THE CANADIAN MEDICAL ASSOCIATION

LE JOURNAL DE

L'ASSOCIATION MÉDICALE CANADIENNE

JULY 18, 1964 • VOL. 91, NO. 3

Incidence of Heart Disease in Children in the City of Toronto

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ABSTRACT

A special registry of children with heart disease in the City of Toronto was set up (a) to provide for follow-up of all children with heart disease in that community, (b) to remove the "cardiac" label from children with functional murmurs, (c) to acquaint parents with facilities available for the management of children with heart disease, and (d) to record useful data regarding heart disease in children.

The 1961-62 Cardiac Registry showed that 542 of 156,775 pre-school and school children had evidence of heart disease; 464 were congenital and 68 rheumatic in origin: 121 children with congenital heart defects had been treated surgically. Congenital cardiac disease ranked fifth in frequency among the causes of death in children. There was a diminution of acute rheumatic fever and rheumatic heart disease in children in 1961-62 when compared with data for previous years. Seventy-eight per cent of children in this series with a history of rheumatic fever were receiving continuous prophylaxis.

SOMMAIRE

L'enregistrement spécial des enfants de la ville de Toronto souffrant de cardiopathies a été mis sur pied pour (a) pouvoir suivre tous les enfants de cette agglomération qui sont atteints de cardiopathies, (b) supprimer l'étiquette "cardiaque" chez les enfants qui ont des murmures fonctionnels, (c) renseigner les parents sur les ressources thérapeutiques qui s'offrent à eux et (d) recueillir des statistiques utiles sur les cardiopathies chez l'enfant.

Le registre cardiaque de 1961-1962 montrait que 542 des 156,775 enfants d'âge préscolaire ou scolaire présentaient des signes d'affections cardiaques. De ce nombre, 464 avaient une origine congénitale et 68 une origine rhumatismale. Par ailleurs, 121 enfants souffrant de lésions cardiaques congénitales avaient été opérés. Parmi les causes de décès, chez l'enfant, les cardiopathies congénitales viennent au cinquième rang. En comparaison des chiffres des années précédentes, on constatait en 1961-1962 une réduction de fréquence du rhumatisme articulaire aigu et de sa complication cardiaque. Au sein de ce groupe, 78% des enfants ayant des antécédents de maladie de Bouillaud recevaient un traitement prophylactique continu.

A SPECIAL registry of children with heart disease was initiated in Toronto in 1948, under the joint auspices of the Department of Public Health of the City of Toronto and the Cardiology Department of the Hospital for Sick Children. The purpose of this program was (a) to provide registration and follow-up of children with all forms of heart disease, (b) to remove the "cardiac" label from the child with a functional or innocent murmur, (c) to acquaint parents with facilities available for the treatment of children with heart disease and with the need for prophylaxis in children with a history of rheumatic fever, and (d) to record useful data regarding heart disease in children.

The first report on the prevalence of heart disease in children in the City of Toronto was

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published by Gardiner and Keith[1] in 1951. Since that time, registration and follow-up has been maintained. The Registry has included pre-school, public school and separate school children with a history of rheumatic fever or congenital heart disease residing in the City of Toronto.

The purpose of this communication is (a) to report on the general findings of the City of Toronto Heart Registry and (b) to review some of the data obtained in the school heart survey during the past five years.

PROCEDURE

The school case-finding program utilized the help of the school physician, the family doctor and the public health nurses. The city's general hospitals, child health centres, cardiac clinics and private patients' files provided additional sources of information. Definite criteria for referral to the cardiac registry were set up. All cases falling into the following groups were referred: (1) every child with an organic heart murmur, (2) any child with a questionable functional murmur, (3) children who had a history of a "heart condition", in particular those whose physical activities had been restricted because of a "heart murmur", and (4) children who had a definite or doubtful history of rheumatic fever or chorea. The Registry was also notified of all deaths of children residing in Toronto when cardiac disease was recorded in the death certificate. In the city public and separate schools, all children referred were seen by one of the authors (V.R.). The parent was asked to be present. A history was obtained and a clinical cardiac examination was carried out. If further examinations such as electrocardiographic and radiographic studies were required, the child was also seen at the cardiac clinic of the Hospital for Sick Children or by cardiac consultants in the city, with consent of the family physician. Children unable to attend school because of rheumatic fever or cardiac defects were seen at home.

RESULTS

Prevalence of Heart Disease (1961-1962) (Table I)

(1) *Birth to 15 years.*—Of a total of 156,775 children resident in Toronto, of pre-school and elementary school age in 1961, 0.34% had evidence of organic heart lesions, 0.29% were cases of congenital, and 0.04% of rheumatic heart disease.

(2) *School-age children, 5-15 years.*—Of a total of 102,219 children in public and separate schools in the City of Toronto, 782 were referred for cardiac examination because of a history and clinical findings suggesting possible heart disease or rheumatic fever. Two hundred and twenty-three of these children (0.28% of the total school-age population) were found to have functional or innocent murmurs; 263 (0.25%) had congenital heart disease, and 66 (0.06%) had rheumatic heart disease. In the 1951 report by Gardiner and Keith of the 1948-49 cardiac survey in Toronto the incidence of congenital heart disease was 0.21% and of rheumatic heart disease 0.16%. In 1961-62, 160 children, or 0.15% of the school population, had a history of rheumatic fever without carditis compared with 0.17% in 1948-49.

TABLE I.—PREVALENCE OF HEART DISEASE IN TORONTO SCHOOL AND PRE-SCHOOL CHILDREN
(Rate per 10,000 population)

Classification	*0 - 15 years* Cases	Rate	*5 - 15 years* Cases	Rate
Population	156,775		102,219	
Number with heart disease	542	34.57	332	32.48
Congenital heart disease	464	29.59	263	25.73
Rheumatic heart disease	68	4.34	66	6.46
Other heart disease	10	0.64	3	0.29
Rheumatic fever without heart disease	160	10.21	160	15.65
Possible rheumatic fever without heart disease	32	2.04	31	3.03
Rheumatoid arthritis without heart disease	19	1.21	18	1.76
Functional heart murmur	244	15.56	223	21.82
Other cases referred to registry	21	1.34	18	1.76
Total cases on registry	1018	64.93	782	76.50

Sex Distribution—Birth to 15 Years (Table II)

Of the 464 cases of congenital heart disease 48.5% were male and 51.5% female. Of the 68 cases of rheumatic heart disease 44.1% were male and 55.9% were female.

TABLE II.—SEX DISTRIBUTION, BIRTH TO 15 YEARS—POPULATION 156,775

Sex	*Congenital heart lesions* Number	%	*Rheumatic heart lesions* Number	%
Male	225	48.49	30	44.12
Female	239	51.51	38	55.88
Total	464	100.00	68	100.00

AGE INCIDENCE

(1) *Congenital heart disease* (Figs. 1 and 2).—The largest number of cases of congenital heart disease are detected when the child is under the age of 1 or 2 years. At 5 years of age when the child is entering school, heart murmurs are again detected and new cases of congenital heart disease diagnosed. Analysis of the age when the murmur is first noted (Fig. 2) shows that during the first year of life most of the murmurs detected are organic in origin. After the first year, and particularly at 5 years of age when the child enters school, the majority of murmurs heard are functional.

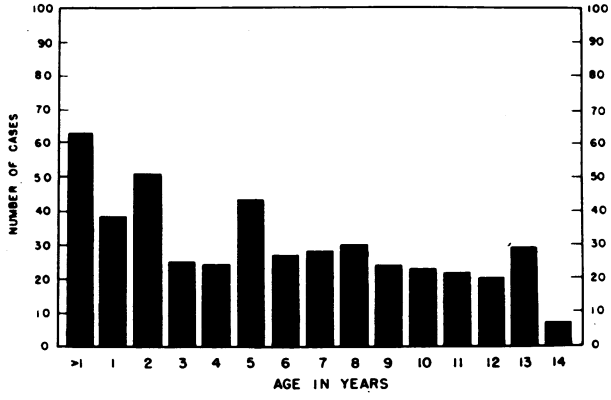

Fig. 1.—Congenital heart disease—age incidence, City of Toronto, 1961-1962.

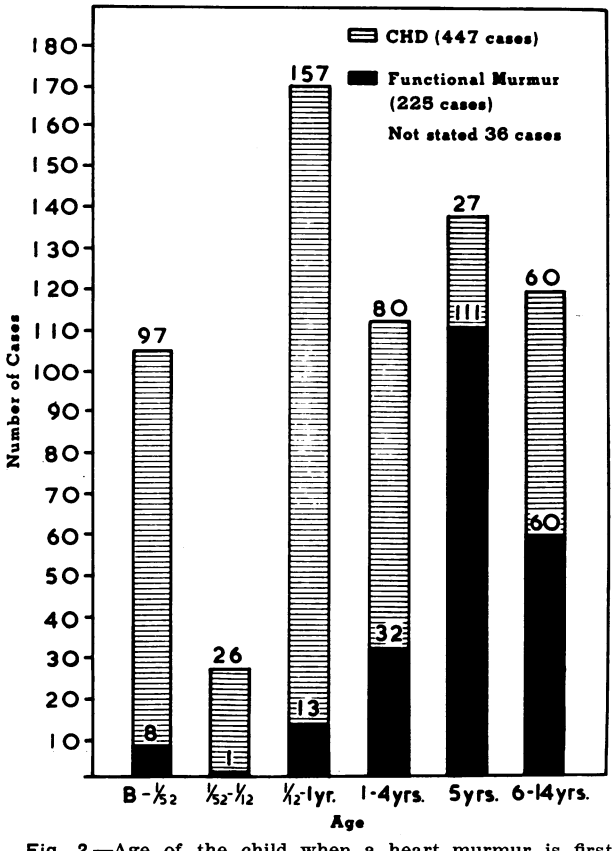

Fig. 2.—Age of the child when a heart murmur is first noticed—City of Toronto, 1961-1962. (CHD = congenital heart disease.)

2. *Rheumatic heart disease* (Fig. 3).—The distribution of rheumatic heart disease according to age shows the greater number of cases occurring in the teens.

Anatomic Diagnosis—Birth to 15 Years (Fig. 4)

Ventricular septal defect was the most commonly occurring type of congenital cardiac defect: it was diagnosed in 30% of cases with heart disease in the 0-15 year age group. Further analysis of this group reveals that 67 cases (46% of the group) had small defects with a pansystolic murmur audible along the lower left sternal border, not conducted and not associated with a thrill. Another 67 cases (46%) had a harsh pansystolic murmur

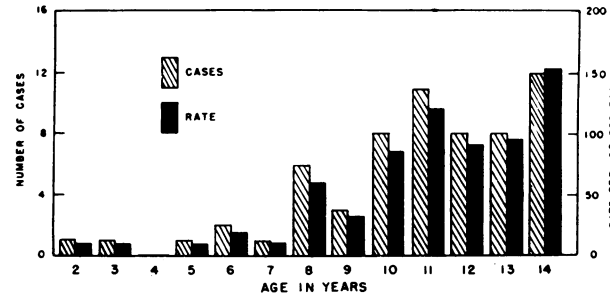

Fig. 3.—Rheumatic heart disease—age incidence, City of Toronto, 1961-1962.

with a thrill. Ten cases in this last group (15%) had the defect closed surgically. Eleven cases (8% of the total ventricular septal defect group) had pulmonary hypertension; three of these have had a banding operation of the pulmonary artery and one child had the defect closed surgically.

Atrial septal defect is next in order of frequency. Sixty per cent of this group had the defect closed surgically.

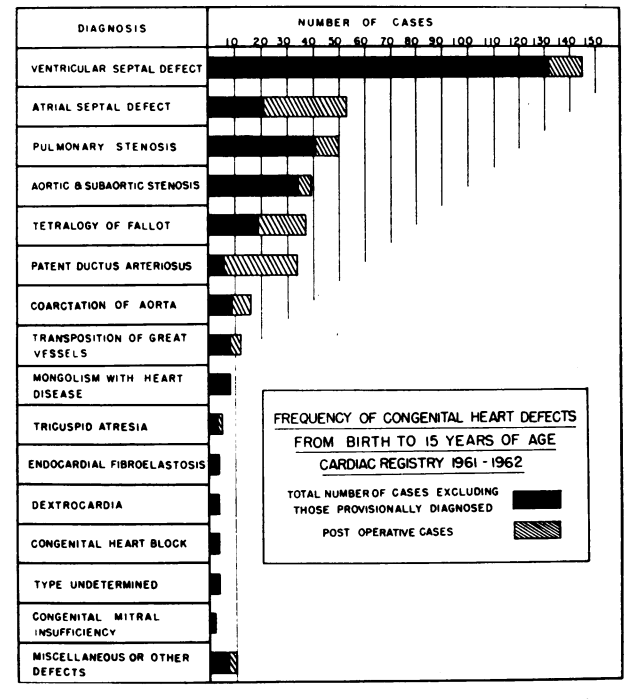

Fig. 4.—Congenital heart disease—frequency of various defects, birth to 15 years, City of Toronto, 1961-1962.

There were 50 cases of pulmonary stenosis with normal aortic root. Twenty-five of these (50%) were catheterized and nine of this group required operation. Fifty per cent of the cases of pulmonary stenosis were mild, diagnosed clinically and not catheterized.

Aortic stenosis was next in order of frequency and in this group 13% had surgery performed.

Tetralogy of Fallot was diagnosed in a total of 37 cases; 18 of them were attending school. Fifty per cent of the total group had undergone surgery; 11 had a Blalock operation, four had total correction, and three had both types of operation. There

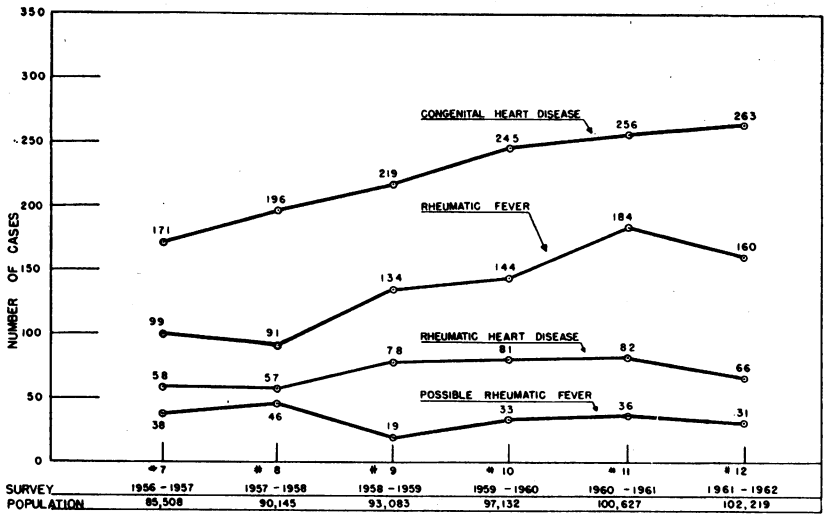

Fig. 5a.—Changing incidence of congenital heart disease, rheumatic fever, rheumatic heart disease and possible rheumatic fever during the past six years, City of Toronto, 1961-1962.

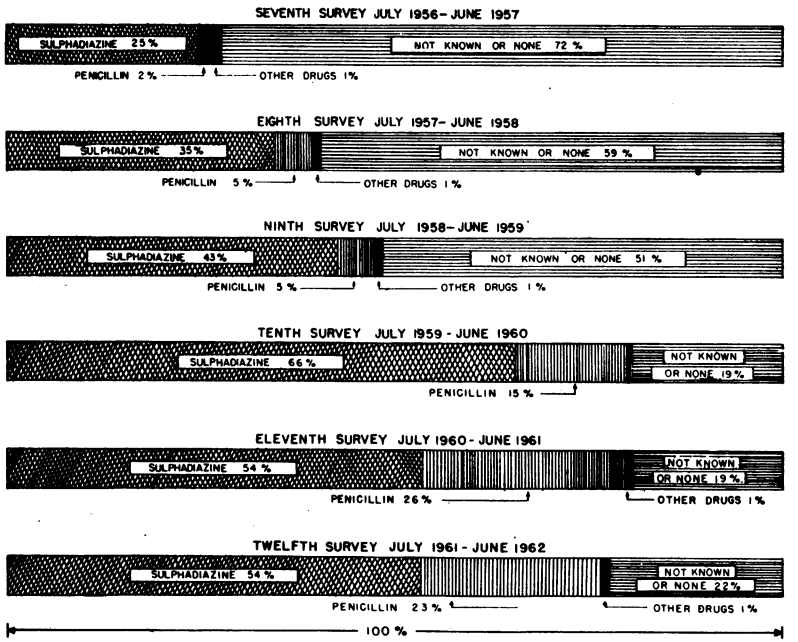

Fig. 5c.—Prophylaxis: antibiotics used by school children with a history of rheumatic fever or rheumatic heart disease.

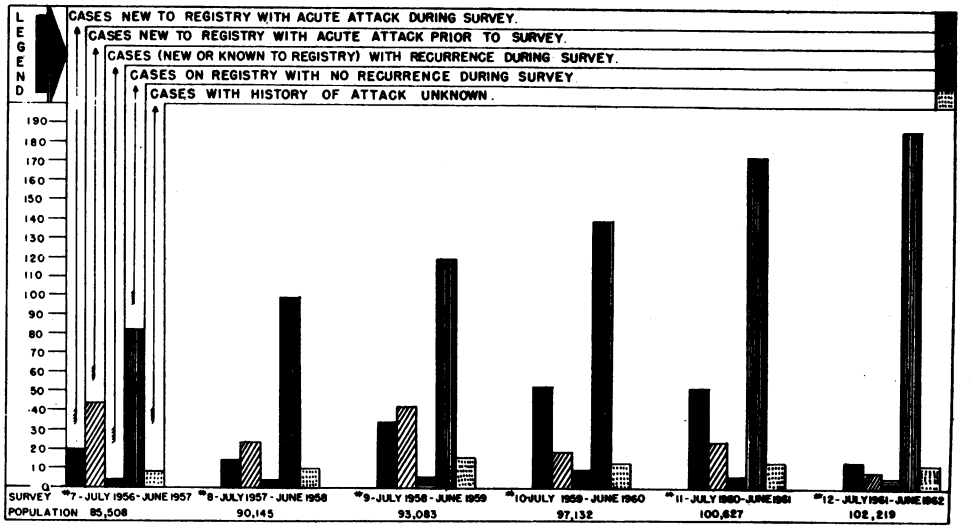

Fig. 5b.—Analysis of cases of rheumatic fever (active and inactive) and rheumatic heart disease, City of Toronto school children.

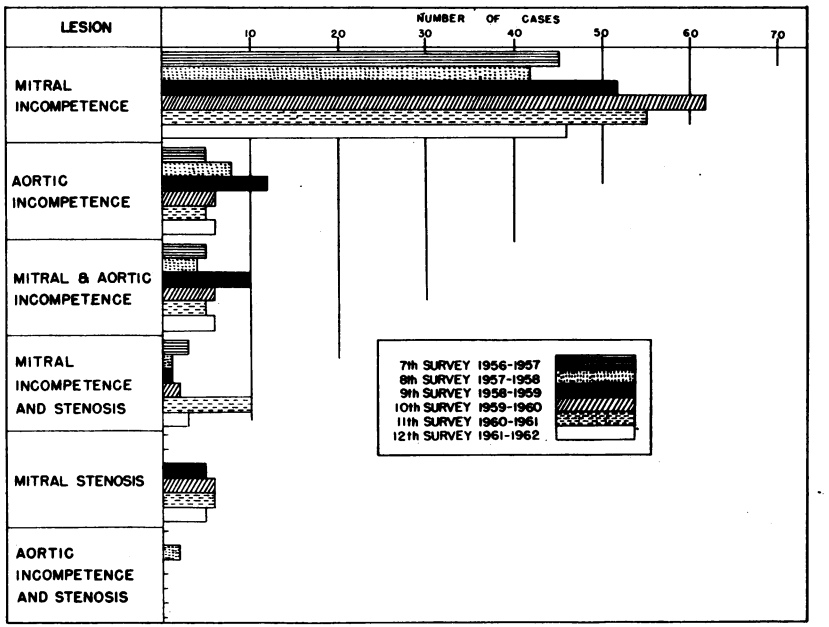

Fig. 5d.—Rheumatic heart disease in school children—types of lesion encountered.

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were three deaths in the operated group, two following total correction and one following a Blalock procedure. In the latter case the operation was performed at 10 days of age.

Patent ductus arteriosus is rarely first diagnosed in the school-age child. The ductus murmur is usually noted during examination of the pre-school child and operation is performed before the child enters school. It is suspected that some patients with this lesion who had been operated upon were probably missed by the cardiac registry. Of the five cases of patent ductus who were not operated upon, three were children of school-age whose parents had not consented to treatment and two were pre-school children awaiting surgery.

TABLE III.—CARDIAC DISEASE COMPARED WITH SOME OTHER CAUSES OF DEATH IN TORONTO, 1961—BIRTH TO 14 YEARS*

	Deaths	*% of total group*
Total deaths—all causes	423	100.0
Immaturity	78	18.4
Accidental causes	58	13.7
Malformations—all types other than congenital heart disease	46	10.9
Postnatal asphyxia and atelectasis	41	9.7
Congenital cardiac deaths	36	8.5
Birth injury	34	8.0
Pneumonia	32	7.6
Malignant neoplasms	10	2.4
Gastroenteritis	8	1.9
Erythroblastosis	7	1.6
Simple meningitis	5	1.2
All other causes	68	16.1

*From the Department of Public Health, Statistical Services, Toronto.

Mortality (Table III)

There were 423 deaths in children under 15 years of age in the City of Toronto in 1961. Thirty-six (8.5%) died of congenital heart disease. There were no deaths due to rheumatic heart disease. Two-thirds of the patients with congenital heart defects died under one month of age; eight patients (25%) died postoperatively.

Rheumatic Fever (Fig. 5)

The changing incidence of rheumatic fever and rheumatic heart disease in City of Toronto school children over the past six years is shown in Fig. 5a. As other surveys have indicated, the prevalence rate of congenital heart disease in school children has increased over the past years and exceeds the rheumatic heart disease prevalence rate. There was an increase in the number of cases of acute rheumatic fever in 1959 and 1960, with no corresponding increase in cases of rheumatic heart disease. Fig. 6, which is a map of the City of Toronto, shows that the new cases of rheumatic fever during those years were particularly prevalent in the west end districts of the City. Further analysis at that time showed that children of families from Mediterranean countries were mainly affected. The most recent cardiac survey (1961-62) shows a reduction of acute rheumatic fever (Fig. 5b) and rheumatic heart disease (Fig. 5a) in the City of Toronto school children when compared with the previous three years. The number of cases with recurrences of rheumatic fever remains small every year. Fig. 5c shows that the prophylactic program has improved over the past six years, only 22% of the cases on the Registry remaining without continuous prophylactic treatment. Analysis of the frequency of rheumatic valvular disease (Fig. 5d) shows that mitral incompetence was the most commonly encountered lesion.

Rheumatic Fever (with a preceding streptococcal infection)

One hundred and twelve children (50% of the total number of children with a history of rheumatic fever with or without heart disease) had evidence of preceding streptococcal infection. Ten per cent of these were adequately treated and 90% were inadequately treated (i.e. penicillin therapy was not continued for 10 days) or were untreated.

DISCUSSION

Increased awareness of heart disease on the part of the general public, the advances in corrective surgery for various types of heart disease, and the development of effective prophylaxis against recurrent attacks of rheumatic fever have made the diagnosis, follow-up and education regarding heart disease among children a valid public health activity. The Toronto Heart Registry reflects the true incidence of the various heart conditions in school children and gives some idea of the incidence of heart disease in pre-school children. Accurate diagnosis of a heart murmur is important now, as is the "de-labelling" of a murmur which is functional or innocent. In the report by Gardiner and Keith[1] of the 1948-49 cardiac survey in Toronto the prevalence of heart disease in school children was 0.37% (0.16% rheumatic and 0.21% congenital cardiac defects). In 1961-62 the incidence of heart disease was 0.32% (0.06% rheumatic and 0.25% congenital cardiac defects). The change is probably in part due to the increased diagnostic acumen of cardiologists as well as to an over-all decrease of not only the prevalence but also the severity of rheumatic fever.

Many reports of cardiac registries are to be found in the literature. Rheumatic fever has been the subject of most of these earlier studies, since only recently has diagnosis of congenital heart disease been made with greater ease. Great caution must be exercised in comparing prevalence rates for heart disease reported from different studies. Differences in age range of the groups and differences in sampling methods and interpretation of findings make it difficult to compare one study with

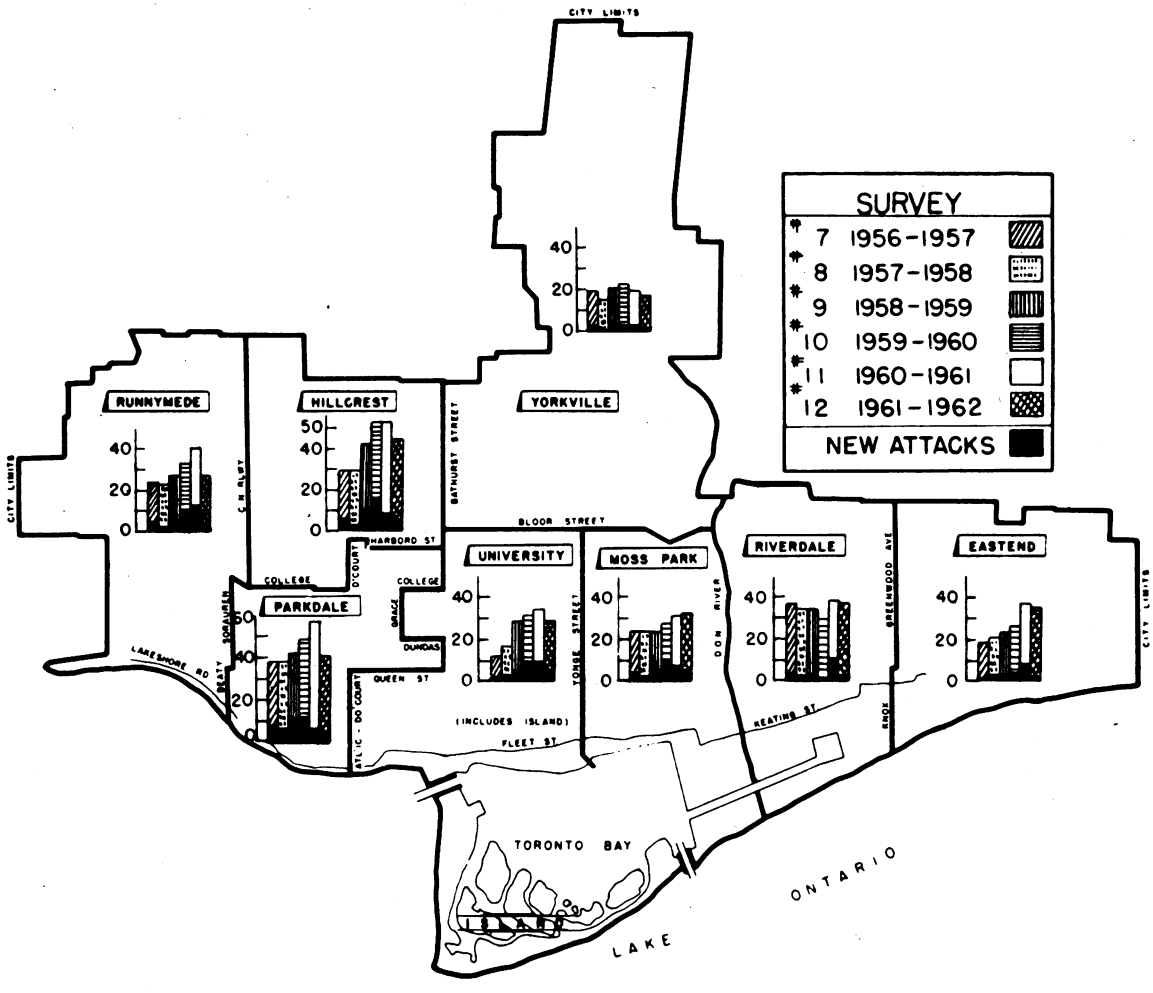

Fig. 6.—Map of the City of Toronto showing distribution of cases of rheumatic fever in public health districts.

another. In a recent report by Morton,[2] 27 heart disease surveys are compared and the difficulties of this comparison are revealed. The author points out that post-streptococcal rheumatic fever may be only one of several stimuli which may cause chronic valvular heart disease. A definite history of rheumatic fever was absent in 12 out of 66 school children with acquired "rheumatic" valvular heart disease in the City of Toronto. In this report these cases have been grouped with those who had a history of rheumatic fever. Some of these children did have a history of recurrent bouts of tonsillitis. There have been no deaths due to rheumatic fever during the past five years in the City of Toronto children. The number of congenital heart defects treated surgically in 1947-49 was 30; in 1961-62 121 were subjected to surgical treatment.

SUMMARY

A Cardiac Registry has been maintained by the Department of Public Health of the City of Toronto, providing follow-up of children in the city with all forms of heart disease. The diagnostic facilities of the Cardiology Department of the Hospital for Sick Children have been available for these children. The present observed prevalence rate of heart disease in the City of Toronto elementary school children is 0.32%. Of those with definite organic heart disease 79% had congenital and 19% rheumatic lesions. Corresponding data reported 13 years previously for the Toronto school population were 55% and 45%, respectively.

The program of the City of Toronto Heart Registry has resulted in (a) a better follow-up of those children correctly diagnosed as suffering from heart disease, (b) the de-labelling of children incorrectly diagnosed as having heart disease or rheumatic fever, and (c) the close supervision and follow-up of children with a history of rheumatic fever and rheumatic heart disease, 78% of whom are receiving continuous prophylactic treatment at the present time.

Grateful appreciation is expressed to the Nursing Division of the Department of Public Health of the City of Toronto, whose interest and co-operation have made this project possible.

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2. MORTON, W.: *Amer. J. Public Health*, 52: 991, 1962.