The Canadian Medical Association Journal

Vol. 60 APRIL, 1949 No. 4

MEDICAL RESURVEY OF NUTRITION IN NEWFOUNDLAND 1948

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The photographic records of this resurvey and of the survey of 1944 were made by M. Sym, Photographer, Winnipeg, Canada. Inasmuch as frequent reference is made in this report to the colour photographs of the previous Medical Survey of Nutrition in Newfoundland,[1] they are reproduced here as originally published, with the original numbering.

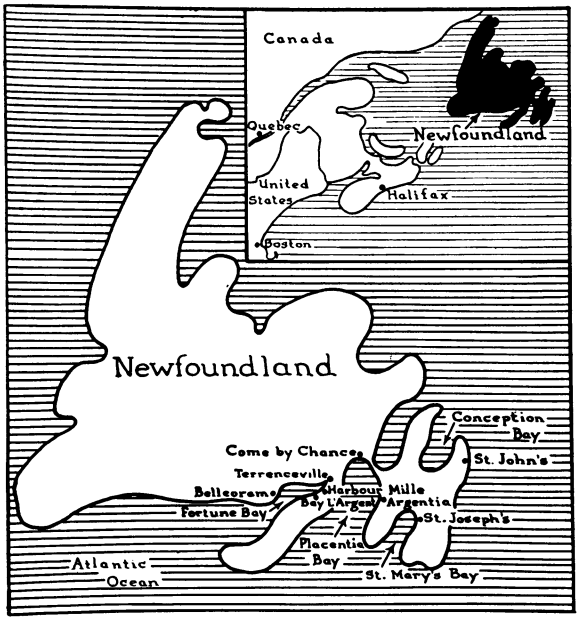
INTRODUCTION

THE nutrition of the people of Newfoundland, for many years a subject of concern to the Government of that island country, was surveyed in 1944 at the invitation of the Government by a group of Canadian, British and American physicians. The group consisted of Adamson, Moore, Tice and Tisdall from Canada, Platt from the United Kingdom and Jolliffe, Kruse, Lowry, Sebrell, Wilder and Zamecnik from the United States.[1] Clinical examinations were conducted on 868 unselected people, part of whom were residents of the city of St. John's and the remainder of whom lived in several of the settlements, known as outports, on the eastern and southern coasts. In addition, chemical analyses of blood or urine of nearly half the subjects were made for hæmoglobin, serum protein, phosphatase, vitamin A, carotene, thiamine, riboflavin and ascorbic acid. The survey revealed a high prevalence of clinical signs attributed to chronic deficiency of vitamin A, riboflavin and ascorbic acid and low values for these nutrients in the blood or urine. Also noted was extensive dental caries. No pellagra was encountered, although signs suggestive of chronic niacin deficiency of mild degree were encountered frequently. Peripheral neuritis was infrequently observed, but low excretion of thiamine in the urine (less than 50 mcgm. per gm. of creatinine in 44% of subjects), together with subjective symptoms, could be interpreted as evidence of frequent occurrence of less severe degrees of thiamine deficiency. Signs of rickets were infrequently encountered. No evidence of protein deficiency was observed, and on the whole the values recorded both for hæmoglobin and for blood phosphatase were satisfactory. Records of average heights conformed fairly closely with the standards of comparison chosen (see page 341) but body weights on the average were somewhat lower than these standards, and muscular development of many subjects was poor.

An estimate of available food supplies was made. In comparison with the Recommended Allowances, National Research Council, U.S.A., the amounts of thiamine available per head were

lower by 32%, of riboflavin by 51%, of vitamin A by 69%, of ascorbic acid by 72%, and of calcium by 58%. On the other hand, the food supplies were on the average liberal in terms of the allowances, with respect to calories and protein.

It is generally agreed that poor nutrition is reflected in poor general health. In Newfoundland the state of health was most unsatisfactory. Evidence of this was provided by such indices as the reported rates for infant mortality and tuberculosis. Both were high, from two to three times those encountered in populations of similar ancestry in more favoured regions.



Other surveys.—In June, 1944, Metcoff and others[2] studied a sample of the population of Norris Point, a village on the west coast of Newfoundland. The sample consisted of 39 women, 16 men and 58 children. On the basis of medical histories and physical examinations, and determinations of hæmoglobin and plasma protein, the prevalence of nutritional deficiency among the women was found to be as follows: obvious, 61%, suggestive, 31%, questionable or none, 8%. The children, and the few men included in the sample, were relatively less affected. Multiple deficiencies were the rule, those most frequently encountered being deficiencies of vitamin A, riboflavin and iron in the women and children, and of vitamin A and riboflavin in the men. Using arbitrarily adopted criteria, a diagnosis of deficiency of thiamine, obvious or suggestive, could be made relative to only 12 subjects (10.6%), but symptoms suggestive of this deficiency were common. The same investigators again visited Newfoundland in 1948, but the findings from this, their second visit, have not as yet been published.

A council of officials representative of all the departments concerned in the promotion of better nutrition of the country was established in Newfoundland late in 1944, and on its invitation D. P. Cuthbertson, then of the Headquarters Staff, Medical Research Council (England) visited the island to advise on ways and means for improving the diet. He spent six weeks there in the summer of 1945, and incidentally examined some 300 persons for clinical evidence of nutritional deficiencies. In his report[3] he stated that "by its circumstances this (his) survey was sketchy and not conducted in a predetermined plan." He noted a lower prevalence of nutritional abnormality than had been reported in either of the surveys of 1944. He found it difficult to interpret this difference. The lower incidence of signs attributable to deficiencies of the B group of vitamins might have resulted from the addition of synthetic thiamine, riboflavin and niacin to wheat flour. This enrichment program had been initiated in the spring and summer of 1944. However, since he found the incidence of deficiencies of vitamins A, D and C also smaller, he inferred that the differences depended mainly on a "difference in the method of assessment of the criteria used to detect departures from normality." "It would appear of value," he suggested, "for those who conducted the 1944 surveys again to review the same field as they studied in that year, the criteria of abnormality being as far as possible the same as those in 1944. This would be the safest way to evaluate whatever benefit the 'enriched' bread had provided to the population."

Resurvey of 1948.—The resurvey here reported was undertaken in the hope of being able to evaluate the effect on health of several measures undertaken by the Government of Newfoundland to improve nutritional conditions. The physicians who participated were with two exceptions (Aykroyd and Shank) members of the group which conducted the survey of 1944. The season of the year was the same (August). The same localities were studied as before, with a few exceptions to be noted later. The number of persons examined was the same (868) and the same criteria were adopted for judging abnormality. A feature of this study, which probably is unique in nutritional investigations, is

TABLE I.

ALL PERSONS EXAMINED
DISTRIBUTION BY AGE AND SEX

	Sample of 1948			Sample of 1944		
Age in years	Outports[1]	St. John's	Total	Outports	St. John's	Total
0 to 9	106.0	173.0	279.0	118.0	131.0	249.0
10 to 19	160.0	163.0	323.0	230.0	78.0	308.0
20 to 29	70.0	13.0	83.0	70.0	23.0	93.0
30 to 39	48.0	25.0	73.0	60.0	21.0	81.0
40 to 49	33.0	15.0	48.0	42.0	11.0	53.0
50 to 59	25.0	3.0	28.0	33.0	3.0	36.0
60 to 69	18.0	1.0	19.0	34.0	2.0	36.0
70 to 79	10.0	1.0	11.0	11.0	0.0	11.0
80 to 89	4.0		4.0			
Totals	474.0	394.0	868.0	598.0	269.0	867.0[2]
Per cent under age 20	56.1	85.3	69.4	58.2	77.7	64.2
Average age in years	24.2	13.9	19.6	24.5	14.6	21.4
Per cent male	39.3	41.9	40.4	40.1	42.9	41.0

PERSONS EXAMINED IN 1944, RE-EXAMINED IN 1948

Age in years (1948)	Outports	St. John's[3]	Total
0 to 9	27.0	1.0	28.0
10 to 19	78.0	29.0	107.0
20 to 29	31.0	1.0	32.0
30 to 39	18.0	3.0	21.0
40 to 49	13.0	3.0	16.0
50 to 59	10.0		10.0
60 to 69	9.0		9.0
70 to 79	2.0		2.0
80 to 89	2.0		2.0
Totals	190.0	37.0	227.0
Per cent under age 20	55.3	81.1	59.5
Average age in years	25.0	19.1	24.0
Per cent male	35.3	43.2	36.5

(1) Settlements on the coasts.
(2) One record lost; total examinations 868.
(3) It will be observed that the number of people re-examined in St. John's, except in the 10 to 19 age group, is too small to be useful statistically. The number re-examined in the outports is, however, large enough to justify comparison with the subjects examined in the outports in 1944.

that 227 individuals examined in 1944 could be re-examined by the same examiners four years later (Table I).

ECONOMIC AND LIVING CONDITIONS

The estimated population of Newfoundland was 316,000 in the fiscal year 1943-44 and 328,000 in 1947-48. A large majority of the people reside in the outports; approximately 60,000 are inhabitants of the capital, St. John's. The war of 1939-45 led to prosperity unparalleled in the history of the country. At one time off the beaten track, scarcely known to outsiders, Newfoundland was catapulted into a new position. As a result of transoceanic aviation it became a world crossroads and a place of great strategic significance in war and peace. Large military and naval installations were established, and from Gander airport commercial airships now leave for Europe and America at all hours of the day and night. At the same time the value of fishing, timber and mineral resources increased substantially.

In 1944 we were only dimly conscious of the significance of these happenings. We did comment in our earlier report on employment, the number of those receiving relief having fallen, according to Government figures, from more than 90,000 in 1933 (one-third of the total popution) to some 60,000 in 1940 and to less than 8,000 in 1943. The improving economic status, which was only just apparent in 1944, was obvious in 1948. Many fishermen and other inhabitants of the outports had money to spend freely for the first time in their lives. They might not spend it wisely, many might be making purchases for which they had little use, but the little stores in all the villages we visited gave striking evidence of an increase in purchasing power. Shelves which had been largely

empty were now piled high with goods and several of the stores had been increased in size. The people too were better dressed and homes looked better tended. We mentioned in our earlier report that the money value of the catch of fish in Newfoundland had averaged only $140 per fisherman per year at the time of the census of 1935. However, we were told in 1948 that occasional fishermen earned as much as $2,000 annually. The same informant made the comment that little of it was saved. However, some money had been saved. In one small bank the amount of interest paid on savings was three times what was paid in 1944.

The Government revenue had increased enormously. His Excellency the Governor informed us that the country's budget rose from a total of $12,000,000 before the war to $28,000,000 in 1943 and to $40,000,000 in 1947. Figures provided by Mr. Raymond Gushue, Chairman of the Newfoundland Fisheries Board and of the Woods Labour Board, were similarly impressive. The payroll alone of the enormous Gander airport amounted in 1947 to $3,400,000. The United States military bases in that year paid to 3,000 Newfoundland permanent employees the sum of $6,500,000, a figure which did not include temporary employees or civilians engaged in the post exchanges or as domestics. Export revenue from Newfoundland forests was $13,750,000 in 1937, $17,000,000 in 1942 and up to $23,750,000 in 1947. Exports of minerals, mainly iron ore, were valued at $6,500,000 in 1937, at $7,300,000 in 1942 and at $13,500,000 in 1947. The fisheries showed even greater gains in export values, increasing five times in the decade from $7,500,000 in the fiscal year 1937-38, to $13,000,000 in 1942 and $34,000,000 in 1946. Total exports were valued at $44,445,000 in the fiscal year 1943-44 and at $80,468,000 in 1947-48.[4] Prices, however, continued to be relatively high in Newfoundland in 1948, and the overall cost of living index had risen there as elsewhere. The index provided by the Department of Supply, based on 100 for 1938, was 141.1 in 1943, 172 in 1947 and 183 for seven months of 1948. The cost of food rose still more sharply in this period.

CIVILIAN FOOD CONSUMPTION

It is scarcely to be questioned that the improved economic status of the population influenced food supplies and diet. The home production of food in Newfoundland always has been limited to a few items, of which fish has been the most important. The greater part of the food supply has been imported, and since the revenue of the country has depended largely on import duties, records of the quantities of the different foods and food groups imported are available. In the previous survey an estimate was made of per head supplies of the different foods, and their calorie value and nutrient content, for the year 1943. It would have added to the interest of the present survey if comparisons could have been drawn between food supplies in a selected year, or series of years, previous to each of the two surveys, so that the picture of the food supply could be correlated with our observations on the nutritional condition of the people. Unfortunately, however, it proved difficult to do this with any degree of accuracy. During the last four years imports of various kinds of foods increased, but the proportion of these actually consumed by the people in any given year between 1943 and 1948 could not be determined. The "pipeline" was relatively empty in 1943, whereas in 1948, as we could see from visiting the retail stores, shelves were well supplied with goods, including processed foods. Another factor tending to cloud the picture of civilian consumption was the presence in the country, in the earlier part of the period between the two surveys, of very considerable military and naval forces with money to spend. While the service personnel obtained their regular rations through service channels, they also consumed foods which had entered the country in the ordinary way and were included in the import returns. Some purchases of food were made by the military establishments and it is well known that soldiers and sailors, when off duty, tend to spend money freely to relieve the monotony of service rations.

For these and other reasons trends in food imports during recent years are difficult to interpret. There had been, however, unquestionably an increase in the imports of evaporated milk. The figures for the fiscal year 1938-39 and the fiscal years 1943-44 to 1947-48 are as follows:

Year	*Imports* *Pounds*	*(Kg.)*	*Grams per head per day*
1938–39	4,430,000	(2,009,000)	18.4
1943–44	6,972,000	(3,162,000)	27.5
1944–45	7,909,000	(3,451,000)	29.8
1945–46	10,472,000	(4,750,000)	40.5
1946–47	13,217,000	(5,995,000)	50.7
1947–48	13,090,000	(5,938,000)	49.6

The population estimates, as has been said, were 316,000 for 1943-44 and 328,000 for 1947-48. The fiscal year was from April 1 to March 31.

Supplies of evaporated milk increased by about 80% between 1944 and 1948. Assuming that all these were consumed by civilians, the per head increase, in terms of reconstituted fluid milk, would be from 1.9 (55 ml.) to 3.5 (100 ml.) ounces per head per day, which would have contributed an additional 0.08 mgm. of riboflavin, 0.02 mgm. of thiamine, 90 interna-

tional units of vitamin A and 54.0 mgm. of calcium to the daily diet.

Imports of fruit, fresh and canned, mostly citrus fruits and juices, almost doubled between the fiscal years 1943-44 and 1944-45, increasing from 6,958,000 (3,156,000 kg.) to 12,038,000 pounds (4,460,000 kg.). They fell again, however, in later years to 6,764,000 (3,068,000 kg.) in 1946-47 and to 4,957,000 (2,248,000 kg.) in 1947-48. Again assuming consumption only by civilians the amount per head per day for the fiscal year 1947-48 was 0.7 ounces (20 gm.), which would represent a contribution to the daily provision of ascorbic acid of no more than 7 mgm.

Imports of sugar, jam and syrups showed a fairly clear upward movement after 1944. The amount of imported sugar, jam and syrups, including confectionery, increased from a yearly supply per head of 81.5 pounds (37.0 kg.) in 1943-44 to 132 pounds (60.4 kg.) in 1947-48. Imports of sugar rose from 17,032,000 pounds (7,740,000 kg.) in the fiscal year 1943-44 to 29,617,000 pounds (13,460,000 kg.) in 1947-48. The amount of candy increased greatly. Imports of confectionery rose from 1,731,150 pounds (787,000 kg.) in 1943-44 to 4,015,202 pounds (1,825,000 kg.) in 1947-48, and in addition two candy factories produced a cheap hard candy locally which is believed to have accounted for a large part of the increased sugar importation.

The reported figures suggest that eggs, fats and oils, and green leafy vegetables may have been imported in increasing quantities in the later years, but definite statements regarding import trends in the case of these and several other foods and food groups cannot be made because of annual fluctuations.

A relatively high proportion of total calories in the Newfoundland diet, about 40%, has been derived from white flour. In recent years there had been little change in this, as is shown by the following figures for imports of flour:

Year	Imports		Grams per head per day
	Pounds	(Kg.)	
1938–39	79,230,000	(3,594,000)	328
1943–44	79,327,000	(3,598,000)	312
1944–45	75,843,000	(3,440,000)	296
1945–46	87,759,000	(3,981,000)	340
1946–47	81,764,000	(3,709,000)	315
1947–48	77,275,000	(3,505,000)	293

In view of the general increase in the imports of various other food commodities, a reduction in flour imports might have been expected. The explanation may be that white flour has occupied a central position in the Newfoundland dietary pattern and that any change in demand and consumption was likely to occur slowly. The additional consumption of other foods may raise calorie intake and add variety to the diet, but does not readily affect the intake of the staple cereal. Again, with increasing prosperity there may be increasing waste of a relatively cheap food. It may also be added that we obtained no information about existing unconsumed stocks of flour.

With regard to locally produced foods the consumption of fresh and dried fish probably remained constant. The home production of meat and milk has always been small, and remained so, though efforts had been made to develop dairy industries in the neighbourhood of St. John's and in a few other places. The total milk production may have been increased as a result of this, but we were disturbed to learn that in the outports the maintaining of cows and goats, which formerly made a small contribution to the diet, had declined. The younger generation, with money in its pockets, found the labour involved unattractive. The last cow in Harbour Mille died (apparently unlamented) the week before we reached that outport. The impression, furthermore, was gained that kitchen gardens were less numerous than in 1944, and that production of vegetables in the outports had declined.

SPECIFIC EFFORTS TO IMPROVE NUTRITION

In addition to the rising economic status of Newfoundland, which had led to greater importation of food and thereby had affected the nutritional situation to some extent, measures aimed directly at improving the nutrition of the people had been undertaken by the Government and other agencies. They comprised a program for public education in nutrition, distribution in the schools of a hot milk drink, distribution of cod liver oil, distribution to certain individuals of concentrated orange juice and improvement of the quality of margarine and white flour through fortification of the margarine with vitamin A and enrichment of the flour with thiamine, riboflavin, niacin, iron and calcium.

Public education. — Increased emphasis on nutritional considerations had entered into the radio advertising of processed foods. The im-

portance of nutrition in the prevention and treatment of tuberculosis had been emphasized in a very excellent coloured motion picture film on tuberculosis. The film, prepared in 1948 by the Newfoundland Tuberculosis Association, had been shown not only in St. John's but also in many outports. Other efforts to teach improved dietary habits had been made by the Department of Public Health and Welfare, the Department of Education and various private organizations, such as the Red Cross. In 1947 an experienced nutritionist was added to the staff of the Department of Public Health and Welfare. Her work was effected through the teachers in the schools, the women's civic bodies and the public health nurses. Another innovation was instruction in nutrition in the teacher's training school, Memorial College, St. John's. A pamphlet on nutrition designed especially to meet conditions in Newfoundland was distributed in 1947 to all school teachers. Other methods of approach included weekly radio talks, press articles and talks to adult education groups.

Little of this educational activity got underway before the early months of 1947. That it was beginning to have effects in 1948 is indisputable, but that it had significantly influenced the nutritional condition of the people by the time of our resurvey is doubtful. Dietary habits change slowly.

School feeding.—Government resources had not permitted undertaking a full-scale school feeding program. What had occurred was the free distribution to a large majority of the schools of dried non-fat milk powder. This was flavoured with cocoa and sweetened with sugar, and from it a hot drink was prepared which the children liked and consumed in cups or mugs they brought to school. The average serving was from 4 to 6 ounces (120 to 180 ml.). The hot drink program was initiated in a small number of schools in 1946. The formula was improved and distribution was extended in the school year beginning September, 1947. The powder had the following percentage composition:

Spray dried non-fat milk powder	70
Sugar	22
Cocoa	8

The quantity of this powder distributed in the school year 1947-48 was 426,762 pounds (194,000 kg.): about 8.5 pounds (3.9 kg.) per child to 50,000 out of a possible total of 70,000 grade school children. It went for the most part to the children of the outports. The school year ran from September 1 to June 30, but the hot milk drink usually was not given in the relatively warmer months of September and June, when the schools as a rule were unheated and facilities were not at hand to heat the drink. Allowing for this and for the Christmas and Easter holidays, assuming also that school attendance was for five days in the week, we estimate that each child obtained 24 gm. of powder per day for 160 days of the year. Thus for a full year the contribution would augment the diet per day per child by no more than 38 calories, 2.7 gm. of protein, 0.03 mgm. of thiamine, 0.15 mgm. of riboflavin, 0.10 mgm. of niacin, 97.0 mgm. of calcium and 0.07 mgm. of iron.

Other distributions. — Also made available free of charge in the school year 1947-48 was cod liver oil. It was distributed during three winter months. The total amount supplied was 3,623 gallons (16,470 litres) which theoretically may have provided a teaspoonful each day for 82 days for each of some 55,000 of the estimated 70,000 grade school children. However, this was not everywhere accepted well. Cod liver oil is a product of the fisheries and perhaps because of this it possesses less prestige in Newfoundland than do other less familiar medicinal preparations. It was not ingested in the school under the teacher's eye, and we heard much doubt expressed by many persons in several districts as to whether many of the children actually consumed it.

Another item distributed free of charge in 1947-48 was concentrated orange juice. It went to expectant and nursing mothers and to infants under one year of age. It was said to contain 220 mgm. of ascorbic acid per 100 gm. and the quantity dispensed was 880 gallons (4,000 litres). However, were this amount to be divided equally among the estimated total of 23,000 mothers and infants each individual would have received from it only 1.1 mgm. of ascorbic acid daily for one year.

Fortification of margarine. — All margarine sold in Newfoundland for years past has been manufactured in Newfoundland from imported fats. After January of 1945 all of it was fortified with vitamin A. The required content of vitamin A was made 30 international units per gram in 1945 and 45 I.U. per gram after January, 1946. Imports of fat for making margarine were estimated at 9 million pounds (4,082,000 kg.) in 1944 and actual imports in that and sub-

sequent years closely approximated that amount. The annual importation represents about 12.7 kg. per head, and fortified to the level of 45 I.U. per gram and equally distributed this would provide per head per day 1,575 units of vitamin A. The contribution would double the estimated provision per head of vitamin A in 1944. This involves the assumption that no margarine was fortified before January, 1945, which is not strictly true. An undetermined amount was fortified but only to the level of 10 or 15 I.U. per gram. In any case, the increase represents a very significant alteration of the nutritional situation.

Enrichment of white flour.—Cognizant of the large contribution of white flour to the total calories of the diet, the Government of Newfoundland took steps in 1943 to improve the nutritional quality of this product. Enrichment of white flour with thiamine, riboflavin, niacin and iron was made compulsory. In consequence, beginning with the fiscal year 1944-45, all imported white wheat flour has contained, per pound (0.46 kg.), a minimum of 2.0 mgm. of thiamine, 1.2 mgm. of riboflavin, 16 mgm. of niacin and 13 mgm. of iron. An additional requirement was imposed in October, 1947, namely, the inclusion of bone meal in an amount sufficient to provide not less than 500 mgm. of calcium per pound. No flour was milled in Newfoundland; hence except for an insignificant amount introduced by smugglers and a very small amount of packaged flour used for cake and pastry making, all white flour consumed had been enriched. Except for the city of St. John's which received enriched flour as early as April, 1944, this happened after our survey of 1944. In point of fact, we witnessed in August, 1944, the arrival at the outports of Fortune Bay of the first shipments of enriched white flour.

Mention was made in our earlier report of the relatively low provision by the average Newfoundland diet of thiamine, riboflavin and calcium. The estimated figures on a per head basis were for thiamine 0.90 to 0.96 mgm., for riboflavin 0.80 to 1.03 mgm. and for calcium 360 to 415 mgm. Enrichment of the flour approximately doubled these low figures, bringing all of them close to the allowances recommended by the Food and Nutrition Board of the National Research Council, U.S.A. Furthermore, by this enrichment the supplies of niacin and iron, which were thought to be borderline in adequacy in 1944, were very substantially increased.

VITAL STATISTICS

As evidence of poor health in Newfoundland in 1944, we cited in our former paper the reported crude mortality rate, the death rate for tuberculosis and the infant mortality rate. These rates were high in comparison with those prevailing in more favoured regions. They now are lower than they were.

Death rate.—The crude mortality rate per 1,000 of the population, deaths from all causes, for the five year period 1940-44 inclusive, ranged from 11.4 to 12.5, an average annual rate of 12.1. The rate for 1947 is not as yet available, but that reported for 1945 was 10.4 and that for 1946, 10.5. These later rates compare quite favourably with those of favoured regions whose racial stocks resemble those of Newfoundland and whose populations, as in Newfoundland, are relatively stable, that is, unaffected greatly either by immigration or by emigration.

Pulmonary tuberculosis. — Public health authorities consider that the nutritional status of a population strongly influences the prevalence and severity of tuberculosis. The death rate for tuberculosis always tends to increase in periods of calorie deprivation; it also is suspected that a food supply which is adequate in calories but deficient in certain nutrients, notably vitamin A, calcium and riboflavin may lower resistance to tuberculosis. While factors other than nutrition unquestionably are involved, there is reason to believe that the very high tuberculosis death rates reported for Newfoundland and cited in our publication of 1944 were to some extent related to nutritional deficiencies. The records of the years 1945 and 1946 suggest improvement, and although this in turn may be attributed in part to other factors than nutrition it is worthy of notation. The reported crude death rate for pulmonary tuberculosis per 100,000 of the population was 114 in 1945 and 101 in 1946, in contrast to an average annual rate of 135 for the five year period 1940-44. Bearing on this question, furthermore, is the fact that from 1945 onwards the Department of Public Health and Welfare and the Newfoundland Tuberculosis Association conducted jointly a vigorous case finding campaign almost island-wide in scope. In 1948 roentgenologic examinations were being made at a rate of 3,000 monthly. The resulting diagnosis of cases

of tuberculosis that otherwise might have passed unnoticed may temporarily have affected the recorded death rate. The record, therefore, may reflect less of a decline in deaths from tuberculosis than actually occurred. Many deaths in the outports of Newfoundland have been reported, of necessity, by persons untrained in medicine, and the causes of death assigned has been correspondingly inaccurate.

Infant mortality and stillbirths.—Most striking among the indices of improvement in the health of the people of Newfoundland between 1944 and 1948 are the reported data for the deaths of infants less than one year of age. The average annual rate for the five year period 1940-44 for the whole of Newfoundland was 96.0 per 1,000 live births, whereas for 1945 it was 74.2 and for 1946, 76.3. In the city of St. John's, for which the rates are more reliable, the corresponding figures are as follows: the average annual rate for the period 1940-44, 102.3; the rate for 1945, 92.2, that for 1946, 77 and that for 1947, 61.0 per 1,000 live births. The reported rate for stillbirths per 1,000 live births also showed improvement. In the decade 1937-46, it ranged from 35.0 to 45.2, whereas in 1947 it was 27.9.

General Observations

The survey of 1948 was confined to the city of St. John's, the outport of St. Joseph's on the Avalon Peninsula and the outports, Terrenceville, Bay L'Argent and Harbour Mille in Fortune Bay on the south coast of the island. For visiting the outports in Fortune Bay the motor vessel *Christmas Seal* was placed at our disposal by the Newfoundland Tuberculosis Association. Examinations were conducted in the schools with the assistance of public health nurses and teachers. Bonavista, which was included in the survey of 1944, was not revisited. Only 58 persons had been examined there in 1944 and their places on the lists were filled by additional persons from St. John's. We were disappointed in St. Joseph's that the subjects assembled for examination were fewer by 84 than the number examined in 1944. The difference was made up by examining a few more subjects in Fortune Bay and an additional number from a school in a poor district in St. John's. The total sample in 1948, although containing a few more urban people, was the same in number as in 1944 (868) and the character of the two samples was essentially the same with respect to economic status and distribution by

Table II.

Heights and Weights of Newfoundland Children

Age	Average heights		Difference in height from Toronto standard*	Average weights		Difference in weight from Toronto standard*
	Newfoundland 1948	Toronto 1939		Newfoundland 1948	Toronto 1939	
Years	Inches	Inches	Inches	Pounds	Pounds	Pounds
	Boys					
5	41.3	43.1	-1.8	38.1	43.0	-4.9
6	43.4	45.1	-1.7	41.5	46.4	-4.9
7	46.1	47.4	-1.3	48.4	51.3	-2.9
8	48.3	49.6	-1.3	52.6	56.8	-4.2
9	49.7	51.7	-2.0	56.7	62.9	-6.2
10	50.9	53.6	-2.7	59.5	68.8	-9.3
11	52.6	55.4	-2.8	64.3	75.2	-10.9
12	56.1	57.4	-1.3	72.9	82.5	-9.6
13	58.2	59.4	-1.2	82.4	90.8	-8.4
14	58.5	61.6	-3.1	84.9	100.9	-16.0
15	62.3	63.9	-1.6	100.3	111.6	-11.3
	Girls					
5	40.5	43.0	-2.5	38.4	42.0	-3.6
6	44.3	44.8	-0.5	45.4	44.9	+0.5
7	45.7	47.1	-1.4	48.5	49.9	-1.4
8	48.2	49.3	-1.1	50.2	55.0	-4.8
9	49.5	51.4	-1.9	53.6	61.2	-7.6
10	50.8	53.4	-2.6	58.0	67.8	-9.8
11	53.0	55.7	-2.7	64.1	75.8	-11.7
12	56.0	58.2	-2.2	73.0	86.1	-13.1
13	58.4	60.2	-1.8	81.8	95.4	-13.6
14	59.2	61.5	-2.3	93.0	103.4	-10.4
15	60.1	62.3	-2.2	99.6	109.3	-9.7

*Heights and weights found for 78,000 Toronto school children in 1939.[21]

Fig. 5.—Perifolliculosis—female, aged 21. Proliferation and engorgement of capillaries around hair follicles.

Fig. 6.—Xerosis conjunctivæ, moderate degree—female, aged 31. Localized thickening with yellow discoloration of conjunctiva on right side.

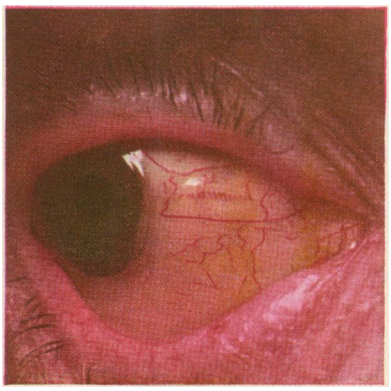


Fig. 7.—Xerosis conjunctivæ, severe degree — male, aged 63. Marked thickening and yellowish brown discoloration of conjunctiva.

Fig. 8.—Folliculosis, mild degree—female, aged 15. "Goose-flesh" appearance of the skin

Fig. 9.—Follicular keratosis—female, aged 16. Dry spinous keratotic plugs.

Fig. 10.—Xerosis of skin — female, aged 56. Atrophy with dryness, scaliness and crinkling. "Mosaic pavement" or "crackled" skin.

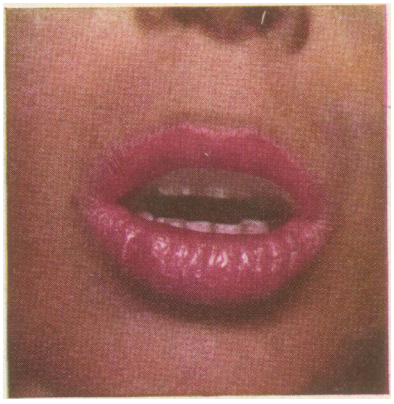


Fig. 11.—Cheilosis—male, aged 14. Swelling and redness of lips. Thinned, scaly, wrinkled epithelium.

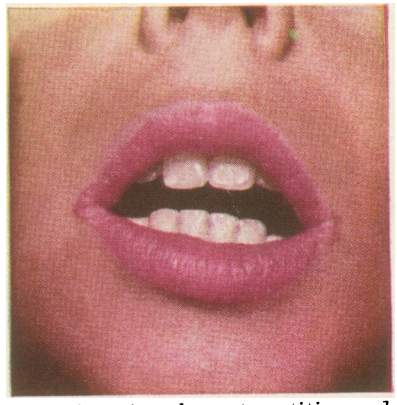


Fig. 12.—Angular stomatitis and mild cheilosis—male, aged 8. Well developed fissures at each angle of the mouth.

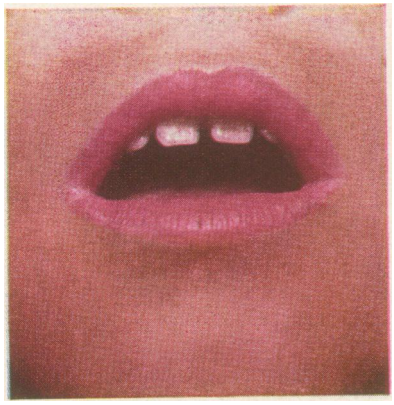


Fig. 13.—Cheilosis—male, aged 11. White macerated areas at angles of mouth (la perlèche).

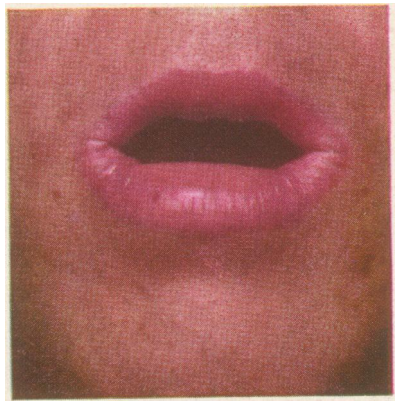


Fig. 14.—Cheilosis and angular scars —male, aged 16. Acute cheilosis superimposed on chronic condition. Early purse-string appearance.

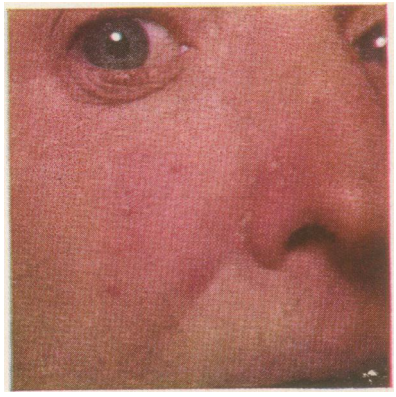


Fig. 15.—Dyssebacia and telangiectasis of skin of cheek—female, aged 40. Scaly, greasy flakes in nasolabial fold. Also mild blepharitis.

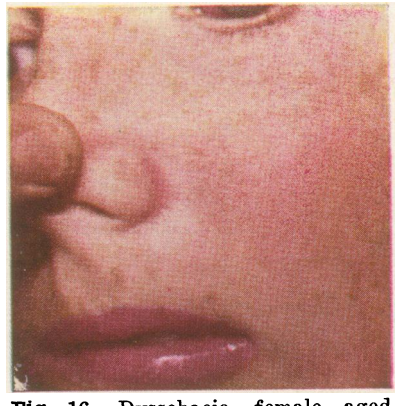


Fig. 16.—Dyssebacia—female, aged 18. Erythema at nasolabial fold. Cheilosis of lips also present.

Fig. 17.—Circumcorneal injection—female, aged 26. Also some general conjunctival injection. (White area is light reflection.)

Fig. 18.—Blepharitis, mild, and suborbital pigmentation—female, aged 7. Slight swelling and crusting of lower eyelid. Brownish area below eye.

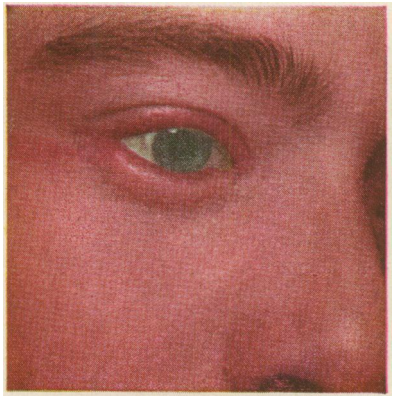


Fig. 19.—Blepharitis, marked—female, aged 22. Marked redness and swelling of the eyelids. Dried exudate and redness at outer canthus.

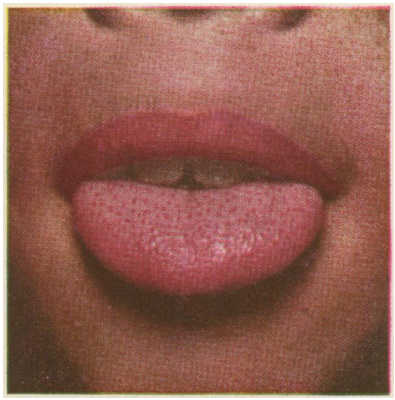


Fig. 20.—Hypertrophy of papillæ of tongue—male, aged 11.

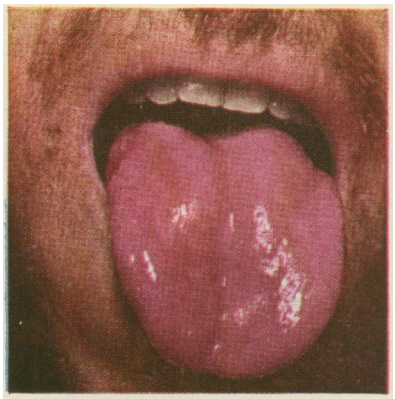


Fig. 21.—Atrophy of papillæ of tongue—male, aged 25. Tongue is thin, almost entirely smooth.

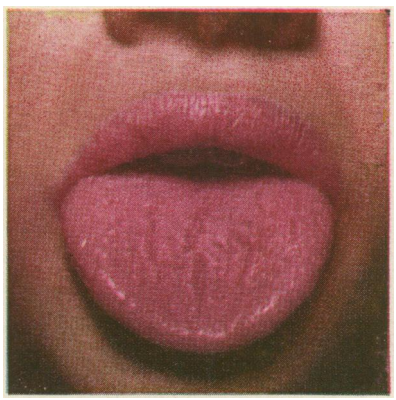


Fig. 22.—Multiple fissuring and slight thinning of tongue—female, aged 14.

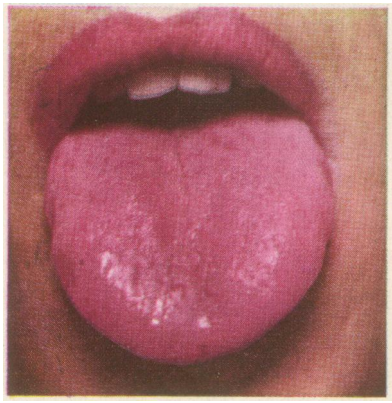


Fig. 23.—Swelling of tongue—male, aged 21. Lateral indentations of teeth. Atrophy of papillæ, most advanced at anterior margin.

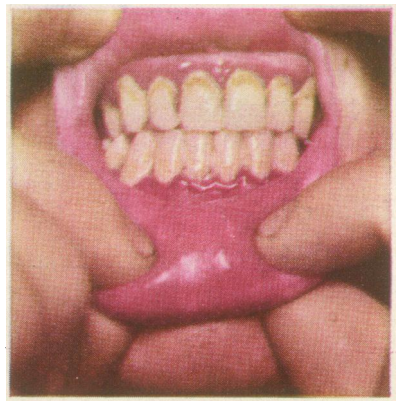


Fig. 24.—Redness and swelling of gingival tissue — female, aged 25. Some loss of lower interdental papillæ.

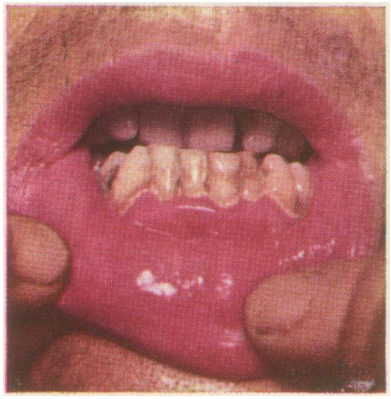


Fig. 25.—Loss of interdental papillæ —male, aged 30.

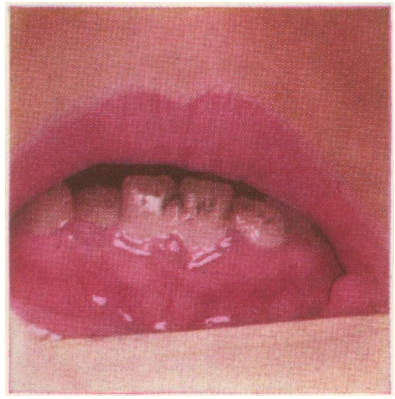


Fig. 26.—Retraction of gum tissue— female, aged 7. Around lower teeth the swollen gingival tissues are detached from teeth.

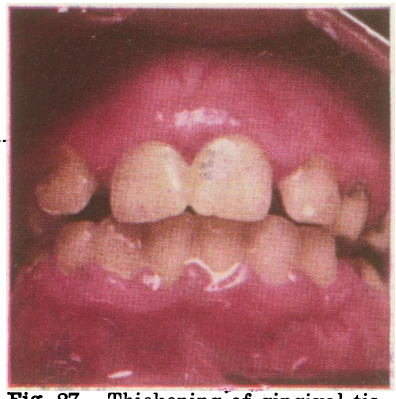


Fig. 27.—Thickening of gingival tissues—female, aged 8. Readily seen in upper gingivæ.

age and sex (Table I). The total sample of 1948 contained 227 individuals who had been subjects of the survey of 1944. It must be emphasized that neither the sample of 1948 nor that of 1944 included representatives of the relatively small proportion of the population in the upper economic groups.

Photographic records were obtained of many lesions, and specimens of blood and urine were secured on a random basis from nearly half the total sample, including 68 of the 227 persons examined previously in 1944.

The comment already has been made that the people we encountered in 1948 were better dressed than they were in 1944, and that their homes looked better tended. This was true not only in St. John's but for the most part also in the outports. Of more significance was the evident increased alertness of the persons we examined. Gone to a great extent was the apathy so noticeable in 1944. The children no longer waited patiently for their examinations. They clustered around the tables of the examiners unless they were shooed away. More monitoring was required. They were interested and curious, as children ought to be. They swarmed over the decks of the motorboat *Christmas Seal* when we docked at outports and had to be herded off. Also they engaged in games and play, whereas the absence of play had been remarked upon before.

In the report of the survey of 1944[1] it was stated that "an early impression of short stature, particularly in the children, was not borne out by measurements." The measuring in 1944 was done by untrained voluntary aids, whereas in 1948 one experienced person was entrusted with this responsibility. The data thus obtained in 1948, as recorded (Table II), support the "early impression" of 1944 that the children were short in stature. The measurements obtained in 1948 revealed that the average boy, depending on his age, was from 1.2 to 3.1 inches shorter than the Toronto school boy of 1939; they showed a somewhat smaller difference for the average girl. The weights of the Newfoundland children in 1948 were below the weights recorded for Toronto school children in 1939, but because of the probable unreliability of the recorded heights in 1944 comparison of the Newfoundland weights for heights of 1948 with those of 1944 is thought to be unjustified. Nevertheless, it can be said with considerable assurance that the more extreme degrees of underweight for height and age were encountered much less frequently in Newfoundland in 1948 than in 1944.

CLINICAL FINDINGS

Clinical examinations in 1948 were limited, as they were in 1944, to a search for lesions of the exposed parts of the body, including the mouth. The lesions to be recorded were those which students of nutrition have attributed to deficiencies of vitamins or minerals. Also recorded was the presence or absence of the tendon reflexes and vibratory sensation of the lower limbs. The criteria of abnormality were the same as those adopted in 1944, but the search for suspected signs of malnutrition was perhaps more thorough, and the recording of the findings more systematic. Individuals, who had been examined in 1944 and presented themselves again in 1948, were re-examined without reference to previous observations, and their records and those for the entire sample were not assembled for comparison with the records of the 1944 survey until the resurvey had been completed.

The occurrence of the several lesions encountered in 1948 is compared in Tables III and IV with that of the same abnormalities recorded in 1944 (see Table IV of earlier report[1]). The prevalence of several types of lesion had decreased; for some types an increase was apparent, for others little change. When the smaller sample, consisting of 227 persons examined in 1944 and re-examined in 1948, is inspected (Table IV), the differences are in general the same as those between the total samples. There was less dry, staring hair in 1948, less mild follicular abnormality of the skin, less abnormality of the skin of the face, less blepharitis, less angular stomatitis and cheilosis and much less abnormality of the tongue. On the other hand, the prevalence of other lesions of the skin had not decreased and that of hyperæmia and swelling of the gums had increased. Likewise the prevalence of severe caries and loss of teeth was greater in 1948 than in 1944.

It is recognized that the lesions here discussed are not of necessity pathognostic of nutritional deficiency; injury or disease in no way related to nutrition can provoke any or all of them. However, it must be recognized that nutritional deficiencies, as has been shown experimentally, can themselves alone account for many of these lesions, either directly or by conditioning the tissues to injury from other causes. Further-

TABLE III.

CLINICAL FINDINGS OF ALL PERSONS EXAMINED

	Outports		St. John's		Total		
	1944	1948	1944	1948	1944	1948	Difference[1] 1948–1944
Number of persons examined	599	474	269	394	868	868	
Signs of abnormality	Per cent		Per cent		Per cent		Per cent
HAIR:							
Dry staring	11.4	1.7	7.4	3.6	10.1	2.5	−7.6
SKIN OF BODY AND LIMBS:							
Xerosis	4.3	7.6	0	3.0	3.0	5.5	*
Mild follicular changes	43.2	23.6	25.6	19.0	37.7	21.5	−16.2
Follicular keratosis	6.2	7.6	1.1	3.3	4.6	5.6	*
Perifolliculosis	2.0	9.9	1.9	2.5	2.0	6.6	+4.6
Crackled skin	2.7	1.9	0.4	0.3	1.9	1.2	*
SKIN OF FACE:							
Folliculosis	9.9	3.4	2.2	1.0	7.5	2.3	−5.2
Dyssebacia	5.5	4.9	3.3	1.5	4.8	3.3	*
Suborbital pigmentation	15.3	2.3	19.4	1.0	16.5	1.7	−14.8
Telangiectasis	13.6	1.3	4.5	0.5	10.7	0.9	−9.8
EYES:							
Thickening of conjunctiva, all grades	79.3	75.1	74.9	36.3	76.6	57.5	−19.1
Hyperæmia, all grades	48.5	29.5	42.0	15.5	46.4	23.2	−23.2
Blepharitis, grade 1	20.0	11.6	13.2	6.1	18.0	9.1	−8.9
grade 2 and greater	7.3	2.3	4.1	1.0	6.3	1.7	−4.6
Lachrymation	8.4	11.0	2.9	8.1	6.2	9.7	*
Photophobia	8.4	10.5	3.7	8.4	6.8	9.6	*
LIPS:							
Angular stomatitis[2]	24.7	12.4	16.3	6.3	21.7	9.7	−12.0
Cheilosis, grade 1	41.0	39.2	45.1	34.0	42.2	36.9	−5.3
grade 2 and greater	32.6	7.6	11.5	4.6	26.2	6.2	−20.0
GUMS:							
Red hyperæmia, grade 1	25.2	33.3	26.8	38.1	25.8	35.5	+9.7
grade 2 and greater	18.2	18.6	7.1	8.6	14.8	14.1	*
Blue congested[3]	7.8		3.3		6.5		
Swollen	46.1	55.9	42.0	49.7	45.2	53.1	+7.9
Interdental papillæ lost	21.7	18.1	16.3	10.4	20.2	14.6	−5.6
Recession	53.9	31.4	47.2	23.4	52.2	27.8	−24.4
Retraction	25.9	22.6	14.9	14.7	22.6	19.0	*
Pus	14.4	8.9	8.9	4.1	12.7	6.7	−6.0
TEETH:[4]							
Malocclusion, severe	19.4	20.3	21.2	19.3	20.0	19.8	*
Active caries, severe	59.6	74.9	65.6	72.8	61.4	74.0	+12.6
Loss of teeth, moderate[5]	16.7	21.1	27.2	16.5	20.1	19.0	*
marked or complete[6]	20.4	45.6	12.3	25.9	17.8	36.6	+18.8
TONGUE:							
Reddened	7.7	3.8	1.8	0.8	5.8	2.4	*
Magenta	10.9	0.6	8.9	0	10.2	0.3	-9.9
Swollen	7.1	1.5	0.4	0.5	4.9	1.0	*
Hypertrophic papillæ tip	13.2	17.5	14.5	11.7	13.7	14.9	*
tip and elsewhere	19.3	7.0	24.9	8.7	21.1	7.7	−13.4
Atrophic papillæ tip	15.4	4.4	10.4	3.0	13.9	3.8	−10.1
tip and elsewhere	21.0	5.7	12.6	1.8	18.4	3.9	−14.5
Fissuring, severe, multiple	11.2	11.8	4.8	3.9	9.2	8.1	*
BONES:[7]							
MUSCLES:							
Poor development, winged scapula	9.6	9.3	12.6	7.1	10.5	8.3	*
NEUROLOGIC SIGNS:[8]							
Absent knee and ankle jerks	2.3	1.3	0.7	1.3	1.8	1.3	*
Loss of vibratory sense							
Toes	4.0	7.0	0.3	2.8	2.9	5.1	*
Malleoli	1.5	2.7	0	1.0	1.0	2.0	*
Tibiæ	0.8	1.3	0	1.0	0.6	1.2	*
Tender calf muscles	2.3	1.7	1.1	0.3	2.0	1.0	*
Squatting test[9]	0.8	–	0.4	–	0.7	–	–

(1) The differences shown in this column when figures are preceded by a minus (–) sign, represent statistically significant improvements in 1948 as compared with 1944. The figures preceded by a plus (+) sign represent worsening in 1948 as compared with 1944. The asterisk (*) indicates that the difference is without statistical significance. A difference was considered significant when it would occur by chance alone less frequently than one time in a hundred. A less critical test (one chance out of 20) was applied to the classification "neurologic signs", but even by this criterion none of the differences in this category proved to be significant.
(2) Scars of healed lesions at the angles of the mouth were recorded in 18% of the persons examined in 1948.
(3) Examination for blue congestion of gums was not made in 1948.
(4) Caries and loss of teeth, so prevalent in 1944, were similarly prevalent in 1948. See H. Mellanby, Study of Teeth in Newfoundland, in press.
(5) Teeth lost numbering four or less.
(6) Teeth lost numbering five or more.
(7) Although included in Table IV of the earlier report and sought on examination in 1948, these data are omitted here because of their lack of value as an index of the prevalence of rickets.
(8) See text (page 345) and footnote (1) above.
(9) Results of squatting test, namely the ability of the person examined to rise from the squatting position without helping himself with his hands, were not recorded in the study of 1948.

more, it is to be expected that severe chronic lesions resulting from long years of deficiency of a vitamin or mineral cannot be cured in months or even years by treatment which is limited to providing no more than a good but not unusually high dietary allowance of the vitamin or mineral in question. Clinical experience has clearly shown that to obtain a rapid and complete response to vitamin or mineral therapy it is usually necessary to give doses which are several times as large as the allowances which suffice for the satisfactory maintenance of the healthy individual. These reflections should be borne in mind in considering the observations here reported.

Hair, dry staring.—Dry, coarse, lack-lustre hair ("rough coat") is a common accompaniment of malnutrition in animals. Similar loss of lustre is seen in the head hair of man. In man, however, its recognition is made difficult by difference in the care of the hair (*e.g.*, in washing, brushing or use of toilet lotions). Notable nevertheless is the fact that dry, staring hair was recorded as being found in the outports in examinations of 11.4% of the sample of 1944 and in only 1.7% of the sample of 1948. For the total sample the percentage figures for 1944 and 1948 were 10.1 and 2.5 respectively, while for the 227 persons examined in 1944 and re-examined in 1948 they were respectively 8.4 and 1.8.

Skin of body and limbs.—The prevalence of xerosis, follicular keratosis and crackled skin was too low both in 1944 and 1948 to justify conclusions from differences in prevalence between these years. However, the abnormality which is designated in Tables III and IV under "Skin of body and limbs" as "Mild follicular changes", by which is meant the folliculosis which resembles permanent "gooseflesh" (Fig. 8), was encountered with sufficient frequency to warrant the conclusion that a statistically significant decrease in prevalence had occurred. This lesion is probably related to deficiency of vitamin A. On the other hand, the lesion designated "perifolliculosis" (Fig. 5)—in which engorgement of capillaries leads to the formation of a reddish or brownish halo around the follicles—had increased in prevalence to a significant degree. Cuthbertson,[3] Crandon, Lund and Dill,[5] and Keil[6] have suggested that deficiency of vitamin C, either separately or combined with other deficiencies, may be involved in the production of this lesion.

Skin of face.—The occurrence of the listed abnormalities of the face, except dyssebacia (Figs. 15 and 16), was frequent enough to justify attaching statistical significance to differences between 1944 and 1948. For suborbital pigmentation (Fig. 18) and telangiectasis (Fig. 15) the decline was striking: from 16.5 to 1.7% for the former, and from 10.7 to 0.9% for the latter. Suborbital pigmentation is not generally thought to be related to vitamin deficiency. It occurs in undernutrition or semistarvation,[7] but the diet in Newfoundland was adequate with respect to calories both in 1944 and in 1948, and its prevalence there in 1944 cannot be explained by lack of calories.

Eyes.—The occurrence of thickening of the conjunctiva (Figs. 6, 7 and 17) was very high in Newfoundland in 1944. Such thickening is commonly observed in adults everywhere. It is, however, generally uncommon in children. One of us (Wilder[8]) compared its recorded prevalence in the 402 children of grade school age in the Newfoundland sample of 1944 with that observed in an examination of some 300 Minnesota children. The prevalence was over 70% in Newfoundland and only about 4% in Minnesota. The causes of this abnormality are not known, but in the 1944 survey a significant correlation was demonstrated in the youngest age groups (5 to 10 years) between serum vita-

TABLE IV.

CLINICAL FINDINGS OF 227 PERSONS EXAMINED IN 1944 AND RE-EXAMINED IN 1948[1]

Signs of abnormality	1944	1948	Difference[2] 1948–1944
	Per cent	Per cent	Per cent
HAIR:			
Dry staring	8.4	1.8	-6.6
SKIN OF BODY AND LIMBS:			
Xerosis	2.6	8.4	*
Mild follicular changes	35.7	25.0	-10.7
Follicular keratosis	5.3	7.0	*
Perifolliculosis	1.3	12.3	+11.0
Crackled skin	1.8	2.6	*
SKIN OF FACE:			
Folliculosis	7.9	3.5	*
Dyssebacia	4.4	5.7	*
Suborbital pigmentation	7.0	2.2	*
Telangiectasis	1.3	0	*
EYES:			
Thickening of conjunctiva, all grades	77.1	79.3	*
Hyperæmia, all grades	51.5	27.8	-23.7
Blepharitis, grade 1	21.6	12.3	*
grade 2 and greater	9.7	0.9	-8.8
Lachrymation	8.4	12.8	*
Photophobia	9.3	14.1	*
LIPS:			
Angular stomatitis	17.2	10.6	*
Cheilosis grade 1	44.9	42.3	*
grade 2 and greater	26.0	7.5	-18.5
GUMS:			
Red hyperæmia, grade 1	24.2	37.0	+12.8
grade 2 and greater	15.0	13.2	*
Swollen	41.4	54.6	*
Interdental papillæ lost	17.2	15.4	*
Recession	52.0	29.5	-22.5
Retraction	24.2	18.1	*
Pus	10.1	7.5	*
TEETH:			
Malocclusion, severe	20.7	22.4	*
Active caries, severe	62.6	70.1	*
Loss of teeth, moderate	12.3	22.5	+10.2
marked or complete	26.4	44.1	+17.7
TONGUE:			
Reddened	3.5	2.2	*
Magenta	9.7	0	-9.7
Swollen	4.8	2.2	*
Hypertrophic papillæ tip	26.4	20.7	*
tip and elsewhere	25.1	10.1	-15.1
Atrophic papillæ tip	31.7	4.4	-27.3
tip and elsewhere	29.1	5.7	-23.4
Fissuring, severe, multiple	8.8	11.0	*
MUSCLES:			
Poor development	15.9	13.2	*
Winged scapula	14.5	9.7	*
NEUROLOGIC SIGNS: (3)			
Absent knee jerks	0	3.1	*
Absent ankle jerks	1.8	5.7	*
Loss of vibratory sense			
Toes	1.3	7.9	+6.6[3]
Malleoli	1.3	4.0	*
Tibiæ	1.3	1.8	*
Tender calf muscles	2.2	2.2	*

(1) Persons examined in outports 190; in St. John's 37.
(2) See footnote (1) Table III.
(3) See text (page 345) and footnote (1) of Table III.

min A levels and this lesion. Improvement with respect to it, in Newfoundland, is apparent from the statistically significant change in frequency of occurrence between 1944 and 1948.

Improvement likewise is apparent between 1944 and 1948 in the prevalence of circumcorneal hyperæmia (Fig. 17) and blepharitis (Figs. 18 and 19). Some evidence that trauma from excessive glare may play an important part in producing blepharitis was obtained. At Harbour Mille, a village surrounded by bare grey rock where the light intensity was greater than in the other places in which examinations were made, the prevalence of blepharitis in 1944 was 37%. This is in contrast to the prevalence for all the outports taken together, which was 27.3% and for St. John's, which was only 17.3%. Nevertheless the prevalence at Harbour Mille decreased from 37% in 1944 to 26.6% in 1948, suggesting that improved nutrition had lessened susceptibility to the ill-effects of glare.

Lips.—Angular stomatitis and cheilosis (Figs. 11, 12, 13 and 14) can be produced experimentally in man by restricting the intake of riboflavin. The prevalence of angular stomatitis in Newfoundland in 1944 was high: 24.7% in the sample examined in the outports, 16.3% in St. John's, and 21.7% in the entire sample. The statistically significant decrease in the occurrence of this lesion represents an improvement, which can be attributed to increased intake of riboflavin. In this and the earlier report the term cheilosis has been employed to designate reddening and swelling of the lips with thinning and scaling of the epithelium. Cheilosis was prevalent in Newfoundland in 1944. The decrease in the occurrence of this lesion is statistically significant, not only for the mild grade (grade 1) with which ordinary chapping of the lips can be confused, but also for the grades of greater severity which can with little hesitation be related to deficiency of riboflavin.

Gums.—No scurvy was observed in Newfoundland in 1944, but 41% of the persons examined had obvious reddening, and 45.2% swelling, of the gums (Figs. 24 and 27). A well-controlled experiment with human volunteers has produced evidence that such lesions may result from deficiency of ascorbic acid.[9] The increase in their prevalence in 1948 is of interest, and suggests that the diet in Newfoundland is still deficient in this vitamin. On the other hand, a statistically significant decline was observed between the prevalence in 1944 and in 1948 of lost interdental papillæ and of recession of the gums (Figs. 25 and 26). The explanation of this improvement is not apparent.

Teeth.—The high incidence of active caries and of loss of teeth in Newfoundland has been the subject of much comment. The prevalence of caries (61.4%) recorded in our survey of 1944 corresponds with that observed by Metcoff and others[2] (53%) and by Cuthbertson[3] (61%). Furthermore, a large percentage of the subjects had lost many teeth, mainly the result of extractions performed by physicians. There is very little conservative dentistry done, and the inhabitants of the outports, as Cuthbertson[3] has written, with infrequent opportunities of visiting a physician, and faced with periodic toothache, often prefer to have all their teeth extracted at one time.

The prevalence of caries and of marked or complete loss of teeth was found to be higher in 1948 than in 1944. The difference is significant in the total samples. Whether dental health will be improved by such measures as the increased use of evaporated milk containing vitamin D, the addition of bone meal to flour and the distribution of cod liver oil in schools, is a question for the future. It may be suspected that one of the results of the increased purchasing power of the inhabitants of Newfoundland has been greater expenditure on candy and other sweets, with consequent ill-effects on teeth.

Tongue. — The most striking difference observed clinically between the persons examined in 1948 and those examined in 1944 was in the appearance of their tongues. Magenta tongue, recorded in 10% of the examinations of 1944, was carefully looked for in 1948 but was found in less than 1% of the persons seen in the outports, and not once in St. John's. The prevalence of hypertrophy of the papillæ, involving more than the very tip of the tongue (Fig. 20), was diminished to a statistically significant degree, and that of atrophic papillæ either of the tip or of a larger area of the tongue (Figs. 21 and 23) had likewise significantly lessened. These lingual lesions correspond closely to those which develop on the tongue of patients suffering from niacin deficiency.

Neurologic signs and symptoms.—Contrary to original expectations, the recorded instances of areflexia and lost vibration sense proved to be greater for 1948 than for 1944 (Tables III and

IV). However, these abnormalities were encountered so infrequently in both years that the differences lack significance even when the less critical test for significance (one chance out of 20) is applied to them. It furthermore is improbable in the light of recent studies of human requirements for thiamine[10] that the diet of many of these people, over the last few years, has been low enough to provoke peripheral neuritis (beriberi). However, other abnormalities for which lesser degrees of deficiency of thiamine may possibly have been responsible were frequently encountered in 1944 and were less in evidence in 1948. The statement applies especially to dyspepsia, constipation, listlessness and apathy. It has been established by controlled experiments on human subjects that an allowance of thiamine sufficient to prevent peripheral neuritis may be insufficient to protect against the development of functional disturbances of the autonomic and central nervous systems. In such experiments dyspepsia, constipation, listlessness and apathy have developed early, to be followed later, when the degree of deprivation was more severe, by objective evidence of peripheral neuritis.[10]

CHEMICAL FINDINGS

The chemical measurements made in 1944 were repeated in 1948 by procedures as nearly as possible identical with those used in the earlier survey. Blood was obtained by finger puncture. Hæmoglobin (0.01 ml. blood) and blood serum protein (0.005 ml. serum) were determined at the time of the survey with the gradient tube-specific gravity method.[11] The balance of the blood serum determinations were made on samples transported to St. Louis on dry ice. Trichloracetic acid was added to the samples for ascorbic acid determination (0.01 ml. serum) before shipment. For the measurement of ascorbic acid (as the dinitrophenylhydrazone) the necessary oxidation of ascorbic acid to dehydroascorbic acid was effected with copper[12] instead of charcoal which had been formerly used in the microprocedure[13] and in the original method of Roe and Kuether.[14] Since the omission of charcoal has been found to yield results which average 0.1 mgm. % too high, a correction of this amount was made. Vitamin A was measured in 0.1 ml. of serum by a spectrophotometric method.[15] Alkaline phosphatase values were determined in 0.01 ml. of serum with the nitrophenylphosphate reagent.[16] Urine samples (non-fasting) were preserved with acetic acid (final concentration 0.1 N). Riboflavin was determined by measuring the fluorescence reducible by hydrosulfite in samples pretreated with excess permanganate and peroxide. Thiamine was measured by the Hennessy and Cerecedo procedure[17] using the correction factor for F_2 of Najjar and Ketron.[18] The methods used for both riboflavin and thiamine give results which are on the average slightly higher than true values. Nevertheless it was felt best not to deviate from the procedures used in 1944.

As before, thiamine and riboflavin were calculated per gram of creatinine excreted since it was not feasible to collect specimens during a fixed time interval. The use of the creatinine basis also helped to take into account the very wide range of age and size in the group surveyed.

Analyses were performed on blood from a little less than half of the persons studied and on urine from a third of them. In the case of 68 persons chemical measurements made in 1944 were repeated in 1948.

Results of analyses. — On comparison of the chemical data of 1948 with those of 1944, there was found to be little change in hæmoglobin or serum protein, and a small decrease in serum ascorbic acid. In contrast, there were dramatic increases in the excretion of thiamine and riboflavin, and in the level of vitamin A in the serum. There was a probable decrease in alkaline phosphatase among children less than 14 years of age. The findings for the group as a whole were confirmed by the findings for the included smaller group of persons who were examined in 1944 and re-examined in 1948.

For purposes of further comparison mention is made of a nutritional survey conducted in 1946 of 1,200 adolescent children in the state of New York.[19] Except for hæmoglobin, which was measured colorimetrically, the same analytic procedures were used in this and the Newfoundland surveys.

Because an age effect was apparent with every substance measured, graphs are presented comparing age, or age and sex, and average concentrations of the substances measured. This also allows evaluation of possible changes between the two surveys in different age groups.

Hæmoglobin. — Because of the marked increase in the concentrations of hæmoglobin in the male during adolescence, it is necessary to

TABLE V.
CHEMICAL FINDINGS

	Years	Hæmoglobin, gm. %[1] Number of persons	<11 %	<12 %	Mean	Serum protein, gm. % Number of persons	<6.2 %	Mean
Outports	1944	216	3	14	13.4 ±.13	162	2	6.91±.03
	1948	175	4	18	13.1 ±.1	237	4	6.88±.03
St. John's	1944	107	4	23	12.7 ±.1	106	1	6.92±.04
	1948	132	2	7	13.1 ±.1	130	2	6.90±.04
All Newfoundland	1944	322	3	18	13.1 ±.1	268	2	6.91±.02
	1948	306	3	13	13.1 ±.1	367	3	6.89±.02

		Alkaline Phosphatase-Units Children[2]				Adults (over 17)		
			>7 %	Mean		>3 %	Mean	
Outports	1944	117	13	5.52±.17	103	6	1.98±.08	
	1948	91	4	4.66±.14	104	11	1.80±.10	
St. John's	1944	59	7	4.75±.18	16	16	2.08±.70	
	1948	83	2	4.50±.12	31	6	1.28±.17	
All Newfoundland	1944	176	11	5.16±.06	119	7	1.98±.06	
	1948	174	3	4.61±.09	135	10	1.68±.06	

		Vitamin A mcgm. %	<20 %	<30 %	Mean	Ascorbic acid mgm. %	<.2 %	<.4 %	Mean
Outports	1944	213	42	66	23±1	230	25	58	.51±.03
	1948	223	2	23	40±1	237	32	71	.33±.02
St. John's	1944	99	61	91	20±1	108	33	59	.47±.05
	1948	119	0	12	42±1	130	20	45	.56±.04
All Newfoundland	1944	312	48	74	22±1	338	28	59	.49±.02
	1948	342	2	18	41±1	367	28	62	.41±.02

		Thiamine mcgm. per gm. creatinine	<50 %	<100 %	Mean	Riboflavin mcgm. per gm. creatinine	<200 %	<300 %	Mean
Outports	1944	208	58	83	65±4	258	39	61	380±24
	1948	143	1	7	294±17	156	2	9	718±28
St. John's	1944	79	6	28	262±15	117	10	24	566±45
	1948	105	1	19	300±21	114	0	8	696±36
All Newfoundland	1944	287	44	69	117±8	385	30	50	437±22
	1948	248	1	12	297±11	270	1	9	708±21

(1) Excluding male persons over 16 years of age.
(2) Girls under 14, boys under 16 years of age.
(3) The value following the ± sign, wherever used, is the standard error of the mean.

take age and sex into account in the evaluation of the status of a group in regard to hæmoglobin. It is apparent (Graph 1) that there is rather close agreement at all ages between the average hæmoglobin values for 1944 and those for 1948. There is, likewise, no significant change in the average value for hæmoglobin or the percentage of cases below 11 or below 12 grams % (Table V). With repeat cases (Table VI) there is a small increase recorded in 1948, an increase which would be expected from the increased ages of the boys and young men.

The average values for hæmoglobin observed for the 1,200 children in New York State would fall almost exactly on the curves of Graph 1.

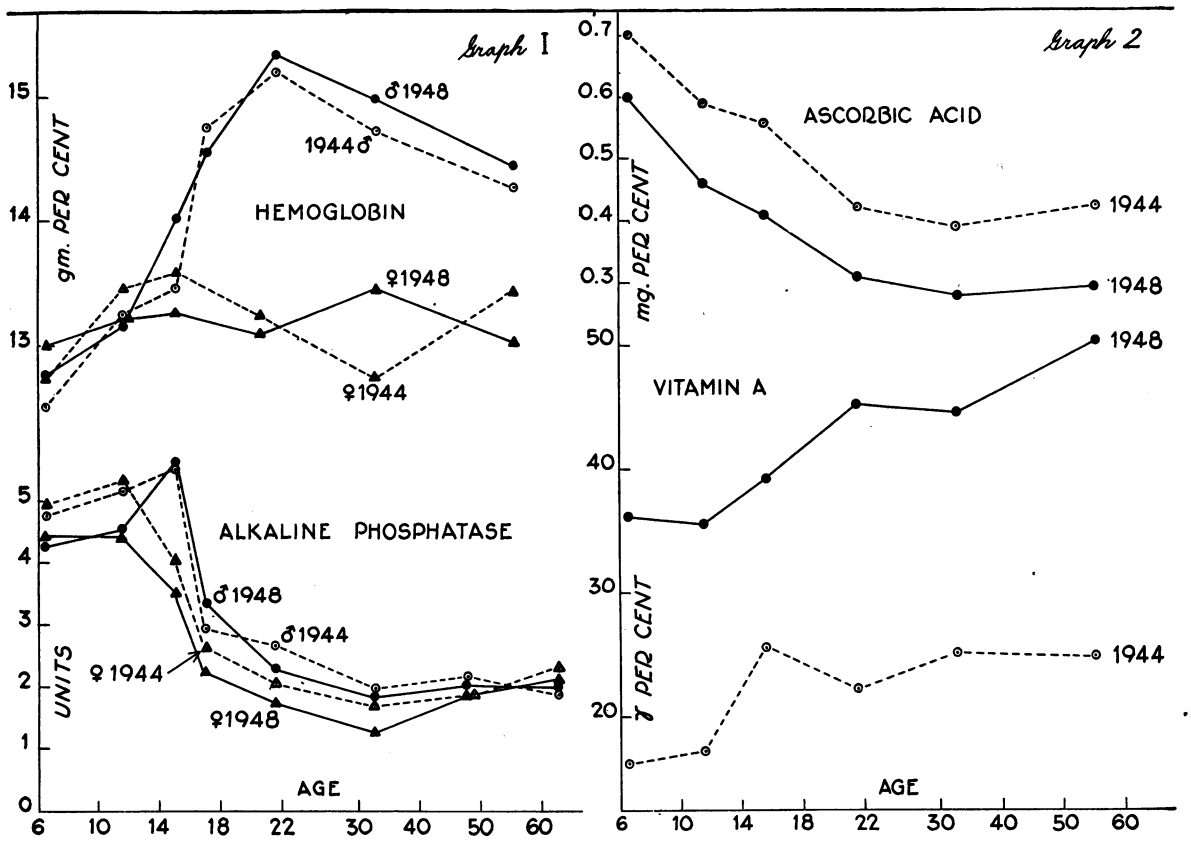
Serum protein ("normal" range 6.2 to 8.0 gm. %).—Nearly identical values were observed in 1948 and 1944, and are adjudged to be satisfactory. An increase of approximately 0.3 gm. % in the mean values for serum protein was found to occur during adolescence in both sexes (not shown).

Phosphatase ("normal" range 2.0 to 8.0 units for children, 1.0 to 3.0 units for adults).—The physiologic decrease in alkaline phosphatase during adolescence is well illustrated by the data from the two surveys (Graph 1). The earlier drop in the female and the rise and subsequent fall in the male are strikingly similar to the changes found with larger numbers of adolescents in the New York State survey cited above. There is a suggestion of a decrease in 1948 in average phosphatase values among children less than 14 years of age, and there were

fewer children with borderline high values (more than 7 units, Table V). Such decrease, if it be real, was not found among the relatively few repeat cases (Table VI). To the extent that the concentration of this enzyme is a valid measure of the adequacy of the diet with respect to vitamin D and calcium, the provision of these nutrients appears to have been satisfactory in 1944 and in 1948.

Vitamin A ("normal" range 30 to 80 mcgm. %).—Between 1944 and 1948 the vitamin A values doubled and there occurred a striking state of nutrition in Newfoundland with respect to vitamin A had progressed from unsatisfactory to satisfactory.

Thiamine and riboflavin (excretion "normal" if 150 mcgm. or more of thiamine and 400 mcgm. or more of riboflavin).—The amount of urinary thiamine or riboflavin excreted per gram of creatinine may be considered as roughly the amount of vitamin excreted per day by a small adult. (The usual excretion of creatinine is about 1 gram per 110 pounds (50 kg.) of body weight.)



Graph 1.—Values for average concentration of hæmoglobin in blood and of alkaline phosphatase in blood serum by age, Newfoundland surveys of 1944 and 1948.

Graph 2.—Values for average concentration of ascorbic acid and of vitamin A in blood serum by age, Newfoundland surveys of 1944 and 1948.

reduction of the percentage of low values (Tables V and VI). In both surveys (Graph 2) there is recorded an unmistakable increase in the levels with age. The average for the oldest age groups was nearly 50% greater than for the youngest. The increase in concentrations of vitamin A was consistent for all ages. The 1948 figures for younger age groups are not very different from those found among New York State children. The conclusion seems warranted that in the 4 years between the two surveys, the

In 1944 the excretion of thiamine and riboflavin in St. John's far exceeded that in the outports. In 1948 the excretion in St. John's had increased only slightly whereas in the outports it had increased five-fold, to equal that found in St. John's (Table V). At the time of the previous survey, flour enriched with thiamine, riboflavin, niacin and iron had been available for several months in St. John's, but had not yet reached the outports. It seems more than likely that the relatively high excretion in

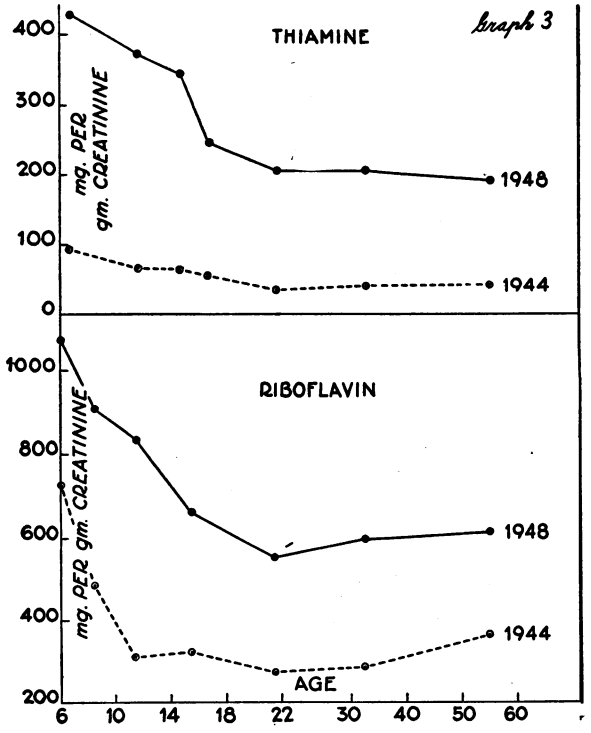
TABLE VI.

CHEMICAL FINDINGS OF 68 PERSONS EXAMINED IN 1944 AND RE-EXAMINED IN 1948

	1944 Mean[1]	1948 Mean	Difference 1948-1944
Serum protein (gm. %)	7.1 ± 0.1	7.0 ± 0.1	-0.1 ± 0.1
Hæmoglobin (gm. %)	13.0 ± 0.3	13.6 ± 0.3	+0.6 ± 0.23[2]
Vitamin A (mcgm. %)	20.0 ± 2.0	45.0 ± 2.0	+25.0 ± 3.0
Ascorbic acid (mgm. %)	0.51 ± 0.08	0.45 ± 0.06	-0.06 ± 0.10
Riboflavin (mcgm. per gm. creatinine)	513.0 ±69.0	631.0 ±51.0	+118.0 ±85.0
Thiamine (mcgm. per gm. creatinine)	91.0 ± 9.0	273.0 ±52.0	+182.0 ±53.0
Phosphatase (girls <13; boys <15 years)	5.15 ± 0.43	5.0 ± 0.42	-0.15 ± 0.17[2]
Phosphatase (adults, over 17)	1.80 ± 0.12	1.55 ± 0.10	-0.25 ± 0.06[2]

(1) The value following the ± sign, wherever used, is the standard error of the mean.
(2) Calculated from pair comparison rather than group comparison.

St. John's in 1944 reflected this. Because of the disparity between St. John's and the outports in 1944, and the presumed cause, only data from the outports are recorded in Graph 3. The higher excretion rate for children is evident in both surveys for both thiamine and riboflavin. This presumably reflects the greater consumption of food by children in relation to their total weight of muscle. It repeatedly has been observed that children have a lower creatinine coefficient than adults. This, together with the relatively greater surface area of children, would in large part explain the observed age effect.



Graph 3.—Values for average excretion of thiamine and riboflavin by age, Newfoundland surveys of 1944 and 1948.

Although it is not possible to set an exact figure for excretion of thiamine below which handicap exists, an excretion of less than 50 mcgm. per gram of creatinine is probably unsatisfactory.[20] In the outports the persons excreting less than 50 mcgm. of thiamine per gram of creatinine fell from 58% in 1944 to 1% in 1948, a remarkable improvement. It is similarly difficult to be certain as to what constitutes satisfactory excretion of riboflavin. There would seem to be, however, little question that less than 200 mcgm. per gram of creatinine is undesirable. In the outports, persons with these small excretions decreased from 39 to 1% (Table V). Thus the excretion of thiamine and riboflavin increased greatly between 1944 and 1948. On examination of the data of individuals in all age groups it was noted that the excretion of thiamine and riboflavin were clearly correlated. This suggests that these two nutrients were derived from the same food source.

Ascorbic acid ("normal" values more than 0.7 mgm. %).—There was no observed improvement in the concentration of ascorbic acid in the serum. Graph 2 suggests that the children were somewhat better off in this respect than were the adults at the time of both the surveys. The concentration of ascorbic acid in the serum for the sample as a whole was unsatisfactory in 1944 and even more so in 1948. There was some improvement in St. John's, but not enough to be statistically significant and in the outports worsening is apparent from the data (Table V).

DISCUSSION AND RECOMMENDATIONS

In an interim report dated August 24, 1948, addressed to the Commissioner for Public Health and Welfare, Newfoundland, we stated that most of the characteristic signs of malnutrition

were less conspicuous and less prevalent in the samples of the population studied in 1948 than they had been in 1944. We pointed out that this change had been accompanied by improvement in certain indices of public health. Reference was made to the sharp reduction in the reported infant mortality rate, but the same could have been affirmed for the reported rate of stillbirths, the reported death rate from tuberculosis and the reported crude mortality rate. We recognized that several factors might have contributed to these changes for the better, and mentioned the increase in the national wealth, the increased quantity and greater variety of foods imported during recent years, the increased emphasis on education in nutrition, the distribution in the majority of schools of dry milk and cod liver oil, the distribution of orange juice to nursing mothers and infants, and the improvement of the nutritive value of margarine and wheat flour through fortification of the former with vitamin A and enrichment of the latter with thiamine, riboflavin, niacin and iron, and after January, 1947, with bone meal. When the preliminary report was written we did not attempt to assess the relative significance of these various factors because the study of the data had not been completed. Now that this has been done, certain tentative conclusions may be drawn.

The program of public education in nutrition, as was noted earlier, was not begun much before the spring of 1947. Education is a slow process and is unlikely to influence significantly the eating habits and hence the nutritional status of a people in as short a period as 15 months. Reference was also made to the distribution in most schools of dry, non-fat milk powder; the amount distributed per child was, however, relatively small, and except for a few schools, this program came into full effect no earlier than the autumn of 1947. Likewise the distribution of cod liver oil to children in the schools, and the concentrated orange juice given to infants and nursing mothers, can scarcely have produced significant results. The oil was unpopular in many districts, the amount of orange juice was small, and these programs were initiated only after April, 1947.

The increased earnings of the people led to increased imports of all kinds. Although food production in the outports seemed to have declined, the stores in 1948 contained more processed foods than in 1944. Moreover, the government after 1947 encouraged consumption of evaporated milk and citrus fruit and juices by eliminating import duties on these products. Whether all this had led to a substantial increase in the consumption of milk, meat, fruit or vegetables by the average inhabitant, either of the outports or of the poor districts in St. John's, cannot be deduced from the available data on imports. This is because an indeterminable proportion of the civilian food supplies had been consumed by the military forces on the island and an obviously large amount of food had gone into stocks and stores.

Information about the current intake in the years 1944 and 1948 of certain vitamins and minerals can be obtained, however, from the results of chemical analyses of blood and urine. Such analyses were made relative to from one-third to a half of the 868 persons examined in each survey. They revealed in the outports a significantly greater percentage of persons with abnormally low concentration of ascorbic acid in the blood, greater, that is, in 1948 than in 1944, and in St. John's no change that was statistically significant. A reasonable deduction is that consumption by the groups examined of foods rich in ascorbic acid, such as leafy vegetables and fresh or processed tomatoes and citrus fruits, had not substantially increased. In contrast, the values in the blood for vitamin A were significantly higher, and the urinary excretion of riboflavin and thiamine was markedly increased. The improvement, in the case of both vitamin A and riboflavin, may be attributed in part to increased use of processed milk. However, the increase in the importation of evaporated milk, even if equality in distribution is assumed, would raise the daily allowance per head of vitamin A by only 80 international units, and that of riboflavin by not more than 85 micrograms. On the other hand, the effect of the fortification of margarine and the enrichment of flour raised the per head daily supply of vitamin A by 1,250 international units and that of riboflavin by at least 775 micrograms. Similarly, the greatly increased excretion of thiamine in the outports in 1948 might be due in part to a somewhat greater consumption of meat, but can be attributed mainly to the enrichment of flour with this nutrient. The positive correlation noted between the urinary excretion of thiamine and riboflavin lends support to the conclusion that the increased amounts of

these two nutrients were derived from the same food source, namely enriched flour. The daily allowance of thiamine from enriched flour would amount to about 1,300 micrograms.

Flour enriched with thiamine, riboflavin, niacin and iron was introduced into the capital —St. John's—from one to three months before the survey in August, 1944, whereas at that date such flour had only just reached the outports in Fortune Bay. This, we now believe, explains the fact that urinary excretions of thiamine and riboflavin were greater in 1944 in St. John's than in the outports. In 1948 the excretions of these vitamins in St. John's and in the outports were almost the same.

The clinical findings show that there was no improvement with respect to the prevalence of lesions which may be related to deficiency of ascorbic acid. The frequency of occurrence of gingival redness and swelling in 1948 was even greater than that recorded in 1944; this applies not only to the entire sample but also to the smaller group of 227 subjects examined in 1944 and re-examined in 1948 (Tables III and IV). Likewise the prevalence of perifolliculosis was higher in 1948 than in 1944, which would appear to support the belief held by some workers[3, 5, 6] that deficiency of vitamin C may be concerned in the production of this lesion. The actual worsening with respect to lesions relatable to deficiency of ascorbic acid correlates with the chemical finding of lower concentrations of ascorbic acid in the blood serum, and this presumably reflects a lower consumption of foods carrying ascorbic acid.

On the other hand, the prevalence of lesions which may be related to deficiencies of vitamin A, and of thiamine, riboflavin and niacin was strikingly diminished. There was less of the mild follicular condition resembling gooseflesh which has been attributed to deficiency of vitamin A; also there was less thickening of the conjunctiva for which, referable to young children, a correlation was found in 1944 to concentration of vitamin A in the blood serum. There was less severe cheilosis, less angular stomatitis, less folliculosis of the face and less magenta tongue, lesions attributable to deficiency of riboflavin. There was less redness, swelling and hypertrophy and atrophy of the papillæ of the tongue such as is observed in persons suffering from deficiency of niacin. A change for the better was noted in the frequency with which complaints were heard of dyspepsia and constipation. Also the alertness of the people had improved, especially that of the children. These improvements can perhaps be credited to the increase in the intake of thiamine.[10, 20]

In summary, it can be said that those signs and symptoms of malnutrition which could have been expected to decrease in prevalence as a result of the fortification of margarine with vitamin A and the enrichment of flour with riboflavin, niacin and thiamine were less frequently encountered and less severe in 1948 than in 1944, whereas the prevalence of lesions which could not have been affected by these measures remained unaltered or actually increased. This does not mean that other programs, in part recommended by the group in 1944, are of any less importance than the two which apparently by 1948 had produced results. Our interim report to the Commissioner for Public Health and Welfare closed by recommending not only continuation of enrichment of flour and fortification of margarine, but also, no less emphatically, the following:

"A. Strengthening and extending the present educational program, especially in the schools and through the Public Health Nursing Service, with emphasis on the desirability of more milk for consumption by children and increasing consumption of citrus juice or fruit and of greater use of uncooked vegetables. With this should go an increased emphasis on cooking methods which conserve the vitamins and minerals in cooked vegetables and other foods; consideration to be given also to an increased use of the radio and newspaper for transmitting appropriate information and to the production and widespread showing of a nutrition film adapted to the special needs of Newfoundland. The excellent film on tuberculosis now in use is the type of film we have in mind.

"B. Co-operation of the closest kind, as recommended for all countries by FAO (Food and Agriculture Organization of the United Nations), between the Department of Public Health and Welfare and the Agricultural and Fisheries Division of the Department of Natural Resources, whenever the nutrition and health of the people is involved in policies affecting food production. Of particular significance, for example, is a recent trend to reduce the number of milk cows in the outports. We respectfully suggest a careful study of the possible consequences of such a trend on the availability of milk for children in the event that the ability of the people to purchase processed milk were lowered by economic recession.

"C. Extension of the distribution of cod liver oil or its equivalent and of milk powder to all schools with consideration given to the possibility of reenforcing this milk with ascorbic acid (vitamin C). The program initiated in 1947-48 of supplying concentrated orange juice to expectant and nursing mothers and to infants under one year, likewise could be extended with advantage.

"D. Maintaining consumption of milk and citrus juices and making these and other foods of high nutritional value available at low prices. The significance to health of an adequate consumption of milk or processed milk, citrus juices, green and yellow vegetables, enriched or whole grain cereals and butter or fortified margarine is so great that profound consideration should be given to procedures by which the cost of these protective foods may be held at such a level

that such foods can be purchased in adequate amounts for health by low income consumers."

ACKNOWLEDGMENTS

We wish in closing to acknowledge our indebtedness to the Honourable H. W. Quinton, Commissioner for Public Health and Welfare, Newfoundland, for extending to us the facilities of his department, to Dr. Leonard A. Miller, Director and Dr. James McGrath, Assistant Director of Medical Services, to Miss Ella M. Brett, B.Sc., nutritional adviser to the Department of Public Health and Welfare, to the nurses of the Public Health Nursing Service, especially Miss Margaret Hall, R.N., to the Child Welfare Association, to Mr. D. L. Butler and his staff for arranging transportation, to Mr. M. F. Ryan, Acting Secretary for Supply, who provided information respecting food imports, and to the Newfoundland Tuberculosis Association and its secretary, Mr. Walter Davis, for putting at our disposal the motor vessel, *Christmas Seal*, for use during that portion of the survey conducted in Fortune Bay. Grateful appreciation also is expressed to Mr. F. Fraser Harris of the Finance Department, Newfoundland, for assistance in the preparation of the statistical records and for providing information on Newfoundland food supplies, to Mr. Robert P. Gage of the Division of Biometry and Medical Statistics, Mayo Clinic, who made possible the statistical analysis of our clinical data; likewise to Miss Elizabeth J. Crawford of the Department of Pharmacology, Washington University, St. Louis, for making the chemical determinations. Nor are we unmindful of the friendliness and courtesy shown by the people of Newfoundland who were examined.

The expense of this investigation and of that of 1944 was met by the Newfoundland Government, the Newfoundland Tuberculosis Association, Merck & Co., Inc., Rahway, New Jersey, Merck & Co., Ltd., Montreal, Quebec, and the individual investigators.

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STAPHYLOCOCCAL PNEUMONIA IN CHILDHOOD

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THE purpose of this communication is to draw attention to the frequency of staphylococcal pneumonia in the young and to less well-recognized pathogenic potentialities of the staphylococcus. This will be illustrated by a description of the sudden and unexpected deaths of two infants in the nursery of a small rural hospital and by a summary of deaths from staphylococcal pneumonia in childhood occurring at Regina General Hospital.

CASE HISTORIES

At 1 a.m. on October 22, 1948, a nurse found two infants dead in their cots in the nursery of a small hospital. The nursery contained ten infants and had been inspected between three and four hours before when all the infants were considered to be normal. The family doctor had seen one of the infants seven hours before the incident and nothing untoward was noticed. One infant, baby girl M., was two days old. Her mother aged twenty-two was a primipara and had been three days in labour. The presentation was a frank breech but delivery was affected without instruments. The condition of mother and child was good and the infant was described as lusty. The other infant, baby girl F., was three days old. The mother, aged twenty-two, also a primipara, was a "lower instrument" delivery. The doctor described both mother and child as normal in all respects. Neither cyanosis nor respiratory embarrassment was ever noticed in the children. The infants had started breast feeding. Mrs. M. and Mrs. F. occupied a two-bed private room in the hospital. No septic condition could be found in either mother or in their attendants. Neither influenza nor the common cold were associated with the event.

AUTOPSY FINDINGS

Both infants were well nourished. The umbilical cords were healthy. There was deep cyanosis of the nail beds and lips. Blood was present in the mouth and nasal passages of baby M. There was no œdema or jaundice.

The structures of the mouth and neck were normal. The trachea and bronchi contained a thin film of mucus but nothing to indicate an inflammatory process. On pressing the lung a frothy fluid was forced into the bronchi; in the case of baby M. the fluid was blood-stained. The pleural membranes and cavities appeared normal. The lungs were fully expanded and sufficiently consolidated to retain their anatomical contours on removal. Section of the lungs showed a brownish, mottled surface and on pressure a moderate amount of frothy fluid was expressed. The lungs felt tougher than one usually encounters in the congested and œdematous lungs of infants dying from a wide variety of conditions. In the case of baby M. numerous dark blue (asphyxial) hæmorrhages were present in the thymus, mediastinal tissue, visceral pericardium, and throughout the lung substance. They varied from pinpoint to a few millimetres in diameter. In the lower lobe of the right lung there was gross confluent hæmorrhage. Snippets of lung tissue floated high in tap water.

The pericardia (apart from the hæmorrhages in baby M.) were normal, the auricles were distended. Other-

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