Prevalence and clinical characteristics of diabetes mellitus in Lebanon: a national survey

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Abstract

Background: Diabetes mellitus in all its forms has been rapidly increasing worldwide, especially in the Eastern Mediterranean Region.

Aims: This national study aimed to assess the prevalence and clinical aspects of diabetes mellitus in Lebanon with special focus on type 1 (T1DM).

Methods: A national multistage, random household sample survey was conducted, using face-to-face interviews with 1 questionnaire per household. A total of 4500 households were selected from all areas based on a pre-existing sampling frame of the Lebanese population.

Results: The prevalence of previously diagnosed diabetes mellitus in the surveyed population of 17 832 persons (mean age ~36 years) was 7.95%. The prevalence of T1DM in particular was estimated at 0.1%, or almost 1% of all detected cases of diabetes mellitus. Most persons with diabetes mellitus reported obtaining their usual care from endocrinologists rather than primary healthcare physicians. Delayed performance of haemoglobin A1c test was reported in 25% of 1418 patients. Hypoglycaemic episodes recently occurred in 30% of patients; of whom, at least one third required medical attention, including hospital admission. Diagnosed complications were reported in 22% of cases, with retinopathy being the most common.

Conclusions: Prevalence of T1DM in this population was lower than international estimates. Diabetes mellitus management appears to be deficient, based on delays in standard control testing, hypoglycaemic episodes and diabetes mellitus-related complications. Coordination of diabetic care management should be devolved to primary healthcare physicians, who can keep track of the need for referral to various types of diabetes mellitus care.

Keywords: hypercholesterolaemia, hypertension, Middle East, noncommunicable diseases, type 1 diabetes.

Introduction

Diabetes mellitus (DM) in all its forms has been rapidly increasing worldwide, with particularly higher peaks in the Eastern Mediterranean Region (1). Uncontrolled hyperglycaemia is responsible for a large spectrum of complications in end-stage organs, because of damage caused to vascular endothelia. Damage is maximized by earlier age of onset, delays in diagnosis and treatment, and comorbidity such as hypertension and dyslipidaemia (2). These characteristics have contributed to DM presenting as a pandemic of global dimensions, with major public health implications at all levels of health care.

Public health decision-makers in Lebanon remain largely unaware of the current magnitude of the disease and its complications. The national prevalence of DM in Lebanon has not been updated since 2009 (3), and at that time, the measured prevalence did not include age categories younger than 25 years, and identified all cases globally as type 2 DM (T2DM). In fact, the relative proportions of the two main subtypes, juvenile type 1 DM (T1DM) and maturity T2DM, are still unknown.

Data on T1DM remain scarce even though it is one of the most common endocrine and metabolic conditions in childhood. The prevalence of T1DM, its clinical characteristics, and geographical and demographic distribution are important epidemiological data that are necessary to plan proper preventive and curative strategies that will ensure better lives for children. Based on international assumptions, the relative proportion of T1DM in high-to-medium income countries such as Lebanon is estimated at < 9% of the overall prevalence of DM (4). The International Diabetes Federation (IDF) estimated the prevalence of diabetes in Lebanon in 2015 at 122 (100–152) per 1000, which assumes a T1DM prevalence in the general population of 12.2 (10.0–15.2) per 1000. Based on a total Lebanese population of 4 million, the total number of persons with T1DM should therefore be 48 000 (4). All these numbers are far from what is seen and reported by public health authorities, scientific societies and healthcare professionals in direct contact with persons with DM in Lebanon.

The gap between mathematical estimations derived from complex algorithms and the perceived clinical and epidemiological reality in Lebanon clearly indicates the importance of running a valid assessment of the current status of DM and its subtypes. The present national

household survey aimed to provide accurate national estimates that will close the epidemiological knowledge gap, estimating the relative prevalence of T1DM, and contributing to better projections of the public health burden in Lebanon.

The objectives of the present study were to: (1) determine the prevalence of previously diagnosed DM, and its two main subtypes; (2) determine the prevalence of previously diagnosed hypertension and hypercholesterolaemia; (3) describe the clinical characteristics of management of DM; and (4) describe coping with T1DM in the immediate social environment of affected children.

Methods

Study design and target population

This study targeted the entire population of Lebanese nationals of all ages. Sampling was carried out in all Lebanese administrative districts (mouhafazats).

Sample size and sample selection

In each of the five mohafazats, an equal number of participants was selected, using the basic equation in random sampling:

$$N \geq [(Z_\alpha)^2 \, p(1-p)]/\delta^2 \times (\text{design effect})$$

where Z_α = 1.96 for a tolerated error α = 0.05; p = estimated prevalence of diabetes in Lebanon (2009) = 8.5% (3); δ = degree of precision expected around the estimation of prevalence = 1%; and design effect = 1.5, to correct for loss of information in the multiple stages of the selection process.

Under these conditions, the minimum number of participants to be selected in each mohafazat was 4481. Given an average of 5 persons per household in Lebanon, a minimum number of 900 households was selected in each mohafazat, with a total of 4500 households in the 5 districts of the country. Beirut was considered with the addition of adjacent areas from Mount Lebanon, to become a single Greater Beirut area. The suburban regions added to Beirut shared socioeconomic and service situations more similar to the capital city than to the rest of Mount Lebanon.

Multistep, random cluster sampling was conducted within each subdistrict (caza) in each mohafazat, using the probability proportional to size approach, based on an existing sampling frame of the Lebanese population, to select a proportional number of households per caza. Households were randomly selected from within buildings, which had previously been selected from city/village blocks. In each household, an interview was conducted with respondents who volunteered to provide data on themselves and on absent household members including children, until full data were obtained for the entire household. Respondents had to be adult (age > 18 years) parents/guardians of minors in the household, to understand Arabic, and be free from any kind of cognitive impairment or difficulties to communicate.

Questionnaire

The survey was conducted in face-to-face interviews using a specially designed questionnaire. The questionnaire was prepared in English, translated to Arabic and piloted for suitability of the questions. One questionnaire was completed for each household. The questionnaire was composed of 30 factual questions that required no validation, with skip patterns allowing the surveyor to move rapidly to details on DM if present. In case of non-response, the surveyors immediately replaced the household with the next on the list. Replacement was generally conducted within the same block to minimize any selection bias associated with refusal to participate.

Variables

The outcome of interest was the prevalence of DM, as well as hypertension and hypercholesterolaemia. In each household, all members were listed by age and sex, and their current disease status recorded. The household crowding index was measured in persons/room as a proxy for socioeconomic status (5). The higher the crowding index was, the lower the socioeconomic status. The geographic location of the household was also entered. Disease status was based on whether a person had been formally diagnosed with DM, hypertension and/or hypercholesterolaemia. For the purposes of this survey, subtypes of DM were defined syndromically as follows: T1DM: any patient who started using insulin within the first year following diagnosis, providing diagnosis occurred before age 25 years (6); and T2DM: all other cases.

Following this initial listing, additional variables were explored specifically for persons with DM: (1) time since diagnosis of DM; (2) use of oral antidiabetic drugs, duration of DM and most frequent categories; (3) use of insulin treatment and its duration; (4) management of DM: disease control [last date of haemoglobin A1c (HbA1C) measurement, specialty of the treating physician (endocrinologist, general practitioner/family physician, others), and presence of medical coverage]; (5) disease severity: symptoms of hypoglycaemia experienced in the 4 weeks preceding the survey, level of intervention needed, and number of hospitalizations during the 12 months preceding the survey for conditions related to DM or its complications; and (6) for patients ≤ 18 years with DM: variables assessing the school's awareness of the patients' condition and response to the latest episode of hypoglycaemia.

Statistical analysis

In the first part of the analysis, national weighted prevalence rates of DM and its 2 subtypes, and of hypertension and hypercholesterolaemia were calculated with their corresponding 95% confidence intervals (CIs). In the second part of the analysis, specific characteristics of DM were described in detail. The χ^2 test was used to assess the significance of differences in the proportion of people with DM between geographical areas (Greater Beirut vs outside Greater Beirut). Data were analysed using SPSS version 23 and Stata version 13.

Ethical considerations

The aim of the study was clearly presented to respondents at the time of their visit. They were assured of the privacy and confidentiality of their responses and informed that their data would be strictly used for scientific and public health planning purposes. Respondents were asked to sign a consent form to provide data anonymously about themselves and their household members before starting the questionnaire. They were explicitly informed that they had the right to skip any question and/or stop the interview at any time. There was no potential for harm expected in this study. The study was reviewed and obtained ethical clearance from the standing Ethics Committee of the Saint-Joseph University, Campus of Health Sciences, Beirut, Lebanon (reference number: USJ-2016-98).

Results

Questionnaires were completed by 4500 households across Lebanon (Table 1). In more than two thirds of households, the main respondent was one of the parents. The average number of persons per household was 4, ranging from 1 (in 6% of households) to 15 (only 1 household). The mean crowding index was 1.16 persons/room (standard deviation 0.64). DM was reported in 29% of surveyed households, hypertension in 31% and hypercholesterolaemia in 25%.

The surveyed households provided data on 17 832 persons of various ages (Table 2). Mean age was 35.9 (20.4) years, with almost equal gender distribution. Participants from the metropolitan area of Greater Beirut comprised 27% of the sample. Previous diagnosis of DM was reported by 1418 persons, putting the estimated prevalence at 7.95% (95% CI: 7.55–8.35). Moreover, 1610 persons were receiving treatment for hypertension, and 1314 for hypercholesterolaemia.

Table 1 Characteristics of surveyed households (n = 4500)

Variables	n (%)
Mean no. of residents	3.96 (SD 1.77)
Households with only 1 person	278 (6.2%)
No. of persons in household	1–15
Mean household crowding (persons/room)[a]	1.16 (SD 0.64)
Range	0.1–7
Geographic distribution (n, %)	
Greater Beirut	1320 (29.3%)
Mount Lebanon	950 (21.1%)
North Lebanon	920 (20.4%)
South Lebanon	750 (16.7%)
Bekaa	560 (12.5%)
Categories of household respondents	
Fathers	1670 (37.1%)
Mothers	1626 (36.1%)
Others	1204 (26.8%)
Household prevalence of selected diseases	
Diabetes	1313 (29.2%)
Hypertension	1406 (31.2%)
Hypercholesterolaemia	1131 (25.1%)

[a]Higher crowding indicates lower socioeconomic status. SD = standard deviation.

Thus, the prevalence of hypertension was 9.0% and that of hypercholesterolaemia was 7.4%.

The mean age of 1418 persons with DM at the time of survey was 60.3 (13.0) years, with around 7% of patients aged ≤ 40 years (Table 3). There was a higher proportion of males in this group. The distribution of DM prevalence by age groups is shown in Figure 1. The mean age at diagnosis was 49.4 (15.9) years, whereas the

Figure 1 Prevalence of diabetes by age groups in Lebanon (2016) (n = 17 832)
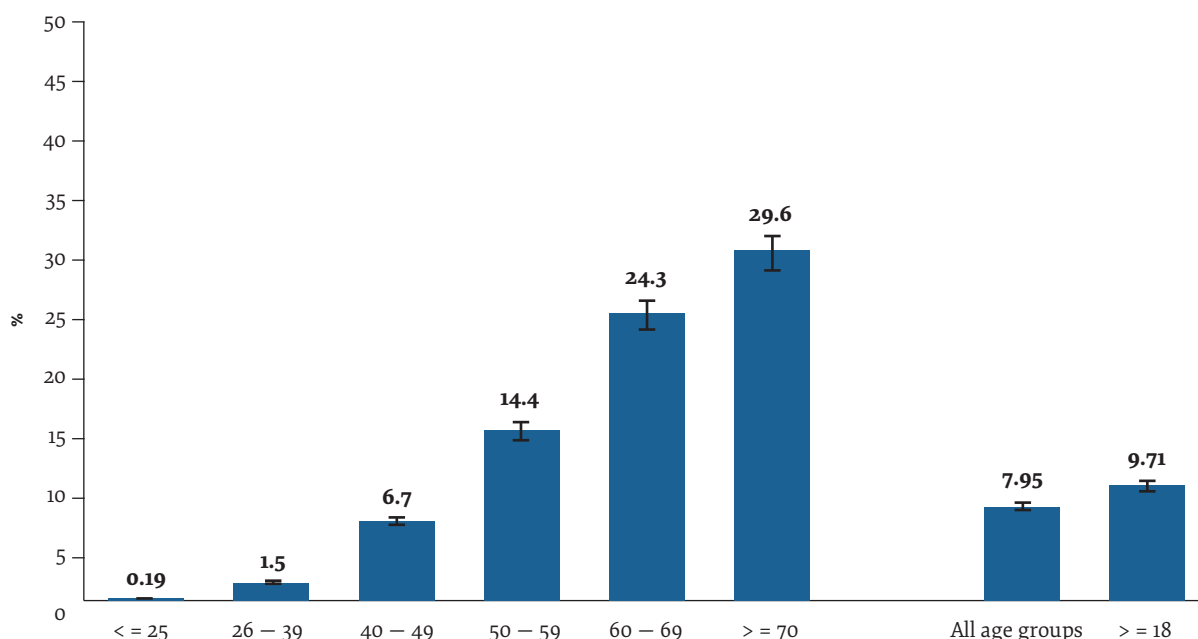
Table 2 **Sociodemographic characteristics of the selected sample and disease prevalence rates (*n* = 17 832 Lebanese)**

Variables	*n* (%)
Mean age, years (SD)	35.9 (20.4)
Sex (n, %)	
Male	8937 (50.1%)
Female	8895 (49.9%)
Geographic distribution (n, %)	
Greater Beirut (urban/suburban)	4844 (27.2%)
Elsewhere (small towns/rural)	12 988 (72.8%)
Prevalence of selected diseases (95% CI)	
Diabetes	7.95 (7.55–8.35)
Hypertension	9.03 (8.61–9.45)
Hypercholesterolaemia	7.37 (6.99–7.75)

CI = confidence interval; SD = standard deviation.

Table 3 **Characteristics of the sample of persons with diabetes mellitus (*n* = 1418)[a]**

Variables	*n* (%)
Sociodemographic characteristics	
Mean age, years (SD)	60.3 (13.0)
≤ 40 years	95 (6.7%)
Sex (n, %)	
Male	786 (55.4%)
Female	632 (44.6%)
Mean age at diagnosis (SD)	49.4 (15.9)
≤ 25 years (n, %)	63 (4.5%)
≤ 10 years (n, %)	17 (1.2%)
Clinical characteristics	
Current use of oral antidiabetic drugs	1289 (90.9%)
Biguanides only	845 (65.6%)
Sulfonylureas only	282 (21.9%)
Biguanides in combination with other types	255 (19.8%)
Others	70 (5.4%)
Current insulin use	256 (18.1%)
Specialty of the physician most involved in follow-up	
Endocrinologist	973 (71.1%)
General practitioner or family physician	375 (27.4%)
Cardiologist	20 (1.5%)
Last haemoglobin A1C test	
Within last 6 months	988 (75.7%)
Between 6 months and 1 year	165 (12.6%)
> 1 year	142 (10.8%)
> 2 years	10 (0.8%)
Recent episodes of hypoglycaemia[b]	
None	1034 (71.7%)
Episodes requiring no help	187 (13.5%)
Episodes requiring medical attention	115 (8.3%)
Episodes requiring hospitalization	48 (3.5%)
Prevalence of complications	321 (22.6%)
Types of reported complications[c]	
Retinopathy	148 (10.4%)
Coronary heart disease	88 (6.2%)
Peripheral artery disease	58 (4.1%)
Ulcer of lower limb	41 (2.9%)
Stroke	29 (2.0%)
Myocardial infarction	27 (1.9%)
Nephropathy	22 (1.6%)
Amputation of the lower limb	16 (1.1%)

[a]18 patients are believed to be patients with type 1 diabetes mellitus.
[b]During the previous 4 weeks preceding the survey.
[c]Not mutually exclusive.

mean duration between time of diagnosis and the survey was 10.9 (9.9) years. Only 18 patients started using insulin within the first year following diagnosis, which occurred before age 25 years, representing 1.3% of the total diabetes caseload. Based on the figures, the prevalence of T1DM was estimated at 0.1% (95% CI: 0.05–0.15). The prevalence of diabetes was significantly higher in Greater Beirut (9.1%) compared to elsewhere (7.3%) (*P* < 0.001), but prevalence did not vary by households' socioeconomic status (data not shown).

One hundred and twenty-nine (9.1%) patients were not using oral antidiabetic drugs at the time of survey (Table 3). The predominant oral drug classes used alone or in combination were biguanides in 1101 cases (85.4%), followed by sulfonylureas in 353 (27.4%). The use of insulin therapy was reported by 256 (18.1%) patients. Fifty-two (3.7%) patients were using neither oral antidiabetic drugs nor insulin at the time of survey. Usual care for DM was obtained mostly from endocrinologists for 973 patients (71.1%). A total of 988 (75.7%) patients had obtained an HbA1C test ≤ 6 months prior to the survey, in concordance with standard international guidelines. The occurrence of at least one hypoglycaemic episode during the 4 weeks preceding the survey was reported in 350 patients (25.3%); of whom, 48 (3.5%) required hospitalization. Overall, 199 patients (14.0%) had been admitted to hospital at least once during the 12 months preceding the survey, with a mean 2.0 (1.8) hospitalizations. Three hundred and twenty-one (22.6%) patients were reported to have DM-related complications at the time of survey, and the most frequent was retinopathy (n = 148; 10.4%).

Discussion

This national survey conducted in 2016 across Lebanon revealed a previously diagnosed DM prevalence of about 8%. Previous studies had implied that up to 50% of actual persons with DM did not know their disease status (7). A recent study of the prevalence of DM among the adult population residing in the Greater Beirut area reported a prevalence of 12.8% of self-reported DM, 15% of definite DM and 18% of probable DM using combined measurement tools (8). In our study, among the same age group (≥ 18 years), self-reported DM was estimated at 9.7% at the

national level, stratified into 10.8% and 9.3% in the Greater Beirut area and outside it, respectively. Taking into consideration the proportion of undiagnosed DM would put the overall national level of diabetes at around 11%, as previously reported by IDF (4). Most importantly, for the first time in Lebanon, an attempt was made to disaggregate figures for the 2 most frequent clinical types of DM. The prevalence of T1DM, estimated at 0.1%, is reasonable despite being lower than international estimates. In fact, T1DM can rarely go undiagnosed, leading no room for prevalence underestimation. The ratio of T1DM/T2DM is usually higher in developed nations. The IDF 2015 atlas suggests that the ratio is nearer to 1: 9 (4). That study recognized that the ratio had not been assessed clearly for middle-to-low-income countries. While the lower ratio found in Lebanon may be accurate, one should discuss the possible effects of potential biases. In particular, poor management of T1DM in early infancy may lead to premature mortality, thus affecting the prevalence. However, there are no current indications that such may be the case in Lebanon, where infant and child mortality rates have been declining steadily for several decades (9).

As in all national surveys, and despite the best possible randomization, our sample was biased towards lower socioeconomic status. In low-to-middle-income countries, the population with higher socioeconomic status tends to display higher incidence of DM. Therefore, this bias should add to the underestimation of T2DM prevalence. However, in countries in rapid social transition such as Lebanon, the effect of the socioeconomic gradient tends to be less dramatic. In such transitional populations, the higher incidence of DM tends to slowly shift towards lower socioeconomic status. The most accurate and efficient approach to evaluating the real magnitude of DM in a given population remains the establishment of valid registries, with disaggregated data entry for each type of DM, including sociodemographic determinants.

The majority of people with DM identified in our survey reported obtaining their usual care from endocrinologists rather than family or primary healthcare physicians. This situation may have a negative impact on the optimal management of the disease, as specialist visits may sometimes cost 5–6 times more than those to a primary healthcare physician. The cost can become an obstacle, especially since at least 50% of the population in Lebanon has to pay for outpatient health services. This leads to a decrease in regular follow-up visits, and therefore, poor disease management. Most disturbing

is the occurrence of diagnosed complications in 22% of patients, with retinopathy being reported in almost half of cases. This prevalence was higher that the global figure, estimated at around 35% of persons with DM (10). In the present study, nephropathy was reported in 6.9% of persons with DM compared to 5.5% and 6.74% in other studies from the Republic of Korea and Spain, respectively (11,12). Macrovascular complications seem also to be frequent in this population, similar to the global estimated prevalence of cardiovascular complications at 5–36% (13). These figures could be an underestimation of the real situation of diabetic complications for 2 reasons: having a family member reporting on all the family in the household; and the probability of having an undiagnosed complication at its early stages. Clearly, improvement in diabetes care is currently needed in Lebanon.

A special focus of this survey was to obtain information on coping with T1DM. The assessment of T1DM prevalence was indirectly obtained, using a case definition based on age at diagnosis and first-year treatment using insulin. A total of 18 patients corresponded to the case definition, most of whom were already adults at the time of the survey. Only 2 patients were still children, and that small number obviously could not provide a clear view of daily coping strategies of young T1DM patients.

The current analysis leads to several recommendations with implications for the therapeutic and public health aspects of DM in Lebanon: (1) given the limitations of our study, there is a clear need to start a National Registry that would allow for routine assessment of the incidence, prevalence, determinants and natural history of DM; (2) the relatively low self-reported prevalence highlights the need for continued opportunistic screening campaigns, especially in more rural areas where the figures were significantly lower than in the Greater Beirut metropolitan area; and (3) management of DM should be devolved to primary healthcare physicians, who can act as coordinators of all the various aspects of diabetes care, including regular referrals to endocrinologists as well as to other specialists with important roles in preventing complications.

Competing interests: None declared.

Prévalence et caractéristiques cliniques du diabète au Liban : enquête nationale

Résumé

Contexte : Le nombre des cas du diabète, sous toutes ses formes, a augmenté rapidement dans le monde entier, et en particulier dans la Région de la Méditerranée orientale.

Objectifs : Cette enquête nationale visait à évaluer la prévalence et les caractéristiques cliniques du diabète sucré au Liban, en mettant l'accent sur le diabète de type 1.

Méthodes : Une enquête nationale par sondage à plusieurs degrés a été menée auprès des ménages sélectionnés de manière aléatoire utilisant des entretiens en présentiel et plus particulièrement. Au total, 4 500 ménages ont été sélectionnés dans toutes les régions à partir d'un cadre d'echantillonnage de la population libanaise.

Résultats : La prévalence d'un diabète déjà diagnostiqué parmi les 17 832 personnes interrogées (âge moyen de 36 ans) était de 7,95 %. La prévalence du diabète de type 1 en particulier a été estimée à 0,1 %, soit près de 1 % de tous les cas de diabète détectés. La plupart des personnes souffrant de diabète ont indiqué être habituellement suivies par un endocrinologue plutôt que par un médecin de soins de santé primaires. Un retard dans la réalisation du test d'hémoglobine A1c a été signalé chez 25 % des 1 418 patients. Des épisodes d'hypoglycémie sont récemment survenus chez 30 % des patients, parmi lesquels un tiers au moins nécessitaient des soins médicaux, y compris une admission à l'hôpital. Des complications ont été diagnostiquées dans 22 % des cas, la rétinopathie étant la plus courante.

Conclusions : La prévalence du diabète de type 1 au sein de cette population était inférieure aux estimations internationales. La prise en charge du diabète semble être insuffisante en raison des retards concernant la réalisation des tests de suivi ainsi que des épisodes d'hypoglycémie et des complications liées à la maladie. La coordination de la gestion des soins aux diabétiques devrait être confiée aux médecins de soins de santé primaires, qui peuvent répondre aux besoins des patients en les orientant vers les différents types de soins.

انتشار داء السُّكَّريّ في لبنان وخصائصه: مسح وطني

إبراهيم بوعرم، سليم أديب

الخلاصة

الخلفية: يتزايد انتشار داء السُّكَرِيّ بكل صوره سريعاً في جميع أنحاء العالم، خاصة في إقليم شرق المتوسط.

الأهداف: تمثَّلَ الهدف من هذه الدراسة الوطنية في تقييم انتشار داء السُّكَّريّ وأعراضه السريرية في لبنان، مع التركيز خاصةً على النمط 1 من داء السُّكَّريّ.

طرق البحث: أُجري مسح وطني متعدد المراحل على عينة عشوائية من الأسر من خلال عقد مقابلات وجهاً لوجه باستخدام استبيان واحد فقط لكل أسرة. وبلغ إجمالي عدد الأسر المُختارة ٤٥٠٠ أسرةٍ من جميع المناطق، استناداً إلى إطار موجود سلفاً لأخذ العينات من السكان اللبنانيين.

النتائج: بلغت نسبة انتشار داء السُّكَّريّ الذي شُخِّصَ سابقاً في السكان الذين شملهم المسح والبالغ عددهم ١٧٨٣٢ شخصاً (متوسط العمر هو ٣٦ عاماً تقريباً) ٧٩٥٪. وقُدر انتشار النمط ١ من داء السُّكَّريّ بحوالي ١، ٠٪، أو ١٪ تقريباً من جميع الحالات التي اكتُشفت إصابتها بداء السُّكَّريّ. وأفاد معظم المصابين بداء السُّكَّريّ بأنهم يحصلون على خدمات الرعاية المعتادة من أطباء الغدد الصماء، لا من أطباء الرعاية الصحية الأولية. وأبلغ عن تدنِّي أداء اختبار HbA1C في ٢٥٪ من ١٤١٨ مريضاً. وحدثت مؤخراً نوبات انخفاض السكر في الدَّم لحوالي ٣٠٪ من المرضى؛ واحتاج ثلثهم على الأقل رعاية طبية استلزمت دخول المستشفى. وأبلغ عن وجود مضاعفات لدى ٢٢٪ من الحالات، وكان أكثرها شيوعاً هو اعْتِلال الشَّبَكيَّةِ.

الاستتاجات: كان انتشار النمط ١ من داء السُّكَّريّ بين هذه الفئة السكانية أقل من التقديرات الدولية. ويبدو أن هناك قصوراً في علاج داء السُّكَّريّ بسبب التأخر في إجراء الفحوصات الدورية، ونوبات نقص السكر في الدم، والمضاعفات المرتبطة بداء السُّكَّريّ. وينبغي أن تؤول مسؤولية التنسيق بشأن التدبير العلاجي لداء السُّكَّريّ إلى أطباء الرعاية الصحية الأولية، الذين يمكنهم متابعة الحاجة بالإضافة الحالة للحصول على أنواع مختلفة من خدمات الرعاية الصحية لداء السُّكَّريّ.

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