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The influence of socio-economic status and life style on self-reported health in diabetics and non-diabetics: a comparison of foreign-born and Swedish-born individuals

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Data from a cross-sectional sample of 21 620 Swedish-born individuals and 2072 foreign-born individuals, aged 16–74 years were used to examine the association between socio-economic status (SES), country of birth (as an indicator of migration experiences), self-reported health status (SRHS) and diabetes. The survey included 31 foreign- and 446 Swedish-born individuals with diabetes mellitus. After accounting for age, sex, circulatory disease, SES (education, car ownership), social network, physical activity, smoking and body mass index, diabetics demonstrated a 3.7 higher risk of poor SRHS than non-diabetics. Foreign-born individuals had the same risk of self-reported diabetes as Swedish-born individuals. All three SES indicators: low/intermediate attained level of education, no car ownership, or renting a dwelling, were significant independent risk factors of diabetes mellitus after adjustment for age, sex, country of birth, circulatory disease, social network and life style. Moreover, low SES was an important risk factor of poor SRHS among diabetics. There was a nonsignificant borderline association between country of birth and poor SRHS among diabetics. These findings suggest that individuals with diabetes have a substantially increased risk of poor SRHS, and that low SES and country of birth (migration experiences) may contribute to further augment poor health among diabetics.

Key words: diabetes; life style; migrants; self-reported health status; social class

Introduction

Although our knowledge about the influence of social factors on diabetes morbidity and control is increasing, the role of socio-economic status (SES), country of birth (as an indicator of migration experiences) and life style on diabetes morbidity has not been clarified.

A study from middle Sweden found that education, housing conditions, life style, and marital status were similar in diabetic patients and their non-diabetic controls (Ingberg *et al*., 1996). Furthermore, another local study from northern Sweden revealed no significant differences in education, socio-economic class, dwelling or household economy between insulin-treated diabetic patients 20–50 years of age and their non-diabetic controls (Gåfvels *et al.,* 1991).

In addition, it has been demonstrated in a Swedish study concerning non-diabetic migrants that ethnicity defined as country of birth can be an important independent social dimension comparable with SES in relation to self-reported illness (Sundquist, 1995). However, there are few studies regarding diabetes mellitus which include foreign-born persons. This is especially disturbing at a time when the foreign-born population in Europe, and particularly in Sweden, is increasing. Sweden became an immigrant country in the post-world

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war II era, and this resulted in a multiethnic society where the foreign-born population increased from approximately 8% of the population (8.4 million) during the eighties to 11.0% in 1997. Today, there are more than 120 different nationalities represented in Sweden, dominated by European labour force migrants (SOS 1997; SOU, 1994). Migration and acculturation studies have shown poorer health among people who migrate and have suggested that the mechanisms are related to poorer housing and living conditions (Sundquist, 1995a), low social support (Sundquist *et al*., 1995b; Williams *et al.,* 1994), life style change (Williams *et al*., 1994), low access to medical care (Gillam, 1990; Shaukat *et al*., 1993), and/or discrimination (Sundquist *et al*., 1995b; Williams *et al*., 1994).

Experiences of the migration process and the stress of integration into a new society can negatively affect diabetes control and morbidity (Zimmet, 1982; King and Rewers, 1993; NIH 1995). Furthermore, irrespective of migratory background, the process of acculturation to a new setting may create stress, in addition to the stress caused by the diabetes disease. However, studies comparing Swedes and European migrant diabetic subjects, with short cultural distance and long residence, have indicated SES to be of greater importance for health than place of birth (Hjelm *et al*., 1996, Hjelm *et al*., 1997).

A few studies have analysed the influence of SES and country of birth (migration) on life style factors. For example, a prospective study of 654 adult Tokelauans who migrated to New Zealand showed that their BMI levels increased significantly compared with non-migrants (Salmond, 1989). Moreover, a prospective study from Sweden of men who emigrated from southern Europe showed that their BMI levels increased significantly from 25.5 in 1980–81 to 27.0 in 1988–89 after adjustment for age, leisure time physical activity, smoking, education and health status (Sundquist and Johansson, 1998). Although the role of life style factors such as lack of physical activity, smoking and increased body mass index (BMI) in the pathogenesis of diabetes mellitus and its complications is well-known (Amos *et al*., 1997; Wing 1998), we have less knowledge about how these factors influence SRHS after adjustment for SES and country of birth.

Poor SRHS is a strong predictor for total mortality (Sundquist and Johansson, 1997) and mortality in late-onset diabetes (Dasbach *et al*., 1994). As health may be the consequence of an interplay between different parts of life in social reality and the individual outcome is a result of the ability to cope with the social environment, health has long served as an indicator of the economic and social conditions under which people live (Blaxter, 1993).

Identification of potential risk factors for health, such as a disadvantaged life style, poor socio-economic circumstances and the stress of migration might be helpful in attempts to promote health in diabetic patients and to prevent development of complications related to the disease. Few studies have disentangled the complex inter-relationships between SES, country of birth, life style, diabetes mellitus and SRHS. Using data from the annual Swedish Survey of Living Conditions provides the unique possibility of comparing foreign- and Swedish-born subjects with and without diabetes mellitus with regard to their health and living conditions.
In this study we expect that:

1) diabetic patients will have poorer SRHS than non-diabetic subjects after adjusting for age, sex, circulatory disease, SES, and life style;
2) individuals of low SES would have an increased risk of self-reported diabetes compared with those individuals of high SES after adjusting for background variables;
3) foreign-born individuals will have a higher risk of self-reported diabetes than Swedish-born individuals of comparable age and SES;
4) diabetics who were born abroad would have poorer SRHS than Swedish-born diabetics, when life style, socio-economic factors and circulatory disease were taken into consideration; and
5) low SES is a risk factor of poor SHRS in persons with diabetes mellitus.

Subjects and methods

Subjects

The Swedish Survey of Living Conditions applies to the whole Swedish population aged 16–84 years and is a representative systematic random sample of about 8000 persons each year. The interviews are undertaken in the respondents' homes by Statistics Sweden (1996). The main purpose of the survey is to collect data at an individual level to be used for continuous description and analysis of

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the distribution of welfare in Sweden. Extended data regarding health and lifestyle were included both in 1980–81 and 1988–89. Central variables of each component have been measured each year, and a more detailed survey of each component, as for example health and life style, has been carried out periodically (Statistics Sweden, 1996). At the time of this study there were no detailed data concerning health and life style collected during the 1990s available for analysis. Extended data regarding health and lifestyle had to date only been studied in 1980–81 and 1988–89.

The present study was limited to people between the ages of 16 and 74 years and comprised 23 692 respondents constituting four, independent simple random samples of the Swedish population of 1980–81 and 1988–89. The same questionnaire and the same sampling procedure were used on the four occasions. The non-diabetic group comprised 21 174 Swedish- and 2041 foreign-born persons and the diabetic group 446 Swedish- and 31 foreign-born individuals (Table 1). The response rate was 85% in the age group studied.

Dependent variables

Those who answered that their health was bad or anywhere between good and bad to the question 'How would you rate your health in general?' were reckoned as having poor self-reported health status.

Self-reported diabetes mellitus (diagnosis 250 by ICD 8; -1987, and ICD 9; 1988-) was based on the question about self-reported long-term illness (Statistics Sweden, 1996). In all, 267 male diabetics (2.3%) and 210 female diabetics (1.8%) were identified, but no separation into insulin-dependent diabetes mellitus (IDDM/Type 1) or noninsulin-dependent diabetes mellitus (NIDDM/Type 2) was possible due to the design of the protocol.

Independent variables

Age was categorized into the following groups: 16–44, 45–54, 55–64 and 65–74 years of age.

Country of birth (migration experiences) was dichotomized into those who were born in Sweden and those who were foreign-born.

The socio-economic status (SES) of an individual was described by the variables 'attained level of education', 'form of tenure', and 'car ownership'. We used educational status instead of occupation as the main proxy for SES (Townsend *et al*., 1989; Winkleby *et al*., 1992) as education mostly remains unaffected over time (Winkleby *et al*., 1992) and since lack of information about occupation in those not gainfully employed would have reduced the study population considerably. Car and house ownership were chosen as two indicators offering a fairly good reflection of income and material standard of living (Townsend *et al*., 1989). Moreover, the use of access to a car as the only indicator has been shown to be a powerful predictor of poor health in previous studies (Goldblatt, 1990; Townsend *et al*., 1989).

For attained level of education the respondents were classified into three groups: 1) low educational level, $\leq$9 years of primary school; 2) intermediate educational level, 10–12 years of education and completed at most 3 years of high school; 3) high educational level, $>$12 years of education and completed some kind of university studies. The lowest and intermediate educational groups were first analysed separately but in the model they had the same regression coefficients and for this reason they were combined into one level.

Form of tenure was dichotomized into those who rented their flats and those who owned their dwelling.

Car ownership was divided into those who had and those who did not have access to a car in the household.

Social network was based on the variables contact frequency with sisters and brothers, neighbours, casual neighbourhood interaction, having a close friend and how often one saw this friend, and also having other friends, with one point for each item, in total a maximum of six points. If the subject scored less than three points the social network was considered as poor.

Life style factors comprised physical activity and smoking habits.

Physical activity consisted of five levels but was classified as: almost no physical activity at all and physical activity regularly at least once a week.

For smoking habits there were questions about the amount of cigarette, cigar and cigarillo smoking and the use of pipe tobacco. The total consumption was summed up as grams per day. In the analysis we used four levels: never smoked, former smokers, daily smokers (1–14 for males and 1–10 g/day for females) or excessive smokers

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Table 1 Sample sizes, estimated population (*N*), and the distribution (%) of the outcome and explanatory variables by country of birth and diabetes

Variable	Level	Non-diabetic persons		Diabetic persons	
		Swedish-born	Foreign-born	Swedish-born	Foreign-born
Sample size (*n*)		21 174	2041	446	31
Estimated *N*		5 330 000	526 000	114 000	8000
Sex	Male	50.2	46.2	56.4	49.2
	Female	49.8	53.8	43.6	50.8
Age	16–44 years	56.4	59.4	20.6	16.8
	45–54 years	15.6	19.4	12.9	16.4
	55–64 years	14.5	14.4	23.7	42.0
	65–74 years	13.5	6.8	42.8	24.8
Health status	Poor	20.3	31.1	64.1	79.9
Circulatory disease	Yes	11.0	9.7	43.1	32.9
Educational	Low–intermediate	80.3	76.0	90.9	81.2
Level	High	19.7	24.0	9.1	18.8
Form of tenure	Renting a flat	33.9	54.4	43.6	56.7
Car ownership	No access to car	16.6	27.1	35.5	45.6
Social network	Poor	20.6	37.6	33.9	57.2
Physical activity	No regular	12.0	18.9	22.7	34.6
Smoking habits	Never smoked	47.1	36	48.4	29.8
	Former smokers	23.8	23.3	30.9	32.2
	Smoking 1–14 g/day	13.8	15.4	9.1	13.1
	Smoking >14 g/day	15.3	25.3	11.6	24.9
BMI	Underweight	6.9	6.9	3.3	0
	Normal weight	57.3	53.5	38.9	23
	Overweight	29.6	31.0	37.3	54.3
	Obesity	6.2	8.6	20.5	22.7

(>14 or >10 g/day for males and females, respectively).

Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2) and comprised four different categories: underweight (BMI <18.6 for females and <20 for males), normal weight (19 < BMI < 23.8 for females and 20 < BMI < 25 for males), overweight (23.8 ≤ BMI < 28.6 for females and 25.0 ≤ BMI < 30.0 for males) and obesity (BMI ≥ 28.6 for females and ≥ 30.0 for males) (WHO, 1985).

Circulatory diseases were based on self-reported long-term illness, and included the diagnoses 390–459 by ICD 8; -1987, and by ICD 9; 1988-, with predominance of hypertension, heart diseases (23 versus 26% and 0 versus 4.6% in foreign- and Swedish-born diabetic subjects, respectively) and peripheral vascular diseases.

Statistical analyses

The data were analysed with logistic regression in main effect models (Hosmer and Lemeshow, 1989). Two kinds of models are presented, one sex- and age-adjusted model for each of the independent variables (model I) and one final model including all independent variables (model II).

In multivariate models three factors were analysed: one with SRHS as the dependent variable, a second with self-reported diabetes and a third with SRHS in diabetic subjects. The results are shown as odds ratios (OR) with 95% confidence intervals (CI). The fit of the model was judged from the Hosmer–Lemeshow Goodness-of-Fit test (the *P* value should be >0.05), and from residual analysis. The reliability of the dependent variable and the majority of the others have been analysed by reinterviews (test–retest method) giving kappa (κ) coefficients between 0.7 and 0.95 (Wärneryd, 1991).

Results

Characteristics of the study population

Foreign-born subjects constituted 6.6% of the diabetic group and 9% of the non-diabetic subjects.

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The foreign-born diabetic subjects were all, except one, born in European countries and 77% of them were Scandinavians as compared with the non-diabetic group with about 88% born in European countries, with a preponderance of Scandinavians (61%).

The prevalence of self-reported diabetes mellitus was 1.5% in foreign- and 2.1% in Swedish-born subjects (Table 1). Poor SRHS was more common among foreign-born compared with Swedish-born individuals reporting diabetes (80 versus 64%) and in foreign- compared with Swedish-born non-diabetic individuals (31 versus 20%). People born abroad and having diabetes mellitus was more likely to have low SES and a poor social network than their counterparts. In contrast, Swedish-born non-diabetic persons more often reported good health, were more likely to own their dwelling, and have a good social network, compared with their foreign-born counterparts. About three-quarters of the foreign-born diabetic persons were overweight/obese compared with just above half of the Swedish-born diabetics. Smoking was more common among those who were born abroad regardless of whether they were diabetics or not. Furthermore, circulatory diseases were more prevalent in Swedish- than foreign-born subjects reporting diabetes and in diabetic compared with non-diabetic individuals, but this did not differ between foreign- and Swedish-born non-diabetic individuals.

SRHS

Diabetes mellitus (OR = 3.70; CI = 2.90–4.49) and circulatory disease (OR = 3.64; CI = 3.22–3.91) were substantially associated with poor SRHS when adjusted for all independent variables (model II) (Table 2). In addition, being born abroad was a strong risk factor for poor SRHS with an OR of 2.04 (CI = 1.84–2.27) after adjusting for age and sex (model I). Low SES, a sedentary life style or chronic disease could not explain the high risk of poor SRHS among foreign-born persons because the OR decreased only slightly in the full model (Table 2). Low SES (no access to a car and low education) were significantly associated with poor SRHS. Poor social network was also significantly associated with poor SRHS. A disadvantaged life style, such as lack of physical activity and being a current smoker or former smoker, were associated with poor SRHS. Underweight and obesity showed a U-shaped relationship with poor SRHS.

Self-reported diabetes

There was no significant association between being a foreign-born person and self-reported diabetes. Circulatory disease was a significant risk factor for diabetes, in a sex- and age-adjusted model, with an OR of 2.95 (CI = 2.39–3.64), which decreased to 2.58 in model II. Male gender was associated with an increased risk of diabetes with an OR of 1.63 (CI = 1.33–1.96) (not shown in the table). Increasing age (not shown), low SES, lack of physical activity, and obesity were significantly associated with an increased risk of diabetes mellitus after adjustment for all variables in the full model (Table 3).

SRHS in diabetic individuals

In the next model the outcome factor is poor SRHS among diabetic subjects, although the further reduction of the study population resulted in loss of power (indicated by the broad confidence intervals) (Table 4). The weak association between being a foreign-born person and poor SRHS in diabetic subjects (OR = 2.34; CI = 0.99–5.54) in a sex- and age-adjusted model decreased slightly in the multivariate model (OR = 2.24; CI = 0.71–7.10). The relationship could not be explained by low educational status, no access to car and the other explanatory factors. For example, low SES, defined as no access to a car, was a substantial risk factor among diabetic subjects. The strongest relation for poor SRHS in diabetic patients was shown for lack of regular physical activity (OR = 3.42; CI = 1.71–6.85). Circulatory disease was also strongly related to poor SRHS.

The fit of the models was good with P values of 0.18, 0.56 and 0.12, respectively, in each of model II presented in Tables 2, 3 and 4 for poor SRHS, self-reported diabetes and poor SRHS in diabetic individuals.

Discussion

This is, as far as we know, the first investigation to estimate the risk of self-reported diabetes mellitus among foreign-born individuals in a national sample of non-patients. Furthermore, it also analysed the relationship between country of birth, SES and

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Table 2 Estimated OR with 95% CI for poor self-reported health status in Model I for each of the independent variables after adjusting for age and sex; in Model II simultaneously adjusted also for country of birth, circulatory disease, diabetes, SES, social network, life style and BMI. $n = 23\,692$

Variable	Level	Model I		Model II	
		OR	CI	OR	CI
Country of birth	Foreign-born	2.04	1.84–2.27	1.73	1.53–1.91
	Swedish-born	1		1	
Circulatory disease	Yes	3.85	3.51–4.22	3.64	3.22–3.91
	No	1		1	
Diabetes	Yes	4.70	3.84–5.75	3.70	2.90–4.49
	No	1		1	
Educational level	Low and intermediate	1.86	1.68–2.05	1.62	1.45–1.78
	High	1		1	
Car ownership	No access to car	1.91	1.77–2.07	1.68	1.52–1.81
	Access to car	1		1	
Social network	Poor	1.53	1.42–1.64	1.24	1.14–1.34
	Good	1		1	
Regular physical activity	No	3.23	2.98–3.52	2.66	2.38–2.85
	Yes	1		1	
Smoking	Never smoked	1		1	
	Former smoking	1.29	1.19–1.40	1.28	1.16–1.39
	Smoking 1–14 (10) g/day	1.43	1.29–1.58	1.34	1.20–1.48
	Smoking >14 (10) g/day	2.14	1.95–2.35	1.75	1.57–1.91
BMI	Underweight	1.48	1.29–1.69	1.34	1.15–1.53
	Normal weight	1		1	
	Overweight	1.24	1.15–1.34	1.08	1.00–1.17
	Obesity	1.98	1.76–2.23	1.36	1.18–1.53

Table 3 Estimated OR with 95% CI for self-reported diabetes in Model I for each of the independent variables after adjusting for age and sex; in Model II simultaneously adjusted also for country of birth, circulatory disease, SES, social network, life style, and BMI. $n = 23\,692$

Variable	Level	Model I		Model II	
		OR	CI	OR	CI
Country of birth	Foreign-born	0.90	0.67–1.30	0.75	0.51–1.10
	Swedish-born	1		1	
Circulatory disease	Yes	2.95	2.39–3.64	2.58	2.04–3.13
	No	1		1	
Educational level	Low and intermediate	1.66	1.21–2.27	1.42	1.02–1.94
	High	1		1	
Form of tenure	Renting a flat	1.52	1.27–1.84	1.31	1.07–1.59
	Privately owned dwelling	1		1	
Car ownership	No access to car	1.85	1.51–2.27	1.61	1.29–1.98
	Access to car	1		1	
Social network	Poor	1.31	1.08–1.59	1.19	0.97–1.45
	Good	1		1	
Regular physical activity	No	1.68	1.35–2.09	1.30	1.03–1.62
	Yes	1		1	
BMI	Normal weight	1		1	
	Overweight	1.33	1.08–1.64	1.22	0.98–1.51
	Obesity	2.98	2.29–3.88	2.38	1.78–3.07

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Table 4 Estimated OR with 95% CI for poor self-reported health status in diabetic subjects, in Model I for each of the independent variables after adjusting for sex and age; in Model II simultaneously adjusted also for country of birth, socioeconomic factors (educational level, car ownership), physical activity and circulatory disease. $n = 477$

Variable	Level	Model I		Model II	
		OR	95% CI	OR	95% CI
Country of birth	Foreign-born	2.34	0.99–5.54	2.24	0.71–7.10
	Swedish-born	1		1	
Circulatory disease	Yes	2.81	1.53–5.16	2.97	1.68–5.24
	No	1		1	
Educational level	Low and intermediate	2.20	0.94–5.13	2.16	0.95–4.91
	High	1		1	
Access to car	No	2.99	1.58–5.65	3.03	1.70–5.38
	Yes	1		1	
Social network	Poor	1.64	1.13–2.37	–	
	Good	1		–	
Regular physical activity	No	4.09	2.07–8.08	3.42	1.71–6.85
	Yes	1		1	
Smoking	Never smoked	1		–	
	Former smoking	0.93	0.57–1.52	–	
	Smoking 1–14 (10) g/day	1.30	0.67–2.52	–	
	Smoking >14 (10) g/day	1.23	0.64–2.38	–	
BMI	Normal weight	1		–	
	Overweight	0.92	0.57–1.49	–	
	Obesity	0.86	0.48–1.54	–	

SRHS in diabetic individuals adjusting for circulatory disease, social network and life style factors.

The main finding of this study was the substantially increased risk of poor SHRS among diabetics compared with non-diabetics after adjusting for age, sex, SES and the other independent factors. All three SES indicators, lack of regular physical activity and obesity were significant independent risk factors for diabetes mellitus. Furthermore, Swedes and foreign-born individuals had about equal risk of self-reported diabetes. There was a non-significant borderline association between country of birth and poor SRHS among diabetics. In addition, low SES was a substantial risk factor of poor SRHS among diabetics.

The finding of diabetes mellitus as a substantial risk factor of poor SRHS agreed partly with a primary health care study that revealed a lower health-related quality of life among diabetic patients compared with a standard population (Wändell, 1997). This chronic condition might create a sense of distress, possibly over and above what is caused by being of low SES and having economic difficulties, demanding an adaptation and coping with physiological changes as a consequence, possibly limiting the individual's action and the sense of autonomy and freedom related to the feeling of health (Blaxter, 1993).

The finding of low SES as a significant risk factor of diabetes did not agree with two local Swedish studies, which found no significant socio-economic differences between young insulin-dependent diabetic individuals and their non-diabetic controls (Gåfvels *et al*., 1991; Ingberg *et al*., 1996). However, our results are in agreement with a large American study which found that SES, defined as poverty–income ratio, was a strong risk factor of NIDDM among women (Winkleby *et al*., 1998). Other investigations have shown an association between low SES and the distribution of risk factors for cardiovascular disease: higher prevalence of smoking, less regular exercise and hypertension (Chaturvedi *et al*., 1996; Connolly and Kesson, 1996; Unwin *et al*., 1996). It is also of importance for glycaemic control and long-term prognosis in IDDM (Chaturvedi *et al*., 1996). The prevalence of ischaemic heart disease in diabetic subjects has been found to be higher among persons living in socially deprived areas than in prosperous wards (Kelly *et al*., 1993).

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The finding that country of birth (born abroad) was not related to an increased diabetes risk agreed with previous population-based studies of migrants, mainly Europeans, in Sweden (Hjelm *et al*., 1996; Hjelm *et al*., 1997) and self-reported diabetes mellitus among Europeans in Australia (Welborn *et al*., 1995). The foreign-born diabetic individuals in this study were mainly labour migrants because European labour force migration with recruitment of healthy workers on a voluntary basis to Swedish industry was the main reason for immigration to Sweden until the 1980s. Thereafter migration shifted towards nonEuropean refugees, but their share did not increase noticeably until the last years of the 1980s (SOS, 1997; SOU, 1994). This and other studies have been mainly of Europeans with short cultural distance, long residence and probably high degree of assimilation into society, indicating living conditions to be of greater importance than place of birth (Hjelm *et al*., 1996; Hjelm *et al.,* 1997). Furthermore, one cannot exclude the influence of the 'healthy migrants effect' because migrants in general and labour migrants in particular are often a selected group of healthy people (Marmot *et al*., 1984). Our results were in contrast to a higher occurrence of NIDDM found in non-European groups such as Asians, American Indians and Pacific islanders, in previous nonScandinavian investigations (King and Rewers, 1993; Zimmet, 1982; Zimmet, 1995). This latter difference is possibly explained by differences in study populations, or probably a more complex influence of both genetic susceptibility and environmental factors. The interrelationship between country of birth/low socioeconomic status and diabetes mellitus is complex and unknown, but the influence of social status on self-reported diabetes was stronger than being foreign-born, as proposed by Marmot *et al*. (1984).

One of the main findings in the present study was the age- and sex-adjusted non-significant association between being a foreign-born respondent and poor SRHS in diabetic individuals. However, the univariate analysis revealed a rather high, but nonsignificant odds ratio of 2.34, which decreased only slightly to 2.24 in a multivariate model when adjusting for socio-economic factors, not taking exercise and circulatory disease into account. Although still a nonsignificant finding, it is reasonable to assume that country of birth might have an influence on SRHS in diabetic individuals. The nonsignificant association could partly be explained by the small number of foreign-born diabetics in the sample.

The finding of low SES as a substantial risk factor of poor SRHS in diabetics agreed partly with other studies. For example, a study of patients with diabetes mellitus in primary health care centres in Trinidad revealed that morbidity in persons with diabetes was associated with indicators of lower socio-economic status (Gulliford and Mahabir, 1998). Furthermore, a Swedish follow-up study of 39 055 subjects (nondiabetic and diabetics), aged 25 to 74 years, from baseline 1979 to 1985 until 1996, demonstrated that diabetic people with a low attained level of education had an increased risk of total mortality (Nilsson *et al*., 1998). An English study found that being unemployed, male gender and less well educated were significant risk factors for mortality after adjusting for duration of diabetes, hospital admissions, and the presence of diabetic complications (Robinson *et al*., 1998). The Whitehall cohort study and the London cohort of the WHO multinational study of vascular disease in diabetes found an inverse socio-economic mortality gradient in diabetic people (Chaturvedi *et al.*, 1998).

Strengths and limitations

Our study has several limitations. For example, the meaning of self-rated health and health-related indicators, e.g., life style and socio-economic circumstances might differ within and between different cultures, introducing an information bias. Cross-cultural adaptation of the measurements, with translation into other languages and back-translation into Swedish by different translators, could reduce this problem but was not performed by Statistics Sweden. However, in the case of non-Swedish speaking individuals, interpreters have been used. The number of Scandinavians with short cultural distance was high (77% versus 61% in diabetic versus non-diabetic subjects), a broad range of socio-economic indicators and internationally used measurements was used, so the influence of bias appears to be negligible. Previous studies have also shown poor SRHS to be an important predictor of morbidity (Kaplan *et al*., 1996; Møller *et al*., 1996) and mortality (Dasbach *et al*., 1994; Sundquist and Johansson, 1997). The validity and usefulness of self-reported data on health and morbidity might be disputed, but several

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studies have shown that reporting of well-defined chronic diseases, such as diabetes mellitus and coronary heart disease, was in close agreement with results from objective measures in terms of medical examinations (Halabi *et al*., 1992; Heliövaara *et al*., 1993). Finally, this study has a cross-sectional design that does not allow one to draw inferences about causal pathways. The effects of migration might differ over the study period, but despite this, the data provide the opportunity to study these effects and further explore the field, especially since no baseline information regarding European migrant diabetics is available.

These limitations are countered by the strengths of the Swedish Survey of Living Conditions which it is the most comprehensive Swedish survey on living conditions with data on self-reported morbidity, life style, and also includes background variables. Other advantages of this study were the large, well-defined study population, the representativeness of the random sample of the entire Swedish population, aged 16–74 years, including immigrants, and the high response rate. This type of population-based survey has a long tradition; the questions are well validated, have been consistent over the years (Statistics Sweden, 1996), and have been proven to be reliable (Lundberg and Manderbacka, 1996; Wärneryd, 1991).

Public health implications

The identification of SES differences in diabetes risk and SES and country of birth differences in poor SRHS among diabetics is important information that argues for appropriate interventions at the governmental, community, family and individual levels that are tailored to the social and cultural needs of these population subgroups. Low SES individuals who live in relatively deprived residential areas might have more difficulty with access to safe leisure opportunities such as running, walking, biking, swimming and other sport activities which are important for prevention of diabetes and other cardiovascular disease risk factors. Another important approach is to reduce inequalities in health and health care and improve the social and material well-being for people of low SES. For example, the UK government has introduced health action zones in deprived communities, to which large economical resources are distributed to health care, education and social services (Secretary of State for Health, 1997). Moreover, it is important for the physician and the nurse in the diabetics' team at hospitals or in primary health care to encourage those who already have diabetes to start or maintain physical activity. Furthermore, foreign-born people who suffer from traumatic migration experiences, diffi-

Implications for practice

In clinical practice it is important to:

- Consider low socio-economic position (SES) as a risk factor for development of DM and poor self-reported health in diabetic subjects comparable with life style and age. Consider also that low SES and country of birth (migration experiences) may contribute to further augment poor health among diabetics.
- Develop interventions that are tailored to the social and cultural needs of these population groups. A key component is education about risk factors for DM and its prevention.
- Consider that individuals in low SES, and particularly foreign-born persons, often live in deprived residential areas with difficult access or safety to leisure opportunities such as sport activities of importance for prevention of DM and CVD.
- Develop health action zones to reduce inequalities in health and health care and improve the social and material well-being for people in low SES, e.g., by collaboration between health care, schools and social welfare.
- Encourage those who already have diabetes to start or maintain physical activity.
- Give special attention to foreign-born people who suffer from traumatic migration experiences, difficulties because of acculturative stress, discrimination and xenophobia.

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culties because of acculturative stress, discrimination and xenophobia need specific attention.

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