Incidence of Type I Diabetes in People Under 30 Years of Age in Barbados, West Indies, 1982–1991

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OBJECTIVE — To determine the incidence of type I diabetes among individuals <30 years of age on the island of Barbados in the Caribbean. The population is predominantly African in origin but exhibits a relatively westernized lifestyle.

RESEARCH DESIGN AND METHODS — Cases occurring during the years 1982–1991 were drawn from records at Queen Elizabeth Hospital and from physicians treating insulin-dependent diabetes mellitus (IDDM) patients. Patients using insulin and <30 years of age at onset were included. Ascertainment was estimated at 94%.

RESULTS — The average annual incidence of type I diabetes among Barbadians was 4.1/100,000 when age-adjusted to the world's population. There were 59 incident cases during this 10-year interval. The risk for males was 4.4 and for females 4.0/100,000. Among those 0–14 years of age, the risk was 5.0/100,000. Mean age at onset (± SD) was 14.7 ± 6.9 for males and 12.5 ± 5.7 for females. Males showed marked seasonal variation in risk and a more than threefold increase in annual incidence during 1984–1985. In contrast, females exhibited a stable pattern of IDDM risk during the 10-year interval.

CONCLUSIONS — The incidence rate in Barbados falls near the lower limits of rates reported for Caribbean populations. There was a marked seasonal effect among males, even though the climate varies little throughout the year. This observation, and the incidence peak during 1984–1985, provide support for the role of environmental factors in the etiology of IDDM.

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IDDM, insulin-dependent diabetes mellitus; CI, confidence interval.

The establishment of a network of population-based registries has advanced the epidemiological knowledge base regarding insulin-dependent diabetes mellitus (IDDM), showing a 40-fold gradient of risk across the world (1,2). Genetic studies demonstrate the substantial role of variant HLA region genes in determining IDDM risk (3). Reports from the U.S. indicate a modest reduction in risk among African Americans (5–8, Table 1), but few data exist for populations of African origin elsewhere (9).

In addition to genetic susceptibility, some evidence supports environmental components in IDDM etiology. Epidemics of IDDM have been reported in association with viral outbreaks, including two in North American and Caribbean black populations (11,12). However, there are wide geographic differences in risk, even among children of the same ethnic background (2,13). Information from Barbados provides further insight into the processes leading to IDDM.

The island of Barbados is the most easterly of the Caribbean islands. It was a British colony from 1627, serving as a trans-shipment point for the slave trade, and later became an important agricultural center (10). Consequently, 90% of the population is of West African origin. Since independence in 1966, education has been universally available. Literacy is high, and health care is provided through a single government inpatient facility, the Queen Elizabeth Hospital, a system of polyclinics, and private practitioners.

RESEARCH DESIGN AND METHODS

Case ascertainment and definition

Eligible subjects were identified by review of medical records at the Queen Elizabeth Hospital, the major health-care facility on the island, for the 10-year period 1982–1991. Records were selected if any diagnosis was coded as diabetes (14). Patients were registered if they were discharged on

Table 1—*IDDM incidence among African-origin groups*

Location	Rate/100,000	Age range (years)	Years
Allegheny County, PA, U.S. (6)	11.8	0–14	1979–85
Philadelphia, PA, U.S. (8)	10.8	0–14	1985–90
Chicago, IL, U.S. (19)	10.4	0–14	1985–90
Ponce, Puerto Rico (20)	10.0	0–14	1985–89
Alabama, U.S. (5)	8.1	0–17	1979–88
U.S. Virgin Islands (11)	5.6	0–14	1979–88
San Diego, CA, U.S. (7)	3.3	0–19	1978–81
Cuba (22)	2.2	0–14	1988

Table 2—*IDDM incidence by age and calendar year, and age-adjusted rates in Barbados, 1982–1991*

	n	Rate/100,000	95% CI	Denominator
Ages 0–29				
1982	6	4.08	1.50–8.89	146,929
1983	6	4.00	1.47–8.72	150,145
1984	13	9.01	4.79–15.41	144,268
1985	10	7.05	3.38–12.97	141,749
1986	5	3.57	1.16–8.32	139,991
1987	3	2.18	0.45–6.37	137,908
1988	4	2.89	0.79–7.40	138,548
1989	4	2.93	0.80–7.50	136,742
1990	5	3.78	1.22–8.81	132,447
1991	3	2.27	0.47–6.63	132,447
10-year average	59	4.21	3.23–5.47	
Ages 0–14				
1982	5	6.74	2.18–15.70	
1983	3	4.04	0.83–11.80	
1984	6	8.76	3.21–19.10	
1985	7	10.63	4.26–21.89	
1986	3	4.63	0.95–13.52	
1987	3	4.72	0.97–13.78	
1988	2	3.16	0.38–11.41	
1989	2	3.20	0.39–11.55	
1990	4	6.45	1.75–16.51	
1991	2	3.23	0.39–11.66	
10-year average	37	5.60	3.95–7.73	
Ages 15–29				
1982	1	1.38	0.03–7.69	
1983	3	3.95	0.81–11.53	
1984	7	9.24	3.71–19.03	
1985	3	3.95	0.81–11.53	
1986	2	2.66	0.32–9.60	
1987	0	—		
1988	2	2.66	0.32–9.60	
1989	2	2.70	0.33–9.75	
1990	1	1.42	0.04–7.91	
1991	1	1.42	0.04–7.91	
10-year average	22	2.97	1.86–4.48	
Age-adjusted incidence				
0–14	37	4.97	3.50–6.85	
15–29	22	2.96	1.86–4.47	
Total	59	4.12	3.16–5.35	

Age-adjusted incidence is adjusted to the world population, 1991 (18).

insulin, <30 years of age, and with onset of disease during 1982–1991. Patients were excluded if their clinical course fit the atypical diabetic syndromes described in the Caribbean by Morrison (15) and others. Aside from the age limits, these criteria are identical to those used in the World Health Organization's multinational study (1), which allows direct comparisons with registries located elsewhere.

An additional ascertainment strategy was to contact 176 practicing physicians and inquire about potentially eligible patients. This method assumed that most IDDM patients were hospitalized at onset or were treated regularly as outpatients. Access to care is readily available, and supplies are provided without charge. Contact with health-care sources is frequent, making it unlikely that patients were missed. Using capture/recapture methods (16), ascertainment from the Queen Elizabeth Hospital's records was estimated at 94%, and overall completeness was also 94%. Private physicians and polyclinics reported 14 cases.

Data analysis

Age- and sex-specific rates were calculated using population estimates by the island demographer from the 1980 and 1990 censuses. Confidence intervals on incidence rates were determined using the Poisson distribution, and seasonality was tested using a log-linear Poisson model (17). Incidence rates were directly age-adjusted to the 1991 world population (18).

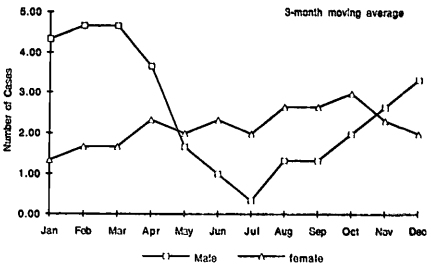

Figure 1—*Month of onset by sex. n = 57.*

Table 3—*Incidence of IDDM by sex and calendar year, ages 0–29 in Barbados*

	Males			Females		
Year	*n*	Rate/100,000	95% CI	*n*	Rate/100,000	95% CI
1982	3	4.04	0.83–11.80	3	4.13	0.85–12.06
1983	2	2.66	0.32–9.60	4	5.34	1.45–13.67
1984	10	13.80	6.62–25.39	3	4.18	0.86–12.21
1985	7	10.01	4.01–20.62	3	4.18	0.86–12.21
1986	2	2.94	0.36–10.61	3	4.16	0.86–12.15
1987	0	—	—	3	4.30	0.89–12.56
1988	2	2.89	0.35–10.43	2	2.88	0.35–10.40
1989	2	2.93	0.35–10.60	2	2.92	0.35–10.54
1990	3	4.52	0.93–13.20	2	3.03	0.37–10.94
1991	0	—	—	3	4.54	0.93–13.26
1982–1991	31	4.44	3.01–6.30	28	3.98	2.65–5.77

1982–1991 is the 10-year average rate per 100,000.

RESULTS — There were 59 cases diagnosed in the 10-year interval 1982–1991; 37 were children 0–14 years of age and 2 were not of African origin. The average yearly risk was 4.2/100,000 people (Table 2). When age-adjusted to the world's population, the incidence was 5.0 for those <15, 3.0 for those 15–29, and 4.1/100,000 overall. The average risk was basically equivalent for males and females (Table 3). Mean age at onset (±SD) was 14.7 ± 6.9 for males and 12.5 ± 5.7 years for females, although this varied widely by year (data not shown).

The month of diabetes diagnosis was available for 57 of the patients. Fewer cases were diagnosed from June through September, although in Barbados seasonal variation is minimal (Fig. 1). When analyzed by gender, seasonality of onset was confined to males ($\chi^2 = 13.987$, $P = 0.003$).

The highest incidence was recorded in 1984 and 1985, where a more than threefold excess of cases was observed (Tables 2 and 3). The rates of 13.8 and 10.0/100,000 observed among males in these years represented more than half the male total over the study period. Females exhibited little temporal variation in diabetes rate, and, excluding the years 1984 and 1985, their average risk was higher than that of males, 3.9 vs. 2.5/100,000 people per year.

CONCLUSIONS — It is apparent that the risk for IDDM in Barbados is intermediate for Caribbean populations studied to date and among the lowest rates worldwide (2). The descriptive epidemiology of IDDM among groups of African origin is limited to a few population-based registries in North America and the Caribbean (Table 1), but such epidemiology is potentially quite informative regarding both the genetic and environmental aspects of etiology. The north-south gradient observed among Europeans is found also among African-origin populations. Findings of twice the risk in African-American children in Chicago compared with Barbados support an environmental factor (19). However, it may also be argued that more admixture is found among African-origin groups in the U.S., which implies a greater likelihood of carrying susceptibility genes. Indeed, a relatively high risk of 10/100,000 person-years was noted in Puerto Rico (20), where the level of European admixture is thought to be greater than in Barbados or the Virgin Islands (Table 1).

The observation in Barbados that peak risk occurs at puberty is consistent with findings elsewhere. Of particular interest were gender differences: seasonality of onset and excess incidence during 1984 and 1985 appeared only among males. During the same years, an epidemic of IDDM was reported in the U.S. Virgin Islands (11). Marked variation in incidence among males was also reported in five Baltic populations with much higher absolute risks of IDDM (21). This apparent gender-linked susceptibility to "epidemic" IDDM in populations with differing genetic backgrounds is an intriguing finding. Although the possibility exists that this is an artifact of small numbers, there may well have been viral epidemics or other occurrences during the years in question.

These data provide epidemiological support for both environmental and host factors in IDDM risk. The incidence of IDDM in Barbados is low and consistent with rates in Cuba and the Virgin Islands (11,22). Excess incidence among males was noted during 1984 and 1985. Comparative studies in African-origin populations with varying degrees of admixture and conditions of life should help to clarify these relationships.

References

1. WHO DIAMOND Project Group: The WHO multinational project for childhood diabetes. *Diabetes Care* 13:1062–1068, 1990
2. Rewers M, LaPorte RE, King H, Tuomilehto J, the Diabetes Epidemiology Re-

search International Study Group: Trends in the prevalence and incidence of diabetes: insulin-dependent diabetes mellitus in childhood. *World Health Stat Q* 4:179–189 1988

3. Dorman JS, LaPorte RE, Stone RA, Trucco M: Worldwide differences in the incidence of type I diabetes are associated with amino acid variation at position 57 of the HLA-DQ beta chain. *Proc Nat Acad Sci USA* 87:7370–7374, 1990
4. Diabetes Epidemiology Research International Mortality Study Group: Major cross-country differences in risk of dying for people with IDDM. *Diabetes Care* 14: 49–54, 1991
5. Wagenknecht LE, Roseman JM, Alexander WJ: Epidemiology of IDDM in black and white children in Jefferson County, Alabama, 1979–85. *Diabetes* 38: 629–633, 1989
6. LaPorte RE, Tajima N, Dorman JS, Cruickshanks KJ, Eberhardt MS, Rabin BS, Atchison RW, Wagener DK, Becker DJ, Orchard TJ, Songer TJ, Slemenda CW, Kuller LH, Drash AL: Differences between blacks and whites in the epidemiology of insulin-dependent diabetes mellitus in Allegheny County, Pennsylvania. *Am J Epidemiol* 123:592–603, 1986
7. Lorenzi M, Cagliero E, Schmidt NJ: Racial differences in incidence of juvenile-onset type I diabetes: epidemiologic studies in Southern California. *Diabetologia* 20:734–738, 1985
8. Lipman TH: The epidemiology of type I diabetes in children 0–14 years of age in Philadelphia. *Diabetes Care* 16:922–925, 1993
9. Tull ES, LaPorte RE: Let's not forget IDDM in African-American children (Letter). *Diabetes Care* 14:613–614, 1991
10. Fraser HS, Carrington S, Forde A, Gilmore J: *A to Z of Barbadian Heritage*. Kingston, Jamaica, Heinemann, 1990
11. Tull ES, Roseman JM, Christian CLE: Epidemiology of childhood IDDM in the U.S. Virgin Islands from 1979–1988: evidence for an epidemic in the early 1980's and variation by degree of racial admixture. *Diabetes Care* 14:558–564, 1991
12. Wagenknecht LE, Roseman JM, Herman WH: Increased incidence of insulin-dependent diabetes mellitus following an epidemic of coxsackievirus B5. *Am J Epidemiol* 133:1024–1031, 1991
13. Siemiatycki J, Colle E, Campbell S, Dewar R, Aubert D, Belmonte MM: Incidence of insulin-dependent (type I) diabetes by ethnic group and by social class in Montreal, and comparisons with comparable ethnic groups living elsewhere. *Diabetes* 37:1096–1102, 1988
14. U.S. Department of Health and Human Services, Health Care Financing Administration: *International Classification of Diseases*. 9th rev., 2nd ed. Washington, DC, U.S. Govt. Printing Office, September 1980 (DHHS publ. no. 80–1260)
15. Morrison E, Richards R: Clinical profile of diabetes mellitus in Jamaica (phasic insulin dependence). *West Indian Med J* 34: 94–97, 1985
16. Sekar CC and Deming WE: On a method of estimating birth and death rates and the extent of registration. *Am Statist Assoc J* 44:101–105, 1949
17. Stata: *Release 3 Reference Manual*. 5th ed. Santa Monica, CA, Computer Resource Center, 1992
18. U.S. Department of Commerce, Bureau of the Census: *Statistical Abstract of the United States, 1992*. Lanham, MD, Bernan, 1992, Table 1360
19. Lipton RB, Jordan OW, Stupnicka E, Fivecoate J, Cruickshank JK, Fraser HS: Substantial geographic and temporal differences in risk of insulin-dependent diabetes mellitus (IDDM) between 2 populations of African origin (Abstract). *Diabetes* 42 (Suppl. 1):200A, 1993
20. DeLlado TF, Hawk B, Vazquez J, Lewis B, Hupka A: Incidence of youth-onset, insulin-dependent diabetes mellitus (IDDM) in Southern and Western Puerto Rico (Abstract). *Diabetes* 40 (Suppl. 1):316A, 1991
21. Tuomilehto J, Podar T, Brigis G, Urbonaite B, Rewers M, Adojaan B, Cepaitis Z, Kalits I, King H, LaPorte R, Lounamaa R, Padaiga Z, Reunanen A, Toumilehto-Wolf E, Walczak M: Comparison of the incidence of insulin-dependent diabetes mellitus in childhood among five Baltic populations during 1983–1988. *Int J Epidemiol* 21:518–527, 1992
22. Diaz OD, Soto TN: Estudio epidemiológico de la diabetes mellitus tipo I, Cuba 1988. *Bol Colectivo Nac Invest Epidemiol Diabetes* 1:8–12, 1990