patients from an urban Bedouin clinic	The prevalence of diabetes was 7.3% in males and 9.9% in females. The mean BMI was 30 in females and 29 in males
Cohen <i>et al</i> ^[41]	2005	Population of the Negev area	The prevalence of diabetes was 5.1% in Bedouins, 3.7% in non-Bedouins, 5.5% in urban Bedouins, 3.9% in rural Bedouins. Diabetes was well controlled in 29.3% of the Bedouins and 46.7% of the non-Bedouins
Tamir <i>et al</i> ^[43]	2007	28449 Bedouins, 14012 Jews, older than 20	The prevalence of diabetes was 12% in the Bedouins compared to 8% in the Jews)
Fraser <i>et al</i> ^[34]	2008	793 Jews and 169 Bedouins aged 35-64 yr	The non-compliance rate for treatment was 72.9% among diabetic Bedouins
Leshem <i>et al</i> ^[36]	2008	31 encampment Bedouin women	The obesity rate was 27.9% among Bedouins and 20% among Jews
Abu-Saad <i>et al</i> ^[35]	2012	683 pregnant Bedouin women	The mean BMI was 30.3
			42% were either overweight or obese (based on their pre-pregnancy BMI)

BMI: Body mass index.

proportion of these indicators relates to the implementation of preventive medicine and monitoring and control of patients with diabetes. The program's data pointed to a serious disparity in the monitoring and control of diabetes in the Arab sector as well as other Israeli sub-populations, including Ethiopian Jews, compared to the general population^[47,48]. In 2008, the Clalit Health Services, which serve 70% of the Israeli population, reached an organizational decision that the reduction of these disparities was a strategic goal, so a dedicated intervention program to address them was designed. Between 2008-2010, a "pilot" program was conducted aimed at 55 clinics serving 400000 clients from "difficult" populations, including Arab and Bedouin communities in the Negev. The program focused on seven quality indicators, including the monitoring and control of diabetes. The strategy included a concerted effort aimed at providing medical solutions to loci of inequality in health quality indicators. Language facilitators were introduced into the clinics and efforts were made to incorporate religious leaders into the program, including lectures by the local Kadi on the religious importance of maintaining a healthy body, the reading of prayers on the importance of preventive medicine and physical activity in mosques on Fridays, and discussions with the village sheikh to grant permission and consent to women to carry out physical activity in the form of walks. As a result of this intervention in key clinics, a reduction of 67% in health quality disparity (including measurements related to monitoring and control of diabetes) were achieved within less than two years. There was an increased risk at baseline of 8% in the key clinics in emergency room visits and hospitalizations, which was reduced to that of other population sectors as a result of the intervention. In light of the success of the pilot intervention, in a relatively short period of time a separate program was developed that was broader and more comprehensive. This program was designed to bring about a reduction in inequality among socioeconomic levels and different sectors of the

population. This program is now in the implementation stage^[48] and its results have not been reported to date.

CONCLUSION

T2DM is a global health problem and the rapid rise in its prevalence in Arab and Bedouin populations in Israel is a cause of the difference in life expectancy between Jews and Arabs. The increased prevalence of T2DM corresponds with increased obesity rates in these populations. The primary at-risk group is Arab women aged 55 to 64 years who have an obesity rate that approaches 70%. There are several genetic and nutritional explanations for the increase. In this review, we found evidence for high rates of hospitalizations and micro and macrovascular complications among diabetic patients of Arab and Bedouin origin. Despite the high prevalence of diabetes and its negative health implications, there is evidence of a lack of appropriate care and counseling about nutrition, physical activity and self-examination of feet. Financial difficulties are frequently cited as reasons for inadequate healthcare and belief in traditional therapy and misconceptions about drugs and their side effects are also significant factors.

Although these overall data are troubling, recent findings are more encouraging.

A quality indicators program in the community has been in existence in Israel for the last 15 years. It is based on some of the world's leading information systems with data regarding sociodemographic factors, drug therapy, healthcare services, laboratory and imaging data, and recording of chronic diseases. It consists of several domains, including preventive medicine and management of chronic diseases. The program has led to an improvement in the quality of medical care, including diabetes control.

Since the program's data indicated inequality in different health quality indicators, including indicators relating to the monitoring and control of diabetes,

between the general population and several population sectors including minorities, a pilot intervention program was conducted to reduce these inequalities in selected clinics from 2008-2010.

This intervention program has contributed to a narrowing of health-related gaps and has reduced inequalities between the Arab and Jewish populations as well as between socioeconomic levels. The program demonstrated that the healthcare system is capable of reducing health inequalities, even if they are the result of variables for which they are not directly responsible, such as disparities in income, educational level, culture differences and isolated residential areas. It appears that an evidence-based, dedicated intervention is the key to success. In the wake of this success, a broader intervention was planned and has now entered into the implementation phase. The results of this program which involves the entire minority population have not been reported yet.

Interventions that are based on empowerment for medical care, cultural elements presented in Arabic terms and concepts, nutritional habits and lifestyle were shown to be effective in other Arabic countries^[49] and can serve as models for diabetes management in the Arab and Bedouin populations in Israel.

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