



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

Sarah Wild FRCPE ¹, John McKnight FRCPE ², Ciara Mackenzie B.Sc. ¹, Alex McConnachie ³, Robert Lindsay ⁴

1. Public Health Sciences, University of Edinburgh, 2. Metabolic Unit, Western General Hospital, Edinburgh, 3. Robertson Centre for Biostatistics, University of Glasgow 4. BHF Glasgow Cardiovascular Research Centre, University of Glasgow,



Background Inequalities in prevalence of diabetes and morbidity and mortality from the microvascular and macrovascular complications of both type 1 and type 2 diabetes by educational or socio-economic status (SES) have been described in many settings. Reasons for the association between low SES and higher prevalence and worse outcomes of diabetes include higher prevalence of risk factors (overweight/obesity associated with unhealthy diet and sedentary lifestyles, smoking, poor blood pressure, cholesterol and glycemic control) and poorer access to and use of services.

In Scotland it is possible to link population-based diabetes register data to hospital records back to 1981 using a unique identifier and subsequent anonymization. SES can be assigned using postal code and deprivation scores derived from the Scottish Index of Multiple Deprivation (SIMD), an area based measure derived from data collected in the 2001 census and administrative databases. SIMD is based on 31 indicators from six individual domains (Current Income; Employment; Health; Education, Skills and Training; Geographic Access to Services and Telecommunications; Housing) across 6505 geographical data zones each covering an average of approximately 780 people.

The aim of this study was to investigate the association between SES and history of hospital admission for selected complications related to diabetes in data from two large registers and to examine the role of current risk factor patterns in any association between SES and hospital admissions. Approval for this study was obtained from local research ethics committees and the Privacy Advisory Committee of NHS Services Scotland.

Methods: Data available in 2005 for people with type 1 or type 2 diabetes from the population of over 1.5 million people covered by the Greater Glasgow and Lothian Health Boards were used for this analysis. SES was categorised by quintile of SIMD score. Estimated glomerular filtration rate (eGFR) was calculated using the abbreviated Modified Diet in Renal Disease equation ($175 \times (\text{Creat} / 88.4) - 1.154 \times (\text{Age}) - 0.203 \times (0.742 \text{ if female})$). Ethnicity was not included in the equation because of poor recording of ethnicity on diabetes registers and the very small number of black people in the population studied.

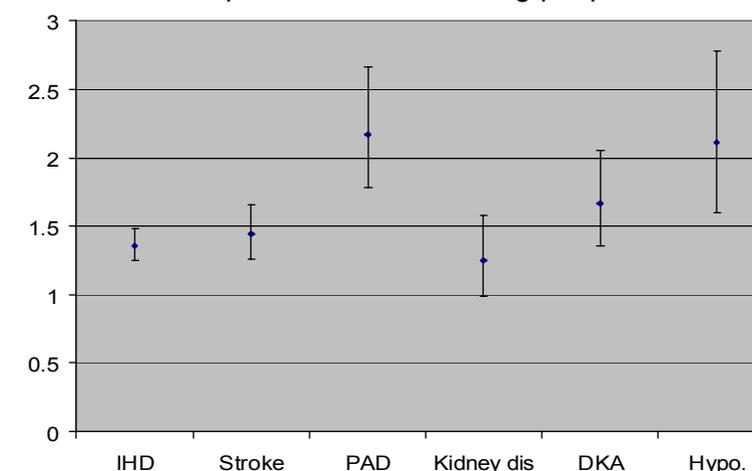
Complications of diabetes were identified from hospital record data using the following International Classification of Disease (ICD) codes: diabetic kidney disease (ICD-9: 585, 586, 587, 581.8, 583.8, ICD-10: N04, N06, N08, N15, N16, N18), diabetic ketoacidosis [DKA] (ICD-9: 250.1; ICD-10: E10.1, E11.1, E14.1), hypoglycemia (ICD-9: 250.8; ICD-10: E16.0, E16.2), ischemic heart disease [IHD] (ICD-9: 410-414; ICD-10: I24-25) stroke (ICD-9: 430-438; ICD-10: I60-69), peripheral arterial disease [PAD] (ICD-9: 443; ICD-10: I73). Logistic regression was used to estimate odds ratios for the various outcomes for each SES quintile using the most affluent quintile as the reference group before and after adjusting for age, sex, Health Board, smoking status, body mass index (BMI), HbA1c, eGFR, cholesterol, SBP, type of diabetes and time since diagnosis of diabetes.

Results: Complete data were available for 35,925 people, representing 69% of the 52,280 people on the 2 registers. The completeness of data for each variable ranged from around 90% for blood pressure and HbA1c to around 80% for body mass index. Lower SES (comparing the most deprived quintile, Q5, with Q1) was associated with higher proportions of women (49 vs 41%) and smokers (32 vs 13%) and higher mean BMI (31.2 vs 29.4 kg/m²) and HbA1c (7.8 vs 7.6%). Lower SES was also associated with lower age (62.2 vs 63.5 years), shorter duration of diabetes (6.7 vs 8.5 years), lower blood pressure (134 vs 137 mmHg), cholesterol (4.3 vs 4.4 mmol/l) and eGFR (67.1 vs 68.4 ml/min/1.73m²).

Similarly lower SES (Q5 vs Q1) was associated with higher proportions of people with history of a hospital admission for diabetes related kidney disease (2.4 vs 2.1%), DKA (3.5 vs 3.0%), hypoglycaemia (1.8 vs 1.4%), IHD (22 vs 17%), stroke (6.8 vs 5.1%) or peripheral arterial disease (4.1 vs 2.1%).

There was a statistically significant association between SES and both cardiovascular disease and diabetes related hospital admissions independently of other factors (see figure). The strongest association with SES was seen for peripheral arterial disease and hypoglycemia admissions.

Figure: adjusted* OR for most deprived vs most affluent quintiles for CVD/ diabetes hospital admissions among people with diabetes



* Adjustments for: age, sex, Health Board, smoking status, BMI, HbA1c, eGFR, cholesterol, SBP, type of diabetes, time since diagnosis of diabetes

Discussion: After adjustment for current risk factors there was an independent association between SES and hospital admission for DKA and hypoglycemia as well as for IHD, stroke and PAD. On stratification by type of diabetes the association between SES and DKA was statistically significant only for type 1 diabetes (OR (95% CI) for Q5 vs Q1 1.74 (1.38-2.19) compared to 1.37 (0.85, 2.22) for people with type 2 diabetes). The association between SES and hypoglycemia admission was statistically significant for people with both type 1 and type 2 diabetes (OR (95% CI) for Q5 vs Q1 2.28 (1.52, 3.41) and 1.82 (1.26, 2.63) respectively). It appears that inequalities in complications of diabetes by SES are unlikely to be abolished by treating current risk factors.

Our data have the advantage of being population based within a national health service in which payment for medication will not influence compliance as it does in other health systems. Limitations of the study include the potential effects of survival bias given the cross-sectional study design. Data on treatment of dyslipidemia and hypertension were not available and current risk factor levels may reflect treated values for many people. Current risk factor levels are unlikely to reflect lifetime exposure which may differ more markedly by SES than do current risk factor levels.

The findings of this study and other similar studies suggest that inequalities in risk of complications of diabetes by SES are unlikely to be addressed fully by tackling any inequalities in processes of care including management of current risk factors such as smoking, BMI and glycemic control. Lower SES may act as a marker for other factors (such as smoking exposure and poor diet) that influence outcomes. Risk of cardiovascular disease is influenced by lifelong exposure to risk factors and the use of risk scores that include a measure of SES may provide a more accurate assessment of risk than those that only use current cardiovascular risk factors. Further work is required to investigate explanations for the higher proportion of DKA and hypoglycemia admissions among lower SES groups. Tackling inequalities in health is complex and involves development of interventions to improve lifestyles, access to care and quality of care. Failure to reduce inequalities in prevalence and complications of diabetes will be costly to both individuals and societies.