

# The Epidemiology of Type I Diabetes in Children 0–14 Yr of Age in Philadelphia

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**OBJECTIVE**— To determine the epidemiology of type I diabetes in children in Philadelphia, particularly with respect to racial differences.

**RESEARCH DESIGN AND METHODS**— This is a descriptive epidemiological study using a retrospective population-based registry in Philadelphia, Pennsylvania, a city with large white, black, and Hispanic populations. All hospitals in Philadelphia that admit children were identified. All charts meeting the following criteria were reviewed: 1) newly diagnosed IDDM, 2) 0–14 yr of age, 3) residing in Philadelphia at the time of diagnosis, and 4) diagnosed from 1 January 1985 to 31 December 1989. Standard IDDM registry data were abstracted from the charts. Ascertainment of the completeness of the hospital registry was validated by two secondary sources: 1) diabetes camp records, 2) Philadelphia School District data.

**RESULTS**— A total of 215 cases were identified, and the combined hospital, camp, and school registry was determined to be 93% complete. The overall age-adjusted incidence rate in Philadelphia was 13.4/100,000/yr. The highest incidence rate was in Hispanics (15.16), followed by whites (13.31), and blacks (10.95).

**CONCLUSIONS**— The incidence of IDDM in Philadelphia is similar to what has been found in other U.S. registries. The unexpected finding was that the incidence in the Puerto Rican Hispanic population was the highest in the city. This is the first data reported on this population, and more studies are needed to elucidate the genetic and environmental causes of this high incidence of IDDM.

The determination of the epidemiology of IDDM in different racial populations is crucial in investigating the genetic and environmental risk factors for diabetes. Few registries in the U.S. have included data on black populations (1–4). Studies of these registries have shown the incidence of IDDM is

greater in whites than blacks; the incidence in blacks varied from 3.3 to 9.6. In no study was the black population >90,000.

Fewer registries have reported incidence rates of IDDM in Hispanic populations (3,5). Data from studies of these two registries demonstrated a lower incidence of IDDM in Hispanics than non-Hispanics. Neither study, however, reported on Hispanics of Puerto Rican origin. No registry data have been reported on the incidence of IDDM in whites, blacks, and Hispanics in the same population.

Philadelphia is a city rich in ethnic and racial diversity. It has large black and Hispanic (mostly Puerto Rican) populations. Of children 0–14 yr of age, ~154,000 are black and 23,000 Hispanic. The Philadelphia registry includes data from white, black, and Hispanic populations and examines the relationship of sex, age, socioeconomic status, and seasonality to the development of diabetes in these racial groups.

## RESEARCH DESIGN AND METHODS

Philadelphia's population of 1,688,210 makes it the fifth largest city in the United States (6). As of 1990, 37.8% of the population was black and 3.8% was Hispanic.

This study included all hospitalized patients 0–14 yr of age, newly diagnosed with IDDM from 1 January 1985 to 31 December 1989. All patients resided in Philadelphia at the time of diagnosis. The study identified 35 acute care hospitals in Philadelphia, as well as 6 easily accessible suburban hospitals close to the city limits. The country of origin of Hispanic cases was ascertained from the childrens' charts or physicians. Socioeconomic rating was determined with ZQ (7).

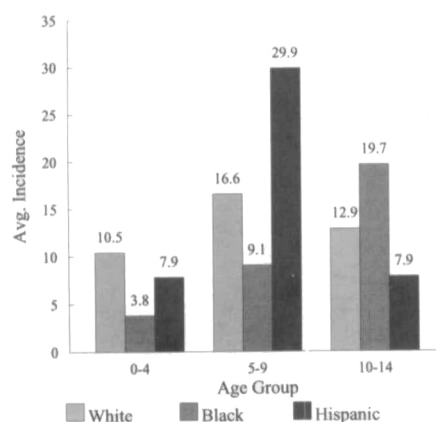
Two secondary sources of validation determined the completeness of the hospital registry: Local diabetes camp records were reviewed from 1985–1990, and nurses from the Philadelphia School

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IDDM, INSULIN-DEPENDENT DIABETES MELLITUS; ZQ, ZIP QUALITY; CI, CONFIDENCE INTERVAL.

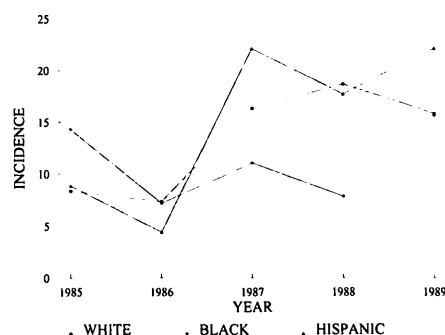


**Figure 1**—The incidence of IDDM in children in Philadelphia by age-group and race.

District obtained parental consent and completed a questionnaire about their students with IDDM.

Incidence rates were calculated for the sample in general and for each subgroup (age, sex, race). The yearly incidence rates were calculated using the 1980 census data and intercensal estimated or postcensal projections, depending on the race being analyzed (8–10). The Poisson distribution was used to calculate 95% CI (11). The GLIM statistical package determined which variables significantly predicted the risk of IDDM (12).

**RESULTS**— The hospital review identified 207 cases of newly diagnosed IDDM in Philadelphia in children 0–14 yr old during the 5-yr period, 1985–1990. The cases were patients from 15 Philadelphia and 3 suburban hospitals. Diabetes camp records and school records (secondary sources) identified 77 eligible children, of whom 69 (90%) also were found in the hospital registry. The total number of estimated cases with the capture-recapture method was 231 (13). The ascertainment rate was calculated for the hospital registry (90%), the secondary sources (34%), and the combined registry of primary and secondary sources (93%). Table 1 gives the break-



**Figure 2**—The incidence of IDDM by race, in children in Philadelphia 0–14 yr old in 1985, 1986, 1987, 1988, and 1989.

down of cases according to sex, race, and age. As shown, 51% were white, 40% black, and 8% Hispanic.

The overall crude incidence rate of 13.0/100,000/yr is comparable to that found in other diabetes registries in the U.S. (4,14,15). The age-adjusted incidence rate was 13.4, and the ascertainment-corrected incidence rate was 14.0. Table 2 shows incidence rates of IDDM by race and sex. Surprisingly, the highest incidence was in the Hispanic population, followed by whites and blacks (age-adjusted rates: 15.16, 13.31, 10.95, respectively). All Hispanic patients were of Puerto Rican origin. The incidence in Hispanics was 1.14 times that of whites and 1.4 times that of blacks. The rate in whites was 1.2 times the rates in blacks.

Because this study showed obvi-

ous differences in incidence by race, the initial GLIM analysis was performed separately for whites, blacks, and Hispanics. The only significant predictors of IDDM risk were diagnosis year and birth cohort in whites ( $P < 0.025$ ). The incidence of diabetes was found to be somewhat higher in females. The incidence in females and males was almost equal in the white population (13.6 vs. 12.7). The difference was greater, although not significant, in black children (13.3 vs. 9.1). The greatest disparity in sex was found in the Hispanic population (19.5 vs. 10.6).

Although race was not a significant predictor of IDDM, when ages at onset and race were combined, the effect was significant ( $P < 0.005$ ). Of the 0–4 age group, 71% were white, although whites comprised only 51% of the total number of cases (Fig. 1). The risk of developing IDDM in children <5 yr of age was 2.8 times greater in whites than blacks. None of the races demonstrated any relationship to socioeconomic status. Blacks and Hispanics, demonstrating the usual pattern of seasonality, displayed more seasonal variation than whites. Whites showed a peak onset in spring. Children 0–4 yr of age demonstrated a minimal seasonal pattern, with a slight peak in winter.

All races exhibited a decreased incidence of IDDM in 1986, but year of diagnosis was a significant predictor only in whites,  $P < 0.025$  (Fig. 2).

**Table 1**—Number of cases in registry according to sex, race, and age in Philadelphia

	AGE-GROUP						TOTAL
	0–4 yr		5–9 yr		10–14 yr		
	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	
WHITE	14	18	23	21	18	15	109
BLACK	6	3	16	8	29	24	86
HISPANIC	2	1	6	5	0	3	17
ORIENTAL	1						1
INDIAN (ASIAN)			2				2
<i>n</i>							215

Table 2—Number of cases of IDDM, population, and average annual incidence of IDDM by race and sex in Philadelphia

	SEX		CRUDE RATE	ADJUSTED RATE
	MALE	FEMALE		
<b>WHITE</b>				
CASES (n)	54	55	109	
POPULATION	84,773	80,698	165,471	
RATE/100,000/YR	12.7	13.6	13.17	13.31
95% CI	9.63–16.70	10.33–17.84	10.87–15.95	10.98–16.12
<b>BLACK</b>				
CASES (n)	35	51	86	
POPULATION	77,043	76,743	153,786	
RATE/100,000/YR	9.1	13.3	11.19	10.95
95% CI	6.34–12.65	10.00–17.64	9.01–13.89	8.81–13.59
<b>HISPANIC</b>				
CASES (n)	6	11	17	
POPULATION	11,365	11,257	22,622	
RATE/100,000/YR	10.6	19.5	15.03	15.16
95% CI	3.89–23.11	9.73–34.91	8.76–24.04	8.84–24.26
<b>TOTAL*</b>				
CASES (n)	95	120	215	
POPULATION	168,030	162,343	330,373	
RATE/100,000/YR	11.3	14.8	13.02	13.35
95% CI	9.20–13.89	12.31–17.74	11.37–14.91	1.65–15.29

\*Total includes 1 Asian, 2 Indian cases. Population data is total population 0–14 yr.

**CONCLUSIONS**— The most interesting finding of this study is that the Hispanic population had the highest incidence of IDDM of any racial/ethnic group. The published studies of U.S. registries stating that the incidence of IDDM is lower in Hispanics than whites have not investigated Hispanic Puerto Rican populations (3,5). This is the first registry including data on the Puerto Rican Hispanic population.

The increased incidence of IDDM in Philadelphia Hispanics of Puerto Rican descent is in agreement with our finding that Hashimoto thyroiditis is common in otherwise normal Puerto Rican children (A.M. DiGeorge, I. Rezvani, T.H.L., unpublished observations) and in Puerto Rican children with diabetes (16). It is not known why autoimmune disorders are more common in this population. More genetic studies are needed of this ethnic group. Studies of the diet, infectious diseases, and living conditions of Puerto Ricans in the U.S. and in

Puerto Rico are needed to investigate the possible environmental factors. Underestimation of the rapidly growing Hispanic population may have contributed to the high incidence. Data must be gathered on this population in the future to confirm these incidence rates.

The most striking difference between whites and blacks in the incidence of IDDM in Philadelphia is in the 0–4-yr age-group. The predominance of white children in the 0- to 4-yr-old population also was found in the Pittsburgh registry (15). Various risk factors must be explored. A recent study determined the protective effect of breast-feeding on the risk of IDDM may be related to the age at exposure to breast milk substitutes in blacks but not in whites (17).

The incidence rates in the 5 yr of the study demonstrate lower rates in all races in 1986, but this trend is significant only in whites. More data are needed to determine if a decreased incidence of IDDM in 1986 occurred in other regis-

tries and to identify possible causes for this finding.

This study demonstrates the wide diversity of incidence of IDDM in blacks, whites, and Hispanics in the same population. The high incidence in American Hispanics of Puerto Rican origin must be explored further in this previously unstudied population.

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## APPENDIX — PARTICIPATING HOSPITALS

### Philadelphia

Albert Einstein Medical Center, Chestnut Hill Hospital, Children's Hospital of Philadelphia, Frankford Hospital, Hahnemann Hospital, Jeanes Hospital, John F. Kennedy Hospital, Hospital of the Medical College of Pennsylvania, Nazareth Hospital, Naval Hospital (secondary source only), Osteopathic Medical Center of Philadelphia, Thomas Jefferson University Hospital, St. Christopher's Hospital for Children.

### Suburban Philadelphia

Abington Memorial Hospital, Fitzgerald Mercy Medical Center, Holy Redeemer Hospital.

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