

### RÉSUMÉ

La leucotomie frontale consiste dans la résection des fibres nerveuses qui relient le thalamus, où les sensations emotives originent, au cortex frontal où elles trouvent leur expression. Cette intervention fut tentée chez quelque 80 individus chez lesquels on avait essayé sans succès l'insulinothérapie et l'électro-choc. Furent choisis de préférence les sujets présentant tension, crainte et agitation, des symptômes qui sont habituellement amendés par la leucotomie.

On nota chez la plupart des opérés une diminution marquée ou une disparition complète de la tension, voire des idées paranoïaques, et celles-ci survenaient-elles encore qu'elles donnaient lieu à des réactions beaucoup moins intenses. Des hallucinations de longue durée, sans tout à

fait disparaître, cessèrent d'inquiéter nombre de patients. Souvent un état de lassitude et d'apathie se transforma en un état d'activité normale, mais on n'observa jamais le phénomène contraire. Il n'y eut pas de complications post-opératoires dignes de mention, sauf quelques cas isolés d'épilepsie.

Plus de soixante pour cent des opérés ont retourné dans leurs foyers depuis quelque temps, neuf mois en moyenne, et nombreux furent ceux qui purent reprendre leurs occupations antérieures. Dix-huit sont employés à des travaux manuels, domestiques ou de bureau; vingt femmes ont repris leurs travaux de ménage. Les autres patients se montrent raisonnablement sociables, si l'on compare aujourd'hui leur comportement à ce qu'il était avant l'opération.

## A STUDY OF THE PREVALENCE OF DIABETES IN AN ONTARIO COMMUNITY\*

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DIABETES mellitus is not a reportable disease and an accurate estimate of its prevalence is difficult to obtain. Death rates are available for most countries and for several large cities. These figures have been used to calculate the incidence of diabetes. There are, however, two main sources of error for which allowance must be made in such a calculation. First, because the diagnosis of diabetes is frequently omitted from death certificates in cases dying from another cause, mortality figures may understate the incidence. Joslin<sup>1</sup> showed that this understatement may be as high as 37%. Secondly, the calculation requires an estimate of the average duration of the disease from diagnosis to death. Joslin<sup>2</sup> estimates the average duration at 15 years. Beardwood,<sup>3</sup> in a study of death certificates mentioning diabetes found the average duration was 7.5 years. By an analysis of death rates, Joslin<sup>2</sup> estimated that there were one million diabetics in the United States in 1946, an incidence of 0.71%. Marks,<sup>4</sup> by a slightly different calculation reaches the figure of 675,000 or 0.48% of the population.

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Another approach to the problem has been made by the house-to-house enquiries in sample populations. The U.S. National Health Survey<sup>5</sup> covered two and one-half million people in 1936-37. The results when adjusted for changes in the U.S. population by 1946 give a figure of 725,000 cases of diabetes in the U.S. population or 0.52%. Beardwood<sup>3</sup> has given the results of interviews covering 34,633 people in Philadelphia. Among this group over 1% were cases of diabetes.

The foregoing estimates include only known cases of diabetes, and therefore give an incomplete picture of the problem. Several case finding studies have been made with the object of revealing undiagnosed as well as known cases. Large groups of selectees for the U.S. forces have been examined for glycosuria. In Blotner's<sup>6, 7</sup> two groups, the first of 45,650 men between 18 and 45 years, the second of 69,688 men between 17 and 37 years at the Boston Induction Station, 208 and 251 cases of diabetes were found. Over three-quarters of these were previously undiagnosed. These figures are equivalent to incidences of 0.45 and 0.36% and these rates are 4 times as great as those found in the corresponding age group in the National Health Survey. Spellberg<sup>8</sup> conducted a similar investigation at the New Orleans Induction Station. Examination of 32,033 men mostly between 18 and 35, produced only 9 diabetics. The large disparity between Blotner's and Spellberg's figures is difficult to explain, and it has been questioned whether the Boston sample was truly representative.<sup>9</sup>

A recent case finding study has been reported by Wilkerson and Krall<sup>10</sup> in which 3,516 persons in Oxford, Mass., or 70.6% of the population

of 4,983, were examined. In the Oxford survey blood and urine samples were examined from each person seen. Blood samples were mostly venous from adults and mostly capillary from children. Blood sugar estimations were made by the method of Folin and Wu.<sup>11</sup> Blood sugar values consistently above 170 mgm. % (venous) or 200 mgm. % (capillary) associated with glycosuria were taken as evidence of diabetes. In interpretation of glucose tolerance tests the height of the curve was given primary consideration. A value above 170 mgm. % (venous) was considered evidence of diabetes if associated with glycosuria.

On these criteria 30 new cases and 40 previously diagnosed diabetics were found. This corresponds to a total incidence of nearly 2% of the tested population. The incidence of previously undiagnosed diabetes was 0.85%. Over half the new cases were above the age of 55. Seventeen of the new cases were diagnosed by the aid of glucose tolerance tests, the remaining 13 on the post-prandial samples alone.

Tabor and Frankhauser<sup>12</sup> in a study of 550 adults over the age of 40 found a total of 22 diabetics of which 16 were previously undiagnosed. The persons selected for this study, were from among 1,000 families invited to participate in a nutrition survey in Ottawa county, Michigan. The prevalence of diabetes among this group appears to be similar to the corresponding age groups in Oxford, Mass.

#### METHOD

Newmarket is a town of 4,800 people. The main source of employment is provided by seven industries, which together employ about 1,200 men and women. Most of the population are of British origin, the only other group of any size is of Dutch origin.

The survey team tried to test all persons over school age. Only a few pre-school children were examined and these only at the special request of the parents. The first survey clinics were held in the schools, about 1,200 students were tested in 6 schools. Next the clinic was set up in each of the seven larger factories; about 1,000 men and women were tested. The remaining people were tested in conjunction with a canvass of the town.

Most of the blood tests were made in the period immediately after breakfast or lunch. About 250 persons normally working out of town

in the day were tested in seven evening sessions of the clinic. As far as possible both blood and urine specimens were obtained about one hour after a meal. Sample bottles for urine were usually distributed the day before the appointment for the blood test, with instructions that the sample should be collected one hour after a meal.

With only a little over two hours available each day for testing, the maximum number tested on any day was about 90 persons. While at the clinic a short history was obtained concerning personal and family history of diabetes. In addition, most adults were asked some questions relating to diabetic symptoms. When known diabetics were seen further information was obtained about insulin dosage, diet and duration of the diabetes.

When the blood sugar was abnormal, or when glycosuria was found, a letter was sent requesting the individual to attend for a second time, when both blood and urine samples were re-examined. If the diagnosis of diabetes was then confirmed, the patient was informed and advised to consult the family physician. A copy of the results was then sent to the physician together with an offer to perform any further blood sugar estimations while the survey clinic was in operation. When the recheck was inconclusive a letter was sent advising a glucose tolerance test. This letter was usually sent about a week before the test and during this period the patient was asked to eat full meals. When known diabetics were tested a report of the results was sent to the family physician and the patient.

Seven months after the conclusion of the survey a follow-up study was made. All diabetics discovered by the survey and a group of persons whose results were equivocal were invited to be re-examined. Those who had previous glucose tolerance tests were re-examined in the same

#### LABORATORY METHODS

(a) *Urine*.—Urine samples were tested qualitatively for reducing substances by means of "Clinitest";<sup>13</sup> 0.25 ml. of urine was mixed with 0.5 ml. of water in a test tube and a clinitest reagent tablet added. The resulting colour was recorded in the symbols suggested by the manufacturers of clinitest as follows: negative, tr, +, ++, +++, +++++. When reducing substance was shown to be present, the sample was rechecked by the same test, and also tested for

ketones by the nitro-prusside reaction using "Acetone-Test".\*

No quantitative estimation of urine sugar was made and no attempt was made to investigate the chemical nature of the reducing substances when present.

(b) *Blood*.—Capillary blood samples taken from the finger-tip or ear lobe were used throughout this survey. It was considered that a capillary method would be more acceptable to the population to be tested than would venipunctures.

Blood glucose estimations were made by a modification of the Somogyi-Nelson<sup>14, 15, 16</sup> colorimetric method. 0.1 ml. of blood was used in each estimation. Protein precipitation was made by the method of Herbert and Bourne.<sup>17</sup> In the method used the blood was pipetted into isotonic sulphate-tungstate solution and the precipitation was brought about by the addition of isotonic sulphate-sulphuric acid solution. Herbert and Bourne have shown that this method is effective in preventing the passage of non-glucose reducing substances (mainly glutathione) into the filtrate. This method estimates true glucose and the values obtained are significantly lower than those obtained by the Folin Wu method.

As blood glucose estimations were made in Toronto there was a delay of several hours between the time the sample was obtained and the time of the estimation. In the case of samples obtained after breakfast, the interval was up to 8 hours while for samples taken after lunch the delay was 2 to 3 hours. During this period the blood samples were standing unprecipitated in isotonic sulphate-tungstate solution, in corked tubes. Any change in the readings caused by this delay was not considered sufficient to affect the clinical interpretation of the results. This factor has been investigated. It was found that 24 hours' delay produced a loss of true blood sugar of 7.5%. When the red cells were re-suspended before protein precipitation was begun, other reducing substances were liberated, causing an apparent increase of 5% above the original estimation.<sup>18</sup>

(c) *Glucose tolerance tests*.—These tests were performed by the same blood sugar method on capillary blood samples taken in duplicate. 50 gm. of glucose was given after fasting blood

and urine samples had been collected. Further blood and urine samples were taken at one-half hour intervals up to two hours after the ingestion of glucose. Most subjects had fasted overnight, in some cases the test was performed after a four hour fasting period following breakfast. Subjects were told to eat full meals for one week prior to the test.

CRITERIA AND PROCEDURE IN SCREENING AND DIAGNOSIS (SEE TABLE I)

TABLE I.  
A SUMMARY OF THE CRITERIA FOR BLOOD SUGAR VALUES USED FOR SCREENING AND DIAGNOSIS

<i>Test</i>	<i>Blood sugar mgm. %</i>	<i>Time after meal</i>	<i>Interpretation</i>
Initial test . . . . .	>160 >150 >120	up to 1½ hrs. 1½-2 hours 2 hours or fasting	abnormal— recheck made
Initial test + recheck test	both >200	anytime	diagnostic of diabetics
Glucose tolerance test (50 Gm. glucose 2 hour curve)	>120 >200 >120	fasting at peak 2 hours	diagnostic of diabetics together diag- nostic of diabetes

NOTE: 1. Blood sugar values—true glucose (Somogyi-Nelson method). 2. All blood samples are capillary. (> indicates greater than).

(a) *Screening values*.—Blood glucose values in excess of 160 mgm. per 100 ml. blood occurring between one-half and one and one-half hours after a meal, or values above 150 mgm. per 100 ml. between 1½ and 2 hours, or values over 120 mgm. per 100 ml. occurring 2 hours and over after a meal or in the fasting state were considered abnormal. Such persons were asked to attend for a second time when both blood and urine samples were re-examined. Persons showing glycosuria were also re-examined. Persons without glycosuria and blood glucose values below those mentioned were considered non-diabetic.

(b) *Diabetic values*.—A diagnosis of diabetes was made (1) if blood glucose values in excess of 200 mgm. per 100 ml. blood were found on two occasions. (2) On the result of glucose tolerance tests. In the interpretation of these tests most stress was laid on the delayed fall of the curve. Diabetes was diagnosed if both the peak was above 200 mgm. per 100 ml. blood and the two hour level was above 120 mgm. per 100 ml. A fasting blood sugar of over 120

\* Manufactured by Denver Manufacturing Company.

m gm. per 100 ml. blood was also considered evidence of diabetes, though this was not seen except in curves which were also abnormal from the above considerations. When the blood glucose was markedly in excess of these values the diagnosis was considered justified even when the presence of glucosuria was not established in the samples examined.

A short medical history obtained from each case was also considered before making the diagnosis and as far as possible, other conditions leading to impairment of glucose tolerance were ruled out.

Glucose tolerance tests were performed (a) when blood glucose values were found to be abnormal (*i.e.*, above the screening level) on two occasions but one or both tests were below the diabetic level. (b) When there was persistent glycosuria of 1+ or more, although blood glucose values were not above the screening level. (c) Where there was a marked discrepancy between the first and second tests. For example, a case in which a "diabetic" blood sugar in the first test was followed by a normal result in the second, was usually investigated by a glucose tolerance test. However, a borderline test followed by a normal one was considered non-diabetic unless some factor, such as glycosuria, indicated further investigation.

#### RESULTS

4,419 persons were tested in the survey in Newmarket and these figures are summarized in Table II. This total includes 843 non-

TABLE II.

ESTIMATED POPULATION OF NEWMARKET AND THE NUMBERS OF PERSONS TESTED IN THE COURSE OF THE SURVEY

Population of Newmarket.....	4,800
Population under six years.....	500
Population over six years.....	4,300
Total number tested.....	4,419
Males.....	2,206
Females.....	2,213
Non-residents.....	843
Residents over six years of age.....	3,502
Percentage of resident population over six years covered.....	81%

residents most of whom were encountered in the schools and factories visited. In the further analysis of the results of the survey this non-resident group has been included in the total. Children under school age (six years) were not tested, as a rule, by the survey. Out of approximately 500 pre-school children in New-

market only 79 or 16% were tested. The authors felt that it was very unlikely that any previously undiagnosed cases of diabetes would be found among children of these ages. Among the remaining age groups present in the Newmarket population 81% of the residents were covered by the survey.

As no recent figures are available for the age and sex distribution of the Newmarket population it has not been possible to estimate the proportion in each age group reached by the survey. However, the age and sex distribution of the population of Ontario in 1947 is shown for comparison with the tested group in Fig. 1. The data on which these graphs were based are to be found in Table III. Compared with that of Ontario, the tested population shows two main differences: (a) an excess of both males and females between the ages of 5 and 19 years and (b) a deficiency of males between the ages of 20 and 29 years. In the remaining age groups from 30 years upwards, the distribution roughly corresponds with that of Ontario.

The racial origin of the tested population was predominantly Anglo-Saxon; 86.6% of the 3,966 persons for whom a record of the racial origin was obtained were of British descent. Nearly two-thirds of this group were of English origin. The remaining 13.4% were composed of Dutch (5.3%) French (2.8%) German (2.1%) and small numbers of Italians, Slavs, Scandinavians and Chinese. Those of Jewish origin accounted for only 0.3% of the total.

*Diabetics.*—Among the 4,419 persons seen at the clinic 54 diabetics were encountered; 33 of this number were previously known cases and 21 were new cases diagnosed on the criteria described. The total incidence was 1.2% (known cases, 0.75%; new cases, 0.5% in the tested population).

The non-resident group (842 persons) provided only 5 of the 54 diabetics and the incidence was 0.6% compared with 1.3% in the resident group. The non-residents tested were mostly school children and factory workers. They, therefore, formed a younger group than the residents and contained a predominance of males. These facts presumably account for the lower incidence in this group.

The age and sex distribution of the diabetics is shown in Fig. 2. The age range was from 36 to 86 years. The largest single number (19 cases) was found between the ages of 60 and 69. There were 20 cases in three decades from

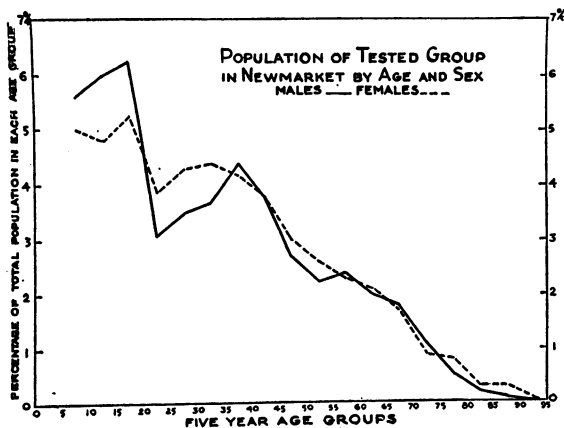


Fig. 1A

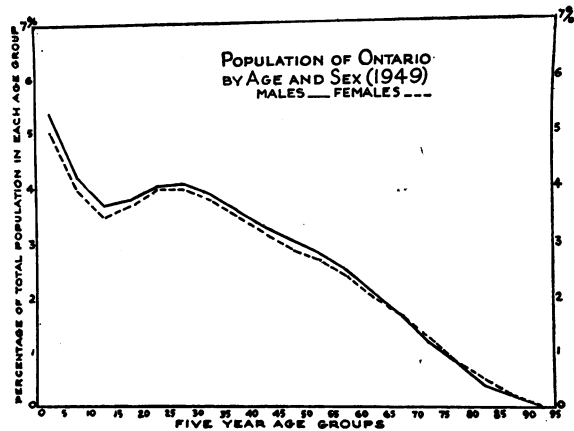


Fig. 1B

Fig. 1.—Population of tested group in Newmarket (A) and estimated population of Ontario in 1949 (B) showing age and sex distribution of each. Data for (B) was taken from Vital Statistics—Analytical Report No. 1—Dominion Bureau of Statistics, Ottawa, 1948.

TABLE III.

AGE AND SEX DISTRIBUTION OF ONTARIO POPULATION, TESTED POPULATION, AND DIABETICS

Age in years	Percentage of population in each group				No. of persons in each group		No. of diabetics in each group					
	Ontario*—1949—		Tested population in Newmarket		Tested population in Newmarket		New cases		Known cases		Total cases	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0 - 9	9.40	9.00	6.00	5.40	265	237						
10 - 19	7.40	7.22	12.23	10.00	542	443						
20 - 29	8.22	8.10	6.60	8.20	292	360						
30 - 39	7.50	7.35	8.05	8.55	357	378	1		1		2	
40 - 49	6.40	6.10	6.45	6.75	284	299		4	3	1	3	5
50 - 59	5.30	5.10	4.69	4.95	207	219		4	1	5	1	9
60 - 69	3.80	3.75	3.80	3.85	168	172	4	4	6	5	10	9
70 - 79	1.95	2.00	1.74	1.75	75	76	1	2	4	5	5	7
80 - 89	0.56	0.70	0.32	0.61	14	27		1	1	1	1	2
90 - 99	0.06	0.09	0.04	0.02	2	1						
Total...	50.59%	49.41%	49.92%	50.08%	2,206	2,213	6	15	16	17	22	32

\*Estimated population for Ontario 1949, taken from Vital Statistics—Analytical Report No. 1, published by the Dominion Bureau of Statistics, Ottawa, 1948.

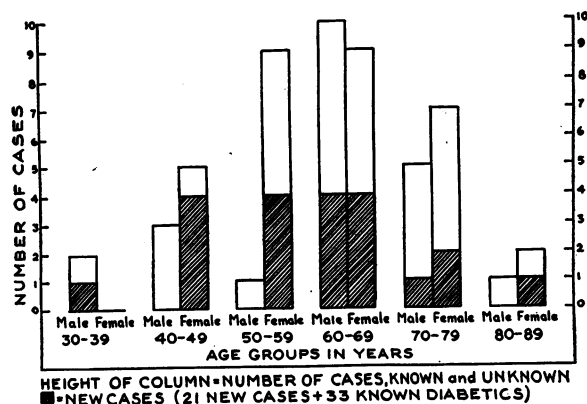


Fig. 2.—Showing age and sex distribution of 54 diabetics, including both known and new cases revealed by the survey.

30 to 59 years and 15 cases in the decades from 70 to 89 years. In the 54 diabetics seen 32 were females and 22 males.

*Previously known diabetics.*—The mean age of this group of 33 cases was 62 years, the range being from 36 to 81 years. 17 were female and 16 male. Nearly half of this group (14 persons) knew of the existence of diabetes in their family histories. The average duration of diabetes in these known cases was 5.6 years, the range from 2 months to 21 years; 8 persons had had diabetes for over ten years. Insulin was taken by 23 persons, the remaining 10 were under treatment by diet alone. On all these cases a report was requested from the family physicians concerned.

*Diabetics discovered by the survey.*—The mean age of this group of 21 cases was 60 years, the range from 37 to 86 years; 15 were female and 6 were males. Four of these persons appeared to be symptom free at the time of diagnosis, but the remaining 17 had at least one symptom. Tiredness was the most common symptom (12 persons); frequently of micturition, suggested by the fact that such persons rose twice or oftener during the night was present in 9 cases. Unusual thirst was recorded by 5, cramps in the legs by 5, and weight loss by 3 persons. Only 4 gave a family history of diabetes.

In the initial blood and urine tests of the new diabetics, most (15 persons) showed both hyperglycæmic and glycosuria. One case showed glycosuria as the only abnormality and there were 5 persons who showed hyperglycæmia only. These 5 individuals would have escaped diagnosis in a survey in which urine tests only were used in screening the population.

Seven months after the completion of the survey, 18 of the 21 new cases were interviewed and re-examined. Nine cases diagnosed by the aid of glucose tolerance tests were retested in the same way. Of the remaining 12 diagnosed on the results of post-prandial tests one was untraced, 2 sent reports and 9 were seen and retested.

The results of this follow-up study were as follows: (1) Treatment.—All the cases traced had been in the care of their physicians since the time of diagnosis. Eight were taking insulin. All had been advised on diet, though the diet followed varied from simple avoidance of sweet foods by some individuals to strict measurement of most food stuffs by others. (2) Results: most of those who had originally noticed symptoms now claimed to feel much better. Of the 9 tolerance tests, all showed some improvement and 4 were virtually normal curves, following only dietary treatment. Of those retested with single blood sugars all 9 showed improvement over the original tests and 3 gave completely normal results following only dietary treatment. In most cases this improvement was associated with reduction of weight. Four typical pairs of glucose tolerance curves showing the changes that have occurred during treatment are shown in Fig. 3 (A-D).

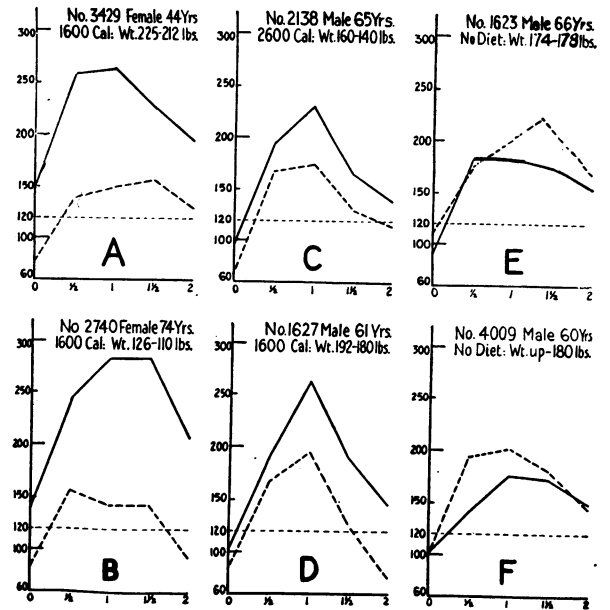


Fig. 3.—The original and follow-up glucose tolerance curves of six persons. Curve at time of diagnosis in continuous line. Follow-up curve in broken line. Time in hours (abscissæ). Blood sugar in mgm. per 100 ml. (ordinates). A to D.—Four previously undiagnosed diabetics showing typical improvement following seven months' dietary treatment. E to F.—Two cases previously classified as "doubtful" who showed further impairment of glucose tolerance. Neither was treated in the interval.

#### DOUBTFUL RESULTS

There are two groups considered under this heading, neither of which was included in either of the foregoing groups of diabetics. First there were 9 persons whose results were abnormal but were not thought to be diagnostic of diabetes. Secondly there were 7 persons who believed that they had or may have had diabetes. No confirmation for their statements could be found, however, either in the results of the survey tests or in reports from their own doctors, when these were obtainable.

The first group contained two persons whose initial tests were suggestive of diabetes but who were unwilling to proceed with any further investigations, either at the survey clinic or, as far as is known, with their own doctor. They were not seen again in the follow-up study. The remaining 7 were persons investigated by glucose tolerance tests. All of these were followed up and the tests repeated after an interval of seven months. Two of these were especially suspicious of diabetes. Post-prandial tests had shown glycosuria accompanied by borderline blood sugars. The glucose tolerance tests showed normal fasting levels, peaks above 180 but below 200 mgm. per 100

ml. blood, and two hour levels above 150 mgm. per 100 ml. When the tests were repeated, glucose tolerance had decreased slightly. On the criteria used, these cases would now be classified as diabetic (see Fig. 3 E and F). During the interval between the two tests neither of these persons had followed any dietary restriction. Both had gained weight. The other 5 glucose tolerance tests were mostly abnormal in that the height of the curve exceeded 200 mgm. %, the fasting and the two hour levels being in every case below 120 mgm. %. When these were repeated none showed any increase in the abnormality. Some remained the same, others had returned towards normal.

The second group, comprising 7 persons believing themselves to be diabetic, were all investigated at the survey clinic. Most gave a history extending over several years, all but one covering at least four years. None was taking insulin and none was dieting although three stated that they avoided sugar. None showed any glycosuria and with one exception all post-prandial blood sugars were well below the upper limit of normal. The exception was a known case of cholelithiasis, whose blood sugar 70 minutes after a meal was 165 mgm. %. In all but two cases reports from their physicians were not available concerning the initial blood and urine tests at the time of the supposed diagnosis. In the absence of any definite confirmatory evidence, the authors have not thought it justifiable to include these persons in the list of known diabetics. If they were to be so included the incidence of known diabetes in the tested population would be raised from 0.75 to 0.9%.

*Glycosuria.* — There were 92 persons whose initial sample showed the presence of reducing substances. In addition there were 6, out of the 172 persons who were examined on more than one occasion, who showed glycosuria in subsequent tests although the initial sample gave a negative reaction. Cases showing glycosuria in the initial test are analyzed in Table IV.

Of the 92 instances of glycosuria 32 were due to diabetes and of this number 16 occurred in known cases. If these known cases are excluded from the total, 16 out of the remaining 76 cases of glycosuria, or 21% were due to undetected diabetes. Of the remaining 60 non-diabetic glycosurias, 14 cases or 23% appeared to be persistent, in that glycosuria of some degree was

TABLE IV.  
ANALYSIS OF ALL PERSONS SHOWING GLYCOSURIA IN INITIAL URINE TEST

Result of test	Total No. of persons with positive results	No. of diabetics		No. of non-diabetics
		Total	Known cases	
Trace	43	6	4	37
+ or ++	18	4	2	14
+++ or ++++	31	22	10	9
Totals . . .	92	32	16	60

present on at least one subsequent occasion. No systematic attempt to classify the non-diabetic glycosurias was possible. There were, however, 8 instances in which glycosuria was noticed during glucose tolerance tests which had been judged to be non-diabetic. Of this number 3 appeared to be related to a lowered renal threshold, and one was associated with a "lag storage" type of curve, or what Lawrence<sup>19</sup> prefers to call the "oxyhyperglycæmic curve". The 60 instances of non-diabetic glycosuria occurred at all ages and in both sexes, but was commoner in males in the ratio of 3 to 2. In females glycosuria most often occurred between 20 and 50 years sometimes associated with pregnancy, while in males most cases occurred after middle age.

#### DISCUSSION

The diagnosis of diabetes mellitus offers no difficulties in frank cases of the disease. Here symptoms associated with glycosuria and a marked elevation of the blood sugar serve to establish the diagnosis without any doubt. However, in a diabetes survey of a normal population, it is inevitable that a large proportion of the cases discovered should be without symptoms and show only slight elevation of the blood sugar above normal levels. The interpretation of such borderline results raises certain problems.

Glucose tolerance as measured by the standard glucose tolerance test is known to be affected by numerous factors. Previous diet,<sup>20 to 23</sup> age, physical inactivity,<sup>24</sup> absorption rate of ingested glucose, emotional stress, as well as endocrine disorders and hepatic disease are examples of such factors. Mosenthal<sup>25</sup> has focused attention on the necessity for standardizing the conditions of the test and has demonstrated the differences which occur between capillary and venous blood sugar levels and the variable error that arises

from the estimation of non-glucose reducing substances in certain techniques.

In interpreting the results of glucose tolerance tests, these factors have been considered. Tests were only performed on ambulant persons. Diet on the days preceding the test was adequate to give a normal response. Mosenthal<sup>25</sup> states that a diet containing 125 gm. carbohydrate per day is adequate to elicit a normal tolerance curve. Emotional factors were eliminated since patients had already visited the clinic twice before and none were disturbed by the procedure.

The criteria selected are in line with those suggested by several authors. Joslin<sup>2</sup> states that a capillary blood sugar level of over 200 mgm. % after food or 130 mgm. % fasting is indicative of diabetes. Mosenthal<sup>25</sup> suggests that in a normal tolerance test the maximum values for capillary blood should be fasting, 120 mgm. %; peak, 200 mgm. %; two hour level, 120 mgm. %. Lawrence<sup>26</sup> also uses substantially the same values. Recently Moyer and Womack<sup>27</sup> have analyzed the results of over 100 tolerance tests on non-diabetics and compared them with those from a group of certain diabetics. Venous blood samples were estimated by the Folin-Wu method. They suggest that the upper normal values for fasting, peak and two hour level should be 118, 195 and 126 mgm. % respectively. These figures represent in each case the mean normal value plus twice the standard deviation. These authors regard the two hour level as the most sensitive index for diagnosis.

The improvement of glucose tolerance that many of the new diabetics showed when retested several months after diagnosis might conceivably be interpreted in two ways. First, it might call the original diagnosis into question. It might be argued that the original impairment of glucose tolerance was a transient phenomenon. Against this it may be observed that all these persons had previously shown suspicious blood glucose levels on more than one occasion before the original tolerance test was performed. Secondly, the improvement in tolerance might be regarded as the direct result of the treatment given in the interval between the two tests. There are many reports in the literature of this change occurring following dietary treatment of middle aged obese diabetics. Simple reduction of caloric intake with no disproportionate reduction of carbohydrate was sufficient in Newburgh's<sup>28</sup> patients to bring about loss of excess weight and return of the glucose tolerance to normal. Hims-

worth<sup>29</sup> and John<sup>30</sup> have also quoted examples of this effect. Newburgh advances reasons for the view that these cases should not be regarded as true diabetics. John, however, does not accept this reasoning. It is generally agreed, that simple weight reduction can bring about cure of both glycosuria and hyperglycæmia in this type of case.

It is of interest that two persons who did not receive any treatment did not show any improvement of glucose tolerance when retested 8 months later. Indeed there was some tendency toward further impairment. The curves are shown in Fig. 3 E and F. The original curves just failed to fulfill the criteria for diagnosis—there was a delayed fall, but the peak did not exceed 200 mgm. %. These two individuals would now fall within the diabetic group.

#### CONCLUSIONS

In this survey, as in others reported in the literature, a considerable number of unknown diabetics were found. Most of these cases were in the middle and upper age groups. Their diabetes appeared in most cases to be mild and dietary treatment alone often brought about a marked improvement in glucose tolerance. It seems that there exists a fairly large group of undiagnosed diabetics in the population. It would, therefore, be advantageous for all persons over the age of 40 to have their urine tested at least once a year. This might lead to earlier detection and treatment, with improvement in the sense of well being and perchance lessen the tendency to complications which may occur as the result of prolonged hyperglycæmia.

#### SUMMARY

1. Samples of blood and urine from 4,419 persons in Newmarket, Ont. were examined for glucose with the object of estimating the number of diabetics in this community: 81% of the town's population were included in this total. All age groups were covered with the exception of the pre-school group.
2. The literature concerning certain other estimates of the incidence is reviewed briefly.
3. The methods used in the survey are described; capillary blood samples were estimated by a modified Somogyi-Nelson colorimetric technique. Urine samples were tested with elinitest.
4. Screening and diagnostic criteria are described.



5. The results of the survey and of a follow-up study seven months later are given. 54 diabetics were seen among 4,419 tested, an incidence of 1.2%. 21 of these were previously undiagnosed. When these cases were re-examined, many showed marked improvement of glucose tolerance. The significance of this effect is discussed.

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PERNICIOUS ANÆMIA, I

Maintenance Treatment with Liver Extract\*

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IN view of fresh interest in the treatment of pernicious anæmia stimulated by the discovery of vitamin B<sub>12</sub> it seemed desirable to evaluate the results of liver extract therapy at The Montreal General Hospital during the past twenty years as a prelude to a long term comparative study. The initial response to treatment and the maintenance of remission with liver therapy are well documented.<sup>1, 2, 3</sup> It is now evident that vitamin B<sub>12</sub> will evoke an initial hæmatologic response in every way comparable to that produced by potent liver extracts.<sup>4</sup> The long term therapeutic effects of this vitamin, particularly its effect on nerve degeneration commonly a feature of the disease, can only be assessed after studies have been

made on groups of cases comparable as to size and duration of treatment.

CLINICAL MATERIAL AND METHODS

321 patients with untreated pernicious anæmia were admitted to the wards of the hospital during the years 1927 to 1949 inclusive. Data concerning sex incidence and age of onset of the disease are presented in Table I. There were 175 women and 146 men in this group.

TABLE I.

SEX AND AGE INCIDENCE  
321 CASES OF PERNICIOUS ANÆMIA

Number of cases	Sex	Age in years	
		Average	Range
175	Women	59.5	20 - 82
146	Men	57.8	28 - 81
321	Total	58.6	20 - 82

The average age of the women (59.5) was similar to that of the men (57.8 years). On leaving hospital, patients, many of them from outside the city, were referred back to their family doctors. Those who had no private physicians were referred to our out patient clinic for maintenance therapy. Unfortunately, adequate follow-up data are not available for the entire group. Consequently the present study has been limited to the 63 patients who were attending

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