High Risk of IDDM in African-American and Hispanic Children in Chicago, 1985–1990

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OBJECTIVE — To determine the incidence of insulin-dependent diabetes mellitus (IDDM) among African-American and Hispanic children <18 years of age in the city of Chicago. These minority communities are large and heterogeneous with respect to socioeconomic status, length of time since migration, and place of origin, so that correlates of IDDM risk can be examined with precision.

RESEARCH DESIGN AND METHODS — Cases occurring during the years 1985–1990 were drawn from records at 37 hospitals in Cook County. African-American and Hispanic patients using insulin, residing within the city limits, and <18 years old at onset were included. Three secondary sources of cases were used: medical records of clinics associated with the Chicago Department of Health, a survey of unaffiliated neighborhood clinics, and lists of children attending diabetes camps. Overall ascertainment was estimated at 86%.

RESULTS — There were 413 new cases during this 6-year interval. The average incidence of IDDM was 12.0/100,000 annually among African-American males, 12.1 among African-American females, 9.1 among Hispanic males, and 10.2 among Hispanic females. Mean age at onset was 11.1, 11.0, 10.7, and 10.1 years for African-American males, African-American females, Hispanic males, and Hispanic females, respectively. Fewer cases occurred during the summer months. Diabetes among the first-degree relatives of children from both ethnic groups was commonly noted on the medical charts.

CONCLUSIONS — The incidence rates in Chicago fall near the upper limits of reports for both African-origin and Hispanic populations worldwide. The relatively early age at onset may point to an environmental factor associated with this high incidence of the disease. Further studies will provide valuable data on comorbid conditions, unusual diabetic syndromes, and family dynamics in childhood chronic disease.

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CDOH, Chicago Department of Health; CI, confidence interval; IDDM, insulin-dependent diabetes mellitus; NIDDM, non-insulin-dependent diabetes mellitus.

Collaborative studies in the past decade have broadened our knowledge of the epidemiology of insulin-dependent diabetes mellitus (IDDM), but the specific etiological sequence leading to the disease remains unclear. Data regarding the ethnic and geographic variation in IDDM risk may shed light on this process. Substantial geographic disparities in risk occur (1), in some measure attributable to genetic differences, particularly in alleles of the human leukocyte antigen class II region (2). There is also good evidence of an environmental component in IDDM etiology, in that geographic differences in risk are found among children from the same ethnic background (3). Epidemics have been reported in association with viral outbreaks, including two in North American and Caribbean black populations (4,5).

The small number of studies among African-origin and Hispanic groups have generally reported lower risks than non-Hispanic whites (4–16; Table 1). Even so, a wide geographic gradient of risk has been seen within each ethnic group: more than a fourfold difference in incidence among African-origin groups and greater than eightfold among Hispanics. Although genetically and environmentally Cuba and Puerto Rico would appear to be more similar than, for example, Chicago and Puerto Rico, there is apparently a sevenfold disparity in risk between the two Caribbean islands (11,16), while the incidence in Puerto Rico and Chicago is similar. U.S. Hispanic children were thought to show a lower incidence than non-Hispanic whites (9,12), but this was not the case among Puerto Ricans on the island or in Philadelphia, where a higher risk has been reported (6,11).

Both the African-American and Hispanic communities in Chicago are economically and culturally diverse. While in many U.S. cities, the Hispanic communities are for the most part homogeneous (e.g., Cuban in Miami, Puerto Rican in New York, Mexican in California, Texas, and Colorado), Chicago is

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

Location	Patients (*n*)	Rate/100,000	Age range (years)	Years	Ref.
African-origin groups					
Chicago	299	13.2	0–17	1985–1990	
Philadelphia	85	10.8	0–14	1985–1990	6
Allegheny County, PA	146	10.3	0–19	1965–1989	7
Alabama	69	8.1	0–17	1979–1988	3
Virgin Islands	17	5.6	0–14	1979–1988	4
Barbados	59	5.0	0–14	1982–1991	8
San Diego	3	3.3	0–19	1978–1981	9
Hispanic groups					
Puerto Rico	1,033	15.4	0–15	1985–1990	11
Philadelphia	17	15.2	0–14	1985–1989	6
Madrid, Spain	501	11.3	0–14	1985–1988	10
Chicago	114	10.8	0–17	1985–1990	
Colorado	76	9.5	0–17	1978–1983	12
São Paulo, Brazil	52	7.6	0–15	1987–1991	13
Avellaneda, Argentina	29	6.7	0–14	1985–1990	14
San Diego	7	4.1	0–19	1978–1981	9
Santiago, Chile	78	2.5	0–14	1990–1991	15
Cuba	267	1.8	0–14	1980–1988	16

All locations are in the U.S. unless a different country's name is included.

uniquely heterogenous. Sixty-five percent of Chicago Hispanics are of Mexican origin, 23% are Puerto Rican, 3% are of Cuban origin, and the remainder are of other backgrounds, primarily Central American and Andean (S. Puente, M. Norkewicz, and R. Paral, personal communication). The spectrum of time since these individuals came to Chicago is also large. Southern blacks and Mexicans began coming to the area in the first quarter of this century, and waves of immigration have continued in response to economic and political events (18), now encompassing migrants from Mississippi, Alabama, and Arkansas, as well as from Central America and the Caribbean. Thus, second- and third-generation descendants, as well as newcomers, are found in both the African-American and Hispanic communities. Acculturation is present to varying degrees among Hispanics. In several low-income, predominantly Mexican barrios, half of those ≥18 years old do not speak English (19). These factors make Chicago an ideal site for investigating the changes in IDDM risk that occur with migration and acculturation, as well as issues such as health care effectiveness and quality.

The enormous financial and social costs of IDDM (20) are likely to affect African-American and Hispanic families disproportionately, since they are overrepresented among the poor in the U.S., although few hard data are available. It has been observed that African-Americans have a higher risk for both acute (e.g., diabetic ketoacidosis) and chronic complications of IDDM (e.g., kidney disease) than do whites (21). Although no similar information exists for U.S. Hispanics, these race differences are presumably due in large part to differences in socioeconomic conditions. In Colorado, the rate of rehospitalization among Hispanic IDDM patients was greater than that among non-Hispanic white patients (22), and those whose mothers had <12 years schooling had twice the risk of rehospitalization than those with mothers who had some college education. These statistics are particularly compelling in light of recent findings that strict attention to diabetes management can cause postponement or avoidance of chronic microvascular complications (23).

The goals of the Chicago Registry Project are to *1*) document the number of IDDM patients among African-Americans and Hispanics in Chicago, 2) determine factors related to development of the disease and its impact on families, and *3*) contribute to patient education and family support in order to prevent long-term complications. This study reports the initial-incidence data only, based solely on medical records. We are now launching the second phase of the study, in which patients are to be contacted and interviewed.

RESEARCH DESIGN AND METHODS

Case ascertainment and definition

Eligible patients were identified by review of medical records at 37 of 40 area hospitals that have more than 200 beds and a pediatrics unit, for the 6-year period of 1985–1990. Records were selected if any diagnosis was coded as diabetes (24). African-American and Hispanic patients were registered if they were discharged on a regimen of insulin, were <18 years old, with onset of disease from 1985 through 1990, and were residents of Chicago at the time of diagnosis. Ethnicity was defined as having African-American listed on the medical record and/or a Hispanic surname as documented by the U.S. Census Bureau (25). There were two African-American females who also had Spanish surnames; these females were classified as Hispanic. This strategy was adopted to correspond with the methods used by the City of Chicago demographer in calculating the denominators. Aside from the age limits, the entry criteria are identical to those used in the World Health Organization multinational study (26), allowing direct comparisons with registries located elsewhere.

This protocol assumed that nearly

Table 2—*Ascertainment of cases in the Chicago Registry, 1985–1990*

All sources considered separately:

	Hospitals and camp lists				
	Both yes	Both no	Hospitals yes; camp lists no	Hospitals no; camp lists yes	Total
Clinics and CDOH					
Both yes	0	0	0	0	0
Both no	29	*	369	3	>401
Clinics yes; CDOH no	0	4	5	0	9
Clinics no; CDOH yes	1	0	2	0	3
Total	30	>4	376	3	>413

Secondary sources aggregated:

	Hospitals		Total
	Yes	No	
Any other source			
Yes	37	7	44
No	369	*	>369
Total	406	>7	>413

Total estimated cases: 481. Estimated completeness: 86% (95% CI: 79–97%). *, number uncertain.

all IDDM patients were hospitalized at onset. Camping lists from the Northern Illinois Affiliate of the American Diabetes Association, a survey of unaffiliated neighborhood clinics, and medical chart review at 16 clinics maintained by the Chicago Department of Health (CDOH), were subsequently used as secondary sources of cases (Table 2). Because so few cases appeared in the three secondary sources, they were combined, and the degree of ascertainment was estimated to be 86% using the capture-mark-recapture method (27). No patient was reported by clinic staff as having had diabetes diagnosed as an outpatient.

Statistical analysis

Rates were calculated using projections of the population at risk calculated by the City of Chicago demographer from the 1980 U.S. Census figures (28). A variety of indicators has shown these to be more accurate than the 1990 U.S. Bureau of the Census count, particularly for African-Americans. The Poisson distribution was used to calculate 95% confidence intervals (CIs) around the rates, and contrasts in incidence rates were tested using the binomial approximation to the χ^2 test (29). Analyses were performed using the statistical package SPSS (30). Incidence rates were directly age-standardized to the 1991 world population (31). Age-standardized rates were calculated for the entire study population and for ages 0–14 only, in order to facilitate comparisons with other registries.

RESULTS — Diabetes was newly diagnosed in 299 African-American patients (149 males and 150 females) and 114 Hispanic patients (55 males and 59 females) between January 1, 1985, and December 31, 1990.

The risk of diabetes was equally distributed among males and females. Age at onset (mean ± SD) was 11.0 ± 4.6 years for males and 10.8 ± 4.4 years for females in both ethnic groups combined. There was little year-to-year variation in age except among Hispanic females, whose mean age at diagnosis decreased by almost 2 years over the 6-year study period, although this was not statistically significant (Fig. 1).

Incidence rates for IDDM are presented in Tables 3 and 4. The average yearly incidence of IDDM among African-American males was 12.0 per 100,000 people (ranging from 6.3 in 1986 to 15.9 in 1988) while among African-American females it was 12.1 (range 10.2 in 1986 to 14.6 in 1990). Among Hispanic males the average annual risk was 9.1 (range 6.9 in 1988 to 12.3 in 1990) and among Hispanic females it was 10.2 (range 7.1 in 1989 to 11.5 in 1985). The average an-

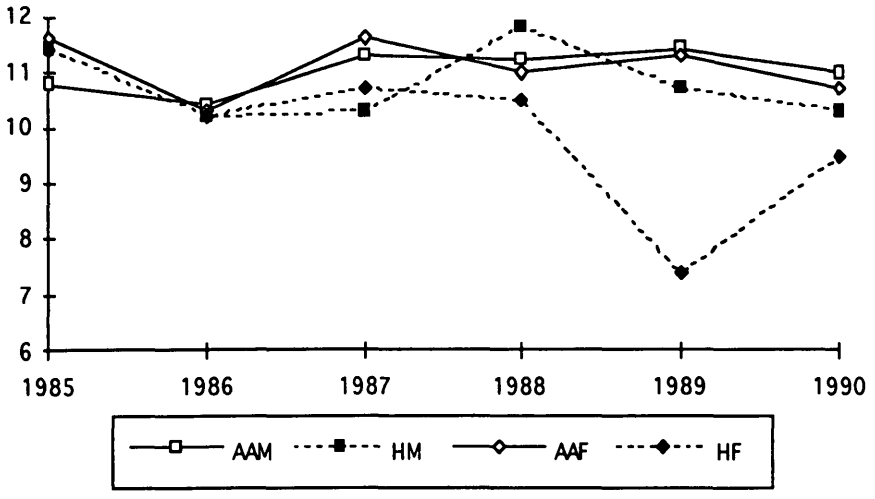

Figure 1—*Mean age at onset of Chicago IDDM patients by ethnicity, sex, and year. AA, African-American; H, Hispanic; M, males; F, females.*

Table 3—*Incidence of IDDM by ethnicity, sex, and calendar year, patients aged 0–17, Chicago*

	Males			Females			All		
	n	Rate	95% CI	*n*	Rate	95% CI	*n*	Rate	95% CI
African-American									
1985	28	13.4	8.9–19.4	24	11.6	7.4–17.3	52	12.5	9.4–16.5
1986	13	6.3	3.4–10.8	21	10.2	6.3–15.6	34	8.2	5.7–11.5
1987	28	13.5	9.0–19.6	24	11.6	7.4–17.3	52	12.6	9.5–16.7
1988	33	15.9	10.9–22.4	29	14.1	9.5–20.3	62	15.0	11.6–19.4
1989	22	10.6	6.7–16.0	22	10.7	6.7–16.2	44	10.7	7.8–14.4
1990	25	12.1	7.9–17.9	30	14.6	9.9–20.9	55	13.3	10.1–17.5
1985–1990	149	12.0	10.2–14.1	150	12.1	10.3–14.2	299	12.0	10.7–13.5
Hispanic									
1985	8	8.3	3.4–16.4	11	11.9	5.9–21.3	19	10.1	6.1–15.8
1986	9	9.1	4.2–17.3	11	11.7	5.8–20.9	20	10.4	6.4–16.0
1987	8	8.0	3.5–15.8	8	8.4	3.6–16.6	16	8.2	4.7–13.3
1988	7	6.9	2.8–14.2	11	11.3	5.6–20.2	18	9.0	5.3–14.2
1989	10	9.6	4.6–17.7	7	7.1	2.9–14.6	17	8.4	4.9–13.4
1990	13	12.3	6.5–21.0	11	11.0	5.5–19.7	24	11.7	7.5–17.4
1985–1990	55	9.1	6.9–11.9	59	10.2	7.8–13.3	114	9.6	8.0–11.6

Rate indicates rate per 100,000 persons. The values for 1985–1990 are 6-year average rates per 100,000.

nual risk for African-Americans was significantly higher than for Hispanics. Among males this difference was also significant at the 0.05 level, while among females the ethnic difference in risk approached significance. A statistically significant variation in rates was noted among African-American males, where the rate in 1986 was significantly lower ($P = 0.005$) and the rate in 1988 significantly higher ($P = 0.038$) than the average rate for other years. Age-standardized, ascertainment-corrected rates (Table 4) were 13.2/100,000 for African-American and 10.8 for Hispanic children aged 0–17, and 12.9 and 10.8, respectively, for ages 0–14.

Diabetes was diagnosed in fewer

Table 4—*Incidence of IDDM by ethnicity, sex, and age-group, and age-standardized rates, Chicago, 1985–1990*

		Males			Females			All		
	Ages	*n*	Rate	95% CI	*n*	Rate	95% CI	*n*	Rate	95% CI
Age-specific incidence										
African-American	0–4	20	5.3	3.2–8.2	16	4.4	2.5–7.1	36	4.8	3.4–6.6
	5–9	36	10.5	7.4–14.5	34	10.0	6.9–14.0	70	10.2	8.0–13.0
	10–14	56	17.3	13.2–22.7	74	22.4	17.7–28.3	130	19.9	16.7–23.7
	15–17	37	18.9	13.3–26.0	26	13.0	8.5–19.1	63	15.9	12.3–20.5
Hispanic										
	0–4	6	3.2	1.2–7.0	8	4.4	1.9–8.7	14	3.8	2.1–6.4
	5–9	17	9.4	5.5–15.0	19	11.1	6.7–17.3	36	10.2	7.4–14.7
	10–14	24	15.5	9.9–23.1	23	15.5	9.8–23.3	47	15.5	11.4–20.7
	15–17	8	9.7	4.2–19.1	9	11.6	5.3–22.0	17	10.6	6.2–17.0
Age-standarized incidence										
African-American	0–14							236	12.9	10.7–15.6
Hispanic	0–14							97	10.8	8.8–13.2
African-American	0–17							299	13.2	11.8–14.8
Hispanic	0–17							114	10.8	9.5–12.3

Rate indicates rate per 100,000 persons. Age-standardized incidence was standardized to the world's population in 1991 (31) and corrected for ascertainment.

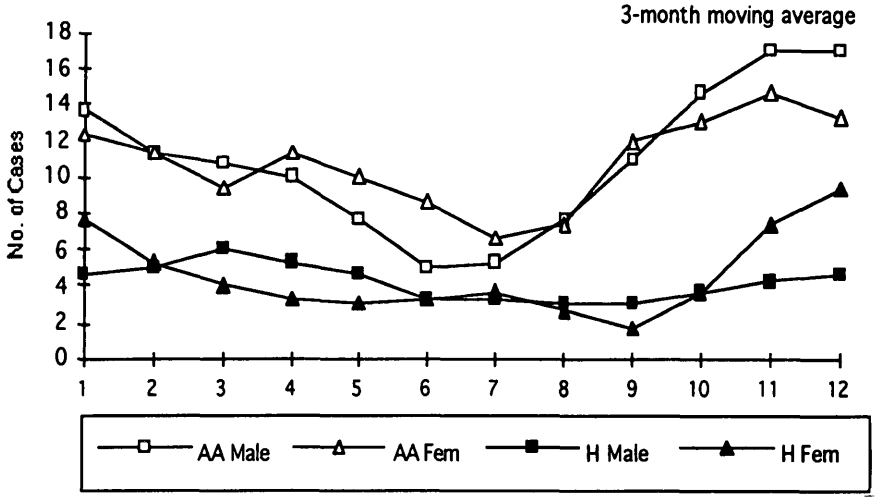

Figure 2—*Month of onset by ethnicity and sex. AA, African-American; H, Hispanic; Fem, female. **Excludes 46 patients whose month of onset was not known.*

patients during the warmer months (Fig. 2), a result that is consistent with observations in other geographic locations. We found this deficit of summer-onset cases among African-Americans and Hispanic females, but not among Hispanic males.

Several additional observations were made from the medical records and deserve further investigation. Many patients had diabetic family members noted on the hospital chart. Obesity was listed as a comorbid condition in 7% of African-American males, 16% of African-American females, and >12% of Hispanic males and females. Asthma was also listed frequently among both ethnic groups.

CONCLUSIONS — The risk for IDDM in Chicago is among the highest yet documented for African-American and Hispanic groups (Table 1). The data for African-Americans are particularly compelling because they derive from the largest number of patients studied thus far. Statistically significant year-to-year differences in incidence were found only among African-American males, although there was an increased risk among all race-sex groups during 1990 (Table 3).

These data provide further evidence that wide geographic differences in risk exist within ethnic groups. Caribbean children of African origin apparently have about half the risk of African-American children in Chicago (4,8). We observed no sex difference in age, perhaps because mean age at onset occurred before puberty. This relatively early onset of IDDM could be linked to an environmental factor, which might in turn be linked to the high incidence rate in Chicago. However, it may also be argued that more European admixture is found among African-origin groups in the U.S. than in the Caribbean, implying greater likelihood of carrying European susceptibility alleles.

An important limitation in research on minorities is the question of error in the denominator. If the overall number of children at risk were greater, i.e., if there were an undercount of the African-American and Hispanic population <18 years old in Chicago, it would lead to an artificially high estimate of risk. The U.S. Department of Commerce has admitted to such an undercount in the 1990 census (32). In population projections based on 1980 census data made by the City of Chicago demographer, there were 20% more black Chicagoans <18 years of age in 1990 than were counted in the U.S. census that year (33). The discrepancy among Hispanics may be less serious, with the City of Chicago estimate exceeding the 1990 U.S. Census count by only ~3%. However, significant numbers of undocumented Hispanic migrants, who would not have been enumerated officially, were undoubtedly living in the city both in 1980 and in 1990. Efforts to validate these denominators using school enrollment or other data have thus far been unsuccessful. We have chosen to use the City of Chicago demographer's projections rather than the official U.S. census figures in order to produce incidence rates that are as accurate as possible.

A large number of both African-American and Hispanic patients had obesity listed as a condition in the medical records, perhaps indicating the presence of atypical diabetes or early-onset non-insulin-dependent diabetes mellitus (NIDDM) (34). There was a high prevalence of the disease among family members, reflecting the ongoing epidemic of NIDDM among U.S. minorities. This resembles the observation in Colorado that more first-degree relatives were diabetic among Hispanic families than among non-Hispanic whites (12). Investigating the variation in diabetic syndromes among both minority groups will be an important goal in the coming years. These findings also have implications for quality of care and health care utilization: the low prevalence of health insurance and high prevalence of NIDDM in minority communities may result in inadequate diabetes treatment for children. Low literacy and the use of traditional healers (*curanderos/as*) in the Hispanic community may contribute to misconceptions and increase the risk of inappropriate treatment for IDDM.

The current data provide support for both environmental and host (genetic) factors in IDDM risk. IDDM incidence in Chicago is high for both ethnic groups, and the disease presents earlier than elsewhere. Comparative studies in African-American and Hispanic populations with varying degrees of admixture and condi-

tions of life will help to clarify these relationships. More importantly, adding to our understanding of IDDM among diverse groups will help in efforts to improve standards of diabetes care.

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