Socioeconomic Status and Clustering of Cardiovascular Disease Risk Factors in Diabetic Patients

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OBJECTIVE — Correction of cardiovascular risk factors is an essential component of good diabetes care. Our goal was to examine the relationship of socioeconomic status on five risk factors: obesity, hypertension, high cholesterol, smoking, and high HbA_{1c}.

RESEARCH DESIGN AND METHODS — We conducted a cross-sectional prevalence study of all patients with diabetes (n = 1,553) attending a clinic in Glasgow, U.K. Area-based codes were used to measure socioeconomic status; these ranged from 1, the most affluent, to 7, the most deprived.

RESULTS — Comparing patients with NIDDM from the seven categories of socioeconomic status, we found that those from deprived categories experienced a higher prevalence of obesity. In the most affluent groups, 30% had a BMI >30 kg/m^2 compared with 47% in the most deprived categories ($P < 0.002$). With regard to smoking, 13% in the most affluent category smoked compared with 33% in the most deprived ($P < 0.001$). In patients with IDDM from affluent categories, 13% smoked compared with 34% from the deprived categories ($P < 0.001$). The proportion of patients with no cardiac risk factors fell by 30.6% from deprivation category 1 to 7 ($P < 0.001$), and the proportion of patients with three or more risk factors rose from 8.6% in category 1 to 20.2% in category 7.

CONCLUSIONS — Diabetic patients from areas of low socioeconomic status are at increased risk of cardiovascular disease. To counter this, specific health education programs should be evolved and resources should be directed toward these areas.

A huge change in mortality in relation to social class among patients with diabetes has occurred in the last 50 years. In the early 1950s, diabetes mortality was highest in social class 1; by the 1980s, standardized mortality ratios for social class 1 were half that in social class 5 (1). These differentials remain unexplained, although coronary artery disease is likely to play a significant role. Compared with the population as a whole, diabetic subjects experience excess mortality associated with coronary artery disease (2–4). A strong inverse correlation exists linking coronary artery disease in the whole population to socioeconomic status (SES), whether it is measured by occupation, social class, or home ownership (5–9). The relationship among socioeconomic factors, diabetes, and coronary artery disease merits further exploration.

Smoking, obesity, hypertension, and hyperlipidemia add to the already high risk of coronary artery disease mortality in diabetic patients (10–12). This risk is increased further by poor glycemic control (12). The St. Vincent Declaration proposed a reduction in coronary risk factors to reduce morbidity and mortality from coronary artery disease (13). Study of the prevalence of these risk factors in different socioeconomic groups may lead to the possibility of focusing preventive measures on areas where maximum effect may be gained.

RESEARCH DESIGN AND METHODS

— The study group consisted of all patients attending the diabetic clinic (n = 1,553) at the Victoria Infirmary, Glasgow, U.K., in 1993. The high prevalence of coronary heart disease in Glasgow is well documented (14). The patients consisted of referrals from primary care and other specialties and also patients with newly diagnosed diabetes. The vast majority of diabetic patients in this area are referred to the Victoria Infirmary, but an unspecified number attend other nearby hospitals. Patients younger than 14 years of age attend the pediatric diabetes service and are then referred to the adolescent diabetes clinic at our hospital.

Data from each clinic visit were recorded on clinic register forms that included sex, date of birth, date of diagnosis, address with full post code, diabetes type, height, weight, smoking habit, blood pressure, and biochemical investigations of HbA_{1c} and cholesterol. IDDM patients were defined as those requiring insulin within 3 months of diagnosis, and all others were defined as NIDDM patients.

SES was measured using the deprivation scores described by Carstairs

Table 1—*Characteristics of study population by deprivation category*

Deprivation category	n	Men (%)	Median age (years)	Median duration (years)	Ethnic minorities (%)	IDDM (%)
1	200	57	63	5	9	29.5
2	237	56	63	4	8	24.5
3	329	58	62	6	6	33.7
4	152	52	59	5	19	34.0
5	239	51	63	5	9	23.0
6	182	48	64	6	3	14.6
7	214	49	61	4	3	19.7

Deprivation category: 1, most affluent; 7, most deprived. For ethnic minorities, $P < 0.02$; for IDDM, $P < 0.01$.

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dBP, diastolic blood pressure; sBP, systolic blood pressure; SES, socioeconomic status.

Table 2—*Median values of cardiac risk factors by deprivation category in NIDDM*

Deprivation category	BMI (kg/m^2)	HbA_{1c} (%)	Cholesterol (mmol/l)	sBP (mmHg)	dBP (mmHg)	Smokers (%)
1	27.6 (24.3–31.5)	4.7 (3.8–6.45)	5.7 (4.9–6.4)	148 (131–170)	84 (78–94)	10.9
2	27.1 (24.3–30.3)	5.2 (3.9–6.4)	5.6 (4.8–6.2)	150 (134–170)	84.5 (78–94)	15.4
3	27.4 (24.8–31.3)	5.3 (4.2–6.6)	5.7 (5.0–6.7)	150 (136–171)	84 (75–93)	17.9
4	27.5 (25.4–31.9)	5.1 (4.15–6.45)	5.9 (5.1–6.7)	142 (128–167)	83 (77–92)	22.2
5	28.0 (25.1–32.0)	5.3 (4.0–6.5)	5.8 (5.0–6.6)	153 (136–167)	87 (79–92)	17.6
6	29.8 (26.5–33.2)	5.6 (4.4–7.0)	5.6 (4.9–6.7)	153 (139–170)	87 (79–93)	27.0
7	29.3 (27.1–32.9)	5.0 (4.1–6.75)	5.8 (5.0–6.5)	148 (133–167)	85 (78–94)	35.4

Data are medians (interquartile range). For BMI, $P < 0.002$; for smokers, $P < 0.00001$.

and Morris (15). These are area-based codes allocated to post code (zip code) sectors. They are calculated from four measures of material wealth: proportion of people living at a density >1 per room (overcrowding), proportion of the population without access to a car (car ownership), proportion of people living in households with the head of the household in social class 4 or 5 (low social class according to the Registrar General's classification), and proportion of economically active men seeking employment (male unemployment). An unweighted deprivation score is calculated from these variables. The deprivation scores are grouped into seven deprivation categories ranging from 1, the most affluent, to 7, the most deprived. Individuals are allocated to a deprivation category on the basis of their post code.

HbA_{1c} was measured by a monoclonal antibody method (Dako, Ely, U.K.), with a normal range of 2.8–5.0%. Serum cholesterol was estimated by an enzyme method (Boehringer Mannheim, Sussex, U.K.). Blood pressure was measured using an automated blood pressure cuff in the sitting position (Lifestat 100, Washington). Height and weight without shoes were recorded, and the BMI was calculated (weight [kilograms])/height [meters] squared). Smokers were defined as those currently smoking one or more cigarettes daily.

Data pertaining to BMI, cholesterol, and HbA_{1c} were expressed as medians with interquartile ranges for each category. These were then individually analyzed in relation to social deprivation using analysis of variance, providing that the samples showed homogeneity of variance and a normal distribution. The proportion of IDDM patients, subjects from ethnic minorities, and smokers in each category were calculated and analyzed by χ^2 for linear trend using deprivation category 1 as the baseline. The number of risk factors experienced by each individual were counted on the basis of smoking one or more cigarettes daily, BMI ≥30 kg/m^2 (16), cholesterol ≥6.5 mmol/l (17), blood pressure ≥160/90 mmHg (18), and HbA_{1c} ≥7%, the highest quartile of the study population. Statistical significance was taken at $P < 0.05$.

RESULTS — Table 1 describes the study group characteristics by deprivation category. The proportion of subjects from ethnic minorities was lower in the more deprived categories ($P = 0.024$). The categories were broadly similar in terms of age and duration of diabetes. However, there was a statistically significant difference among the seven strata in the distribution of diabetes type, there being proportionately more NIDDM in the deprived categories ($P = 0.005$). Ascertainment for sex, date of birth, date of diagnosis, and deprivation categories was 100%; for BMI was 96.8%; for HbA_{1c} was 99.3%; for cholesterol was 94.5%; for blood pressure was 93.7%; and for smoking was 95.2%.

Tables 2 and 3 describe for IDDM and NIDDM, respectively, the median levels of BMI, HbA_{1c}, cholesterol, blood pressure, and the percentage of smokers in each deprivation category. Higher BMIs are evident in the most deprived categories of NIDDM patients. The data indicate higher BMI, blood pressure, and proportion smoking in the more deprived categories. Analysis of serum cholesterol levels in subjects younger than 70 years of age by deprivation category indicated higher cholesterol levels in the deprived categories ($P < 0.03$). When analyzed for all patients, systolic blood pressure (sBP) and diastolic blood pressure (dBP) levels were higher in the deprived groups ($P < 0.04$ and $P < 0.02$, respectively). How-

Table 3—*Median values of cardiac risk factors by deprivation category in IDDM*

Deprivation category	BMI (kg/m^2)	HbA_{1c} (%)	Cholesterol (mmol/l)	sBP (mmHg)	dBP (mmHg)	Smokers (%)
1	23.9 (22.5–26.6)	6.1 (5.05–8.0)	5.05 (4.4–6.1)	138 (122–158)	78 (68–85)	13.3
2	24.3 (21.9–26.6)	6.2 (4.9–7.5)	5.1 (4.2–5.6)	133 (119–150)	78.5 (70–87.5)	21.7
3	25.3 (22.8–27.8)	6.45 (5.1–7.8)	5.2 (4.4–6.0)	133 (122–150.5)	80 (71–88)	23.2
4	25.0 (22.8–27.8)	6.35 (5.0–7.7)	5.05 (4.4–6.1)	130 (115–153)	75 (70–83)	36.7
5	25.0 (22.9–27.3)	6.10 (5.2–7.7)	5.1 (4.3–6.1)	134.5 (122–155)	78.5 (70–87)	25
6	26.7 (22.4–30.7)	6.45 (5.6–8.4)	5.05 (4.05–5.65)	153 (123–171)	80.5 (76–95)	40.5
7	25.6 (22.3–29.1)	6.4 (5.2–7.8)	5.2 (4.2–6.0)	132 (121–145.5)	78 (70–84)	41.4

For smokers, $P < 0.001$.

Table 4—*Proportion of patients with 0, 1, 2, 3, and 4 or more risk factors by deprivation category*

Deprivation category	No. of risk factors				
	0	1	2	3	4 or more
1	26.5	43.0	21.9	7.9	0.7
2	25.1	41.1	26.3	7.4	0
3	20.7	45.6	23.7	8.3	1.7
4	23.0	41.6	18.6	14.2	2.7
5	28.4	31.5	25.9	11.1	3.1
6	14.8	29.6	34.1	17.0	4.4
7	18.4	31.3	30.1	18.4	1.8

$P < 0.001$ for trend.

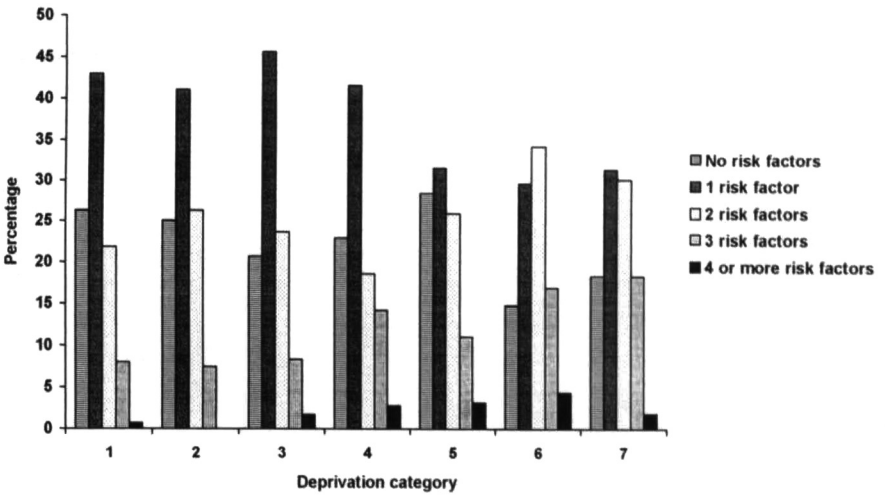

Figure 1—*Percentage of patients with 0, 1, 2, 3, and 4 or more risk factors by deprivation category.*

ever, when analyzed by diabetes type, blood pressure was no longer significantly related to deprivation.

Table 4 describes the distribution of risk factors among the seven deprivation categories. The proportion of patients with three or more risk factors was sharply higher in the most deprived categories (Fig. 1). This also applied when IDDM ($P < 0.001$) and NIDDM ($P < 0.001$) were analyzed separately. The most affluent categories also had the highest proportion of patients without additional risk factors.

CONCLUSIONS— Using an area-based index of SES and a diabetic clinic population, we have demonstrated that smoking, obesity, and hypertension are higher among diabetic subjects of low SES. The higher prevalence of cardiovascular risk factors among diabetic subjects of low SES may in part explain the relative increase in mortality (19). Area-based codes of SES describe the area in which an individual lives. Health resources could thus be targeted toward these localities.

The study group consisted of patients attending a hospital-based diabetic clinic. By analyzing the proportion of subjects in 10-year age bands and the proportion treated with insulin, we found our population distribution by age and treatment consistent with data from U.K.-based population studies (21). The higher proportion of patients with NIDDM in the more deprived categories has been previously observed (22), as has been a higher prevalence of diabetes in men (23).

The uptake of primary care health checks was lowest in the lowest social class (class 5) (24), suggesting that the impact of health education will be of little benefit; thus novel approaches to health are required. Specific programs of health education for people from areas with low SES should be developed, explaining the benefits of risk factor correction within their environment.

Important issues about the impact of social deprivation on diabetes remain to be clarified. Although diabetes affects all aspects of life, it is also true that social circumstances affect aspects of diabetes.

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