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Is there equity of service delivery and intermediate outcomes in South Asians with type 2 diabetes? Analysis of DARTS database and summary of UK publications

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ABSTRACT

Background There are doubts whether diabetes care is equitable across UK ethnic groups. We examined processes and outcomes in South Asians with diabetes and reviewed the UK literature.

Methods We used name search methods to identify South Asians in a regional diabetes database. We compared prevalence rates, processes and outcomes of care between November 2003 and December 2004. We used standard literature search techniques.

Results The prevalence of diabetes in South Asians was 3–4 times higher than non-South Asians. South Asians were 1.11 times (95% confidence interval 1.06, 1.16) more likely to have a structured review. South Asian women were 1.10 times more likely to have a record of body mass index (95% CI 1.04, 1.16). HbA1c levels were 1.03 times higher (95% CI 1.00, 1.06) among South Asians, retinopathy 1.36 times more common (95% CI 1.03, 1.78) and hypertension 0.71 times as common (95% CI 0.58, 0.87).

Conclusions We found evidence of equity in many aspects of diabetes care for South Asians in Tayside. The finding of higher HbA1c and more retinopathy among South Asians needs explanation and a service response. These findings from a region with a small non-White population largely support the recent findings from other parts of the UK.

Keywords ethnic groups, outcome measures, quality of service, Scotland, South Asian, Tayside, type 2 diabetes mellitus

Introduction

UK South Asians have a four- to six-fold increased prevalence of type 2 diabetes compared with the White European population.[1–3] South Asians develop diabetes earlier in life, at lower levels of obesity, suffer longer with complications and have a subsequent higher mortality risk than their White European counterparts.[4]

The provision of diabetes care in Scotland is guided by evidence-based standards set out in the Scottish Diabetes Framework[5] and in guidelines produced by the Scottish Intercollegiate Guidelines Network (SIGN).[6] These describe processes of care in relation to clinical management and patient monitoring, education and screening.

The Race Relations (Amendment) Act 2000[7] and NHS policy in Scotland[8] require the NHS to promote equitable provision of services. To demonstrate compliance, data are needed to show that services are provided in an equitable manner (i.e. in proportion to needs) and that outcomes are similar.

However, despite local efforts to collect information on diabetes among ethnic minority groups in Scotland,[9] national level data remain incomplete. The 2007 Scottish Diabetes Survey found that only 33% of patients on diabetes registers had a record of ethnic group.[10] Efforts to improve the collection of these data are proving successful, but when this work was started other approaches were needed to examine potential ethnic inequalities in diabetes care.

The Diabetes Audit and Research in Tayside, Scotland (DARTS) database is part of the diabetes managed clinical network in Tayside and provides information on treatments,

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outcome and service quality for all those diagnosed with diabetes in the area covered by NHS Tayside.[11] In the 2001 census, 1.9% of the population of Tayside NHS Board were from ethnic minority groups, with 0.32% being Indian, 0.51% Pakistani and 0.07% Bangladeshi (all South Asians comprising 1.04%).[12] As part of a larger project to develop additional sources of information on the health of ethnic minorities in Scotland,[13] we used the DARTS database to examine processes of care and diabetes outcomes among South Asians (the largest non-White ethnic minority population in Scotland) and to compare these with the non-South Asian population. Our prior stated expectation was that, in the light of potential linguistic, cultural and access barriers, the quality of care would be comparatively poor in South Asians. This setting provided an opportunity to examine health care in a region where ethnic minority populations are sparse, adding to the more substantial literature from metropolitan areas with large ethnic minority populations. We defined South Asians as those whose names suggested ancestral origins in India, Pakistan or Bangladesh. Our paper reports on the use of the name searching method in a Scottish context; documents empirical findings on the quality and intermediate outcomes of care and compares our findings to the UK literature.

Methods

The DARTS database holds details of all patients known to have diabetes within the area served by NHS Tayside, which had a population of 387 908 in 2004.[14] The database draws information from primary and secondary care and has been validated by manual comparison with case notes.[11] We included patients with type 2 diabetes mellitus (on the basis of a clinical diagnosis by their general practitioner or specialist) who were on the DARTS database in November 2003. We extracted demographic details (age, sex and postcode), current treatment and details and date of the last record of HbA_{1c}, blood pressure, body mass index (BMI), cholesterol level and eye screening between November 2003 and December 2004. We used the proportion of those with a record of these clinical measures as an index of the process of care. We extracted outcomes (retinopathy, myocardial infarction, stroke, hypertension and foot ulcers) recorded up to the end of 2004. We used all the process and outcome measures available in the database at the time of extraction with the exception of end-stage renal disease for which numbers were too small for analysis.

We used the Nam Pehchan 2 computer package[15] to identify possible South Asian names in the diabetes database. All the names identified by the programme as South Asian (and a sample of those not so identified) were independently assessed by two expert observers with knowledge of South Asian cultures and languages to confirm their South Asian ethnicity. To decrease the risk of disclosure, the list of names of people with diabetes was mixed randomly with the same number of names taken from a publicly available electoral register before being assessed.

The age-adjusted prevalence of diabetes in November 2003 was calculated using direct standardization, using the total study population as the reference group and the mid-2004 population estimate for Tayside as the denominator. The proportion of the population in mid-2004 that were of South Asian ethnic origin was estimated using the equivalent proportions from the 2001 census. Obesity was defined as a BMI of 30 kg/m^2 or greater. In addition, we repeated analyses using a BMI cut-off value of $\geq$27.5 kg/m^2 for South Asians.[16,17]

Differences in proportions and 95% confidence intervals (95% CIs) were calculated using large sample statistics. Adjusted prevalence rate ratios were calculated using Poisson regression with robust standard errors using the method described by Barros and Hirakata.[18] The regression models included sex, ethnic group and age, categorized into four groups: 15–44, 45–54, 55–64 and 65 and older. Additional models also included social and economic deprivation in quintiles of Carstairs scores for Scotland.[19] Continuous outcome measurements were log transformed to take account of their skewed distribution and results are presented as geometric means. Adjusted ratios of geometric means were estimated using linear regression.

The project was approved by the Tayside Local Research Ethics Committee.

For our literature review, we searched electronic databases (Medline, Embase, Google Scholar), using the terms 'ethnicity', 'South Asian', 'diabetes', 'quality' and 'care', for studies published between 1988 and June 2008 that described individual quantitative measures of quality of care among UK South Asians with diabetes. We checked the reference lists of key references found in the search, and in personal literature files. Abstracts were reviewed by a single reviewer and full papers were taken where results were relevant. The data were extracted by R.B. and checked by C.M.F..

Results

On 4 November 2003, the DARTS database included records for 17 442 patients with diabetes, of whom 12 958 (74%) had type 2 diabetes. The Nam Pehchan software identified 448 of these as South Asian, and this was confirmed by an expert review in 274 cases (a positive

predictive value of 61.2%). Of the 12 958 people, 10 509 people (176 of 274 South Asians) were alive and living in Tayside in November 2003.

By the end of 2004, 676 people (18 South Asians) had died or left Tayside, leaving 9833 (158 South Asians) with complete follow-up information. The loss to follow up was greater among South Asians (10.2%) than non-South Asians (6.4%).

Based on those on the register at the start of the study period (November 2003), the age-standardized prevalence of type 2 diabetes in South Asians (Table 1) was around three to four times higher than that for non-South Asians (10.5% [95% CI 3.0–12.4%] versus 3.0% [2.9–3.0%] in men and 9.8% [7.6–12.1%] versus 2.4% [2.3–2.5%] in women).

Table 1 Prevalence of type 2 diabetes by age, sex and ethnic group[a]

	South Asians, n (%)	*Non-South Asians, n (%)*
Males		
0–14	0 (0.0)	0 (0.0)
15–24	0 (0.0)	4 (0.0)
25–34	7 (2.3)	40 (0.2)
35–44	13 (5.8)	229 (0.8)
45–54	32 (16.2)	709 (2.7)
55–64	29 (25.2)	1381 (6.4)
65–74	20 (33.9)	1805 (10.5)
75–84	6 (21.4)	1142 (12.3)
≥ 85	0 (0.0)	189 (8.5)
Total	107 (5.6)	5499 (3.0)
Age-adjusted prevalence (%) (95% CI)	10.5 (3.0–12.4)	3.0 (2.9–3.0)
Females		
0–14	0 (0.0)	0 (0.0)
15–24	0 (0.0)	7 (0.0)
25–34	1 (0.4)	35 (0.1)
35–44	11 (4.7)	168 (0.6)
45–54	24 (16.3)	499 (1.8)
55–64	16 (26.7)	993 (4.4)
65–74	15 (30.6)	1588 (7.6)
75–84	2 (10.5)	1203 (8.2)
≥ 85	0 (0.0)	341 (5.6)
Total	69 (4.3)	4834 (2.4)
Age-adjusted prevalence (%) (95% CI)	9.8 (7.6–12.1)	2.4 (2.3–2.5)

[a]Baseline population, DARTS database, November 2003, $n = 176$ South Asian, 10 333 non-South Asian; percentages are prevalence based on the mid-2004 population of Tayside.

All subsequent analyses are based on those with complete information up to the end of 2004. Table 2 shows that in this group South Asians had similar patterns of treatment compared with non-South Asians, but were considerably younger, more likely to be males and more likely to live in socio-economically deprived areas.

Table 3 shows the proportion of people who had a record of specific assessments between November 2003 and December 2004. South Asians of both sexes were significantly more likely than non-South Asians to have had a structured review (adjusted prevalence rate ratio [95% CI] 1.11 [1.06,1.16] for both sexes combined). BMI was significantly more likely to be recorded among South Asian than non-South Asian women. Measurement of cholesterol and blood pressure was more common in South Asian than non-South Asian women, but the difference was not statistically significant. In general, the ethnic differences were more marked in women than men.

In relation to the outcomes of care, Tables 4 and 5 show the proportion of participants who had a record of specific complications at the end of 2004. Adjusting for age and sex, South Asians were 1.36 times (95% CI 1.03, 1.78) more likely to have retinopathy than non-South Asians. They were

Table 2 Demographic characteristics and treatment of the study population[a]

	South Asians, n (%)	*Non-South Asians, n (%)*
Age (years)		
15–44	28 (17.7)	468 (4.8)
45–54	52 (32.9)	1180 (12.2)
55–64	39 (24.7)	2288 (23.7)
≥ 65	39 (24.7)	5739 (59.3)
Mean age (95% CI)	55.0 (53.2, 56.8)	66.2 (65.9, 66.4)
Sex		
Female	66 (41.8)	4524 (46.8)
Male	92 (58.2)	5151 (53.2)
Deprivation quintile		
1 (least deprived)	31 (19.6)	2548 (26.3)
2	39 (24.7)	2615 (27.0)
3	5 (3.2)	1046 (10.8)
4	14 (8.9)	1106 (11.4)
5 (most deprived)	69 (43.7)	2335 (24.1)
Treatment		
Diet alone	33 (20.9)	2362 (24.4)
Oral treatment	99 (62.7)	5571 (57.6)
Insulin	23 (14.6)	1531 (15.8)
Combination	3 (1.9)	172 (1.8)

[a]Restricted to those with complete follow-up information (158 South Asian, 9675 non-South Asian).

Table 3 Proportion of patients with a record of assessments

	South Asians (n = 66 females, 92 males)		*Non-South Asians (n = 4524 females, 5151 males)*		*Difference (95% CI)*	*Prevalence rate ratio (95% CI)[a]*
	n	*%*	*n*	*%*		
Structured clinical review						
Female	62	93.9	3706	81.9	12.0% (6.2, 17.9)	1.13 (1.06, 1.21)*
Male	83	90.2	4278	83.1	7.2% (1.0, 13.3)	1.09 (1.02, 1.17)**
HbA_{1c}						
Female	64	97.0	4338	95.9	1.1% (−3.1, 5.3)	1.01 (0.97, 1.06)
Male	88	95.7	4961	96.3	−0.7% (−4.9, 3.5)	1.00 (0.96, 1.05)
Cholesterol						
Female	64	97.0	4200	92.8	4.1% (−0.1, 8.3)	1.04 (1.00, 1.09)
Male	87	94.6	4832	93.8	0.8% (−3.9, 5.4)	1.02 (0.97, 1.07)
Blood pressure						
Female	63	95.5	4087	90.3	5.1% (0.0, 10.2)	1.05 (1.00, 1.11)
Male	83	90.2	4672	90.7	−0.5% (−6.6, 5.6)	1.01 (0.94, 1.08)
Retinal screening						
Female	57	86.4	3788	83.7	2.6% (−5.7, 11.0)	1.02 (0.93, 1.12)
Male	78	84.8	4398	85.4	−0.6% (−8.0, 6.8)	1.01 (0.92, 1.10)
BMI						
Female	63	95.5	3878	85.7	9.7% (4.6, 14.9)	1.10 (1.04, 1.16)***
Male	81	88.0	4469	86.8	1.3% (−5.4, 8.0)	1.02 (0.95, 1.11)

[a]Prevalence risk ratio comparing South Asians with non-South Asians, adjusted for age in four categories.
*$P < 0.001$, **$P = 0.012$, ***$P = 0.001$.

significantly less likely to have hypertension. The numbers with stroke, coronary revascularization and foot ulcers were too small to estimate ethnic differences precisely, but the direction of the effect favoured South Asians. South Asians were less likely to be obese using conventional definitions of BMI cut-off, but on the basis of ethnic-specific cut-offs the age-adjusted difference was not significant. Further adjustment for deprivation did not appreciably affect these comparisons (data available from authors). Numbers were too small to allow separate analysis for males and females.

HbA_{1c} levels recorded between November 2003 and December 2004 were marginally higher among South Asians compared with non-South Asians in both sexes. For men and women combined, the ratio was 1.03 (95% CI 1.00, 1.06, $P = 0.03$). Systolic blood pressure recorded during the same period was lower among South Asians of both sexes, though the difference was significant only among men. Cholesterol levels were significantly lower among South Asian women and BMI levels were lower in South Asians of both sexes.

Tables 6 and 7 set our findings in the context of the UK scientific literature and are discussed below.

Discussion

Main finding of this study

Our analysis shows that even in a setting with relatively few South Asian people the automated name search method, combined with visual review by experts, is useful in the absence of alternative methods—producing information that helped to fill a major gap. The technique should be considered where ethnic coding is not achievable. Surprisingly, South Asians were more likely than non-South Asians to have had a structured review during the year under examination, and were as likely, or even more likely, than non-South Asians to have other measures carried out. Despite these satisfactory processes of care, the outcomes for diabetic control (reflected in higher HbA_{1c} levels and retinopathy) in South Asians were not as good as the White population. Cholesterol and BMI tended to be lower in South Asians than in non-South Asians, though differences in obesity were no longer apparent when ethnic-specific definitions of obesity were used. Other outcomes were comparable between the ethnic groups. Overall, the equity of the care given is extremely encouraging,

Table 4 Clinical measurements in South Asians and non-South Asians (categorical measures)

	South Asians		*Non-South Asians*		*Difference (95% CI)*	*Prevalence rate ratio (95% CI)*[c]
	n	%	*n*	%		
Retinal screening						
Retinopathy	37	27.4	1832	22.4	5.8 (−2.4, 14.0)	1.35 (1.03, 1.77)*
Normal	86	63.7	5711	69.8		
Result unknown	12	8.9	643	7.9		
CVD outcomes						
Myocardial infarct	14	8.9	1314	13.6	−4.7 (−9.2, −0.2)	0.93 (0.57, 1.51)
Stroke	8	5.1	755	7.8	−2.7 (−6.2, 0.7)	1.02 (0.52, 2.01)
Coronary revascularization	6	3.8	588	6.1	−2.3 (−5.3, 0.7)	0.78 (0.36, 1.70)
Hypertension	57	39.0	5549	63.4	−24.3 (−32.3, −16.3)**	0.71 (0.58, 0.87)***
Foot ulcers	2	1.3	626	6.5	−5.2 (−7.0, −3.4)	0.27 (0.07, 1.09)
Obesity						
Obese[a]	55	38.2	4006	48.0	−9.8 (−17.8, −1.8)[#]	0.66 (0.54, 0.81)**
Obese (ethnic-specific cut-offs)[b]	87	60.0	4006	48.0	12.4 (4.4, 20.5)[##]	1.04 (0.92, 1.19)

CVD, cardiovascular disease.

[a]BMI $\geq$ 30 kg/m^2 in both groups.

[b]BMI $\geq$ 27.5 (South Asians) and $\geq$30 (non-South Asians).

[c]Adjusted for sex and for age in four categories.

*$P = 0.028$, **$P < 0.001$, ***$P = 0.001$, [#]$P = 0.02$, [##]$P = 0.003$.

Table 5 Clinical measurements in South Asians and non-South Asians (continuous measures)

	Sex	*South Asians*		*Non-South Asians*		*Proportion (%) achieving targets (South Asian, non-South Asian)*[a]	*Ratio*[b]
		n	*Geometric mean (95% CI)*	*n*	*Geometric mean (95% CI)*		
HbA_{1c}	Male	88	7.74 (7.46, 8.04)	4961	7.32 (7.28, 7.36)	43, 59	1.03 (1.00, 1.07)
	Female	64	7.89 (7.54, 8.25)	4338	7.35 (7.31, 7.39)	40, 59	1.03 (0.98, 1.08)
Systolic blood pressure	Male	83	133.1 (129.9, 136.5)	4672	138.0 (137.5, 138.5)	74, 59	0.97 (0.94, 1.00)*
	Female	63	133.8 (127.9, 139.9)	4087	141.1 (140.5, 141.7)	58, 52	0.97 (0.93, 1.00)
Cholesterol	Male	87	4.47 (4.25, 4.69)	4832	4.34 (4.32, 4.37)	71, 77	0.99 (0.95, 1.04)
	Female	64	4.53 (4.33, 4.74)	4200	4.65 (4.62, 4.68)	77, 66	0.95 (0.91, 1.00)**
BMI	Male	81	27.9 (27.1, 28.8)	4469	29.4 (29.3, 29.6)	69, 56	0.92 (0.88, 0.95)***
	Female	63	29.6 (28.1, 31.2)	3878	30.4 (30.2, 30.6)	54, 48	0.90 (0.86, 0.95)***

[a]Targets defined as $HbA_{1c} < 7.5\%$, systolic blood pressure $\leq$140 mmHg, cholesterol $\leq$5 and BMI $<$30.

[b]Ratio of geometric means adjusted for age in four categories.

*$P = 0.035$; **$P = 0.045$; ***$P < 0.001$.

particularly given that at the time of the study there were no particular local policy initiatives to achieve this, and that the study preceded the 2004 quality and outcomes framework for primary care. The work adds to the small body of literature, and provides rare information on health care in ethnic minority groups outside the metropolitan centres.

What is already known on this topic

The literature examining ethnic variations in processes of care, and intermediate outcomes, for diabetes is sparse; a systematic review (1987–2004) by Lanting *et al.*[20] found 37 such studies, most in the USA. None of the studies meeting their criteria were on South Asians, and only one on Asians

Table 6 Overview of methods of UK published literature on quality of care and intermediate outcomes in South Asian populations

Study	*Ethnic minority group studied*	*Allocation of ethnic group*	*Sample*	*Sample size (minority group)*	*Sample size (comparison group)*	*Main outcome measures*	*Process measures*	*Design*
Fischbacher *et al.* (present study)	South Asians	Name search	Population based sample—Tayside	158	9675	Complications, HbA_{1c}, BP, BMI	Structured review, record of measurement	Diabetes register analysis of those who attended during a 12-month period
Close *et al.*[23]	South Asians	Not stated	Hospital clinic, Birmingham	258	1231	BMI, fructosamine (similar to HbA_{1c})	None	Case–control comparison including all patients seen in 1992 matched with white Europeans on age, sex, duration of diabetes and treatment
Stewart *et al.*[24]	South Asians	Name search	Primary care, 14 practices in Sandwell, England	198	576	Complications, HbA_{1c}, BMI	Review of records	Analysis of case series
McElduff *et al.*[25]	South Asians	Assigned by health professionals	Blackburn hospital	820	2070	BP, cholesterol, HbA_{1c}	Structured review	Diabetes information system, 1995–2001, with trend analysis
Chowdhury *et al.*[26]	Bangladeshis	Not stated	Hospital clinic in London	912	1162	Complications, HbA_{1c}, BP, lipids, smoking, BMI	Number of clinic visits	Case note review of those who attended during a 12-month period (2003)
Mukhopadhyay *et al.*[27]	South Asians, mainly Pakistani	Not stated	Hospital clinic in Glasgow	210	1557	HbA_{1c}, BMI, BP, lipids	Time to referral to hospital	5.3 year prospective follow-up of clinic population
Millett *et al.*[28]	South Asians	Self-reported	General practice based—Wandsworth PCT	820	1360	HbA_{1c}, BMI, BP, lipids	Drug prescription	Practice-based diabetes register study at two points in time
Soljak *et al.*[29]	South Asians	A mix of self-reported and health professional assigned (70% had an ethnic code-64%	Population (practice) based-3 London PCTs	5509	6229	HbA_{1c}, BMI, BP, cholesterol, smoking	Completeness of risk factor recording; insulin and statin prescriptions	2002 survey of practice records including most recent values recorded in previous 5 years
Gray *et al.*[30]	South-Asians	Self-identification based on census categories	32 primary care practices	1506[a]	2654[a]	Range of indicators including smoking, HbA_{1c}, microalbuminuria	Measurement of BMI, BH, and cholesterol, and retinal screening	Cross-sectional analysis of GP records

Millett *et al.*[31]	South Asians	Self-identification	Health survey for England—secondary analysis	Not given NA Total population of diabetics: 1998–401 1999–357 2003–557 2004–372	Range of indicators including cholesterol, BP and HbA_{1c}	Use of Medications	Repeated cross-sectional surveys

[a]Estimated from %'s given in paper as exact numbers were not reported.

(a broad category, including Chinese and other far Eastern populations). We have referred to some studies they did not include. Several studies have been published in the UK recently, largely spurred by the quality and outcomes framework introduced in British primary health care in 2004, and by the increasing availability of ethnically coded data, albeit often incomplete, and with questionable validity. The UK studies are summarized in relation to this one in Tables 6 and 7. In addition, we are aware of Hawthorne's pilot study[21] and the data published in abstract from Newcastle upon Tyne in the mid-1990s.[22] Hawthorne reported that glycaemia was greater in South Asians than in a comparison group. In Newcastle upon Tyne, Unwin *et al.*[22] compared 92 South Asians with 78 non-South Asians. For virtually every measure, South Asians were seriously disadvantaged. For example, a record of eye examinations was available for 73% of non-South Asians, but only 55% of South Asians. The corresponding figures for HbA_{1c} tests were 94% and 75%.

At the conception of the study, around 2001, when the main published work was that by Close *et al.*[23] and Hawthorne,[21] and we were aware of the Newcastle upon Tyne findings,[22] we anticipated such an inequity in Tayside. For processes of care, the recent UK literature summarized in Tables 6 and 7, much of it based on data after the introduction of the quality and outcomes framework in primary care in 2004, shows surprising similarities between South Asians and comparison populations. For some outcomes, especially HbA_{1c} and retinopathy, South Asians are consistently worse off. Before summarizing the work in Tables 6 and 7, we examine each study briefly.

Close *et al.*[23] found that glycaemic control was similar but insulin treatment was less common in South Asians than Europeans. Stewart *et al.*[24] found that South Asians received a similar number of standard tests but had worse glycaemic control than a comparison population. McElduff *et al.*[25] found similar risk factor recording but higher cholesterol, blood pressure and HbA_{1c} levels among South Asians compared with non-South Asians. Chowdhury *et al.*[26] reported higher HbA_{1c} levels and more frequent retinopathy in Bangladeshis in a hospital clinic population in London. Mukhopadhyay *et al.*[27] found higher HbA_{1c}, lower blood pressure, lower BMI and lower cholesterol among Pakistanis. Millett *et al.*[28] found that South Asians in London had higher HbA_{1c} levels but were less likely to have raised cholesterol or to receive insulin. In contrast to the present study, Soljak *et al.*[29] reported that risk factor recording was poorer among South Asians in London. Gray *et al.*[30] reported that South Asians had similar processes of care, but higher HbA_{1c}. Finally, Millett *et al.*[31] used Health Survey

Table 7 Overview of results of UK published literature on quality of care and intermediate outcomes in South Asian populations

Study	*Results—overview*	*Process of care*	*BP control*	*Cholesterol control*	*HbA_{1c} control (fructosamine)*
Present study	Equity in most aspects of care. Higher HbA_{1c} and more retinopathy	Similar	Worse	Better (women)	Worse
Close *et al.*[23]	South Asians were more likely to get oral hypoglycaemic drugs, less likely to receive insulin, had lower BMI and similar fructosamine	No data	No data	No data	Similar
Stewart and Rao[24]	Very similar for review, though fewer HbA_{1c} checks	Similar	Better	No data	Worse
McElduff *et al.*[25]	Processes of care similar. Improvements in time for BP and cholesterol poorer for South Asians. Glycaemic control worse in South Asians	Similar	Worse	Worse	Once
Chowdhury *et al.*[26]	Bangladeshis had more macrovascular disease, retinopathy, nephropathy, poorer HbA_{1c}, cholesterol and BP	Worse	Worse	Worse	Worse
Mukhopadhyay *et al.*[27]	South Asians were younger and had lower BMI and blood pressure. More rapid deterioration of HbA_{1c} among SAs. Insulin therapy no more common in SAs despite faster HbA_{1c} deterioration. Smaller improvement in BP and cholesterol.	Worse	Worse	Worse	Worse
Millett *et al.*[28]	HbA_{1c} worse than European in Indian, Pakistani and Bangladeshi and improved less insulin prescribing less in South Asians and lower increases in South Asians compared with European cholesterol lower and improved more BP similar/ better but improved less prescribing same/less but improved same/better	No data	Similar	Similar in Indians and Pakistanis, and better in Bangladeshis	Worse (but not statistically significant)
Soljak *et al.*[29]	Risk factor recording more incomplete for HbA_{1c}, cholesterol and smoking; less incomplete for BMI and BP HbA_{1c} levels higher; BP levels similar, BMI lower	Worse	Better	Better	Worse
Gray *et al.*[30]	South Asians are less likely to meet a national targets for HbA_{1c}, and for the three specific targets	Similar	Similar	Better	Worse
Millet *et al.*[31]	Excepting insulin, South Asians had a comparatively rapid increase in the use of medications.	Worse	Better	Better, though rate of change worse	Best of the ethnic minority populations (no data for the white British)

for England data reporting that South Asians were worse off in relation to glycaemic control.

Overall, our study and most of those in Table 7 show a more encouraging picture than earlier research. With one main exception,[29] most recent studies show equity in process measures. While explaining discrepancies between studies is difficult, it appears that quality of care is now similar, but control of major risk factors generally worse in South Asians than in White comparison populations. Unfortunately, it is unclear how this could be addressed. The one major randomized controlled trial of a tailored intervention—the United Kingdom Asian Diabetes Study[32]—was not cost-effective and had minimal impact on HbA_{1c} and other major risk factors.

What this study adds

The strengths of this research include it being population based, the provision of diabetes prevalence data in a Scottish context, important information on processes of care in a part of Scotland where South Asians only comprise 1% of the population, availability of a large comparison group, use of a well-established diabetes database and interpretation within a summary of the UK literature. The work provides scarce data from UK locations where the ethnic minority population is relatively small. It helps to provide a baseline from which to assess and evaluate new initiatives. The DARTS database is continuing, so this work can be repeated at regular intervals as necessary.

This work was the first to confirm in Scotland the very high prevalence of diabetes in South Asians reported internationally. It has shown that on important process indicators of quality of care, prior to the implementation of the quality and outcomes framework, and in a location where the ethnic minority population is small, South Asians were not disadvantaged. These observations are encouraging in relation to the broader challenge of providing equitable services for ethnic minority groups. Our analysis showed that despite equivalent processes, the key outcomes of retinopathy and glycaemic control were comparatively poor—clearly more attention needs to be given in the care of South Asian patients with type 2 diabetes. In contrast, in our sample, South Asians had similar or slightly better macrovascular outcomes, which probably reflects the lower blood pressure, similar cholesterol and lower smoking prevalence seen in most UK surveys.[33]

Recording of ethnicity in Scottish diabetes registers remains incomplete but better recording is being achieved. Preliminary data from the greater Glasgow and Clyde and Lothian NHS boards, reported by Lindsay *et al.*[34] at the Diabetes UK conference in 2008, largely confirm our findings both in relation to the high prevalence of diabetes and poorer control of glycaemia. Our empirical data, combined with our review, points to an urgent challenge that will not be resolved easily.

Limitations of this study

Tayside has a relatively small ethnic minority population, and as a result the numbers of South Asians are small, so measures are imprecise as indicated by the confidence intervals. The name search method has some disadvantages. It performs less well in women than men as the married name may not reflect the ethnic group when marriage occurs outside the ethnic group. Ideally, ethnic group should be self-assigned, while name analysis assigns it, a limitation shared with several of the other studies in Table 6. There is likely to be some heterogeneity within the South Asian group,[33] but the name search method and the small numbers did not allow separate groups to be examined. As this is a population study the participants are likely to reflect the ethnic composition of Tayside. We did not have population estimates for 2004 by ethnic group, so we used the overall population projection for 2004 together with the ethnic composition of the population of Tayside in 2001 to estimate the size of the denominator population. Although this has the potential to introducing error in our estimate, we think that the change in population composition between 2001 and 2004 is likely to be small. We did not have information on the date of outcome events, so that outcomes such as retinopathy may reflect differences that existed at baseline (November 2003) rather than new events arising during the year under study (November 2003 to December 2004). We did not have the information necessary to adjust for disease severity and duration at baseline.

Losses to follow up during the year were modest, but we did not have information on the characteristics of those lost to follow up in order to assess the potential for selection bias. These limitations are unlikely to explain the main findings, i.e. similar or better processors of care, but worse intermediate outcomes, which are in concordance with the literature. Our review was not a formal systematic review, but it showed that an international systematic review was published in 2004, that the UK literature is relatively sparse, that recent studies have provided a consistent message and that a new, full systematic review is unlikely to yield different conclusions.

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