

Causes of Blindness in Canada:

An Analysis of 24,605 Cases Registered with The Canadian National Institute for the Blind

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ABSTRACT

A survey of blind persons in Canada, based on registrations with The Canadian National Institute for the Blind (C.N.I.B.), is reported. This is the first study of its type having national scope and based on data registered in a central file. It covered 24,605 living registered blind persons ranging from premature infants to very elderly persons. Causes of blindness are broken down with respect to topography (site and type of lesion) and etiology. In terms of frequency, the principal causes were lesions affecting the globe (e.g. glaucoma, myopia), 36%; the retina, 23%; the lens, 16%; and the optic nerve, 11%. In this study, 32% of the blindness was due to prenatal causes. The prevalence of blindness per 100,000 persons in Canada, based on C.N.I.B. data, was 131, varying among the provinces from 108 to 376. Serious ocular disease was four times more prevalent than blindness; 101,436 such cases (the prevention group) were listed by the C.N.I.B.

SOMMAIRE

Il s'agit d'un relevé des aveugles au Canada, supporté par les enregistrements à l'Institut National Canadien pour les aveugles (C.N.I.B.), relevé qui est le premier du genre à l'échelle nationale et qui s'appuie sur les statistiques d'un registre central. Il couvre 24,605 aveugles vivants, allant des prématurés aux vieillards. Les causes de cécité sont réparties par rapport à la topographie (siège et type de lésion) et à l'étiologie. Dans l'ordre de la fréquence, les principales causes provenaient de lésions affectant le globe oculaire (par ex. glaucome, myopie) 36%, la rétine 23%, le cristallin 16% et le nerf optique 11%. Dans la présente étude, 32% des cas de cécité relevaient de causes prénatales. La proportion de cécité par 100,000 habitants du Canada, s'appuyant sur les données du C.N.I.B., était de 131, variant, suivant les provinces, de 108 à 376. Les affections oculaires graves étaient quatre fois plus nombreuses que la cécité: 101.436 cas semblables (le groupe de la prévention) ont été enregistrés par C.N.I.B.

BLINDNESS, a devastating world-wide affliction, has attracted the interest of both individuals and groups in many countries. The long search for a comprehensive international system of classification of the causes of blindness has, paradoxically, been hampered by the great interest of the public, because in many countries competing organizations were set up to investigate these matters.

Canada has been fortunate in that there are available records of eye examinations of blind people in all parts of the country that have been collected under one roof. Since 1918 these records of The Canadian National Institute for the Blind have been assessed and categorized, and are kept up to date in one central file in Toronto.

By arrangement with the Government of Canada, The Canadian National Institute for the Blind was charged with the rehabilitation, training and provision of a variety of services for blind veterans

of the First World War. These benefits were so well administered that they were gradually extended to cover registered civilian blind persons of Canada's 10 provinces and the far northern regions. It should be mentioned that other agencies, both voluntary and governmental, also provide rehabilitation and other services to the blind in Canada. The story of The Canadian National Institute for the Blind, a voluntary agency, and its war-blinded director who presided over the expansion of its work will soon be published by McClelland & Stewart Ltd., Toronto.

DEFINITION OF BLINDNESS

In Canada the definition of blindness (as amended by Federal Order in Council on July 25, 1962) reads as follows: "A person is considered blind if the visual acuity in both eyes with proper refractive lenses is 20/200 (6/60) or less with the Snellen chart or equivalent, or if the greatest diameter of the visual field in both eyes is less than 20 degrees." This definition amended, without changing the meaning, a former standard that had been approved by the Canadian Ophthalmological Society in 1953.

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This 1962 standard is used by the Blindness Control Section of the Department of National Health and Welfare to administer the payment of assistance, and independently by The Canadian National Institute for the Blind in registration of blind persons. For the purposes of coding, blindness in an individual is determined for the better of the two eyes for vision and field. "Guiding sight" is a term used to describe the amount of vision, just less than 3/60 (10/200), that enables a person to move about unaided.

DESCRIPTION OF SURVEY

The present survey was the third such conducted in Canada and differed from the preceding surveys in 1946¹ and 1954² in that each patient's history was studied by the consulting ophthalmologist who was responsible for the cross-classification of topography (site and type) and etiology (primary cause of blindness). In respect of trauma as a cause of blindness, a supplementary code indicated the individual's activity at the time of injury. This survey is probably the first to include blind persons of all ages in one nation in a punch-card file that will be continued indefinitely.

This survey is based on an analysis of the records of those persons registered as blind with the C.N.I.B. It is not a national survey of all blind persons in Canada, and it should be noted that registration of blindness is not mandatory in Canada. The C.N.I.B. registry is not of all blind persons, but it is the most comprehensive of its kind in Canada.

The directors of The Canadian National Institute for the Blind (C.N.I.B.) authorized this third survey because of the steady increase in the number of registered blind persons. Medical advances in the treatment of serious ocular conditions and active preventive work have not halted this increase. The survey reported in this communication also looked toward the future control of the complex of services available to the blind person, as well as the simplification of future periodic surveys on the causes of blindness. The individual punch-cards prepared for every person registered with the C.N.I.B. as blind contain much information beyond the ophthalmic codification, such as the blind person's status, place of residence, services needed, and so on, which would be useful to those responsible for the administration and integration of the work of some 50 branches of the C.N.I.B.

About 1740 new cases are added yearly to the blind group, and an additional 278 persons are transferred from the "prevention group". Deletions by death amounted to 1384 cases, and transfers from the blind to the prevention group numbered 180 cases. When good vision in each eye is obtained after surgery, the patient is placed in Category 3, which designates those individuals who receive optical aids and assistance only.

From this time onward, the coding routine is to be carried out on each new blind person admitted to the registry, at the time of registration. Each day the findings are transferred to lists for processing by the IBM computer staff. It is expected that periodic reviews for causes of blindness will be made to detect or confirm trends in the various categories being studied.

RESULTS OF SURVEY

The preliminary report of the major causes of blindness that is here recorded is based on the records of 24,671 people of all ages—the living C.N.I.B.-registered blind persons in this country. The reports of eye examinations carried out on each of the 12,680 males (51.40%) and 11,991 females (48.60%) in this group are deposited centrally at Toronto, and these reports were coded prior to the preparation of individual punch cards. The C.N.I.B. national register includes the names of blind persons of all ages—from premature birth to five men and eight women over 100 years of age (Table I).

TABLE I.—AGE DISTRIBUTION OF BLIND PERSONS REGISTERED WITH THE C.N.I.B.

Age (in years)	Cases	Per cent
100 and over.....	13	0.5
70 - 99.....	9041	36.65
65 - 69.....	2329	9.44
40 - 64.....	7979	32.34
21 - 39.....	3053	12.37
7 - 20.....	1891	7.66
6 and under.....	365	1.48

The status of persons in the blind group is shown in Table II. The blind group is referred to as the "Reg." (Registered) group. There are two other groups: No. 2 (Prevention) and No. 3 (Aids).

TABLE II.—OTHER CHARACTERISTICS OF THE REGISTERED GROUP

	Cases	Percent
<i>A. Marital status*</i>		
Married women.....	8346	33.83
Single women.....	3645	14.77
<i>B. Vision</i>		
Nil or light perception.....	5948	24.11
Guiding sight.....	18,723	75.89
<i>C. Source of cases</i>		
Mentally ill (in institutions).....	799	3.24
Workmen's Compensation Board.....	298	1.21
War-blinded.....	327	1.33
Blindness allowance.....	8286	33.59
Indians and Eskimos.....	610	2.47

*Marital status of men is not recorded by the C.N.I.B.

At the time the survey ended, 101,436 patients suffering from serious ocular disability were placed in the "Prevention" group. It is estimated that 539 persons per 100,000 in this group may progress to blindness, as defined above.

TABLE III.—AGE IN YEARS AT REGISTRATION (MAJOR CAUSES ONLY)

	0	0-8	9-18	19-64	65-69	70+
Cataract.....	718	164	190	1569	246	835
Glaucoma.....	6	1	9	1388	239	741
Myopia.....	146	84	327	1464	85	126
Retinopathy.....	5	6	24	889	133	403
Macular degeneration.....	49	23	68	354	87	726
Retinal pigmentation.....	98	54	204	898	9	29
Multiple anomalies.....	400	102	184	163		2
Detached retina.....	4	5	31	333	20	44

Age in years, at the time of registration, for the major causes of blindness in Canada is shown in Table III.

Absolute blindness (no perception of light) is not required for registration. In Canada 6/60 (20/200) vision is accepted as blindness when glasses fail to improve the vision of the person beyond this level—such a person sees at only six metres (20 feet) what is normally seen at 60 metres (200 feet). The definition of blindness was applied strictly, but defective fields of vision accounted for the registration of 710 persons with better than 6/60 (20/200) who are not included in Table IV.

TABLE IV.—VISION AT REGISTRATION

	No. of cases	O-L.P.	1-3/60	3-6/60*
Cataract.....	3723	759	1695	1216
Glaucoma.....	2384	755	812	537
Myopia.....	2232	106	1072	1041
Retinopathy.....	1460	196	782	467
Macular degeneration...	1318	32	656	621
Retinal pigmentation...	1292	233	696	621
Multiple anomalies.....	852	162	317	355
Detached retina.....	437	188	171	77

*O-L.P. = Absolute blindness—perception of light only.

1-3/60 = The symbol normally seen at 60 metres (200 feet) is seen only at one to three metres.

3-6/60 = The symbol normally seen at 60 metres is seen only at three to six metres.

Classification According to Site and Type, and Etiology of Lesions Causing Blindness

Codification for topography (site and type of lesion causing blindness) and etiology was the responsibility of the consulting ophthalmologist who examined each individual's record which often included reports of many examinations. This survey was begun late in 1959, using some modifications to include causes of blindness that have been omitted from the 1957 National Society for the Prevention of Blindness (N.S.P.B.) cross-classification³ (see Table V gatefold on page 267). Some of these are amblyopia, sympathetic ophthalmia and those surgical procedures for cataract in which, after operation, the patient had remained in the blind group or was later returned to it. The C.N.I.B. consultant recorded the patient's age at the time of ocular involvement, but the presence of similar

familial visual defects, if other close relatives were affected, was indicated by the registrar.

Code for Age

In the work of the C.N.I.B., and in applying preventive measures, age is so important that it is recorded twice. The Annual Report of The Canadian National Institute for the Blind gives the age at the time of registration as blind. The coding used in this survey reports the age at onset of blindness, to distinguish between prenatal and postnatal causes in recording blindness due to toxoplasmosis and histoplasmosis, infection, gonorrhoea, syphilis, ulceration and phthisis, cataracts, trauma and retrobulbar disease. For many of these diseases the onset of the condition may precede, sometimes by years, the time of registration, as in retinitis pigmentosa which is a genetic defect.

Cross-Classification

With modification, the 1957 cross-classification of the National Society for the Prevention of Blindness (U.S.A.) (N.S.P.H.-114A) was used. It is a flexible system and the master sheet (Table V) shows the topography (site and type), a whole number coded as 110-990, and etiology coded as 11.0-99.0. For trauma, there is a supplementary classification to show the individual's activity at the time of injury. For example, a firearm using explosive may cause blindness in war .05; at play or sports .03, by violence and suicide or murder attempt .08, etc. Table VI shows for each category the N.S.P.B. code number, the condition and the number of blind persons reported for each type or cause.

RESULTS

Prevalence of Blindness

This national survey of blindness in Canada, based on C.N.I.B. data, ended on March 31, 1963, and, using the estimate of the National Bureau of Statistics for the population of Canada as 18,913,000, Table VII shows the percentage of blind persons registered with the C.N.I.B. in each province and the prevalence per 100,000.

In this temperate-zone nation that extends from its southern boundary to three oceans, the C.N.I.B. provincial prevalence of blindness varies from a low of 108 per 100,000 to 376 per 100,000 for the North West Territories that are above the latitude, 60th parallel north. In 1946, Aylesworth¹ obtained a prevalence of blindness of 105 per 100,000 population and in 1954 MacDonald² noted that this C.N.I.B. figure had increased to 127. The present survey shows a further increase to 131 for the 24,671 blind persons. The study only includes reports on 24,605 persons because the survey ended just before the C.N.I.B. Annual Report of March 31, 1963.

TABLE VIA.—CAUSES OF BLINDNESS—24,605 CASES

N.S.P.B. Code number	Type and site of affection	No. of cases
<i>Eyeball in general—9245 cases</i>		
110	Glaucoma	2384
130	Panophthalmitis and endophthalmitis	57
140	Malignant myopia	2232
141	Albinism	380
142	Anophthalmos (excluding surgical)	41
143	Megalophthalmos	292
144	Microphthalmos	298
145	Aniridia	128
146	Coloboma, any part (excluding surgical)	182
147	Multiple structural anomalies	852
148	Other specified structural anomalies	94
149	Other not specified structural anomalies	4
151	Disorganized eyeball—phthisis	2059
158	Other degeneration—specified	52
159	General degeneration—not specified	10
180	Other general affection—specified	174
190	Other general affection—not specified	6
<i>Cornea—1456 cases</i>		
311	Interstitial keratitis	295
312	Phlyctenular keratitis	68
313	Ulcerative keratitis	225
314	Sclerosing keratitis	16
315	Hypopyon with keratitis	1
318	Other keratitis—type specified	121
319	Keratitis type—not specified	94
320	General dystrophy, degeneration	115
351	Vascularization without ulceration	41
352	Vascularization with ulceration	36
359	Vascularization, ulceration not specified	222
360	Keratomalacia	3
370	Keratoconus	144
380	Other affection—specified	68
390	Affection—not specified	7
<i>Lens—3904 cases</i>		
410	Cataract	3723
420	Dislocated lens	173
480	Other affection—specified	8
<i>Uveal Tract—1634 cases</i>		
510	Iritis	148
520	Iridocyclitis and uveitis	646
550	Choroiditis	212
560	Chorioretinitis	457
580	Other affection—specified	167
<i>Retina—5563 cases</i>		
610	Retinitis or retinopathy	1460
620	Retinal hemorrhage	243
630	Retrolental fibroplasia	336
640	Detached retina	437
650	Retinitis pigmentosa	1292
660	Macular degeneration	1318
670	Other retinal degeneration	363
680	Other affection—specified	113
<i>Optic nerve—2556 cases</i>		
710	Atrophy	1398
720	Neuritis (papillitis)	93
730	Papilledema (choked disc)	34
740	Neuroretinitis	8
750	Retrobulbar and intracranial lesions	956
780	Other affection—specified	65
<i>Vitreous—126 cases</i>		
810	Hemorrhage	123
880	Other affection—specified	3
<i>Site not specified—121 cases</i>		
980	Site not specified	74
990	No report on site and type of affection	47

TABLE VIB.—CAUSES OF BLINDNESS—24,605 CASES

N.S.P.B. Code number	Etiology	No. of cases
<i>Infectious diseases—3065 cases</i>		
11.0	Diphtheria	4
12.0	Gonorrhea, excluding ophthalmia neonatorum	1
13.0	Measles	102
14.0	Meningitis	115
15.0	Ophthalmia neonatorum	801
16.0	Scarlet fever	27
18.0	Smallpox	22
19.1	Prenatal syphilis	318
19.2	Syphilis acquired after birth	308
19.9	Syphilis, prenatal or postnatal—not specified	46
20.0	Trachoma	144
21.0	Tuberculosis	235
22.0	Typhoid fever	16
23.0	Rubella	1
25.0	Toxoplasmosis	31
28.0	Other infectious disease—specified	353
29.0	Infectious disease—not specified	541
<i>Trauma—1339 cases</i>		
30.0	Chemical causing burn	89
31.1	Radiation: infra-red	2
31.2	Radiation: gamma	6
32.0	Other cause of burn	8
33.0	Firearm using explosive	122
35.0	Fireworks, any type	6
36.0	Other explosive	282
37.0	Sharp or pointed object	136
38.0	Blow or fall	268
39.0	Foreign body in eye	120
48.0	Other agent or source—specified	143
49.0	Agent or source not specified	157
<i>Poisonings—441 cases</i>		
51.0	Methyl alcohol	63
53.0	Lead	7
54.0	Quinine	1
55.0	Excessive oxygen	332
58.0	Other poison—specified	34
59.0	Kind of poison not specified	4
<i>Neoplasms—355 cases</i>		
61.0	Retinoblastoma	52
62.0	Melanosarcoma	6
68.0	Other types—specified	286
69.0	Type not specified	11
<i>Diseases not elsewhere classified—3831 cases</i>		
71.0	Anemia and other blood disease	60
72.0	Diabetes mellitus	1238
73.0	Nephritis and other kidney disease	62
74.0	Vascular	1167
75.0	Multiple sclerosis	167
76.0	Disease of pregnancy	37
77.0	Nutritional deficiency	84
78.0	Other not elsewhere classified—specified	999
79.0	General not elsewhere classified or specified	17
<i>Prenatal influence not elsewhere classified—7899 cases</i>		
81.0	Genetic origin, established by family history	3904
82.0	Genetic origin, presumed	3979
89.0	Prenatal influence—cause not specified	16
<i>Etiology undetermined or not specified—7675 cases</i>		
91.0	Unknown to science	6451
92.0	Evidence insufficient for diagnosis	786
99.0	No report on etiology	438

TABLE VII.—PREVALENCE OF BLINDNESS BY PROVINCE PER 100,000

	Population	Per cent	Registered	Per cent	Prevalence
Newfoundland.....	482,000	2.55	773	3.13	160
Nova Scotia.....	758,000	4.01	1465	5.94	193
New Brunswick.....	614,000	3.25	1307	5.30	212
Prince Edward Island.....	107,000	.56	147	0.6	137
Quebec.....	5,475,000	28.95	6496	26.33	118
Ontario.....	6,462,000	34.17	7580	30.62	117
Manitoba.....	951,000	5.03	1439	5.83	151
Saskatchewan.....	934,000	4.94	1315	5.33	140
Alberta.....	1,408,000	7.44	1534	6.22	108
British Columbia.....	1,697,000	8.97	2521	10.22	148
North West Territories.....	25,000	.13	94	.38	376
	18,913,000	100	24,671	100	131

A condensed synopsis of the approximate results of the cross-classification according to etiology, and type and site of lesions causing blindness is shown in Table VIII.

TABLE VIII.—CLASSIFICATION OF BLINDNESS ACCORDING TO ETIOLOGY, TYPE AND SITE*
(REGISTERED 24,671—PRESENT STUDY 24,605)

Etiology	99.5%	Site and type	99.5%
Infectious.....	12	Globe.....	36
Trauma.....	5	Cornea.....	5
Poisonings.....	2	Lens.....	16
Neoplasms.....	1.5	Uvea.....	7
Diseases N.E.C.**.....	16	Retina.....	23
Prenatal influence		Optic nerve.....	11
Established.....	16		
Presumed.....	16	Vitreous.....	1
No report.....	5	No report.....	0.5
Unknown to science... ..	26		

*Per cent is shown to the nearest one-half.

**N.E.C. = not elsewhere classified.

Causes of Blindness by Site and Type

Glaucoma.—Glaucoma, excluding the infantile congenital type, accounted for 10% of the blindness in the registered group—2384 cases. There was evidence of a familial tendency to glaucoma in 187 patients. Among those with glaucoma, there were 22 diabetics. With respect to cause, the remaining 2138 cases were classified as “unknown to science”. Various other known causes not elsewhere classified accounted for an additional 37. Vision was nil or reduced to light perception in 755 individuals; 812 had 3/60 vision or less, and 537 had less than 6/60. Limited fields of vision led to the registration of 279 persons whose vision was better than 6/60. The greatest number, 1388 patients, were registered when they were between the ages of 19 and 64.

Myopia.—Malignant myopia was a major cause of blindness in 2232 cases (9%). The vision in 106 persons was nil or reduced to light perception only; it was 3/60 or less in 1072 and 6/60 or less in 1041. The majority, 1464 persons, were registered when they were between the ages of 19 and 64 years. Prenatal and familial influences were noted in the blindness of 801 persons in the myopia group, and 25 had severe anemia or other blood diseases.

Phthisis bulbi.—This condition has been reported in Canada for nearly 50 years. In this survey, 967 patients had this lesion in whom it was a chronic condition associated with a vague history of infectious disease; of these, 64 had ophthalmia neonatorum. In 773 the condition was due to trauma,

and in 67 to neoplasms. Diseases not elsewhere classified in the National Society for the Prevention of Blindness (U.S.) system accounted for 80 cases, and 120 were due to prenatal influence. There was no report on etiology in 19 cases. Phthisis bulbi accounted for 8% of all the blindness encountered in this study.

Cornea.—Interstitial keratitis was the major cause of blindness due to corneal disease (295 cases). Corneal lesions caused blindness in 1456 persons, 6% of the entire group.

Cataract.—Cataract, one of the major causes of blindness, accounted for over 15% of the total (3723 cases). Of these, 1349 cataracts were established as or presumed to be congenital. Other causes were diabetes (225 cases) and traumatic lesions (198).

Early in the survey it was noticed that surgical extraction of cataract did not always lead to the removal of the patient from the blind group, because of complications such as high myopia, trauma, macular degeneration, retinitis pigmentosa and the retinopathies.

Prenatal cataract was present in most of the patients who, after operation, remained in or later returned to the blind group. Of those with established congenital cataracts, 238 persons (41%) remained blind and of those with presumed congenital cataracts, 763 (54%) were blind early or late after operation. In all other types of cataracts, traumatic, diabetic, senile, etc., 590 persons (23%) returned, early or late, to the blind group. Of those with dislocation of the lens, 12 were due to trauma; the rest, 161, were congenital.

Uveal tract.—Iridocyclitis and uveitis (646 cases) and chorioretinitis (457 cases) were the major causes of blindness in the 6½% that were registered with uveal pathology.

Retinal lesions.—Retinal pathology accounted for 5563 cases—23% of the blindness in this survey. Specified retinopathies numbered 1460; of these 815 were diabetic and 456 were vascular. Macular degeneration (1318 cases) was followed in order of frequency by retinitis pigmentosa (1292 cases). Retinal detachment (437 cases) was more frequent than retrolental fibroplasia (336 cases). Hemorrhage and degeneration and specified conditions accounted for the remainder, 720 cases. Among those with blindness due to disorders affecting the retina, 1786 cases were considered to be due to familial and prenatal causes.

Optic nerve and central nervous system.—The central nervous system was involved in 10.5% of those registered with the C.N.I.B. as blind; atrophy of the optic nerve was present in 1398 cases. Retrobulbar and intracranial lesions numbered 956.

Vitreous.—Vitreous hemorrhage occurred 123 times.

Not specified.—Only ½% of all the registered blind were recorded under “site not specified” or ill-defined.

Causes of Blindness by Etiology

Infectious disease.—The diseases listed in the 1957 N.S.P.B. classification (114A) as "Infections Specified but not listed" and "Infections not Specified" accounted for 3065 cases of blindness (12%). Ophthalmia neonatorum is a condition that is now well under control but blindness of long standing caused by this disease is difficult to diagnose. This fact might account for many of the 541 cases in this group in which evidence was insufficient for diagnosis.

Syphilis.—Another cause, syphilis, was responsible for only 672 cases of blindness, less than 3% of cases in this study. Ophthalmologists of long experience do not now find syphilis to be a common cause of blindness.

Records of serological testing for syphilis carried out on public patients at the Toronto General Hospital are kept at the Wassermann Laboratory⁴ of the Banting Institute. In 1917, when suspected patients were selected for the test, 9.95% of 3869 patients had a positive reaction; in 1927, 3.8%, and in 1947, 2%. In 1957 when 11,377 routine examinations were performed on all public ward patients, the percentage of positive reaction was 0.53%. In 1962 only 0.5% of 14,341 patients had a positive serological reaction for syphilis.

Trauma.—The individuals with traumatic blindness include 327 cases of war injury. Some were the result of the explosion of munition ships in Halifax harbour during World War I. Injury was due to glass fragments from windows shattered in the first blasts; later, people became aware of the danger of flying fragments. In mining and road-building, dynamite is a work hazard; also, children find and tamper with dynamite caps. Such accidents as these, and laboratory and gas explosions accounted for 282 cases of blindness.

Retrolental fibroplasia.—Under "poisonings" 329 cases of retrolental fibroplasia are recorded. Most of these occurred before the specific cause, oxygen poisoning, was found; now it occurs only sporadically in premature low-weight incubator babies. All branches of The Canadian National Institute for the Blind have been particularly attentive in their service to the child and the family. Members of the Canadian Ophthalmological Society were alerted by the Central Committee of the Society on December 17, 1953, in the following communication: "All premature babies should receive the least possible quantity of oxygen (just enough to prevent cyanosis). At the discretion of the pediatrician, the concentration of oxygen should be gradually reduced as soon as possible." This information was circulated to every member of the Society and has prevented blindness in a great number of infants.

Neoplasms.—Classified under specified types, 286 cases of blindness were due to intracranial tumours. Surgical intervention in this field is now so much more successful that many more patients

survive. Fifty-two cases of blindness were due to retinoblastoma and seven to malignant melanoma. In all, neoplasms were responsible for 355 cases, 1½% of the blind group, including 11 cases in which the type of tumour was not specified.

Diseases not elsewhere classified.—It was noted that diabetes as a cause of blindness was on the increase, associated with retinal lesions and hemorrhages into the vitreous. This impression has been confirmed by the finding of 1238 (5%) diabetic subjects among those registered as blind in the present survey. In the 1954 survey there were only 636 diabetic subjects in a group of 18,998. Vascular pathology accounted for 1167 cases of blindness (4½%). Among the disorders in the group categorized as "diseases not elsewhere classified—specified" are mongolism, cerebral palsy, hydrocephalus, pemphigus, lupus erythematosus, Purtscher's disease (traumatic fat embolism of the retina), oxycephaly, Kuhnt-Junius disease (chorioretinal exudates), Still's disease (rheumatoid arthritis in children), exsanguination, and so on.

Unknown to science.—The causes of the innumerable variations in the rate of senescence and degeneration in man are not yet known and, as is the custom, senescence and degeneration are classified in this study as disorders for which the cause is "unknown to science". Cataracts and glaucoma (excluding those due to congenital causes), myopia and many of the degenerations form a large proportion of the causes of blindness in the 6451 cases (26%) in this group.

GENERAL DISCUSSION

In 1857 the spread of an epidemic of blindness due to trachoma and venereal ophthalmia led to the calling of the First International Congress of Ophthalmology at Brussels. Since then 19 such meetings have been held to consider the art and practice of medicine and surgery of the eye, the prevention of blindness and the preservation and restoration of sight. Many local and regional reports have been made on the prevalence of blindness at these and other meetings, coming from a variety of sources. Frequently, older or younger age groups are omitted from these surveys, and overlapping of populations or causes probably occurs. Census reports of blindness have been found to be unreliable and, in Canada, actual registration of blind persons gave an estimate that was double that of the corresponding census estimation.

The matter of *international comparison* deserves special comment. The standard adopted by the C.N.I.B. in Canada for the assessment of blindness as a condition of registration is more liberal than that used in many countries, and for this reason, adjustments must be made in comparing reports from other countries. The number of blind persons covered in this report (the third C.N.I.B. survey) would have been reduced by approximately 30%

if the visual standard 3/60 or 10/200 had been used. The reduction in the number of cases registered would have been most marked for myopia (1041 less cases), cataract (1216 less), and macular degeneration (621 less). For the age groups frequently omitted or emphasized in published reports in the past there would be a noticeable difference. For example, excluding the age group 70 years and over would have reduced our registration by approximately 37%. If the group "blind at birth" were excluded, the reduction would be 13%, and if all those under eight years of age were removed from the register, 20%.

It is confidently expected that this survey will meet the requirements for standardization of reporting that will be proposed at the next International Congress of Ophthalmology. Standards for the reporting of the causes of blindness were presented at New Delhi in 1962 by the International Association for the Prevention of Blindness. The International Council of Ophthalmology accepted the report and set up a European committee that in 1966 will report its recommendations to the Twentieth International Congress of Ophthalmology meeting in Munich. It is hoped that the system proposed there will be accepted for a firm trial period of eight years. The following recommendations are to be included in the European committee's proposals: that all reports of examinations be collected centrally; that details of the standard of blindness be included in each report; that all ages be included; that coding be done for etiology and topography by an ophthalmologist, or by a trained worker under his supervision.

The unique compilation of the causes of blindness on a national basis is a remarkable achievement made possible by excellent team-work. An account of most of this team-work will be found in the history of the origin and development of The Canadian National Institute for the Blind which will soon be available in book form.

The ophthalmologists of Canada, over 500 in number, have supported and co-operated in the work of the Institute. Even before standard printed forms were adopted for recording the details of eye examination, only a few reports (0.5% of the total) failed to give sufficient evidence with regard to the type and site of the lesions responsible for the blindness, and in only about 5% of the records was information concerning etiology deficient.

It may be possible in future surveys, through re-examination of individuals, to reduce the number of defective reports, which are now classified as "evidence insufficient for diagnosis" or those with "no report" concerning etiology. However, in spite of these minor deficiencies this survey provides a panoramic view of national statistics on blindness and its causes, a genuine sample from a medium-sized nation in the temperate zone.

This survey brings to light the fact that over one-third of the cases of blindness registered with the C.N.I.B. are due to prenatal causes. Of the more than 500 named congenital syndromes producing serious defects of the body, probably one-third involve the visual apparatus. Only recently, in 1960 at London, the first International Congress on Congenital Malformations, and in 1962 the first Inter-American Conference on Congenital Defects pointed out the urgency and the magnitude of the search for means of preventing congenital causes of blindness.

In the second largest group, those blind from causes "unknown to science", some reduction in incidence is possible through better nutrition, hygiene and through new studies on the causes of premature senescence.

The Research and Statistics Division of the Department of National Health and Welfare publishes lists of the many allowances and other forms of financial aid that are available to registered blind persons. The various plans take into account the blind person's age, residence, means, work or war service, and so on. Each province contributes 25% of the funds used for this purpose and administers them. No other nation has a more comprehensive arrangement for prevention, assistance and care of the blind. Many well-trained blind men and women are fully employed as executives, field workers or teachers, or at tasks in the many types of sheltered workshops or homecrafts that ensure happiness and the self-respect that comes with a constructive contribution to the national economy.

CONCLUSION

The increase in blindness in Canada, reported herein on the basis of C.N.I.B. data, may be more apparent than real and may simply reflect the increased use of the many services that are available for blind persons. Even those of independent means seek help in varying degree. Medical advances have brought many of the causes of blindness under control, and surgery restores vision even in those conditions designated as having a "cause unknown to science". However, the longer life span permits many more cases of blindness due to degenerative changes to become manifest.

Preventive work in Canada goes hand in hand with the care of the blind. It is demonstrated in this survey, however, that progressive ocular disabilities that may end in blindness were four times as common as the registered cases of blindness. Diabetic patients, because of earlier diagnosis and better treatment, live long, useful lives, but eventually made up 5% of the blind group. The challenge posed by the prenatal causes of blindness can best be met by a sympathetic approach to a problem that is characterized by a variety of emotional complications. In the past an informed public has supported vaccination, sanitation, pasteurization

and isolation in the prevention of disease. Likewise the incidence of prenatal causes of blindness may in the future be reduced. The value of prevention is emphasized by the fact that 180 patients were transferred from the registered blind group to the "prevention" group as a result of treatment or operation that restored vision.

The long search for national statistics on the causes of blindness still depends upon the addition of accurate and comparable reports from other countries. We may have to wait a long time for such reports from tropical nations, but in Canada we can expect even better periodic reports that will be indicative of changing etiology and prevalence.

SUMMARY

The causes of blindness of living persons of all ages registered as blind with The Canadian National

Institute for the Blind was studied. Each eye-examination report was assessed and coded at the C.N.I.B. by the consultant ophthalmologist. Individual punch-cards were prepared using the cross-classification system developed in the U.S.A. in 1957.³ It is hoped that this survey, which is the most comprehensive one available in Canada, will meet the standards that will be proposed in 1966 for world-wide use by the International Congress of Ophthalmology.

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