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Socio-economic status and diabetes-related hospital admissions: a cross-sectional study of people with diagnosed diabetes

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What this paper adds**What is already known on this subject?**

Less affluent people with diabetes have poorer outcomes than more affluent people

Inequalities in disease management may contribute to socio-economic differences in diabetes outcomes

What does this study add?

Differences in prevalence of complications of diabetes by socio-economic status were more marked than differences in disease management measures in this cross-sectional study

The role of socio-economic status should be considered when developing risk scores and comparing quality of care between populations of people with diabetes

Abstract

Background: Low socio-economic status (SES) is associated with adverse cardiovascular risk factor patterns and poorer outcomes for people with diabetes

Methods: We performed a cross-sectional study using data for 35,925 people with diagnosed diabetes in Scotland and an area-based measure of SES using linked hospital and population-based diabetes register records. Comparisons by quintile of SES were made before (with p values presented for trend across quintiles given below) and after adjusting for other factors using multivariable logistic regression.

Results: People in the most deprived quintile were more likely than people in the most affluent quintile to have hospital records for diabetic kidney disease (2.4% vs 2.0%, $p=0.049$), diabetic ketoacidosis (3.5% vs 3.0%, $p=0.11$), hypoglycaemia (1.8% vs 1.4%, $p=0.008$), ischaemic heart disease (22% vs 17%, $p<0.0001$), stroke (6.8% vs 5.1%, $p<0.0001$) and peripheral arterial disease (4.1% vs 2.1%, $p<0.0001$). An independent effect of SES persisted for cardiovascular disease outcomes after adjusting for age and sex. There were minimal differences in disease management measures by SES.

Conclusion: Managing current risk factors equitably is unlikely to remove socio-economic inequalities in diabetes-related outcomes. Measures of SES may be valuable in risk scores and in making valid comparisons of quality of diabetes care.

Introduction

Inequalities in prevalence of diabetes and its complications by socio-economic status (SES) have been described in many settings. [1] Potential explanations include differences in prevalence of risk factors and access to and use of services. [1-3] Socio-economic differences in longer term outcomes appear to be more marked than in processes of care as reflected by disease management measures in several health care systems. [4-8]

In Scotland population-based data on people with diagnosed diabetes are collated electronically by capturing data from primary and secondary care systems. [9] We have previously reported that prevalence of type 2 diabetes and of cardiovascular disease among people with diabetes was inversely associated with SES in central Scotland. [10] The aim of this analysis was to investigate the association between SES, current risk factor patterns and history of hospital admission for selected complications of diabetes.

Methods

We used data available in 2005 for people with diabetes from a population of over 1.5 million people from two Health Boards in central Scotland. Data on most recent risk factor values were extracted from diabetes registers for people with diabetes and linked to hospital admissions data. The study was approved by local research ethics committees, data guardians and the Privacy Advisory Committee of NHS Services Scotland.

Records in which data on age or sex were missing (8.0%) or with obvious errors in the date of diagnosis (0.1%) were excluded from the analysis. Quintile of SES was assigned

using the Scottish Index of Multiple Deprivation (SIMD), an area based measure derived from health and administrative data.[11] The health domain includes standardised mortality ratios, hospital episodes related to emergencies, drug and alcohol use, a comparative illness factor, the estimated proportion of the population being prescribed drugs for anxiety, depression or psychosis and the proportion of live singleton births of low birth weight. [11]

Complications of diabetes were identified from hospital record data using International Classification of Disease (ICD) codes (see footnotes to table). Comparisons were made between quintiles of SES using chi-squared tests for trend for the proportions of people with a history of hospital admission for renal disease, diabetes-related emergencies and cardiovascular disease occurring since 1981 when electronic hospital records began. Logistic regression was used to adjust associations between SES and complications of diabetes for confounding factors. All analyses were performed using S-Plus for Windows v6.1 (or later) software.

Results

There were 35,925 people with diabetes for whom complete data were available on all cardiovascular risk factors (69% of people on the registers) and 85% of people had a history of one or more hospital admissions. Mean age fell from 63.5 to 62.2 years of age and the proportion of women increased from 41% to 49% from the least to the most deprived quintile ($p < 0.001$ for trend for both age and sex). There were small differences in disease management measures by SES, for example mean HbA1c, cholesterol level and systolic blood pressure for the least and most deprived quintiles were 7.6 and 7.8%, 4.4 and 4.3 mmol/l and 137 and 134 mmHg respectively. There were more marked

differences between the least and most deprived quintiles in prevalence of smoking (13.4 and 32.4%) and mean body mass index (29.4 and 31.2 kg/m²).

Proportions of people in each SES quintile with history of a hospital admission for outcomes of interest and results of logistic regression models adjusting for age and sex are shown in the table. Further adjustment for Health Board, smoking status, body mass index, HbA1c, estimated glomerular filtration rate, cholesterol, type and duration of diabetes had modest effects for most outcomes but increased the OR(95% CI) for diabetic ketoacidosis and hypoglycaemia to 1.67 (1.36-2.06) and 2.11(1.60-2.78) respectively.

Discussion

We have shown that a history of hospital admission for various complications of diabetes is more common among deprived than affluent people with diabetes. Our finding that there were more marked socio-economic differences in complications of diabetes than among disease management measures are consistent with those of previous studies. [5,12-14] A recent cross-sectional study in a Glasgow population concluded that the association of deprivation with atherosclerosis is not adequately explained by classic or emerging risk factors.[15]

This study has a number of limitations including its cross-sectional study design which means that the role of lifetime exposure to risk factors in explaining the association between SES and disease outcomes can not be addressed. Current risk factor levels reflect treated values for many people and presence of complications may lead to more aggressive treatment. Treatment and individual level data on SES were not available. It

was not possible to remove the health domain from SIMD for this analysis but a previous study suggests that this has little effect on socio-economic health inequalities. [16] Our findings may be influenced by survival bias which would be expected to minimise the effect of SES.

The findings of this and other similar studies suggest that tackling any inequalities in current measures of disease management will, at best, only partly address inequalities in risk of complications of diabetes by SES. A history of complications of diabetes is itself associated with increased risk of future complications and prevention of diabetes and its complications including early treatment of risk factors are therefore crucial for reducing inequalities. The use of risk scores that include a measure of SES may provide a more accurate assessment of risk than those that only use cardiovascular risk factors. [17,18] Prospective studies are needed to investigate whether SES could provide a valuable addition to risk scores for complications of diabetes. In addition, the potential role of SES should be considered when making comparisons of diabetes related outcomes and quality of care between different populations.

Tackling inequalities in health is complex and will only be successful if the social determinants of health are addressed. [19,20] Failure to reduce inequalities in prevalence and complications of diabetes will, however, be detrimental to both individuals and societies. [21,22]

Table: History of diabetes-related and cardiovascular hospital admissions by socio economic status: numbers, proportion and age-sex adjusted odds ratio (using least deprived quintile- Q1 as reference group)

Type of hospital admission		Quintile of socio-economic status					Test for trend (unadjusted)
		1 (least deprived)	2	3	4	5 (most deprived)	
	N	6936	4551	5017	7568	11853	
Diabetic kidney disease	N (%)	142 (2.0%)	94 (2.1%)	107 (2.1%)	178 (2.4%)	286 (2.4%)	p=0.049
	OR (95% CI)	1.00	1.06 (0.81, 1.38)	1.10 (0.85, 1.42)	1.22 (0.97, 1.52))	1.29 (1.05, 1.59)	
Diabetic ketoacidosis	N (%)	206 (3.0%)	143 (3.1%)	188 (3.7%)	239 (3.2%)	411 (3.5%)	p=0.11
	OR (95% CI)	1.00	0.92 (0.74, 1.16)	1.20 (0.97, 1.48)	1.07 (0.87, 1.30)	1.15 (0.97, 1.38)	
Hypoglycaemia	N (%)	95 (1.4%)	55 (1.2%)	84 (1.7%)	116 (1.5%)	212 (1.8%)	p=0.008
	OR (95% CI)	1.00	0.84 (0.60, 1.17)	1.18 (0.88, 1.59)	1.10 (0.84, 1.45)	1.26 (0.99, 1.61)	
Ischaemic heart disease	N (%)	1180 (17.0%)	771 (16.9%)	935 (18.6%)	1502 (19.8%)	2588 (21.8%)	p<0.0001
	OR (95% CI)	1.00	1.08 (0.98, 1.20)	1.22 (1.11, 1.35)	1.31 (1.20, 1.42)	1.57 (1.45, 1.70)	
Stroke	N (%)	355 (5.1%)	240 (5.3%)	274 (5.5%)	490 (6.5%)	804 (6.8%)	p<0.0001
	OR (95% CI)	1.00	1.12 (0.94, 1.32)	1.15 (0.98, 1.36)	1.36 (1.18, 1.57)	1.52 (1.33, 1.73)	
Peripheral arterial disease	N (%)	146 (2.1%)	132 (2.9%)	170 (3.4%)	255 (3.4%)	486 (4.1%)	p<0.0001
	OR (95% CI)	1.00	1.50 (1.18, 1.91)	1.76 (1.41, 2.21)	1.74 (1.41, 2.14)	2.25 (1.86, 2.72)	

ICD codes were used to identify disease groups as follows: diabetic kidney disease (ICD-9: 585, 586, 587, 581.8, 583.8, ICD-10: N04, N06, N08, N15, N16, N18), diabetic ketoacidosis (ICD-9: 250.1; ICD-10: E10.1, E11.1, E14.1), hypoglycaemia (ICD-9: 250.8; ICD-10: E16.0, E16.2), ischaemic heart disease (ICD-9: 410-414; ICD-10: I24-25) stroke (ICD-9: 430-438; ICD-10: I60-69), peripheral arterial disease (ICD-9: 443; ICD-10: I73).

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Competing interests

None

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