Diabetologia (2001) 44 [Suppl 3]: B 32–B 36

Diabetologia

Comparative incidence of Type I diabetes in children aged under 15 years from South Asian and White or Other ethnic backgrounds in Leicestershire, UK, 1989 to 1998

N. T. Raymond[1], J. R. Jones[2], P. G. F. Swift[3], M. J. Davies[4], I. G. Lawrence[4], P. G. McNally[4], M. L. Burden[5], R. Gregory[5], A. C. Burden[5], J. L. Botha[6]

[1] School of Post Graduate Medical Education, University of Warwick, Coventry, UK
[2] Department of Epidemiology and Public Health, University of Leicester, Leicester, UK
[3] Children's Hospital, Leicester Royal Infirmary, Leicester, UK
[4] Department of Diabetes and Endocrinology, Leicester Royal Infirmary, Leicester, UK
[5] Diabetes Care, Leicester General Hospital, Leicester, UK
[6] Trent Cancer Registry, Sheffield, UK

Abstract

Aims/hypothesis. Estimates of incidence of Type I (insulin-dependent) diabetes mellitus in childhood populations vary around the world. This study aimed to estimate and compare the incidence of Type I diabetes in Leicestershire of children of South Asian and White or Other ethnic backgrounds.
Methods. All new cases of childhood-onset Type I diabetes diagnosed before 15 years of age in Leicestershire during the period 1989–98 were studied. Population data for Leicestershire from the 1991 census was used. Ethnicity was assigned to all children in the study according to their surnames. Incidence rates (95 %-Confidence limits) for the South Asian and white or other ethnic group were estimated and compared.
Results. Over the 10-year period, 46 South Asian children and 263 children who were white or from another ethnic group fulfilled the criteria for inclusion in the study. Crude incidence rates per 100 000 person-years were 19.2 (12.0, 29.1) girls and 20.3 (13.0, 30.3) boys for South Asians and 17.7 (14.8, 21.1) girls and 17.7 (14.8, 20.9) boys for whites/others. Age and sex-specific rates were higher for South Asians over 5 years of age but differences were not statistically significant.
Conclusion/interpretation. Type I diabetes incidence rates for South Asian children in Leicestershire were very similar to those for children who were in the white/other ethnic group, in contrast to very low rates reported from Asia. The convergence of rates for South Asians with other ethnic groups in Leicestershire suggests that environmental factors are more important than genetic predisposition in causing Type I diabetes in people of South Asian ethnic background. [Diabetologia (2001) 44 [Suppl 3]: B 32–B 36]

Keywords Type I diabetes, incidence, ethnicity, migrants, environmental factors, genetic predisposition.

Over the last 15 years there has been a huge expansion in the research literature on the incidence of childhood-onset Type I (insulin-dependent) diabetes mellitus. This has been a response, at least in part, to reported increases in the incidence in children in western Europe [1–8]. Estimates of incidence have been made in many populations using different cases, sources, methods of ascertainment and reference populations for direct standardisation [9–19]. Much of this work has been concentrated on European and North American populations. More recently, comparative data from Australia, Asia and South America have been reported [20–26]. Another development has been the establishment of large scale collaborative studies, using standardised methodologies to enable a comparison of results over wide geographical areas and aiming to develop a truly global picture of the pattern of Type I diabetes incidence [6, 27–29].

Studies comparing incidence rates between different ethnic groups within defined populations have been reported [17, 21–26, 30–33] and a number of studies following migration [23, 34, 35]. Results from one migrant study in the United Kingdom found that

Corresponding author: N.T. Raymond, School of Post Graduate Medical Education, University of Warwick, Coventry, CV4 7AL, UK
Abbreviations: ONS, Office for National Statistics; SA, South Asian ethnic group; W/O, Whites/Others ethnic group; 95 %-Cl, 95 % confidence limits.

the incidence of Type I diabetes after migration converged with that of the indigenous population, indicating that environmental factors are important causes of Type I diabetes [34]. Other studies suggest, however, that the incidence remained similar to that observed in the country of origin, lending support to the importance and variability of genetic predisposition in the risk of Type I diabetes in different populations [23, 35].

In Leicestershire (UK) a register of childhood-onset diabetes has been in existence since the 1940s and has been expanded into a formal local Diabetes Register since the 1980s [36]. Data has been contributed to international collaborative studies and much effort expended to ensure an accurate ascertainment and verification of cases [27–29, 33, 36].

This study aimed to use locally collected data to estimate and compare the incidence of Type I diabetes in populations in Leicestershire from South Asian (SA) and white, combined with all other (W/O), ethnic backgrounds.

Table 1. Incidence rates by age, sex and ethnicity of children

		Incident cases (%) 1989–1998	Population 1991 census	Incidence rates (95%-Confidence limits)/100 000 person-years
South Asians:				
Girls	0–4	3 (14)	3886	7.7 (1.6, 22.6)
	5–9	11 (50)	3991	27.6 (13.8, 49.3)
	10–14	8 (36)	3578	22.4 (9.7, 44.1)
		22 (100)	11455	19.2 (12.0, 29.1)
Boys	0–4	2 (8)	4066	4.9 (0.6, 17.8)
	5–9	10 (42)	4075	24.5 (11.8, 45.1)
	10–14	12 (50)	3658	32.8 (17.0, 57.3)
		24 (100)	11799	20.3 (13.0, 30.3)
Whites/others:				
Girls	0–4	30 (23)	25338	11.8 (0.8, 16.9)
	5–9	47 (37)	23755	19.8 (14.5, 26.3)
	10–14	51 (40)	23087	22.1 (16.4, 29.0)
		128 (100)	72180	17.7 (14.8, 21.1)
Boys	0–4	28 (21)	26569	10.5 (7.0, 15.2)
	5–9	39 (29)	25233	15.5 (11.0, 21.1)
	10–14	68 (50)	24598	27.6 (21.5, 35.0)
		135 (100)	76400	17.7 (14.8, 20.9)

Subjects and methods

Subjects for study comprised all children resident in Leicestershire, diagnosed with diabetes and receiving insulin treatment from diagnosis, during the 10-year period 1989–1998, inclusive. Ascertainment of around 90% and verification of notifications to the Register were ensured by using multiple sources, including diabetes specialists, dietitians and diabetes specialist nurses as previously described [27, 29, 33, 36].

Leicestershire is a mainly rural county in central England, with one major urban centre comprising approximately one third of the population. Health authority and administrative boundaries are coterminous. The total population according to the 1991 decennial census was 867521, of whom 77537 (9%) described their ethnic origin as Indian, Pakistani or Bangladeshi. These were combined to form the South Asian (SA) group with all other people grouped together into White/Other (W/O) for this study. There were relatively small numbers of people of other ethnic origins, comprising 18 000 (2%) of the total population, including 8000 (1%) people who were classified as Caribbean, African or Other Blacks. The Office of National Statistics (ONS) estimates of population for Leicestershire between census years do not include ethnicity specific estimates. Because the numbers of cases of Type I diabetes are relatively small compared with the denominator, changes in population over a 10-year period are likely to make a great difference to estimated rates. To check the validity of this assumption, we examined population estimates for 1997 and re-estimated rates using two 5-year bands of population data, these being 1991 for the first and 1997 for the second five years, with assignment to ethnicity group for 1997 in the same proportions as observed in the 1991 census data.

Ethnicity was assigned to all cases on the basis of surnames, because self-assessed ethnicity data was not available from the Diabetes Register. It is recognised that using names is not perfect and that some degree of error could arise but this was the only practicable way of assigning ethnicity. In previous studies of English cohorts, sensitivity in excess of 90% has been reported for assigning South Asian ethnicity according to names [37, 38]. A locally produced algorithm was used, with manual scrutiny of all names, to check for inconsistencies and errors. This manual checking procedure identified two children whose ethnicity appeared to be incorrectly assigned and who were then transferred to the SA group. To further investigate the accuracy of the local algorithm, we used the ASNQ Names Analysis software (Nam Pehchan) produced in Bradford [39].

Incidence rates were estimated for the whole 10-year period, split by age groups (0–4, 5–9 and 10–14), sex and ethnicity (SA versus W/O). Rates were calculated per 100 000 person-years. Owing to the relative rarity of Type I diabetes and the small numbers of cases, 95%-Confidence limits (95%-Cl) were estimated using the Poisson distribution [40]. Standardised incidence rates were estimated for comparison purposes, using the combined Leicestershire population data for all ethnic groups.

Results

A total of 309 children resident in Leicestershire were identified as newly diagnosed with Type I diabetes from 1989 to 1998 inclusive. Using the locally produced algorithm and manual checking, we found 46 (15%) children of South Asian and 263 (85%) of white/other ethnicity. This result compared to 37 (12%) children of South Asian ethnicity found using the Nam Pehchan algorithm [39].

The numbers of children diagnosed over the 10-year period by age, sex and ethnicity are shown in Table 1 together with population data for Leicestershire. Very few SA children were diagnosed before age 5 years, only 3 (14%) girls and 2 (8%) boys in the whole 10 years, compared with 32 (25%) girls and 28 (21%) boys in the W/O group. Overall crude incidence rates (95%-Cl) and age-specific rates (95%-Cl) per 100 000 person-years for boys and girls by ethnic group are shown in Table 1. Age and sex specific rates were high-

er for South Asians at ages over 5 years but differences were not statistically significant.

The Nam Pehchan estimates of incident cases produced crude estimates for the SA children of 14.8 (9.3, 24.8) and 16.1 (9.7, 25.1) per 100 000 for girls and boys respectively, compared to 18.3 (15.3, 21.7) girls and 18.3 (15.4, 21.6) boys in the W/O group.

Directly standardised rates (95%-Cl) for the groups, using the Leicestershire population as a reference, were 19.0 (11.6, 29.4) and 20.4 (13.0, 30.4) for SA girls and boys, respectively. For the W/O group, the corresponding rates were 17.7 (14.8, 21.1) for girls and 17.7 (14.8, 20.9) for boys. None of these differences were statistically significant.

Discussion

Accurately monitoring the incidence of Type I diabetes is important for providing data to evaluate trends in diabetes at local, national and international levels. This monitoring has been undertaken in Leicestershire for many years. Leicestershire has a total population of 900 000, with geographic, political and health-care boundaries which are coterminous. Migration of people of South Asian ethnic origin to Leicestershire started in the early 1970s. By the time of this study, the majority of children of South Asian ethnic origin in Leicestershire had been born in the United Kingdom.

Our locally produced algorithm, based on South Asian names gathered in Leicestershire, identified 7 more children than the Nam Pehchan algorithm, with a further two children identified by a manual search. At a national level, the Office for National Statistics (ONS) Longitudinal Study stressed the possible limitations of using computerised algorithms to assign ethnicity based on names due to an incomplete name dictionary [41]. This could explain the differences we found which probably reflect differences between the South Asian groups migrating to Bradford rather than Leicester. The crude incidence rates showed little difference between the groups whichever ethnicity assignment method was used and the overall interpretation of the results, showing a convergence of rates, did not change.

Ethnic group specific population data was not available for most of this study period and we used 1991 census data as denominators throughout the study period. By 1997, population estimates had grown for children by 5.4% for girls aged 0–14 years and 6.6% for boys. Taking the effects of this population growth into account lowered estimates of crude incidence rate slightly but not significantly. We assumed that the ethnic group proportions in the total population remained constant over time. However, given the relatively small population changes and few cases identified in the SA group, it is not likely that population changes over the period had a great impact on our estimates.

A comparison of subgroups within one geographically defined area, especially with reference to a migrant subgroup, allows the relative importance of genetic and environmental factors in the causation of Type I diabetes to be examined. Previously published data relating to SA migrants to the United Kingdom reported incidence rates converging with those of the indigenous population over time, suggesting that environmental rather than genetic factors were more important determinants of Type I diabetes onset in this population [34].

In Italy, the incidence rate for migrant children of Sardinian heritage, born and living in Lazio, was similar to that of Sardinia and four times the rate of children of Lazio heritage [35]. Data from Hawaii relating to Japanese migrants found incidence rates in Japanese children similar to those reported in Japan [23]. Both of these studies, from the high incidence area of Sardinia, and the low incidence region of Japan, support the relative importance of different genetic susceptibilities of different populations rather than environmental agents in causing Type I diabetes. Current research into specific predisposing gene frequencies between populations could help to explain variations in the importance of genetic and environmental influences between ethnic groups.

Type I diabetes incidence rates reported from Asia are generally very low compared with Western Europe [25, 26]. Few data were reported until relatively recently, owing to the difficulty of establishing good quality population-based surveillance in large geographical areas with small numbers of patients.

There are few published data relating to incidence of Type I diabetes in children of South Asian ethnic origin resident either in Asia or in the United Kingdom. One city-based study from Karachi, Pakistan, found a low incidence rate of 1.02 per 100 000 person-years in children aged 0–16 years at diagnosis [42]. In contrast, another city-based study, from Madras, India, using data for 1991–1994, inclusive, estimated an incidence rate of 10.5 per 100 000 person-years, for children aged 0–14 years [43]. This estimate was based on numbers of reported cases, corrected for ascertainment. An incidence rate of 2.1 (1.5, 3.0) per 100 000 person-years for children aged 0–14 years from Mauritius, was reported for 1986–1990, with no differences between Mauritians of Asian Indian, Chinese or Creole ethnic origin [32]. Substantial variation in relatively low incidence rates across Asia has been reported. Both the Karachi and Mauritius estimates are similar to data reported from other areas of Asia [25, 26]. These studies were urban-based and no account is taken of rural children. The incidence rate from the Madras study is very high compared with other data and the tenfold difference in ascertainment-corrected estimates is much greater than in

the raw estimates, suggesting a possible problem with independent ascertainment. Primary and secondary sources were very different; government and service hospitals as opposed to diabetes camp, private diabetologists and endocrinologists [43]. The identification of different subjects by the different sources would lead to an upwards biased estimate of missing cases and corrected incidence rates.

The main period of migration to Leicestershire by people of South Asian ethnic origin, initially from East Africa, was during, and since the 1970s. Data from Leicestershire for 1974–80, the period including and shortly following the initial wave of migration, showed an incidence rate in children of South Asian ethnic origin aged 0–14 years of 3.0 (0.5, 10.0) per 100 000 person-years [44]. In Bradford, incidence data for children aged 0–14 of Asian ethnic origin increased significantly, from 3.1 per 100 000 person-years in 1978–1981 to 11.7 per 100 000 person-years for 1988–1990 [34]. The later rate was no different to the 12.0 per 100 000 person-years reported for a similar group of non-Asian children.

Results from the current study, showing rates in the South Asians to be very similar to those in whites/others, support the previously reported migrant study from the United Kingdom. Together with the earlier data from Leicestershire which showed a difference between the ethnic groups and current lower incidence estimates from South Asia, these results confirm the previous suggestion that the incidence rate for migrants is converging. This convergence reinforces the importance of environmental factors for people of South Asian ethnicity, in contrast to the importance of genetic factors which suggested for Japanese migrants to Hawaii and Sardinian migrants to Lazio, Italy [23, 35]. It is possible that lifestyle and environmental-exposure changes for South Asian migrants to the United Kingdom have been greater than those for Sardinians moving to Lazio and Japanese to Hawaii.

Using a long period of incidence surveillance in Leicestershire (United Kingdom), we have been able to estimate age, sex and ethnicity specific rates of Type I diabetes in children aged 0–14 years at diagnosis. Even with a study period of 10 years, the number of cases in the minority population was small, resulting in wide confidence intervals around incidence estimates. This highlights the importance of continuing routine, long-term monitoring of Type I diabetes incidence in different populations across the world as well as in subgroups within populations to identify environmental triggers and determine the relative importance of genetic predisposition.

Acknowledgements. This study has been supported in part by the European Community Concerted Action Programme (Grants BMH1-CT92–0043 and BMH4-CT96–0577). We thank C. Sanders, University of Leicester for help with Nam Pehchan software.

References

1. Green A, Anderson PK (1983) Epidemiological studies of diabetes mellitus in Denmark: 3. Clinical characteristics and incidence of diabetes among males aged 0 to 19 years. Diabetologia 25: 226–230
2. Patterson CC, Thorogood M, Smith PG, Heasman MA, Clarke JA, Mann JI (1983) Epidemiology of Type I (insulin-dependent) diabetes in Scotland 1968–1976: Evidence of an increasing incidence. Diabetologia 24: 238–243
3. Burden AC, Hearnshaw JR, Swift PGF (1989) Childhood diabetes mellitus: An increasing incidence. Diabet Med 6: 334–336
4. Joner G, Sovik O (1989) Increasing incidence of diabetes mellitus in Norwegian children 0–14 years of age 1973–1982. Diabetologia 32: 79–83
5. Nystrom L, Dahlquist G, Rewers M, Wall S (1990) The Swedish childhood diabetes study. An analysis of the temporal variation in diabetes incidence 1978–1987. Int J Epidemiol 19: 141–146
6. Diabetes Epidemiology Research International Group (1990) Secular trends in incidence of childhood IDDM in 10 countries. Diabetes 39: 858–864
7. Metcalfe MA, Baum JD (1991) Incidence of insulin dependent diabetes in children aged under 15 years in the British Isles during 1988. BMJ 302: 443–447
8. Tuomilehto J, Virtala E, Karvonen M et al. (1995) Increase in incidence of insulin-dependent diabetes mellitus among children in Finland. Int J Epidemiol 24: 984–992
9. LaPorte RE, Fishbein HA, Drash AL et al. (1981) The Pittsburgh Insulin-dependent Diabetes Mellitus (IDDM) Registry: The Incidence of Insulin-dependent Diabetes Mellitus in Allegheny County, Pennsylvania (1965–1976). Diabetes 30: 279–284
10. Dahlquist G, Gustavsson KH, Holmgren G et al. (1982) The incidence of diabetes mellitus in Swedish children 0–14 years of age: A prospective study 1977–1980. Acta Paediatr Scand 71: 7–14
11. Dahlquist G, Blom L, Holmgren G et al. (1985) The epidemiology of diabetes in Swedish children 0–14 years – a six year prospective study. Diabetologia 28: 802–808
12. Waugh NR (1986) Insulin-dependent diabetes in a Scottish region: incidence and urban/rural differences. J Epidemiol Community Health 40: 240–243
13. Bingley PJ, Gale EAM (1989) Incidence of insulin dependent diabetes in England: a study in the Oxford region, 1985–1986. BMJ 298: 558–560
14. Levy-Marchal C, Papoz L, de Beaufort C et al. (1990) Incidence of juvenile Type I (insulin-dependent) diabetes mellitus in France. Diabetologia 33: 465–469
15. Rios MS, Moy CS, Serrano RM et al. (1990) Incidence of Type I(insulin-dependent) diabetes mellitus in subjects 0–14 years of age in the Communidad of Madrid, Spain. Diabetologia 33: 422–424
16. Tuomilehto J, Podar T, Brigis G et al. (1992) Comparison of the Incidence of Insulin-Dependent Diabetes Mellitus in Childhood among Five Baltic Populations during 1983–1988. Int J Epidemiol 21: 518–527
17. Lipman TH (1993) The epidemiology of type I diabetes in children 0–14 years of age in Philadelphia. Diabetes Care 16: 922–925
18. Padaiga Z, Tuomilehto J, Karvonen M et al. (1997) Incidence trends in childhood onset IDDM in four countries around the Baltic Sea during 1983–1992. Diabetologia 40: 187–192
19. Songini M, Berardinelli L, Clayton D et al. (1998) The Sardinian IDDM Study: 1. Epidemiology and geographical

distribution of IDDM in Sardinia during 1989 to 1994. Diabetologia 41: 221–227
20. Kelly HA, Byrne GC (1992) Incidence of IDDM in Western Australia in Children Aged 0–14 Years from 1985 to 1989. Diabetes Care 15: 515–517
21. Verge CF, Silink M, Howard NJ (1994) The incidence of childhood IDDM in New South Wales, Australia. Diabetes Care 17: 693–696
22. Larenas G, Montecinos A, Manosalva M, Barthou M, Vidal T (1996) Incidence of insulin-dependent diabetes mellitus in the IX region of Chile: ethnic differences. Diabetes Res Clin Pract 34 [Suppl]: S147-S151
23. Patrick SL, Kadohiro JK, Waxman SH et al. (1997) IDDM incidence in a multiracial population: The Hawaii IDDM Registry, 1980–1990. Diabetes Care 20: 983–987
24. Shamis I, Gordon O, Albag Y, Goldsand G, Laron Z (1997) Ethnic differences in the incidence of childhood IDDM in Israel (1965–1993). Marked increase since 1985, especially in Yemenite Jews. Diabetes Care 20: 504–508
25. Yang Z, Wang K, Li T et al. (1998) Childhood diabetes in China. Enormous variation by place and ethnic group. Diabetes Care 21: 525–529
26. Lee WW, Ooi BC, Thai AC et al. (1998) The incidence of IDDM in Singapore children. Singapore Med J 39: 359–362
27. Green A, Gale EAM, Patterson CC, for the EURODIAB ACE Study Group (1992) Incidence of Childhood-onset Insulin-dependent Diabetes Mellitus: The EURODIAB ACE Study. Lancet 339: 905–909
28. Karvonen M, Tuomilehto J, Libman I, LaPorte R, for the WHO Diamond Project Group (1993) A Review of the Recent Epidemiological Data on the World-wide Incidence of Type I (insulin-dependent) Diabetes Mellitus. Diabetologia 36: 883–892
29. EURODIAB ACE Study Group (2000) Variation and trends in incidence of childhood diabetes in Europe. Lancet 355: 873–876
30. Lipton RB (1996) Patterns of hospital use, family history and co-existing conditions among urban African-American and Hispanic-American children with insulin dependent diabetes mellitus. Diabetes Res Clin Pract 34 [Suppl]: S173-S179
31. Kostraba JN, Gay EC, Cai Y et al. (1992), Cruickshanks KJ, Rewers MJ, Klingensmith GJ et al. Incidence of insulin dependent diabetes mellitus in Colorado. Epidemiology 3: 232–238
32. Tuomilehto J, Dabee J, Karvonen M et al. (1993) The incidence of IDDM in Mauritian children and adolescents from 1986 to 1990. Diabetes Care 16: 1588–1591
33. Gujral JS, McNally PG, Botha JL, Burden AC (1994) Childhood-onset diabetes in the white and South Asian population in Leicestershire, UK. Diabet Med 11: 570–572
34. Bodansky HJ, Staines A, Stephenson C, Haigh D, Cartwright RA (1992) Evidence for an environmental effect in the aetiology of insulin dependent diabetes in a transmigratory population. BMJ 304: 1020–1022
35. Muntoni Sa, Fonte MT, Stoduto S et al. (1997) Incidence of insulin-dependent diabetes mellitus among Sardinian-heritage children born in Lazio region, Italy. Lancet 349: 160–162
36. Raymond NT, Langley JD, Goyder E, Botha JL, Burden AC, Hearnshaw JR (1995) Insulin treated diabetes mellitus: causes of death determined by record linkage of population based registers in Leicestershire, UK. J Epidemiol Community Health 49: 570–574
37. Nicoll A, Bassett K, Ulijaszek SJ (1986) What's in a name? Accuracy of using surnames and forenames in ascribing Asian ethnic identitiy in English populations. J Epidemiol Community Health 40: 364–368
38. Winter H, Cheng KK, Cummins C, Maric R, Silcocks P, Varghese C (1999) Cancer incidence in the south Asian population of England (1990–92). Br J Cancer 79: 645–654
39. South Asian Names Analysis (1996) Version 1.1, Windows Version 3.15, Bradford Health Authority & City of Bradford Metroploitan District Council
40. Gardner MJ, Altman DG (1989) Statistics with confidence – Confidence intervals and statistical guidelines. BMJ publications, London
41. Harding S, Dews H, Simpson SL (1999) The potential to identify South Asians using a computerised algorithm to classify names. Popu Trends 97: 46–49
42. Staines A, Hanif S, Ahmed S et al. (1997) The incidence of insulin dependent diabetes mellitus in Karachi, Pakistan. Arch Dis Child 76: 121–123
43. Ramachandran A, Snehalatha C, Krishnaswamy CV (1996) The incidence of IDDM in children in urban population in southern India. Madras IDDM Registry Group Madras, South India. Diabetes Res Clin Pract 34: 79–82
44. Burden AC (1992) Childhood Diabetes in Indian Asians following migration to the United Kingdom. In: Rahman MA, Samad Shera A (eds) Diabetes in the Tropics: Proceedings of the Vth (1990) World Congress on Diabetes in the Tropics and Developing Countries. Diabetic Association of Pakistan