Socioeconomic differences in mortality among diabetic people in Finland: five year follow up

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Abstract

Objective—To compare socioeconomic differences in mortality (by cause of death) among diabetic people with those in the rest of the population.

Design—Five year follow up of mortality in the population of Finland, comparing people with diabetes and those without diabetes.

Setting—Finland.

Subjects—All residents of Finland aged 30 to 74 included in the 1980 census. Subjects were classified as diabetic (230 000 person years) or other (12 400 000 person years) according to whether they were exempted from charges for medication for diabetes. During 1981-5 there were 114 058 deaths, of which 11 215 were in people with diabetes.

Main outcome measures—Age standardised mortality by sex, social class, and cause of death for the diabetic and non-diabetic populations.

Results—No significant social class differences in mortality were found among women with diabetes. Among diabetic men there was a slight increasing trend in mortality from the upper white collar group to the unskilled blue collar workers but it was much less steep than that of non-diabetic men.

Conclusions—Among people with diabetes in Finland the quality of treatment and compliance with treatment probably do not vary by socioeconomic status. Health education for diabetic people seems to be effective in all socioeconomic strata; in people from the lower strata this leads to greater changes because their health behaviour was originally less good.

Introduction

Diabetes is a common chronic condition which requires regular treatment and attentive surveillance of the effects of treatment. Both the patient and medical staff have crucial roles in treatment, which includes adequate diet and exercise in addition to pharmacological measures to maintain glucose concentrations close to the normal range. Optimal glucose control reduces the risk of complications, which may lead to premature death.^{1 2} Diabetes also increases the risk of cardiovascular diseases,³ so it is particularly important for diabetic patients to reduce their cardiovascular risk factors.

People in higher social classes have better than average resources for maintaining good health,⁴⁻⁶ and they tend to accept health education and change their habits more readily than those in lower classes.⁷⁻⁹ These health maintaining resources and readiness to improve one's health behaviour are particularly relevant for patients who contract a life shortening chronic disease such as diabetes. Diabetes would therefore increase the risk of death more among people from lower than higher classes, leading to wide differences in mortality among people with diabetes, particularly when the cause of death is connected with the quality of treatment and health behaviour.

Methods

Our data are part of a set of data files used in the analysis of mortality trends and differences between various population groups.¹⁰⁻¹³ Our population consisted of people aged 30 to 74 included in the 1980 census.

Census records included the person's entitlement to be reimbursed for medication for specified diseases at the end of 1980. This information was based on the national drug register, which is maintained by the Social Insurance Institution of Finland.¹⁴ Patients with insulin dependent diabetes are entered in the register almost immediately after the diagnosis. Patients with non-insulin dependent diabetes are first treated by diet for at least three months; if dietary control does not achieve normoglycaemia the patient is entered in the national drug register and provided with drug treatment free of charge. Our data did not include information on the type of diabetes or on the time of onset of the disease.

Deaths in the 30-74 age group registered in 1981-5 were obtained from the national register of cause of death and linked to the data from the 1980 census. Fewer than 0.2% of all deaths could not be linked.¹⁰ Registers were linked by Statistics Finland through personal identification numbers, which were then erased from the data. The data include 230 000 person years and 11 215 deaths for people with diabetes and 12 400 000 person years and 102 843 deaths for people without diabetes.

Information on cause of death was restricted to the underlying cause. Causes of death were classified according to ICD-8 (international classification of diseases, 8th revision).

Social classes were constructed from the socioeconomic classification routinely used by Statistics Finland,¹⁰ in which social class is based on occupation at the beginning of the follow up for people who are economically active and on earlier occupation for retired and unemployed people. The occupation of the head of the household is used for those who gave no information on their own occupation. "Upper white collar workers" roughly corresponds to class I in the British registrar general's classification,⁴ "lower white collar workers" to classes II and III(N), "skilled blue collar workers" to classes III(M) and IV, and "unskilled blue collar workers" to class V. "Farmers" refer to all people who receive their main income from farming, regardless of farm size or the number of employees. All other self employed people and employers are classified as "others." We excluded farmers and others from most analyses as these groups are heterogeneous regarding socioeconomic position.

Age standardised mortality by social class was calculated for the diabetic and non-diabetic populations. Age standardised mortality of people with diabetes relative to people without diabetes was calculated by social class for specific causes of death. The relative age standardised death rates were obtained from Poisson regression models including age (in five year groups) as a categorical variable,¹⁵ using the GLIM programme.¹⁶

Results

Among non-diabetic women and men death rates increased consistently with declining socioeconomic

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Table 1—Age standardised relative mortality (95% confidence interval) by social class in women and men aged 30-74 with and without diabetes in Finland, 1981-5

	Diabetic population*		Non-diabetic population	
	No of deaths	Relative mortality	No of deaths	Relative mortality
Women				
Upper white collar workers	193	1.00	1957	1.00
Lower white collar workers	1051	1.08 (0.92 to 1.26)	8227	1.14 (1.09 to 1.20)
Skilled blue collar workers	1595	1.05 (0.91 to 1.23)	9669	1.29 (1.23 to 1.36)
Unskilled blue collar workers	1093	1.07 (0.91 to 1.25)	6314	1.41 (1.34 to 1.49)
Farmers	1577	0.99 (0.85 to 1.16)	7136	1.21 (1.15 to 1.27)
Others	363	1.17 (0.98 to 1.39)	2005	1.67 (1.57 to 1.78)
P values:				
For heterogeneity †		>0.1		<0.001
For trend ‡		>0.1		<0.001
For interaction §			<0.001	
Men				
Upper white collar workers	447	1.00	4222	1.00
Lower white collar workers	1111	1.12 (1.00 to 1.25)	9546	1.39 (1.34 to 1.45)
Skilled blue collar workers	1928	1.12 (1.00 to 1.24)	25974	1.66 (1.61 to 1.72)
Unskilled blue collar workers	573	1.25 (1.10 to 1.42)	10947	2.30 (2.22 to 2.38)
Farmers	1113	1.05 (0.94 to 1.17)	13729	1.48 (1.43 to 1.53)
Others	171	1.07 (0.89 to 1.28)	3117	1.96 (1.87 to 2.05)
P values:				
For heterogeneity †		<0.01		<0.001
For trend ‡		<0.001		<0.001
For interaction §			<0.001	

*People who were provided drugs for diabetes free of charge at the end of 1980.

†Significance of global test for heterogeneity of relative mortality rates of the six social classes after adjustment for age; separate analyses for diabetic and non-diabetic populations.

‡Significance of test for trend in relative mortality after adjustment for age, excluding farmers and others; separate analyses for diabetic and non-diabetic populations (1 = upper white collar workers ... 4 = unskilled blue collar workers).

§Significance of the difference between the diabetic and non-diabetic populations in age-adjusted social class mortality pattern (interaction between social class – treated as a categorical variable – and presence of diabetes).

position (table 1). Farmers (of both sexes) fell between lower white collar workers and skilled blue collar workers. In men the mortality gradient of the social classes was much steeper than in women.

For the diabetic population, however, the findings were different (table 1). In diabetic women death rates were slightly lower among farmers and upper white collar workers, but mortality did not vary significantly between social classes either globally or in a test for trend in the four first classes. In diabetic men, differences in mortality among social classes were significant and ran in the expected direction, but the class gradient was small compared with that among non-diabetic men.

A dichotomous class variable was used for further analyses. The two white collar classes were combined to form the higher class in the dichotomy and the two blue collar classes constituted the lower class. Farmers and others were excluded.

In the non-diabetic population, the relative class differentials declined with increasing age (table 2). A similar tendency was seen in diabetic men, but the interaction was not significant. In diabetic women there was no excess mortality of blue collar workers at any age.

Figure 1 shows that absolute class differences were considerably larger among people without diabetes than in the diabetic population, even though the average mortality was higher among people with diabetes. This means that the absolute excess mortality associated with diabetes was larger in white collar workers than in blue collar workers.

In the non-diabetic population, mortality was higher among blue collar workers than among white collar workers for each cause of death included in table 3. In non-diabetic women, the excess mortality of blue collar workers was significant in all causes other than neoplasms and suicide. For non-diabetic men, this difference was significant for each cause, except diabetes itself, which also caused a few deaths among people defined as non-diabetic (their diabetes was diagnosed after the start of the follow up period, and they died before the end of follow up).

Among people with diabetes, the social class differences were much weaker or even reversed. Blue collar workers showed significant excess mortality only for deaths from lung cancer in men. Mortality from a number of causes was higher among white collar workers than among blue collar workers. This was significant only for women who died of diabetes, but the reversed class gradient was also quite pronounced in mortality from neoplasms other than lung cancer and from suicide in women.

Table 4 shows an excess mortality in people with diabetes compared with people without diabetes among

Table 2—Age standardised mortality (95% confidence interval) of blue collar workers in comparison to white collar workers (= 1.00) in broad age groups among the diabetic and non-diabetic populations in Finland, 1981-5*

	Diabetic population	Non-diabetic population	P value for interaction of diabetes and class†
Women			
30-49	0.94 (0.66 to 1.34)	1.33 (1.24 to 1.43)	<0.05
50-64	1.02 (0.87 to 1.18)	1.17 (1.12 to 1.22)	<0.1
65-74	1.02 (0.94 to 1.11)	1.17 (1.13 to 1.21)	<0.01
P value for interaction of age and class‡	>0.1	<0.01	
Men			
30-49	1.15 (0.93 to 1.43)	1.81 (1.72 to 1.89)	<0.001
50-64	1.09 (0.98 to 1.22)	1.46 (1.41 to 1.51)	<0.001
65-74	1.03 (0.94 to 1.12)	1.32 (1.28 to 1.36)	<0.001
P value for interaction of age and class‡	>0.1	<0.001	

*White collar workers refers to both upper and lower white collar workers; blue collar workers include both skilled and unskilled blue collar workers; farmers and "others" are excluded from the analysis. The diabetic population consists of people who were provided drugs for diabetes free of charge at the end of 1980.

†Significance of the difference between the diabetic and non-diabetic populations in age-adjusted relative mortality of blue collar workers compared with white collar workers (interaction between social class and presence of diabetes).

‡Significance of the difference between large age groups in age-adjusted relative mortality of blue collar workers compared with white collar workers (interaction between class and large age group).

Fig 1—Age specific mortality among diabetic and non-diabetic white collar and blue collar workers in Finland, 1981-5

Table 3—Age standardised mortality (95% confidence interval) of blue collar workers in comparison to white collar workers (= 1.00) by cause of death among the diabetic and non-diabetic populations aged 30-74 in Finland, 1981-5*

	Diabetic population	Non-diabetic population	P value†
Women			
Neoplasms	0.87 (0.72 to 1.04)	1.01 (0.97 to 1.06)	<0.1
Lung cancer	1.39 (0.62 to 3.15)	1.12 (0.96 to 1.30)	>0.1
Other	0.84 (0.69 to 1.02)	1.00 (0.96 to 1.05)	<0.1
Circulatory diseases	1.07 (0.98 to 1.17)	1.35 (1.29 to 1.40)	<0.001
Ischaemic heart disease	1.02 (0.92 to 1.14)	1.35 (1.28 to 1.43)	<0.001
Cerebrovascular diseases	1.17 (0.97 to 1.40)	1.31 (1.21 to 1.41)	>0.1
Other	1.15 (0.92 to 1.46)	1.39 (1.27 to 1.53)	>0.1
Diabetes	0.77 (0.62 to 0.95)	2.30 (1.44 to 3.67)	<0.001
Other diseases	0.99 (0.78 to 1.26)	1.27 (1.18 to 1.36)	<0.05
Accidents and violence	0.88 (0.55 to 1.39)	1.19 (1.09 to 1.30)	<0.1
Suicide	0.48 (0.17 to 1.32)	1.04 (0.90 to 1.20)	>0.1
Other	1.01 (0.60 to 1.69)	1.29 (1.15 to 1.45)	>0.1
All causes	0.99 (0.93 to 1.06)	1.19 (1.16 to 1.23)	<0.001
Causes strongly related to smoking‡	1.18 (0.66 to 2.13)	1.22 (1.09 to 1.36)	>0.1
Men			
Neoplasms	0.96 (0.81 to 1.15)	1.36 (1.30 to 1.41)	<0.001
Lung cancer	1.49 (1.04 to 2.12)	1.93 (1.80 to 2.07)	>0.1
Other neoplasms	0.82 (0.67 to 1.01)	1.10 (1.04 to 1.15)	<0.01
Circulatory diseases	1.07 (0.99 to 1.16)	1.35 (1.31 to 1.39)	<0.001
Ischaemic heart disease	1.09 (0.99 to 1.19)	1.33 (1.29 to 1.37)	<0.001
Cerebrovascular diseases	0.94 (0.77 to 1.13)	1.39 (1.29 to 1.49)	<0.001
Other circulatory diseases	1.17 (0.91 to 1.50)	1.43 (1.32 to 1.55)	>0.1
Diabetes	0.92 (0.73 to 1.15)	1.37 (0.79 to 2.36)	>0.1
Other diseases	1.17 (0.93 to 1.46)	1.59 (1.50 to 1.69)	<0.01
Accidents and violence	1.35 (0.96 to 1.89)	1.98 (1.88 to 2.10)	<0.05
Suicide	1.19 (0.63 to 2.24)	1.83 (1.67 to 2.00)	>0.1
Other	1.41 (0.95 to 2.08)	2.08 (1.94 to 2.23)	>0.1
All causes	1.06 (0.99 to 1.13)	1.45 (1.43 to 1.48)	<0.001
Causes strongly related to smoking‡	1.35 (1.01 to 1.81)	1.97 (1.86 to 2.09)	<0.05

*White collar workers refers to both upper and lower white collar workers; blue collar workers include both skilled and unskilled blue collar workers; farmers and "others" are excluded from the analysis. The diabetic population consists of people who were provided drugs for diabetes free of charge at the end of 1980.

†Significance of difference between diabetic and non-diabetic populations in age-adjusted relative mortality of blue collar workers compared with white collar workers (interaction between social class and presence of diabetes).

‡Lung cancer (ICD-8 162), upper aerodigestive cancer (140-150, 161), chronic bronchitis, emphysema and asthma (490-493).

both blue collar workers and white collar workers from almost all causes of death. As an exception to this pattern, people with diabetes did not have a significant excess mortality from causes strongly related to smoking: among blue collar men, the difference was significant in favour of the diabetic population. Furthermore, diabetic blue collar workers had a lower suicide rate than non-diabetic blue collar workers. For almost all causes of death, the relative increase in mortality

Table 4—Age standardised mortality (95% confidence interval) of people aged 30-74 with diabetes in comparison to others (= 1.00) among white collar workers and blue collar workers by cause of death in Finland, 1981-5*

	White collar workers	Blue collar workers
Women		
Neoplasms	1.54 (1.32 to 1.80)	1.32 (1.18 to 1.48)
Lung cancer	0.86 (0.42 to 1.76)	1.07 (0.70 to 1.63)
Other	1.60 (1.37 to 1.88)	1.35 (1.20 to 1.52)
Circulatory diseases	5.41 (5.00 to 5.85)	4.30 (4.09 to 4.54)
Ischaemic heart disease	6.42 (5.82 to 7.09)	4.87 (4.55 to 5.20)
Cerebrovascular diseases	4.29 (3.62 to 5.08)	3.84 (3.44 to 4.28)
Other	3.93 (3.18 to 4.85)	3.25 (2.84 to 3.72)
Diabetes	439 (288 to 670)	146 (105 to 204)
Other diseases	2.29 (1.86 to 2.81)	1.79 (1.55 to 2.06)
Accidents and violence	2.09 (1.44 to 3.03)	1.54 (1.15 to 2.06)
Suicide	1.61 (0.79 to 3.27)	0.74 (0.35 to 1.55)
Other	2.38 (1.54 to 3.67)	1.86 (1.36 to 2.54)
All causes	3.86 (3.63 to 4.10)	3.21 (3.07 to 3.35)
Causes strongly related to smoking†	0.93 (0.56 to 1.54)	0.90 (0.65 to 1.24)
Men		
Neoplasms	1.47 (1.28 to 1.70)	1.05 (0.93 to 1.18)
Lung cancer	0.97 (0.72 to 1.31)	0.75 (0.61 to 0.91)
Other neoplasms	1.74 (1.48 to 2.04)	1.30 (1.13 to 1.50)
Circulatory diseases	3.54 (3.31 to 3.78)	2.80 (2.66 to 2.95)
Ischaemic heart disease	3.51 (3.25 to 3.80)	2.88 (2.71 to 3.06)
Cerebrovascular diseases	4.47 (3.91 to 5.24)	3.02 (2.65 to 3.43)
Other circulatory diseases	2.65 (2.14 to 3.26)	2.15 (1.84 to 2.52)
Diabetes	484 (298 to 786)	325 (227 to 465)
Other diseases	2.10 (1.74 to 2.52)	1.53 (1.34 to 1.76)
Accidents and violence	1.63 (1.23 to 2.16)	1.11 (0.91 to 1.35)
Suicide	1.36 (0.81 to 2.26)	0.88 (0.60 to 1.29)
Other	1.79 (1.29 to 2.49)	1.22 (0.97 to 1.52)
All causes	3.01 (2.85 to 3.17)	2.19 (2.10 to 2.28)
Causes strongly related to smoking†	1.07 (0.84 to 1.35)	0.73 (0.62 to 0.87)

*People who were provided drugs for diabetes free of charge at the end of 1980. White collar workers refers to both upper and lower white collar workers; blue collar workers include both skilled and unskilled blue collar workers; farmers and "others" are excluded from this analysis.

†Lung cancer (ICD-8 162), upper aerodigestive cancer (140-150, 161), chronic bronchitis, emphysema and asthma (490-493).

associated with diabetes was larger for white collar workers than for blue collar workers.

Discussion

We started this study with the assumption that diabetes increases the risk of death more in the blue collar classes than the white collar classes, leading to particularly wide socioeconomic mortality differences in the diabetic population. This assumption seemed reasonable as optimal glucose control^{1,2} and lack of behavioural risk factors, such as smoking and unhealthy diet,³ reduce the incidence of fatal complications of diabetes, and people from higher socioeconomic classes tend to accept health education and improve their health behaviour more readily than those from lower classes.⁷⁻⁹ In line with these findings, it has been shown that in Finland survival from cancer¹⁷ and heart disease¹⁸ is best in the higher social classes. Furthermore, earlier studies in the United States¹⁹ and Japan²⁰ have suggested that mortality of people with insulin dependent diabetes is highest in those with a low socioeconomic position.

Our results were almost totally opposed to this assumption. We found no significant social class differences in mortality among diabetic women in any age group or with any cause of death except diabetes itself, for which the class gradient was reversed. Among diabetic men there was a slight increasing trend in mortality from the upper white collar group to unskilled

Key messages

- No social class differences in mortality were found among diabetic women
- In diabetic men a slight increasing trend in mortality was found from the upper white collar group to the unskilled blue collar workers, but it was much less steep than that in non-diabetic men
- These results may show that among diabetic people in Finland health education is effective in all socioeconomic strata, leading to greater changes in the lower strata due to their poor original health behaviour
- Equitable health services may alleviate health inequities in a subpopulation where the impact of health services is particularly important

blue collar workers, but it was much less steep than in non-diabetic men. Contrary to our expectations, diabetic white collar employees did not have a particularly great advantage over diabetic blue collar workers in mortality from causes of death that are strongly connected with health behaviour, such as diabetes, cardiovascular diseases, and other causes of death related to smoking.

Among men, deaths from smoking related diseases were less common in diabetic than in non-diabetic blue collar workers, and diabetic women in all social classes had a slightly reduced mortality from smoking related causes.

EXPLAINING THE FINDINGS

The surprising results could, in principle, be due to biased data. Deficiencies in the coverage of diabetic patients in the national drug register could reduce social class differentials in death rates if severe cases of diabetes in the blue collar classes or mild cases among the white collar workers, or both, were not adequately covered. Socioeconomic differences in the coverage of the national drug register data have not been studied, but the register's data and analyses of representative population samples give similar estimates of the prevalence of drug treated diabetes in Finland.¹⁴ Moreover, patients with severe diabetes are most likely to be entered in the register quickly after they have developed obvious symptoms, irrespective of their social class. Mild cases, where the need for drug treatment is less obvious, may not always be entered in the register, but there is no reason why this kind of undercoverage would be particularly pronounced among white collar workers.

Deficiencies in the mortality follow up of diabetic blue collar workers could, in theory, have caused the observed lack of socioeconomic mortality gradient in the diabetic population. This can be ruled out, however, as registration of deaths in Finland is complete.

In addition to inadequate data, there are at least two alternative explanations. We could hypothesise that diabetes is more severe among higher than lower social classes, but there is no evidence to support this assumption.

The most likely explanation of our results is that among diabetic Finns there are no major differences between social classes in health behaviour, quality of treatment, and other factors importantly related to the risk of death. Equitable health services have been an important goal in Finnish health policy for decades. Analyses of the distribution of outpatient and hospital services show that, after use of services has been adjusted for need, no significant differences have been found between social classes in their use of health services.²¹⁻²³ The benefits of equitable health services may be greatest for groups whose situation is worst. If

the quality of treatment and compliance do not vary by socioeconomic status and if health education is effective in all socioeconomic strata—leading to greater changes in the lower strata due to their poor original health behaviour—one may expect to find smaller than average mortality differences in the diabetic population. The results of this study can be interpreted as showing that equitable health services can alleviate health inequities in a subpopulation where the impact of health services is particularly important.

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Conflict of interest: None.

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Correction

Adequacy of cervical cytology sampling with the Cervex brush and the Aylesbury spatula: a population based randomised controlled trial

An authors' error and a proof reading error occurred in this paper by Paola Dey and colleagues (21 September, pp 721-3). In table 2 under "Subgroup analysis" the numbers allocated the Cervex brush and the Aylesbury spatula in centres with historically low and high inadequate smear rates were transposed. These should have read: "Low (<6%) (n = 1278, n = 992)" and "High (>12%) (n = 2041, n = 1712)." In addition, the reference to "table 3" in the text was erroneous and left over from a previous version of the manuscript. There was not intended to be a table 3 in the published version.