ORIGINAL ARTICLE
PREVALENCE OF DIAGNOSED TYPE 2 DIABETES MELLITUS IN GREENLAND 2008: THE IMPACT OF ELECTRONIC DATABASE IMPLEMENTATION ON THE QUALITY OF DIABETES CARE

Michael Lynge Pedersen
Center for Primary Health Care in Nuuk, Nuuk, Greenland

Received 17 June 2008; Accepted 5 January 2009

ABSTRACT

Objectives. To estimate the age specific prevalence of diagnosed type 2 diabetes mellitus (T2DM) in Greenland in 2008, and to evaluate the influence of electronic database access on the quality of the clinical management of the disease.

Study design. Observational and cross-sectional study, review of medical records and databases.

Method. Data on T2DM patients were collected from each rural district in Greenland.

Results. The number of patients with T2DM, their age and gender were collected from 5 out of 7 districts and from the outpatient clinic of internal medicine in Nuuk. This sampling represents 90% of the population in Greenland. The prevalence among Greenlanders ≥ 40 years old is 2.1%. The prevalence increased with age. The quality in the management of T2DM based on process indicators is significantly higher in clinics with an electronic database than those without.

Conclusions. The prevalence of diagnosed type 2 diabetes mellitus in Greenland is low. When compared with previous population-based surveys, this suggests that the prevalence of undiagnosed diabetes is high, especially in the age group between 40 and 60. Consequently, the focus should be on identifying undiagnosed type 2 diabetes in this group. The quality in the management of type 2 diabetes mellitus seems to be improved by the use of an electronic database. Implementation of databases in all the clinics in Greenland is desirable.

(Int J Circumpolar Health 2009; 68 (1):34-41)

Keywords: Greenland, diabetes mellitus, prevalence, database
INTRODUCTION

The prevalence of diabetes mellitus type 2 diabetes (T2DM) was previously considered to be low in Greenland (1). New epidemiologic studies of the population in Greenland performed, in the period 1998–2001, indicated a dramatic change in the prevalence of diabetes and suggested an age standardized prevalence of diabetes among men and women of 10.8% and 9.4%, respectively. Furthermore, 70% of those with diabetes were undiagnosed (2). A high prevalence of diabetes has also been reported among Greenlanders living in Denmark (3). Both studies have established an epidemiological diagnosis of diabetes after performing an oral glucose tolerance test. Furthermore, the prevalence of T2DM has been predicted to increase in Greenland (4). However, the actual prevalence of patients with a clinically verified diagnosis is not known in Greenland.

The population of Greenland is around 56,000 inhabitants widely spread geographically in a country with a total area of approximately 2,166,086 km² (5). Immigrants born outside Greenland represent approximately 10% of the whole population (5). The majority (around two-thirds) of the immigrants are males.

Greenland is divided into 17 health care districts. Patients with T2DM are followed in each district, and in addition a small group is followed in the outpatient clinic of the Department of Internal Medicine, Queen Ingrid's Hospital in Nuuk. In 2 towns, Nuuk and Aasiaat, the Primary Health Care Centres have focused on the management of the patients with T2DM. Thus, an electronic database, Fyns Diabetes Database (FDDDB), was implemented in November 2006 to improve the quality in management of T2DM. However, the quality has not yet been evaluated.

The aim of this study is therefore to estimate the age-specific prevalence of T2DM in Greenland and to test the hypothesis that the quality in management of T2DM is influenced by the use of an electronic database.

MATERIAL AND METHODS

All 17 districts and the outpatient clinic of internal medicine in Nuuk were contacted and asked to list patients with T2DM, including information regarding age, gender and ethnicity.

Information about the age and gender for the whole population in Greenland was obtained from Statistics Greenland (5).

Information about the latest examination of blood pressure, blood lipids, microalbuminuria, eyes (performed by an ophthalmologist) and feet were collected from the database in Nuuk and Aasiaat and from medical records in the other districts excluding the data collected from the outpatient clinic of internal medicine in Nuuk.

The age- and gender-specific prevalence were estimated both for the whole population and for the Greenlanders, based on the number of patients in age groups 20–29, 30–39, 40–49, 50–59, 60–69 and ≥70 years old.
The following indicators designated as a percent of the total patients in each age group were used for the measurement of quality:

1. The percentage of patients with T2DM in whom glycosylated haemoglobin was measured within the previous year.
2. The percentage of patients with T2DM in whom blood pressure was measured within the previous year.
3. The percentage of patients with T2DM in whom blood lipids were measured within the previous 2 years.
4. The percentage of patients with T2DM in whom urine was tested for microalbuminuria within the previous years.
5. The percentage of patients with T2DM who had their eyes examined within the previous 2 years.
6. The percentage of patients with T2DM who had their feet examined within the previous 2 years.

Statistical analyses
The quality indicators were calculated for clinics with a database and for clinics without a database and the frequencies were compared using a chi-square test. Parameters with normal distribution are described as means±SD and compared with a t-test.

RESULTS
The number of patients with T2DM and their age and gender were collected from 15 out of 17 districts and the outpatient clinic of internal medicine in Nuuk. This represents 90% of the population in Greenland.

The total sample
The total sample consists of 475 persons with T2DM (220 women and 245 men). Of those, 364 (206 women and 158 men) were classified as Greenlanders, whereas 111 (14 women and 87 men) were classified non-Greenlanders (mostly Danish men).

A total of 457 persons aged ≥40 years were reported having T2DM (217 women and 230 men), corresponding to a prevalence of 2.2% for the whole group. The prevalence of T2DM among Greenlanders aged ≥40 years is 2.1% and 2.9% for non-Greenlanders. Thus, the prevalence among the Greenlanders is significantly lower than among the non-Greenlanders (p<0.001).

The age- and gender-specific prevalence for the whole group is shown in Figure 1. The prevalence is low for persons under 50 years of age, less than 1%. The prevalence increases with age and the highest prevalence at 7.4% was found among women at or above 70 years old.

The age- and gender-specific prevalence among the Greenlanders is shown in Figure 2. The prevalence increased with age especially among the women where the highest prevalence found was 7.7% for persons at or above 70 years.
Figure 1. Prevalence of T2DM in the population in Greenland 2008.

Figure 2. Prevalence of T2DM among Greenlanders in Greenland 2008.
Process indicators
Information was collected about the latest examinations of blood pressure, blood lipids, microalbuminuria, eyes (performed by an ophthalmologist) and feet from the FDDB database in Nuuk and Asiaat, and from health records in the other 10 districts.

The number of patients registered in the clinics with a database totaled 140 (65 women and 75 men) with a mean age of 62 ±10 years, and in the clinics without a database 245 (119 women and 119 men) with a mean age of 63 ±11 years. There were no differences between the two groups (those with and those without database registration) regarding distribution of gender or age (p=0.415).

The indicators of the quality of the management in Greenland of type 2 diabetes mellitus are shown in Table I. There are significant differences concerning all indicators. The highest screening rates are found in clinics with a database with the exception of results for screening for retinopathy. However, results from the screening for retinopathies are not updated in clinics with a database or clinics without a database due to a shortage of eye doctors. More patients in both groups have been screened for retinopathy.

In one of the clinics with a database the results of screening for microalbuminuria and examinations of the feet have not been updated in the database leading to an underestimation of the percentage of patients screened.

Table I. The quality of the management in Greenland of type 2 diabetes mellitus in clinics with and without an electronic database.

| Indicator          | The % of patients with T2DM in whom/who had | Clinics with database | Clinics without database | Standard | Type | \(\chi^2\) |
|--------------------|---------------------------------------------|-----------------------|--------------------------|----------|------|----------|
| Metabolic          | Glycosylated haemoglobin was measured within the previous year | 95                    | 69                       | 95%      | Process | p<0.001  |
| Hypertension       | Blood pressure was measured within the previous year | 96                    | 69                       | 95%      | Process | p<0.001  |
| Blood lipids       | Blood lipids were measured within the previous 2 years | 94                    | 66                       | 90%      | Process | p<0.001  |
| Micro-albuminuria  | Urine was tested for microalbuminuria within the previous 2 years | 76*                   | 24                       | 95%      | Process | p<0.001  |
| Eye examination    | Eyes were examined within the previous 2 years | 32*                   | 48*                      | 90%      | Process | p<0.001  |
| Foot examination   | Feet were examined within the previous 2 years | 64*                   | 25                       | 95%      | Process | p<0.001  |

*The examinations were done in some cases but the results were not received from the ophthalmologist, and in some instances were not updated in the database.
DISCUSSION

The prevalence of diagnosed T2DM among Greenlanders in Greenland aged ≥40 years is low (2.1%) and lower than among non-Greenlanders living in Greenland.

The patients were identified in each district due to lists and local knowledge. It cannot be excluded that some patients with the diagnosis have been forgotten in this process leading to an underestimation of the actual prevalence. However, the population in each district is quite small and generally the medical staff has good local insight.

The prevalence of patients with T2DM was lower than reported in the population study by Jørgensen et al. (2). However, only 30% of all cases of diabetes in their study had been previously diagnosed. Assuming that the percentage of diagnosed cases is still only 30%, the prevalence of diagnosed diabetes of 2.1% in this study would correspond to a true prevalence of diabetes of about 7–8%. Furthermore, the clinical diagnosis must be confirmed with 2 examinations of blood sugar on 2 separate days (6), but only 1 test was performed in the population-based study. Thus, the prevalence of true diabetes in their study may be overestimated.

The prevalence of diabetes in other Inuit populations has been increasing through the last decades (7–12). However, the prevalence is still lower than among the American Indians (7–11). Thus, the prevalence of diabetes among the Yup’ik Eskimos has grown from 1.7% in 1962 to 4.7% in 1992 (9). Furthermore, the prevalence among different Eskimo populations shows great variation (10–13). Thus, high prevalence of diabetes (2.8%–9.6%) in adults (≥25 years) was reported among 3 Eskimo populations in Alaska (14). The combined prevalence of diabetes and impaired glucose tolerance in the population ≥55 years was 30.4%. This is a higher prevalence than reported in this study. However, 47% of those with diabetes had not been diagnosed previously. Thus, the prevalence seems to be comparable. A recent study among Alaskan Eskimos (≥18 years) reported a prevalence of diabetes at 3.8% (15). This quite low prevalence is also comparable to the prevalence in this study since it is also a population survey where undiagnosed cases of diabetes are included in contrast to the present study. However, the prevalence of impaired fasting glucose in the study was high (15.6%), and it is suggested that diabetes may become an increasing problem among Alaskan Eskimos (15).

The majority of patients with diabetes in this study are males. However, a quite large group of males are non-Greenlanders, and among the Greenlanders the majority is women. Thus, the highest age-specific prevalence of diabetes in the present study is found among female Greenlanders. This is similar to the difference in prevalence between the genders in other Inuit populations (14–17).

The low prevalence of clinically diagnosed cases of T2DM demonstrated in this study, combined with the high prevalence of diabetes and undiagnosed diabetes in the population survey in Greenland (2) and other Inuit populations (13,15–16) indicates that probably a rather large group with undiagnosed T2DM exists in Greenland. In the present study, the age-specific prevalence increased dramatically after the age of 60. Thus, most likely, the undiagnosed group with T2DM belongs to the age group between
Increased awareness of the disease seems to be important.

The quality in the management of T2DM based on process indicators is significantly higher in clinics with an electronic database than those without. This suggests that a database is a valuable tool for use in the clinics to improve the quality of diabetes care. However, the existence of a database or its lack is not the only difference between the clinics. It is very likely that because diabetes management had been more in focus in clinics with than without a database the results were influenced positively. The results, however, also demonstrate the limits of a database when it is not properly updated; in which case the quality reported is lower than the factual quality. The process indicators show very high performance in the monitoring glycosylated hemoglobin, blood pressure and blood lipids in the clinics with a database. However, the process indicators also demonstrate that the clinics without a database focused on these 3 parameters. The results here do not differ much from the levels reported in older American Natives and Alaska Natives in 2004 (18). Screening rates within 12 months were high for glycosylated hemoglobin (72%), lipid profile (84%) and foot examination (72%), but were low for urinalysis (23%) and ophthalmology examination (23%). However, the monitoring is of a lesser quality than reported recently in the follow-up study after implementation of the Special Diabetes Program for Indians (19). Screening rates after implementation were within 12 months: 85% (lipid profile), 67% (foot exam) and 56% (eye exam).

The screening rates are also lower than those reported for the diabetes population in the National Danish Indicator Project 2007 (20). The process indicators here are among the highest reported yet, with screening rates within 12 to 24 months for glycosylated hemoglobin (99%), blood pressure (97%), lipid profile (95%) and foot examinations (85%), urinalysis (86%) and ophthalmology examinations (84%). Thus, it seems realistic to improve the monitoring of the patients in Greenland. However, a special effort to do so is needed.

Conclusions

The prevalence of diagnosed T2DM in Greenland is low. This may be due to a lack of diagnosis especially in the age group from 40 to 60 years. Focus should be placed on this group to detect possible instances of type 2 diabetes mellitus. The quality of the management of type 2 diabetes mellitus is improved by the use of an electronic database when it is properly updated. Implementation of a database is desirable in all the clinics in Greenland. The importance of keeping a database updated is a matter that also needs attention.

Acknowledgements

I want to thank all the health workers who generously helped to collect these data and to Novo Nordisk A/S for financial support.

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Michael Lynge Pedersen,
Center for Primary Health Care in Nuuk
Postbox 3333
3900 Nuuk
GREENLAND
Email: MILP@peqqik.gl