The "Hälsan" Institute in Norrbotten : an experiment on the lines of social hygiene in the far north of Sweden organized by the Swedish National Association against Tuberculosis, together with a study on the dissemination of tuberculosis in Sweden / by Gustaf Neander ; translated from the Swedish by Grenville Grove.

SWEDISH NATIONAL ASSOCIATION AGAINST TUBERCULOSIS

THE „HÄLSAN“ INSTITUTE IN NORRBOTTEN

BY

GUSTAF NEANDER, M. D.

FROM ACTA TUBERCULOSEA SCANDINAVICA
COPENHAGEN MCMXXVIII

THE „HÄLSAN" INSTITUTE IN NORRBOTTEN

AN EXPERIMENT ON THE LINES OF SOCIAL HYGIENE IN THE FAR NORTH OF SWEDEN

organized by

The Swedish National Association against Tuberculosis

together with a Study on

THE DISSEMINATION OF TUBERCULOSIS IN SWEDEN

by

GUSTAF NEANDER, M. D.
SECRETARY GENERAL OF THE SWEDISH NATIONAL
ASSOCIATION AGAINST TUBERCULOSIS

Translated from the Swedish by GRENVILLE GROVE,
Translator to the British Legation, Stockholm.

LEVIN & MUNKSGAARD PUBLISHERS
COPENHAGEN MCMXXVIII

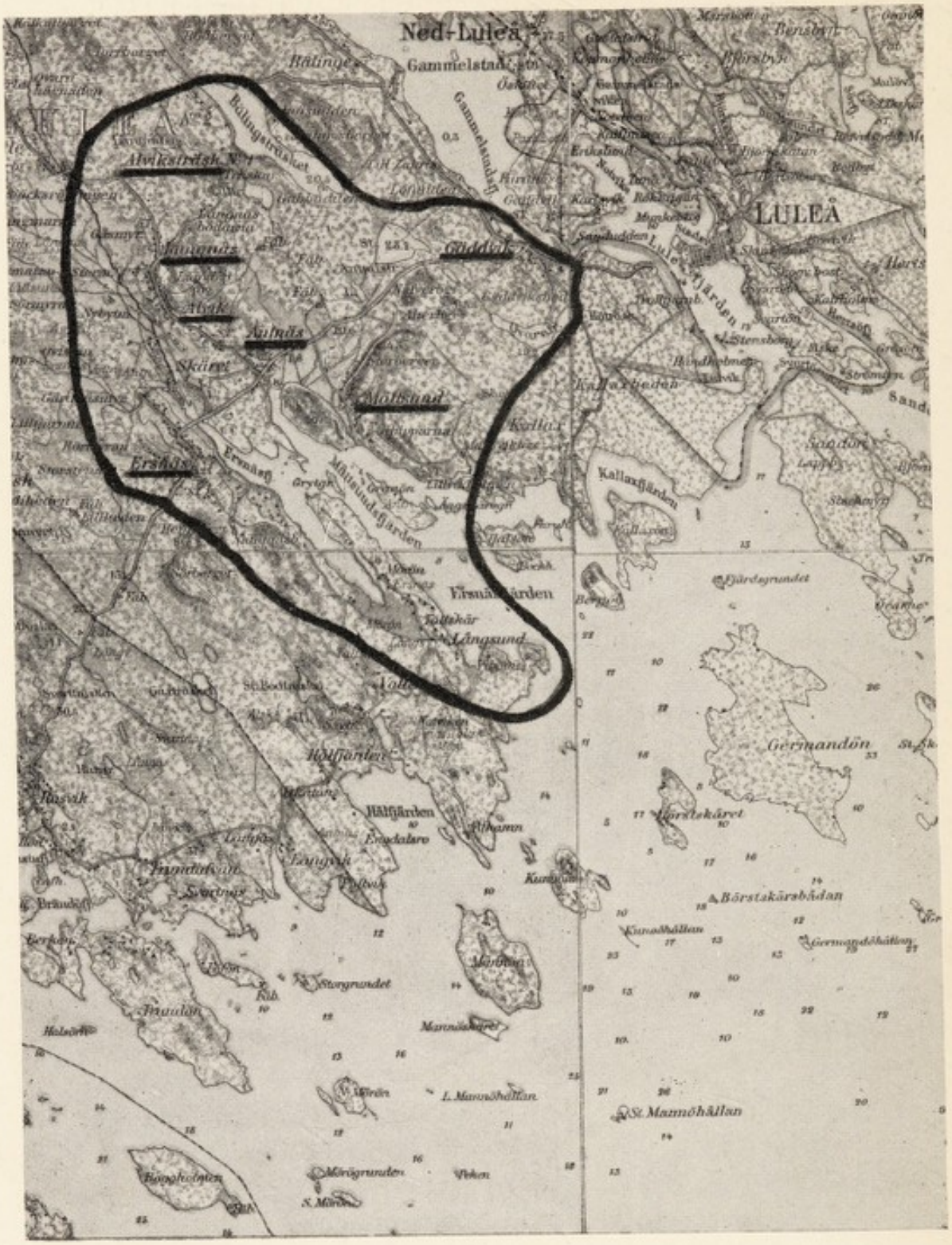


Fig. 1.
The experimental area and adjacent villages.

I.

PLAN OF THE EXPERIMENT. HISTORICAL SKETCH.

On the 8th April 1904 a detailed programme for the future work of the Swedish National Association against Tuberculosis, drawn up by its Secretary, Dr. *B. Buhre,* was submitted to the Council of that Association. In this programme attention was directed to the necessity of instituting experiments on the lines of social hygiene, both in town and country, with a view to finding out the most suitable measures for counteracting tuberculosis, and more especially for preventing the transmission of the infection to the children.

The following is an extract from Dr. *Buhre*'s programme: — »In regard to rural districts, I would suggest that the experiment be organized on the following lines: — A poor parish, of medium size, situated in a remote spot with bad communications, inhabited by a comparatively stationary population, and infested with tuberculosis, to be selected. An attempt to be made there to protect the rising generation from infection. A cottage hospital for tuberculous patients of all kinds to be erected there, a home to be established for able-bodied consumptive patients without families, and moreover a home for the accommodation of healthy children«.

»A practitioner who has made a special study of tuberculosis, assisted by a staff of nurses, to be stationed on the spot. To begin with, the entire population of the parish should be subjected to a general examination, whereupon the campaign against tuberculosis should be vigorously pursued for a year or more. The results of the campaign could then be brought to light by a renewed general examination«.

As a first step in this direction, the Secretary at the same meeting submitted the following motion: — »That the Council

should issue a circular to the chief county medical officers, requesting them severally to suggest to the Council some parish which might be considered suitable for the purpose of an experimental attempt to protect the children from tuberculosis«.

A similar request was moreover made to the county anti-tuberculosis societies. These societies drew attention to several places in Sweden which might be considered suitable for the purpose in question. In view of these suggestions, careful investigations were made at some places in the Counties of Jämtland and Kronoberg; but none of the suggested areas were found to be entirely suitable.

In November of the same year, the Norrbotten Tuberculosis Committee, whose Chairman, Mr. *K. J. Bergström,* the County Governor, was keenly interested in the matter, directed attention to the district of Neder-Luleå as apparently being admirably adapted for the projected work. This district had long been known as one of the worst hot-beds of consumption in this country. But, as it was considered that the district in its entirety, which has an area of 1 182 sq. kilometres, and a population (1904) of 12 596 souls, was too large for the experiment, it was proposed that the work should be concentrated in four villages, namely, *Antnäs, Ersnäs, Alvik* and *Långnäs,* in the southern part of the district.

In these villages, at the beginning of June 1905, four practitioners from the neighbouring town of Luleå made a preliminary investigation into the dissemination of consumption among the population. This investigation showed that in these villages consumption was disseminated on an immense scale, and that scrofulous processes were widely prevalent among the children.

At the beginning of October the place was visited by Dr. Buhre, who desired to make his own observations and to obtain further information on the spot. Having convinced himself by this visit as to the suitability of the place, he elaborated the scheme in detail and submitted it to the Council of the National Association at its meeting on the 14th November 1905.

At this meeting the Chairman of the National Association, Baron *G. Tamm,* announced that the Grängesberg Mining Com-

pany had engaged to make an annual contribution of 12 000 kronor for eight years in support of the projected experiment in social hygiene in Norrland. By this munificent gift the experiment was placed on a sound economic basis.

The Council now adopted a definitive resolution, that an attempt, on the lines of social hygiene, to check the spread of tuberculosis, on the basis of the scheme drawn up by the Secretary of the National Association, should be made in the villages of *Antnäs, Ersnäs, Alvik* and *Långnäs* in the district of Neder-Luleå in the County of Norrbotten, beginning at Antnäs and Ersnäs.

In order to provide premises for a cottage hospital, a children's home and a doctor's residence, it was resolved to purchase a house offered for sale at Antnäs. When this house had come into the possession of the National Association, it received the name *Hälsan* (Health).

For the purchase of this house, as well as for rebuilding and furnishing, a sum of 12 500 kronor was appropriated.

It was moreover decided to issue the following proclamation to the inhabitants of the villages: —

Proclamation.

»Probably nowhere in this country are the ravages of tuberculosis, or so-called consumption, more severe than in your villages. Should this dangerous disease be allowed to spread unchecked, it will certainly not be many years before the entire rising generation in these villages is infected with it.

»Upon the proposal of the Tuberculosis Committee of the County of Norrbotten and of the Governor of that County, The Swedish National Association against Tuberculosis have accordingly resolved, *provided the inhabitants are themselves willing to cooperate,* to take drastic measures for checking the spread of the disease«.

»A medical officer, with a staff of nurses, will be stationed on the spot, hospital accommodation will be provided for those who cannot stay in their homes, and special measures will be taken to prevent the infection from spreading to the healthy

population, and in particular to the children who are still exempt from the disease.«

»For the last-mentioned purpose it is necessary that various precautions should be taken in the homes. Consumptives must not sleep in the same bed as healthy persons, »cupboard-beds« must be done away with, dwellings must be frequently aired and kept thoroughly clean: the inhabitants must observe the most scrupulous cleanliness in their own persons, etc.«.

»In order to provide the increased accommodation which is necessary, it will probably be sufficient in the majority of homes to utilize the existing rooms, one or more of which are now unused. In some homes, however, the accomodation is too limited to afford any assurance that healthy persons will not be infected by those who are diseased«.

»In such cases it is necessary either that the diseased persons shall agree to move to another dwelling, or else that the child or children who have not yet been infected with the disease shall be boarded, at the expense of the National Association, in another neighbouring family, or shall be placed under the care of a nurse engaged in the service of the Association«.

»The eradication of tuberculosis in this manner will involve the National Association in considerable expenditure. And the inhabitants may be assured that in no commune throughout the whole of Sweden are such efforts being made to banish this scourge of humanity. But, if the experiment is to succeed, it is above all things necessary that the inhabitants themselves should give their earnest and whole-hearted cooperation. We do not demand from you any contributions in money. But we do expect that you yourselves assist with will and work, that you support us in every possible way, that you comply willingly with the instructions given by doctor and nurse, and that, realizing that we intend everything for your best, you show confidence in ourselves and in our fellow-workers.«

»We will do all that we can to nurse the sick and to protect your children from also succumbing to the disease. If you are willing to do all that lies in you power to free your descendants from this wasting and terrible disease, then we may hope for

success. As an earnest of your good will, we beg you to sign your names on the list which will be presented to you.«

This proclamation, dated 14th November 1905, was signed by the Council of the National Association. It was moreover endorsed by several representative persons, well-known in the locality, namely the Governor of the County, the bishop of the diocese, the chief county medical officer, the rector and curate, the chairman of the Vestry Meeting, and the local sheriff's officer.

The general interest taken in the project was indicated by the fact that the lists were signed by almost the entire population of the villages.

The rebuilding of the purchased house was started without delay and was carried on energetically under the superintendence of the County Governor.

On the 18th January 1906 the Council of the National Association appointed Dr. *Emmerik Danielsson* to be physician to the Institute.

Dr. Danielsson took up the appointment on the 1st March of the same year. At the same time two nurses were engaged. The doctor's first task was to direct and superintend the rebuilding of the house and its furnishing. In addition, he simultaneously commenced an investigation into the dissemination of tuberculosis among the population. The results will be reported in detail in the sequel.

The rebuilding of the house was terminated in June, and the first patients were admitted in the middle of that month.

The project is set forth in detail in the following communication, published at that time, regarding the »*Hälsan*« Institute, established by the Swedish National Association against Tuberculosis, and the experiment in social hygiene in the district of Neder-Luleå, planned in connection with that Institute.

»The projected undertaking, which extends to the parishes of *Antnäs, Ersnäs, Alvik* and *Långnäs* in the district of *Neder-Luleå,* has the following objects: —

»(a) In *the* »*Hälsan*« *Institute,* in the village of Antnäs, or

otherwise, to provide good and effective nursing for those affected with tuberculosis or a disease which is liable to lead to the development of tuberculosis.«

»(b) To endeavour to introduce and maintain a scientific tuberculosis hygiene both in the dwellings where tubercular disease occurs and in regard to the occupants of those dwellings.«

»(c) In this manner, to endeavour to prevent the transmission of the disease to the healthy population of the villages and particularly to the children.«

»The medical service at the Institute to be discharged by a physician, who shall moreover be in charge of the work in general. One or more nurses to be engaged to assist the physician.«

»The physician to pay periodical visits to individual homes within the area, and also in other ways to endeavour as far as possible to get into personal touch with the inhabitants and to make himself acquainted with the hygienic conditions and the state of health of the people.«

»Where the physician considers it expedient, he may depute a nurse to visit certain homes.«

»In connection with these visits the physician should pay special attention to the occurrence of tubercular disease, and carefully examine persons whose condition of health is in any way suspicious.«

»By friendly personal rapprochement, the imparting of information, the delivery of lectures, the organization of social gatherings, and other means of persuasion, the physician should endeavour to win the interest, confidence and cooperation of the inhabitants in the measures which he finds expedient. He should in every way strive to induce the inhabitants to follow persistently the advice and instructions which he has imparted.«

»In homes where tubercular disease occurs, the physician should in person, if that is possible, or, if not, through the nurses, furnish advice and instructions on the following matters: — How, with a view to the above indicated purposes, the dwellings should be cleaned and aired; how the sleeping accommodation of the family should be arranged; how the diseased

persons are to deal with their sputum; how the family's provisions are to be protected from the infectious matter; what rules should be observed in regard to personal cleanliness; and finally with regard to any additional hygienic measures that may be necessary in individual cases with respect to dwellings or persons.«

»Where, with a view to hygiene, it is necessary that a dwelling should undergo certain alterations, for example with regard to the arrangement of fireplaces or sleeping accommodation, or for the purpose of ventilation, the doctor should advise as to the steps to be taken in these respects.«

»Should the occupant of the dwelling, though desirous that some such alteration should be made, lack the necessary means, the requisite steps may be taken, after due consideration by the directors of the Institute, wholly or partially at the expense of the National Association.«

»In the case of a consumptive person whose conditions of life are such that his presence at home involves risk to children living with him, the physician may, with his consent, procure a suitable dwelling for him, the expense to be defrayed similarly as stated in the preceding paragraph.«

»Special attention should be devoted to scrofulous children. In the case of lack of means, such children, with the authorization of the physician, may obtain the necessary medicine at the expense of the Institute. Should there be reason to presume that they do not obtain sufficient or suitable food in their homes, they may receive full or partial board at *Hälsan.*«

»Healthy children from homes infected with tubercular disease, if the physician considers it expedient and the parents or guardian give their consent, may, with the approval of the Directors, be either (1) admitted to *Hälsan,* or (2) be boarded out in homes which have been found to be free from tuberculosis and in other respects satisfactory, the expenditure to be borne entirely or in part by the National Association.«

»Spittoons to be supplied by the Institute; persons without means to obtain them free of charge.«

»Tuberculous persons residing within the area whose

condition requires treatment at a hospital or sanatorium may be received at *Hälsan* for any length of time, and be nursed there free of charge.«

»Facilities shall be provided at *Hälsan* for persons who need a rest cure. Such persons, where the physician considers it necessary, may moreover receive board free of charge or for a fee to be determined by the directors of the Institute.«

»Consumptives and their families, according as the physician

Fig. 2.
The »Hälsan« Institute.

may advise, to obtain *baths* free of charge, or for a fee to be determined by the directors of the Institute.«

»All medical attendance, as well as instructions in hygienic matters, with regard to tubercular disease or scrofula in the case of persons residing within the area shall be free of charge. The physician to be entitled to receive remuneration for other medical practice.«

The board of directors of the Institute, to be appointed by the Norrbotten Tuberculosis Committee, was elected on the 20th January 1906. It was composed of the following members: — Mr. *K. J. Bergström,* County Governor, his wife, Madame *Fanny Bergström,* née *Malmqvist,* Madame *Linda Fa-*

gerlin, née *Håkansson,* Mayoress, Mr. *N. E. Nilsson,* dairy superintendent, and Dr. *F. Block,* chief county medical officer. The following were appointed to be deputy members: Dr. *Hj. Hackzell* and Dr. *Signe Salén.*

The following changes were subsequently made in the composition of the board of directors: — The two first-mentioned members were replaced by the new County Governor, Mr. *Oscar von Sydow,* and his wife *Mary von Sydow,* née *Wijk.* Dr. *F. Block* and Dr. *Signe Salén,* who had likewise been transferred, were replaced by Dr. *E. Börjesen,* chief county medical officer, and Herr *Linus Lundström,* member of the Riksdag.

The first physician to the experimental Institute, Dr. Emmerik Danielsson, retired from this post at his own request on the 1st August 1907, after zealous and laborious work under the comparatively unfavourable conditions which were bound to exist before the inhabitants had fully realized the significance of the project. During the last two months of 1907 the Author was temporarily appointed physician to the Institute. During the period August—October 1907 and 1st January—7 March 1908 the duties of the physician were discharged by Dr. F. Block. From the 8th March 1908 to August 1913 inclusive the Author acted continuously as physician to the Institute and director of the work. During the period September 1913—February 1914 the duties of the physician were discharged by Dr. E. Börjesson.

The following have been employed as nurses to the Institute: *Agnes Berglund, Adelaide Bölling, Stina Johansson, Naemi Hammarlund, Natalia Moreus, Clara Bengtsson* and *Ester Edman.*

On the 1st March 1914 the Institute was taken over by the County Council of Norrbotten. A cottage hospital and a dispensary have now been established in connection with the Institute. The district covered by the dispensary is the original experimental area extended to a few additional villages in the parish of Neder-Luleå. The hygienic supervision of the homes is thus being continued even after the special work of the National Association has ceased in its original form.

II.
AREA. CLIMATE.

The four above-mentioned villages of *Antnäs, Ersnäs, Alvik* and *Långnäs,* selected for the projected work, are adjacent to one another, and form a unified and well delimited area. The villages are situated close to the coast of the Gulf of Bothnia. Antnäs and Ersnäs lie on the »coastal highway« between the towns of Luleå and Piteå, Antnäs being at a distance of 16 kilometres and Ersnäs 19 kilometres from the first-mentioned town. Alvik and Långnäs, which merge into one another, are situated along the highway proceeding in a north-westerly direction from Antnäs.

The village of Antnäs is situated approximately at 65° 33′ N. Lat.

The strip of coast here is very low, flat, and in parts swampy. A considerable part of the area occupied by the villages of Antnäs and Ersnäs consists of the former sea-bottom, as is indicated by names such at »the rock«, »the naze«, etc., borne by several places now situated on the mainland. At Ersnäs the long, narrow firth of Ersnäs cuts deep into the area; the shores of the forth are of the same swampy, muddy character as at Antnäs. Into this forth runs the river Aleån, which, proceeding from forest lakes in the district of Över-Luleå, passes through the villages of Ale and Alvik down to Ersnäs.

The coastal district as well as the valley of the River Aleån are exposed to severe frosts and fogs. Formerly the same conditions prevailed in the extensive low-lying area north of Antnäs, called »Gökviken«; this area, however, which in recent years has begun to be systematically drained for the purposes of cultivation, has now considerably improved in this respect. From the coast the country rises slowly and passes by gradations into firm, dry ground. The greater part of the village of Antnäs is seldom visited by fogs. The region on the interior (western) side of the cultivated area occupied by the villages consists of extensive forests of pine and fir.

As a rule the winter sets in at the end of October, attended by snow and ice, and lasts till the middle of April. Those who

have been brought up in the southern parts of Sweden find the winter in the north long and oppressive. At Christmas the sun at Luleå c 65° 35′ N. Lat.) is above the horizon for only three hours, from 10 a. m. to 1 p. m. At Stockholm the sun at this season remains exactly twice as long above the horizon. After the melting of the snow in April the wintry weather still continues: May as a rule is cold and bleak. Not till the end of that month or the beginning of June does the vegetation awake from its winter slumber, but then develops with astonishing rapidity: within the course of a few days the birches are in leaf and the ground is green.

The grass on the waste lands and the barley in the fields grow and mature with wonderful rapidity under the rays of the sun, which is now above the horizon practically throughout the twenty-four hours.

The long darkness of winter is compensated in these regions by an abundance of sunlight hours. On Midsummer night the sun is below the horizon for merely an hour and a half.

The autumn is as a rule rainy and windy. The dwellers in these regions are much harassed by the bitterly cold, biting winds, which sweep over the plain from the sea. These winds are very persistent and frequently continue without intermission for three or four days. In the autumn especially, those parts of the area which are adjacent to the coast are often shrouded in thick fog. The climate of autumn and spring in particular must in fact be regarded as rather severe and trying to the health.

The reader who desires to obtain a more detailed knowledge of the climatological conditions in this part of Sweden is referred to the Meterological Records for the years 1908—1913 compiled by *E. Petri*, State meteorologist (Appendix pp. 109—127).

III.

POPULATION. CONDITIONS OF LIFE.

The bulk of the population of the district consists of small landed proprietors. In addition, there are a number of workmen who own a small cottage, or a little cultivated plot within the

district, but who derive their principal income from their employment in industries in the vicinity of Luleå.

There are no industrial plants in the actual area covered by the experiment.

The dwellings of the inhabitants and their hygienic conditions will be described in detail in the sequel.

The number of persons registered in the district in 1905 according to the parish records was 2 293. Their distribution over the several villages is shown by the following table, which gives also other data with regard to the villages.

Table 1.

	Area in hectares*)	Number of allotments	Number of inhabitants
Antnäs	3 400	75	381
Ersnäs	7 297	176	885
Alvik	9 995	172	668
Långnäs	2 466	61	359
Total	23 158	484	2 293

*) 1 hectare = 2.471143 statute acres.

It should be noted, however, that some 400 of these 2 293 persons, though entered on the parish registers for those villages, actually lived in isolated homesteads in the forest, or in small village communities situated beyond, and in some cases rather remote from, the village area proper. In view of the difficulty of paying frequent visits to, and supervising, these out-of-the-way homes, they have not been reckoned in the experimental area proper.

In the investigation made in 1908—1909 the number of inhabitants in the area proper was approximately 1 900. Owing to the stability of the population, this figure remained practically unchanged during the entire period of the experiment. In this investigation the entire population was found to consist of 371 separate households.

The number of the inhabitants in the several villages, and the number of the households are shown by the subjoined summary: —

Table 2.

	Total number of inhabitants	Number of		Number of households
		Adults	Children under 15 years of age	
Antnäs	393	240	153	76
Ersnäs.....	720	475	245	138
Alvik.....	523	330	193	111
Långnäs	224	148	76	46
Total	1 860	1 193	667	371

The following table shows in detail the size of the families and the number of children in the families in the different villages: —

Table 3.

Number of members of family	Number of families				Total	Number of children under 15 years of age	Number of families				Total
	Antnäs	Ersnäs	Alvik	Långnäs			Antnäs	Ersnäs	Alvik	Långnäs	
12	2	—	—	—	2	8	1	—	—	—	1
11	1	1	3	2	7	7	3	—	—	1	4
10	2	4	—	1	7	6	2	6	2	—	10
9	3	7	1	1	12	5	4	8	5	3	20
8	5	13	6	2	26	4	8	16	13	5	42
7	10	15	8	4	37	3	9	23	14	3	49
6	10	22	24	6	62	2	9	20	18	7	54
5	9	26	17	8	60	1	15	19	26	11	71
4	12	10	18	6	46	0	25	46	33	16	120
3	9	21	19	10	59						
2	8	13	4	3	28						
1	5	6	11	3	25						
	76	138	111	46	371		76	138	111	46	371

Even a cursory glance at the tables gives the impression that these families must have a large number of children. A more thorough examination of the figures shows that the number is in fact above the average. Out of a total of 1 860 persons, 667 are children under 15: this is 35.86 %. According to the official statistics for 1909, the percentage of children under 15 in pro-

portion to the total population is 31.88 %, a figure which is considerably lower than that given for the area under consideration.

This fact is brought out even more clearly if the population is arranged according to age groups of ten years. The results of classification on these lines are shown in the subjoined table 4, which also gives the averages for the entire country for the period 1751—1900 and for 1909, according to the Swedish official statistics.

Table 4.

Age groups	Number of persons	Percentage for the experimental area, 1909	Percentage for the whole of Sweden	
			1909	1751—1900
0—10 years ...	551	29.4	22.0	23.1
11—20 „ ...	361	19.4	19.2	19.1
21—30 „ ...	274	14.8	15.4	16.1
31—40 „ ...	207	11.4	12.4	13.4
41—50 „ ...	168	9.0	10.3	11.0
51—60 „ ...	150	8.0	8.8	8.3
61—70 „ ...	105	5.7	6.6	5.7
71—80 „ ...	39	2.1	4.0	2.7
81—90 „ ...	5	0.2	1.3	0.6
	1,860	100.0	100.0	100.0

The high figure for the age groups 0—10, in conjunction with other data given here, is an index of the high birth-rate which is characteristic of the entire county. According to the records for 1921, the birth-rate in the County of Norrbotten exceeded that for the whole country by 43 %, whilst the excess of births over deaths was no less than 91 % higher than for the country at large.

According to a statement in »Nordisk Familjebok« (a Swedish encyclopaedia), 1913 edition, »the increase of the popula» tion in this county has been much greater than in the rest of » Sweden. This is due to a very great excess of births over deaths » and considerable immigration. In recent years, however, the » latter has been largely couterbalanced by emigration on a

» considerable scale. During the past twenty years the popu-
» lation has increased by close on 54 %, as against not quite
» 17 % in the country as a whole.«

In 1810, when Norrbotten was made a separate county, it had a population of 32 402 souls; at the end of 1925 the population had increased to 190 252. The population of the whole of Sweden in those years was 2 396 351 and 6 044 840 respectively. Thus in the course of these 115 years the population of Norrbotten had been almost sextupled, whilst that of the entire country had not been quite trebled.

The population of the County of Norrbotten consists of three separate races, Swedes, Lapps and Finns, as well as crossings between them. In the coastal district, however, the bulk of the population is pure Swedish, and in the experimental area there were only a few persons of undoubtedly Finnish or Lapp origin. But there is reason to presume that even in this area there is a by no means inconsiderable mixture of races, in view of the high frequency of brown and motley-coloured eyes, as is shown by the following summary: —

Table 5.

	Colour of eyes		
	Light	Mixed	Brown
Sweden (according to Lundborg)	86.9 %	8.1 %	5 %
Norrbotten „ „	76.4 %	13.5 %	10.1 %
The experimental area	70.8 %	14.1 %	15.1 %

As previously indicated, the bulk of the population in the experimental area consists of small holders. The homesteads are as a rule quite small, those which feed seven or eight cows and one horse being regarded as larger than the average. There are no large agricultural estates, as in central and southern Sweden.

It may be said, generally speaking, that this agricultural population manage to eke out a subsistence which, however

meagre and hard-earned, suffices to keep sheer poverty away from the door. But, to this end it is necessary that all the members of the family, not excepting the women and children, contribute with their whole energy to the maintenance of the common home.

A very heavy burden of work falls on the women in particular, and their marvellous endurance has often called forth the author's admiration. Besides attending to their homes and the cooking, the women have to look after the cow-house — this work was formerly considered to belong solely to the domain of women — and to take part in most of the work in the fields, such as sowing, hay-making and harvesting. — And withal, the frequent child-beds, the suckling of the babies, and the care of the continuously increasing family of children. Thus perpetual, monotonous toil and drudging, day after day, year after year, without even the possibility of getting a proper night's rest, with but rare opportunities for social intercourse or other recreation — and all this often under conditions where their delicate organisms should have been sheltered from rough usage. It is therefore scarcely surprising that the women in these parts age prematurely, and that the young face soon assumes a set expression of weariness. Nor need any other explanation be given of the fact that consumption is more prevalent there among the women than among the men.

This, however, must not be understood to imply that the men, for their part, have not a sufficiently heavy burden of work. Especially the harvest season, when every moment of time must be utilized in order that the food for man and beast during the entire coming year may be garnered within a few short weeks, makes almost superhuman demands on the working capacity of the men. But, generally speaking, those who are well acquainted with the conditions must recognize that a disproportionately heavy burden falls upon the shoulders of the women, and that a reform is imperatively necessary. And indeed there is already a distinct tendency in this direction. It seems to be becoming increasingly usual for the men to take part in the heavier work in the cow-house. Moreover, owing to

the increasing use of agricultural machines, the women do not need to participate so much as before in the actual farm-work in the fields and meadows.

It has already been indicated that the peasants in these parts as a rule have their bread and butter, though by no means in superfluity. This, however, very largely depends on whether the members of the family are able to work, are thrifty, and retain their health. A deficiency in any of these respects may easily cause a break-down in the family's economy.

In many of these peasant homes life has an old-world patriarchal character.

The old Swedish custom of beginning the work-day at a very matutinal hour still survives in these parts. The work in cow-house and kitchen as a rule commences at 5 a. m., and the family retire to bed at 7 or at latest 8 p. m. A stranger visiting a home in these parts for the first time will be surprised to find that the clock on the kitchen wall shows quite the wrong time: it is at least two hours fast. This has not happened by chance: it has been done deliberately, and is carried out consistently in almost every household. In the height of the harvest season the hands of the clock are, as a rule, moved forward another hour, so that this »summer-time« is at least three hours in advance of the standard time. In making appointments it is always necessary to indicate whether »country time« or »standard time« is meant.

Another thing which strikes the visitor is that, when the members of the family are conversing with one another, he can scarcely understand a word they say. As in other parts of the country which have been kept free from tourist traffic, industry, etc., the ancient dialect still survives. This dialect, rich in diphthongs and beautiful old forms, is very attractive to the ear. All young and middle-aged persons can, if necessary, speak also standard Swedish, but the every-day language in the home is still the old vernacular. Moreover a good many old people speak nothing but dialect.

The farm-work for the year usually begins towards the end of May or beginning of June, with the spring-sowing. The prin-

cipal cereals in these parts are barley and oats. The barley, when ripe, is used for the making of bread. The oats are as a rule cut during the late summer and used as fodder for the cattle. After the termination of the spring-sowing, potatoes are planted.

When this work has been completed, the cattle are taken from the winter cow-houses, — some of which are still of the old-fashioned type, that is dark and crowded —, up to the outlying dairy-farms, where they are put to graze in the forest and are lodged at night in so-called summer cow-houses. On the pasture-grounds of the dairy-farm, which, as a rule, belong jointly to several villagers, there are small, simple cottages, for the accommodation of those persons, usually young women, who look after the cattle.

At this season moreover the whole family removes from the winter dwelling into the little summer cottage which is found on every farm. The winter dwelling undergoes a thorough cleaning: the floors are scoured, the ceilings are washed, the fireplace is whitened, and the gaping hearth is filled with green leafy boughs. At the same time certain preparations are made for the coming exertions of the hay-making season. The women bake quantities of »tunnbröd«, that hard, barley bread in cakes, thin as paper, which is a speciality of Norrbotten. The implements for the hay-making are mended and put in order, and the barns on the meadows are brought into repair.

The time-honoured day for the beginning of the hay-making in these parts is »Hermans' day«, that is the 12th July. All other work is then laid aside. The whole family take part in the hay-making, — except very old people, invalids and infants. The babies, being thus left without proper attendance, are but too liable, during this season, to get into close touch with sources of infection.

At a very early hour, 2—3 a. m., whilst the dew is still on the grass, the hay-makers begin to ply their scythes. The time available for the gathering-in of the hay is but too short, and it is necessary to utilize the day to the full. The hay is garnered in small barns, which are scattered plentifully over the fields.

These barns are built in a peculiar fashion, with a downward taper.

After the hay-making comes the harvesting of the barley. At the beginning of the experiment, the old-fashioned sickle was the implement usually employed for this purpose, and the work, as a rule, was performed by the women.

During the autumn the fields are ploughed and land is brought under cultivation, until the work in the soil is prevented by frost. In winter firewood is chopped, and the hay is brought from the small barns into the farm.

Domestic industries, which played a great part in former times, are now declining. It is, however, still usual for the peasant to make his own agricultural implements. Moreover, cloth for the wearing-apparel of the family is generally woven at home, especially the grey home-spun of which the men's clothes are as a rule made.

The villages are rather isolated from one another, and there is little daily intercourse beyond the borders of the village. There are, however, a few occasions in the course of the year when the inhabitants of all the villages gather together in friendly social intercourse. These are the great church festivals, when the »church-village« is the meeting-place for the population of the entire parochial district. Every peasant family has a little »church cottage« of its own, so that the church-village is like a small town dotted with little houses.

Certain of these church festivals are marked out, in the popular view, as having a character peculiarly appropriate to old people, whilst others are regarded as fit occasions for youth to have their day. Thus, New Year's Day, Epiphany, Lady Day, Whitsuntide and Michaelmas Day are occasions on which young people meet and make each other's acquaintance; and at these seasons there is much marriage-making. Easter, the third and fourth Rogation Day (the former usually known as »old Midsummer«) and Christmas are the special festivals of the old people. At these great festivals the church-goers usually arrive at the village on the Friday evening and stay till the following Monday. At such times there is a busy throng of life in the little cot-

tages, and the church is crowded during divine service. On other Sundays the little town is deserted and the church is rather empty.

What has been recounted above with regard to the farm-work and daily life in the peasant homes applies chiefly to the time at which the experimental work was started, that is, nearly twenty years ago. Much has been changed since then, especially owing to the increasing adoption of modern agricultural machinery. The isolation of the villages from another is now much less marked than formerly, since the motor-car, which has gradually been making its way even into these regions, has facilitated rapid communication between distant places.

IV.

DWELLINGS, FOOD, HYGIENIC CONDITIONS ETC.

The dwelling-houses are as a rule built of timber. These wooden houses consist of two distinct types: the farm-house and the crofter's cottage. The former are occupied by small holders, the latter either by crofters or by workmen.

The farm-house usually contains several rooms. As a rule, however, only one or two of the rooms are provided with fire-places and can be lived in during the winter.

The ground-plan (Fig. 4) shows the usual disposition of the rooms in a farm-house. One end of the building is taken up by a large room, the so-called »summer hall«, which as a rule is devoid of a fireplace and accordingly cannot be used in winter. At the other end of the house is the kitchen, which does duty also as a living-room and sleeping-room. It is warmed either by a large open fireplace, or, as is more usual nowadays, by an iron kitchen-range. At one of the gable-ends, as well as opposite the main entrance-door, there are usually small rooms (»chambers«), which in some houses are provided with a fireplace.

The kitchen floor is as a rule painted and covered in winter with rag-carpets.

Only in rare cases is there any possibility of opening the windows in winter. For, in accordance with an ancient custom,

the double windows at this season of the year are nailed down on the outer side. In exceptionally cold winters the ordinary windows may be reinforced with an extra set of outer double windows, similarly nailed down.

The smaller type of dwelling-house usually contains merely a single large room — the kitchen — and a small »chamber«. The general arrangement of these houses is otherwise quite similar to that of the farm-houses.

As has been already indicated, the kitchen as a rule serves

Fig. 3.
Farmstead at Antnäs.

as a sleeping-room for the entire family, however numerous.

At the time when the experimental work was started, so-called »cupboard beds« or »shutter beds« were found in almost all homes. They were moreover very common in the greater part of Norrbotten.

These beds consist of large cupboards firmly fitted to the wall, with berths in two storeys. Here the sleepers are actually confined in a kind of cupboard. For not only are the beds shut in on the wall side and at both ends, but the opening in front is provided with shutters, which are kept tightly closed during the night. The origin of these peculiar sleeping-places

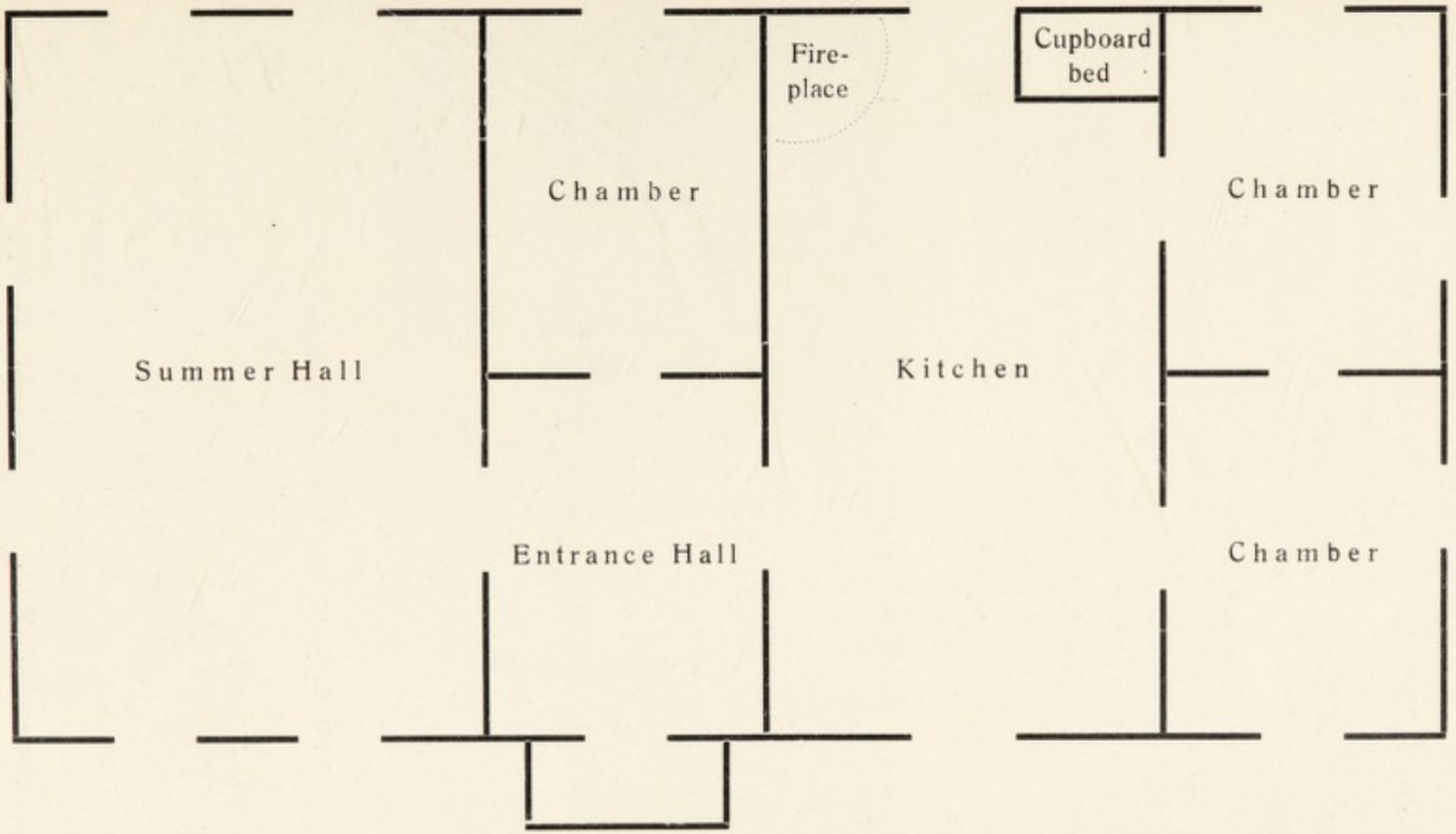


Fig. 4.

Ground-plan of a farmstead at Antnäs.

may be attributed firstly to the necessity of economizing space where many beds have to be arranged in a single room, and secondly to the desire to utilize the available warmth during the cold season of the year.

Such inadequate utilization of the available accommodation obviously entails great evils from a hygienic point of view. For

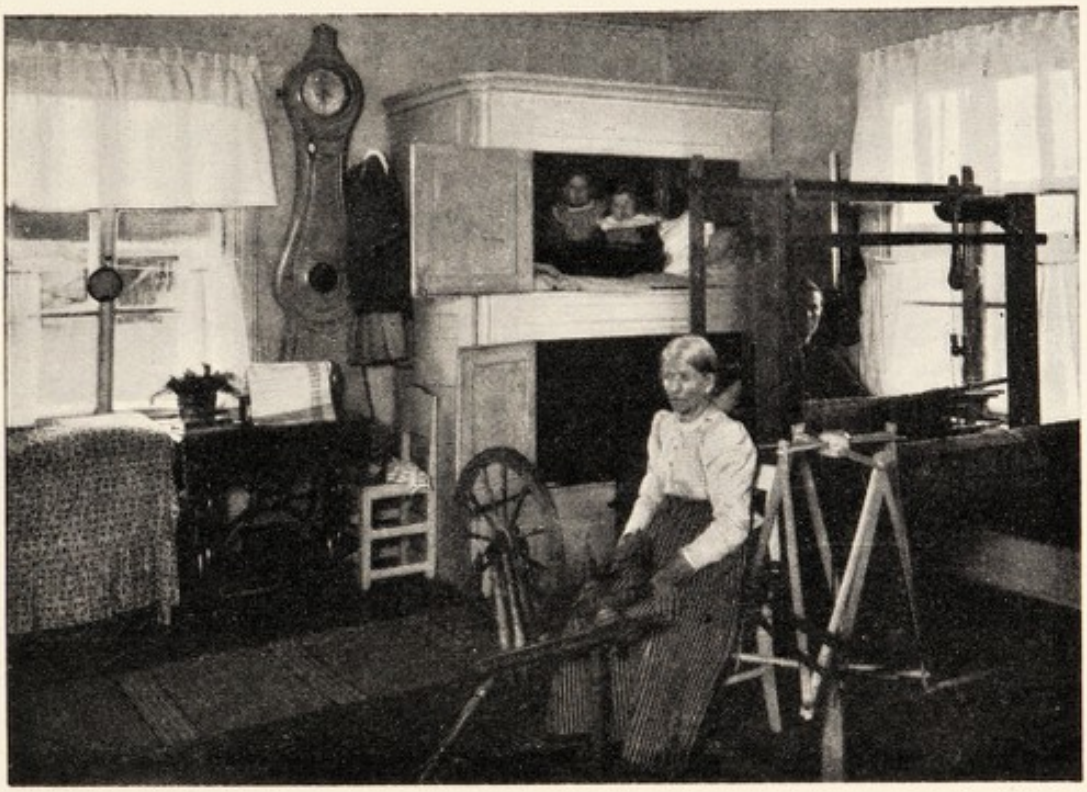


Fig. 5.
The interior of a farmstead at Antnäs with cupboard-bed.

example, in a big house containing many large and small rooms only a single room — the kitchen — was occupied in winter. In many such cases healthy persons were obliged to share a berth with consumptives, usually in one of those tightly closed cupboard beds. And all this without the slightest precaution being taken with regard to expectorations.

The state of the atmosphere in such a dwelling, especially at night, may be more easily imagined than described. From ten to twelve persons, let us say, are sleeping in the same room. In this room food has been cooked and meals taken, and here reeking working-clothes and soggy boots are put up over night to

dry. And the tightly nailed double windows do not allow a breath of fresh air to enter in.

From the very outset of the experiment a vigorous campaign was carried on against these unhygienic conditions, especially against the cupboard beds and the huddling together of the whole family in a single sleeping-room.

The food of these people is as a rule monotonous and insipid. It consists chiefly of dishes made of milk and flour, potatoes, bread and fish (fresh or dried). Meat is regarded as a luxury.

The following is a typical bill of fare (given by Dr. Danielsson): —

5 a. m. Coffee, usually without bread or cakes.

7 a. m. Breakfast, consisting of bread, milk and potatoes, or salt fish.

11—11.30 a. m. Dinner, consisting of potatoes, butter, bread and gruel (occasionally meat).

3 p. m. Bread and milk.

6—7 p. m. Supper: porridge and milk.

The milk is usually curdled.

Coffee is taken at least three or four times a day, usually without bread or cakes. Here, as in other parts of Norrbotten, coffee is positively abused and in many cases takes the place of food. There is reason to presume that the numerous disorders of the digestive organs which occur in these parts have their origin in this prevailing abuse of coffee. It may be mentioned here that the intestinal parasite named *Bothriocephalus latus* is extremely common among the population of these parts, which is doubtless due to the consumption of fish in a semi-raw condition.

It will be seen that the bill of fare is extremely montonous, and that the food is by no means rich in albumen and fats. It is questionable whether such a dietary suffices for a hard-working people in a severe, cold climate, and whether part of the population are not, at times at any rate, underfed.

The desirability of improving the food of the country people, both in quantity and quality, had previously been realized in other quarters. For example, school courses in cooking for

women from peasants' homes had been arranged in the county by private societies.

Personal hygiene in these parts was in many respects deplorable. The people as a rule did not take a single bath during the whole winter, one of the reasons being that no suitable form of public bath was available. The practice of paying regular visits to the »badstu« (vapour-bath), which is characteristic of the Finnish-speaking parts of Norrbotten, was in this district unknown.

One of the items on the programme of work was therefore to provide facilities for vapour-baths and to endeavour to interest the people in this form of bath.

The care of the children, particularly of infants, in these parts, as in rural districts in general, leaves much to be desired. The mothers indeed usually suckle their babies, and often continue to do so until the child enters on its third year. But in those cases where the mother does not give the breast, the food is often ill-adapted to the child's age.

Another defect is the anxious care with which the babies are guarded from fresh air. They are swathed in a plethora of clothing and warmly coddled up, so as to prevent the access of the slightest breath of pure air. In this district, where the cold season of the year is very long and where the dwellings are so badly ventilated, children born in the autumn may be nearly a year old before they get a single breath of fresh air into their lungs.

The people of this district are hard-working and thrifty. Like the Swedish rustic population in general, most of the peasants in these parts cling obstinately to traditional practices and views, and require a great deal of persuasion before they can be induced to adopt changes and innovations, of which they are as a rule very suspicious.

In spite of this, modern improvements have been introduced in many fields, for example, agriculture, cattle-breeding and dairying.

Temperance reforms have gained numerous adherents in this locality, and the great majority of the inhabitants are teetota-

lers — a very marked improvement compared with the conditions in a not remote past.

Such were the outstanding traits of the people and their characteristic habits of life in the area selected as the basis for the projected experiment in social hygiene.

Fig. 6.
The family gathered round the fireplace in the evening.
View from Antnäs.

V.

INVESTIGATIONS INTO THE DISSEMINATION OF TUBERCULOSIS.

(a) *Within the experimental area proper.*

Dr. Danielsson, almost immediately after his arrival, entered upon an examination of the entire population in the experimental area, with a view to obtaining a rapid survey of the dissemination of tuberculosis in that area.

The examination began at the village of Antnäs, and was continued to Ersnäs, Alvik and Långnäs, in the order mentioned. It was terminated in December 1906.

As regards the villages of Antnäs and Ersnäs, the examina-

tions were willingly attended by the great majority of their population. At Alvik and Långnäs, on the other hand, a number of persons, for somewhat trivial reasons, took up a suspicious attitude towards the project, and a considerable number of families absented themselves entirely, or almost entirely, from the examinations. Thus, out of a total population of 1 027 souls, only 589 persons from these two villages were examined.

These examinations completely corroborated the view previously held that tuberculosis was very widely prevalent among the population in the experimental area. Dr. Danielsson examined altogether 1 498 persons and obtained the following results:

Undoubted tuberculosis of the lungs in 161 persons = 10.75 %
Suspected » » » » » 88 » = 5.9 %

In regard to the occurrence of tuberculosis of the lungs, considerable differences were noted in the various villages, as shown by the following records: —

	Antnäs	*Ersnäs*	*Alvik-Långnäs*
Undoubted cases	49 = 14.5 %	60 = 10.4 %	52 = 8.8 %
Suspected „	23 = 6.8 %	36 = 6.2 %	29 = 4.9 %

In the course of this investigation, Dr. Danielsson moreover directed special attention to the occurrence of swollen cervical lymph-glands, which he considered to be as a rule indicative of tuberculosis. He found these glandular swellings to be of very frequent occurrence, especially in children under the age of fifteen, among whom they were observed in no less than 61.9 % of those examined. In persons above the age of fifteen he found these swellings only in 10.3 % of those examined. The percentage figure for the total number of persons of all ages examined was 30.2 %.

As previously mentioned, Dr. Danielsson retired from this office as early as 1907, having been transferred to another post.

In March 1908 the Author took up his appointment as Physician to the Institute, and immediately set out upon a renewed examination of the population.

A new examination was found desirable for the following

reasons. Firstly, in order to enable the Author to acquire as soon as possible an intimate personal knowledge of the people among whom he was to work for several years to come. And secondly, because it was considered that a better basis of comparison would be provided for the examination to be made at the termination of the experimental period, if both the preliminary and the final examination were made by the same investigator. It was indeed almost inevitable that the views taken by different investigators in regard to individual cases should show some divergence.

The procedure adopted in the two preliminary investigations was substantially the same. In regard to each family, extracts from the parish register had been made in advance. It was thus possible to control whether the examination was attended by *all* the members of the family and to draw up a list of absentees.

A few days beforehand the homes were visited by the nurse, who summoned the families to attend the examination, so far as possible in full numbers, at an appointed date and hour. The examination was held at a large farm in the village.

In the course of these visits the nurse moreover endeavoured to make herself well acquainted with the general conditions of the family and home. She drew up an outline plan of the entire dwelling, showing the position of the rooms, the fireplaces, the ventilation, the occurrence of cupboard beds, and in particular the disposition of the sleeping-places of the whole family.

In examining the various families the physician had this outline plan in front of him. On the basis thereof, he could give any preliminary instructions that might be necessary, for example, with regard to the arrangement of the sleeping-places. Those who had been found to be affected with tuberculosis of the lungs were recommended as far as possible to have a separate bedroom, or at any rate a separate bed, and were strongly warned against sharing their bed with others, especially with children.

The renewed investigation was attended by almost the entire population, who exhibited great interest in it. The

opposition which had previously been encountered from two of the villages seemed now to have subsided, especially after a proposal had been mooted for selecting in their stead another adjacent village for incorporation in the experimental area.

Out of 1 860 persons resident within the area, 1 652, or close on 90 percent, attended the examination. The majority of the remaining 208 persons were temporarily absent in other places, and many of them were examined later.

The renewed investigation was conducted, broadly speaking, on the same lines as that previously made by Dr. Danielsson and gave roughly the same results, to wit: —

Undoubted tuberculosis of the lungs in 169 persons = 10.23 %
Suspected » » » » » 69 » = 4.0 %

In this examination also the frequency of tuberculosis in the different villages was found to vary considerably, as shown by the following figures: —

	Antnäs	*Ersnäs*	*Alvik*	*Långnäs*
Undoubted cases	54 = 15 %	69 = 11.4 %	26 = 5.7 %	20 = 9.3 %
Suspected „	17 = 4.7 %	29 = 4.8 %	16 = 3.2 %	7 = 3.2 %

As for the cases of »lymph-gland tuberculosis« recorded by the previous investigator, the Author was unable to adhere to the latter's view that these glandular swellings, even when very small and few, were almost always indicative of tuberculosis. He considered it, however, to be useful to record the occurrence of a considerable number of enlarged cervical lymph-glands irrespective of their tuberculous or non-tuberculous character. In a large-scale investigation such as this, the frequency of those swellings might, he thought, be regarded as a kind of index of the hygienic conditions in the homes and among the children, and should therefore not be disregarded.

The Author included in his records all those cases where *a plurality* of non-sensitive swollen lymphatic glands could be observed by palpating the throat. He excluded those cases where the swelling could be attributed to temporary causes such as caries of teeth or pediculosis, as well as cases where only a few

minor swellings could be found by palpation. Undoubtedly tuberculous lymphomata of the throat were recorded separately.

The figures which will now be given in regard to the occurrence of swollen lymph-glands are thus not commensurable with the records made in the previous investigation.

I found such glandular swellings in 45.4 % of the children under the age of fifteen, in 4.7 % of the persons above that age, and in 21 % of the total number of persons examined.

Those individuals who had been recorded as undoubtedly suffering from tuberculosis, or as suspected of tuberculosis, were of course subsequently subjected to repeated examination. The latter category in particular were observed with the greatest care, with a view to determining, if possible, whether tuberculosis of the lungs existed or not.

After repeated examinations, often in consultation with other doctors, and after observation for a considerable length of time, the Author considered himself able to declare that 30 out of the 69 cases recorded as suspect were unmistakeable cases of tuberculosis. Thus the number of indubitable cases of pulmonary tuberculosis within this area at this time amounted to 199, or *12 % of the total population examined*. The figures for the separate villages were as follows: —

Antnäs	60 cases	= 16.7 %
Ersnäs	78 »	= 12.9 %
Alvik	34 »	= 7.2 %
Långnäs	27 »	= 12.6 %

These 199 cases of tuberculosis included all those which, on the ground of anamnesis, status, and continued observation, could be diagnozed as pulmonary tuberculosis, irrespective of whether the process was to be regarded as cured or progressive, inactive or active. In view of the occurrence of fever, positive finds of bacilli, low state of health, or other tokens, the Author considered himself able to pronounce 68 of the cases to be *active* or progressive. This represents somewhat

more than one-third (34 %) of the recorded cases of tuberculosis and *4.1 % of the total population examined.* The following are the figures for the individual villages: —

Antnäs	20 cases	= 5.6 %
Ersnäs	24 »	= 4 %
Alvik	15 »	= 3.2 %
Långnäs	9 »	= 4 %

Tuberculosis in forms other than pulmonary was observed in this investigation in 33 cases, to wit: —

in the lymph-glands of the neck	26 cases
in the knee-joint	1 case
in the hip-joint	1 »
in the finger-joints and metatarsal bones (Spina ventosa)	3 cases
in the elbow-joint	1 case
lupus	1 »
Total	33 cases

If these 33 cases of tuberculosis in other organs, which corresponds to 2 % of the total number examined, are added to the previously mentioned 199 cases of tuberculosis of the lungs, the total number of cases of tuberculosis figures out at 232, that is, *14 % of the total population examined.*

Out of the total number of cases of tuberculosis those of tuberculosis of the lungs amounted to 86 % and other localizations to 14 %. Among the latter, cervical lymphomata predominated, being approximately four-fifths of the number of cases.

The population examined comprised 355 separate families. In the course of the investigation one or more cases of tuberculosis were found in 156 families, that is in 44 % of the total number. The following are the figures for the different villages:

Antnäs	75 families	.....	tuberculosis	in 44 = 59 %
Ersnäs	130 »	.....	»	in 60 = 46 %
Alvik	105 »	.....	»	in 28 = 27 %
Långnäs	45 »	.....	»	in 24 = 53 %

I give below detailed reports, in diagrammatic and tabular form, on the 355 cases examined. The outline charts of the villages in figs. 7—11 illustrate the distribution of the cases of tuberculosis of the lungs. The rectangular frames represent the individual families in the village. A black frame indicates that tuberculosis of the lungs exists in the family in question, whilst the dots show the number of cases in that family. The figures appended to the frames correspond to the numbers in the first column of the following table 6. These numbers refer to the list of families kept by the Institute.

Table 6 gives the number of members of the family (adults and children under 15), the number of observed cases of tuberculosis of the lungs, and the social position of the supporter of the family. The last column contains such information as could be obtained with regard to known deaths from tuberculosis of the lungs among the parents or brothers and sisters of the husband and wife in the several families.

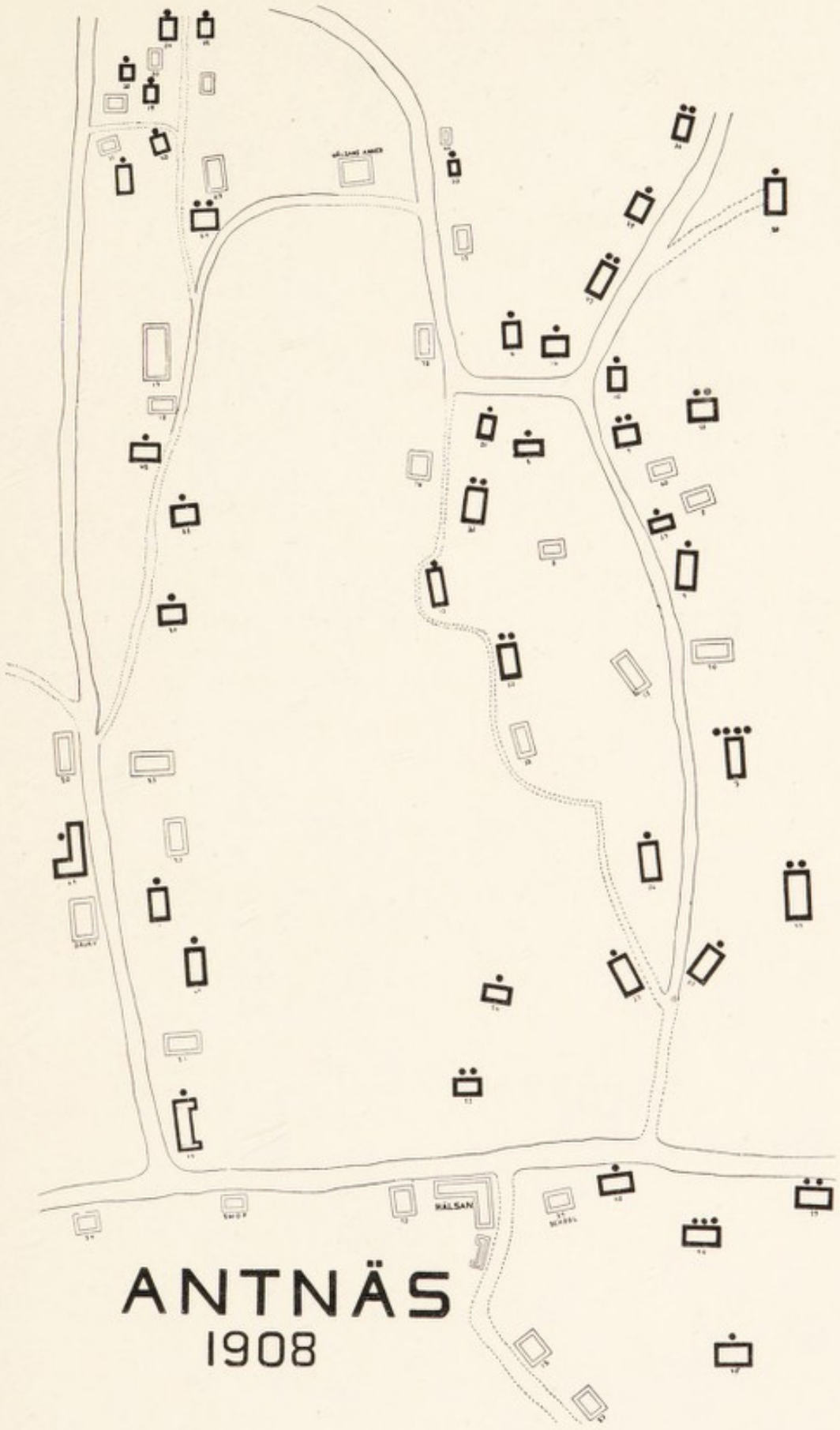


Fig. 7.

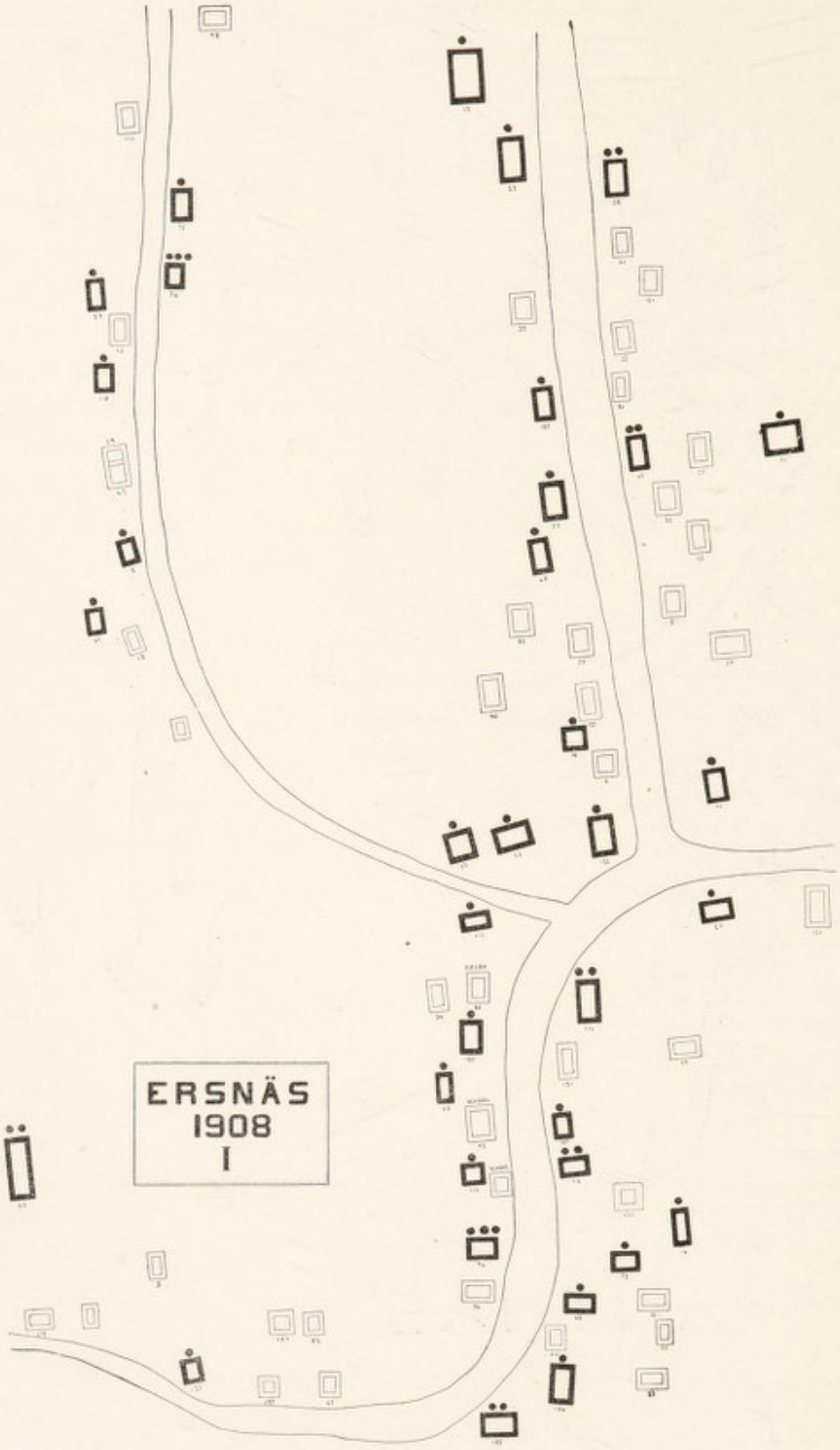


Fig. 8.

Fig. 9.

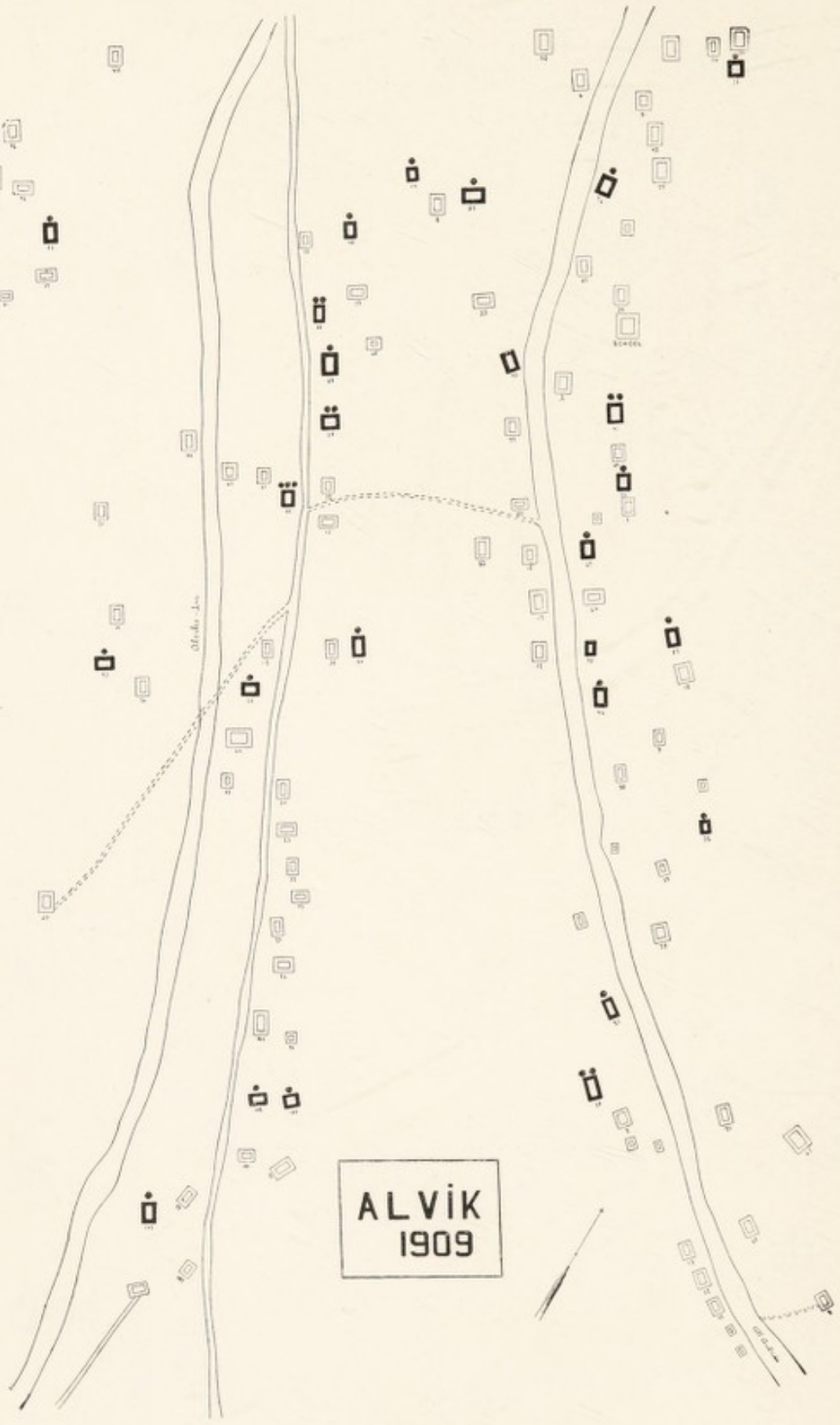


Fig. 10.

Fig. 11.

Table 6.

ANTNÄS

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
1	5	6	11	1	Farmer	a) 0, b) 1 brother or sister*)
2	4	4	8	1	„	a) 3 brothers or sisters, b) 1 brother or sister
3	2	7	9	—	„	a) father, 1 brother or sister, b) 0
4	3	—	3	1	„	a) 1 brother or sister, b) 0
5	3	2	5	—	„	a) „ „ b) 0
6	1	—	1	1	Cook	mother, 2 brothers or sisters
7	3	1	4	4	Farmer	a) mother, 4 brothers or sisters, b) 1 brother or sister
8	2	—	2	—	Crofter	a) 0, b) 0
9	2	—	2	2	„	a) 1 brother or sister, wife, 9 children, b) mother, 1 brother or sister
10	2	4	6	1	Workman	a) child, b) 0
11	2	—	2	—	Soldier	a) 0, b) 0
12	4	—	4	—	Farmer (unmarried)	a) 0
13	2	4	6	1	„	a) mother, 2 brothers or sisters, b) 0
14	6	5	11	1	„	a) mother, 2 brothers or sisters, b) 2 brothers or sisters
15	1	5	6	1	Farmer (widower)	a) wife, 3 children (?)
16	4	4	8	1	„	a) 0, b) 2 brothers or sisters
17	2	—	2	—	„	a) father, 1 brother or sister, b) 0
18	1	—	1	—	Farmer (unmarried)	a) father, 1 brother or sister
19	4	1	5	1	Soldier	a) 0, b) 0
20	1	3	4	—	Farmer's widow	b) 1 brother or sister
21	2	—	2	—	Farmer (unmarried)	a) 2 brothers or sisters, grand-father (father's father)
22	3	3	6	1	„	a) father, b) ?
23	3	4	7	—	„	a) ?, b) mother, 2 brothers or sisters
24	2	2	4	1	„	a) 0, b) 1 brother or sister
25	6	1	7	—	„	a) father, b) 2 brothers or sisters
26	5	1	6	1	„	a) 0, b) ?
27	3	1	4	—	Farmer (widower)	a) wife, 3 children
28	2	6	8	1	Farmer	a) 0, b) 0

*) Swedish has a single word for »brother(s) and/or sister(s)«.

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
29	3	1	4	1	Workman	a) ?, b) 2 children
30	4	—	4	1	„	a) 0, b) 0
31	3	3	6	—	„	a) 0, b) 1 child
32	3	—	3	1	„	a) 0, b) 1 brother or sister
33	2	2	4	2	„	a) ?, b) mother, 1 brother or sister, 1 child
34	1	4	5	1	Soldier	a) ?, b) 0
35	4	6	10	2	Farmer	a) father, b) 0
36	2	1	3	1	„	a) 0, b) 0
37	4	1	5	1	„	a) 0, b) 1 uncle (mother's brother), 1 uncle (father's brother)
38	2	—	2	1	Farmer's widow	b) father, mother, 1 brother or sister
39	3	3	6	2	Farmer	a) 1 brother or sister, 2 aunts (mother's sisters), b) 0
40	2	—	2	1	Workman	a) 0, b) 0
41	1	—	1	—	Farmer unmarried	a) 0
42	3	1	4	1	Farmer's widow	b) 0
43	2	—	2	1	Workman	a) 0, b) ?
44	5	7	12	2	Farmer	a) father, mother, 1 sister, 3 children b) mother
45	3	1	4	1	Farmer's widow	b) 0
46	5	2	7	3	Farmer	a) father, mother, 2 brothers or sisters, b) father, mother, 1 brother or sister
47	2	1	3	2	Workman (widower)	a) father, mother, 3 brothers or sisters
48	2	4	6	1	Farmer	a) uncle (father's brother), b) 0
49	2	8	10	1	„	a) 1 brother or sister, b) 0
50	2	—	2	1	„	a) 0, b) ?
51	2	2	4	—	„	a) 1 brother or sister, b) 0
52	3	4	7	—	„	a) 0, b) 0
53	5	—	5	2	„	a) 0, b) 2 brothers or sisters
54	2	2	4	—	Workman	a) 0, b) mother, 1 brother or sister
55	3	—	3	2	Workman (widower)	a) 1 brother or sister
56	6	1	7	2	Farmer	a) mother, 1 sister, 1 daugther, b) 2 brothers or sisters
57	4	2	6	1	Workman	a) 1 child, b) husband, in first marriage, 3 children
58	2	5	7	2	Farmer	a) 0, b) 0
59	4	—	4	1	Farmer	a) 0, b) 0

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
60	2	2	4	—	Farmer	a) 0, b) 1 brother or sister
61	2	3	5	—	Soldier	a) 0, b) 0
62	1	2	3	—	„	a) ?, b) 0
63	2	3	5	—	Travelling agent	a) 0, b) 1 brother or sister
64	2	5	7	2	Farmer	a) 0, b) 0
65	1	—	1	—	Workwoman	0
66	4	1	5	—	Farmer (widower)	a) wife, 2 children
67	2	1	3	—	Crofter (widower)	a) 1 brother or sister, wife, 1 child (?)
68	1	—	1	—	Teacher (woman)	0
69	4	2	6	1	Farmer	a) 0, b) mother, 3 brothers or sisters
70	3	3	6	—	„	a) first wife, 2 children, b) 0
71	5	3	8	—	Crofter	a) 1 sister, b) father, mother, 3 brothers or sisters
72	3	—	3	—	Farmer	a) ?, b) mother, 1 brother or sister
73	2	—	2	—	Teacher (widower)	a) 3 children
74	1	—	1	—	Farmer (unmarried)	a) 0
75	3	—	3	—	Farmer	a) 2 brothers or sisters b) 1 sister
	209	150	359	60		

ERSNÄS

1	1	2	3	—	Farmer	a) first wife, 3 children, b) father, mother, 2 brothers or sisters
2	2	2	4	1	Crofter	a) ?, b) 1 sister
3	2	5	7	—	Farmer	a) 1 brother, b) sister
4	5	3	8	2	„	a) 0, b) 0
5	3	—	3	2	„	b) 1 sister, 1 child, b) 1 child
6	1	4	5	—	Workman	a) ?, b) 0
7	2	2	4	—	„	a) 0, b) 0
8	3	3	6	—	Farmer	a) 1 brother or sister, b) 0
9	3	5	8	1	„	a) father, mother, 1 child, b) 1 child
10	2	1	3	—	„	a) father, 1 brother or sister, b) 0
11	2	3	5	—	„	a) ?, b) ?
12	1	1	2	—	Workman	a) ?, b) mother, 4 aunts (mother's sisters)
13	1	4	5	—	Farmer	a) ?, b) grandfather (father's father), grandmother (mother's mother), mother (?)

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
14	4	1	5	—	Farmer	a) father, 2 brothers or sisters, b) 0
15	1	—	1	—	Farmer (unmarried)	a) ?
16	5	—	5	1	Farmer (widower)	a) wife
17	3	3	6	1	Farmer	a) mother, b) mother, 1 brother or sister
18	2	—	2	—	,,	a) 0, b) 0
19	4	3	7	—	,,	a) o, b) 0
20	2	3	5	1	,,	a) 0, b) mother
21	2	5	7	—	,,	a) 0, b) 0
22	5	—	5	1	,,	a) 0, b) 0
23	4	2	6	—	,,	a) 1 sister, b 0
24	2	3	5	1	Workman's widow	b) 1 sister, 1 child
25	2	3	5	—	Farmer	a) 0, b) 0
26	8	—	8	—	,,	a) 0, b) 1 brother
27	2	—	2	1	Workman	a) 0, b) father
28	3	2	5	1	Farmer	a) 2 brothers or sisters, b) 0
29	3	4	7	—	Workman	a) ?, b) 0
30	2	3	5	—	Farmer	a) ?, b) father, 1 brother
31	2	3	5	1	Workman (widower)	a) wife
32	2	6	8	1	Farmer	a) ?, b) mother, grandmother (father's mother) 1 son
33	3	—	3	—	Crofter	a) 0, b) 1 child
34	3	4	7	—	Farmer	a) 1 brother or sister, b) father, 3 brothers or sisters.
35	3	1	4	—	,,	a) 1 sister, b) 0
36	3	6	9	3	Workman	a) father, b) ?
37	3	—	3	—	,,	a) mother, b) ?
38	3	2	5	2	Farmer	a) mother, uncle (father's brother) 2 brothers or sisters, b) 1 brother
39	3	3	6	—	,,	a) 0, b) mother
40	2	1	3	—	,,	a) 0, b) 0
41	3	—	3	—	,,	a) father, b) 1 brother
42	2	4	6	1	,,	a) ?, b) 0
43	1	3	4	—	,,	a) ?, b) 0
44	3	5	8	1	,,	a) father, 1 brother or sister, b) father
45	1	1	2	—	Farmer (widow)	a) 0, b) 1 sister
46	2	—	2	—	Farmer	a) 0, b) father, 2 brothers or sisters

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
47	3	5	8	—	Farmer	a) uncle (father's brother), aunt (father's sister), 1 sister, b) 0
48	5	—	5	1	Farmer's widow	b) husband
49	4	1	5	2	Farmer	a) 1 brother, b) 0
50	2	—	2	—	Workman	a) 0, b) 0
51	3	—	3	1	Farmer (widower)	a) 1 brother, the wife
52	3	—	3	—	Farmer	a) 0, b) mother
53	2	—	2	1	Farmer (unmarried)	a) 1 sister
54	3	1	4	1	Farmer	a) 1 sister, b) 0
55	5	2	7	1	Farmer's widow	b) father
56	4	2	6	1	Farmer	a) 1 sister, b) 0
57	4	5	9	1	„	a) 0, b) 0
58	5	—	5	—	Workman	a) mother, b) 0
59	5	2	7	—	Farmer	a) 1 sister, b) mother, 2 brothers or sisters
60	1	3	4	—	Farmer (widower)	a) 0
61	2	1	3	1	Farmer	a) ?, b) 2 brothers or sisters
62	3	3	6	1	„	a) 0, b) father, 1 sister
63	2	2	4	—	Workman	a) father, 7 brothers or sisters, b) father, mother
64	3	—	3	—	Farmer's widow	b) 1 sister
65	3	2	5	2	Farmer	a) 1 sister, b) 0
66	5	1	6	1	Farmer's widow	b) 1 sister, 1 child
67	1	—	1	—	Workman	a) 0
68	3	5	8	1	Farmer	a) 1 brother, b) mother, 1 brother or sister
69	2	—	2	—	„	a) ?, b) ?
70	2	1	3	—	Crofter	a) 2 brothers or sisters, b) father, mother
71	2	1	3	1	Farmer (widower)	a) wife
72	3	—	3	1	Farmer (unmarried)	a) 0
73	2	3	5	1	Farmer	a) mother, b) 0
74	5	2	7	2	„	a) mother, b) 0
75	2	2	4	—	Workman	a) 1 sister, b) 0
76	5	—	5	1	Farmer's widow	b) ?
77	3	—	3	—	Farmer	a) grandfather (father's father), grandmother (father's mother), b) 0
78	3	—	3	—	„	a) father, mother, b) 0
79	4	1	5	1	„	a) grandmother, grandfather, 2 sisters, 3 child., b) 1 brother

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
80	1	—	1	—	Dairymaid	0
81	3	3	6	1	Soldier	a) 0, b) father, 1 sister
82	1	—	1	—	Farmer	0
83	3	—	3	—	,,	a) mother, b) sister, wife (in first marriage)
84	2	4	6	—	,,	a) 0, b) 0
85	3	3	6	—	,,	a) father, b) 0
86	1	—	1	—	Farmer (unmarried)	0
87	1	6	7	1	Farmer	a) ?, b) ?
88	1	—	1	—	,,	?
89	4	6	10	2	,,	a) 1 sister, b) 1 brother
90	5	2	7	2	Farmer (widower)	a) father, wife, 3 children
91	3	1	4	1	Farmer	a) father, b) 0
92	2	3	5	—	Teacher	a) 1 brother, b) 1 aunt (mother's sister)
93	1	—	1	—	Farmer	a) 2 uncles (father's brothers), 1 aunt (father's sister)
94	3	—	3	—	,,	a) 0, b) mother, 1 brother
95	2	2	4	—	Workman	a) ? b) father, mother, 1 brother or sister
96	4	2	6	3	Farmer	a) father, mother, 1 brother or sister, b) mother, 1 sister
97	2	—	2	1	,,	a) father, mother, 1 brother or sister, b) mother, 1 sister
98	1	3	4	1	,,	a) father, mother, 2 brothers or sisters, b) father
99	4	2	6	1	,,	a) mother, 1 brother, b) 6 brothers or sisters
100	3	—	3	—	Baker	a) 0, b) ?
101	2	3	5	1	Workman	a) ?, b) father
102	1	3	4	—	Soldier	a) ?, b) 0
103	2	3	5	—	,,	a) ?, b) father
104	6	3	9	-	Crofter	a) 0, b) 2 brothers or sisters
105	5	—	5	2	Farmer	a) father, 3 brothers or sisters, b) mother
106	5	2	7	1	,,	a) 0, b) 0
107	3	4	7	—	,,	a) father, b) 0
108	1	—	1	—	Farmer's widow	b) husband
109	2	4	6	1	Tradesman	a) 0, b) father
110	2	—	2	1	Farmer (unmarried)	a) mother
111	2	—	2	—	Farmer	?
112	2	2	4	—	,,	a) ?, b) ?

Table 6. (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
113	3	4	7	1	Farmer	a) grandfather (father's father), father, b) 0
114	3	3	6	1	Painter	a) first wife, 2 children, b) 2 brothers or sisters, 2 children
115	1	—	1	—	Bookbinder	a) 0
116	4	—	4	2	Farmer	a) 1 sister, b) first husband, 1 son
117	2	—	2	2	Crofter	a) ?, b) 1 sister, 3 children
118	5	3	8	1	Farmer's widow	b) husband
119	4	1	5	—	Farmer (widower)	a) father, mother, 5 brothers or sisters, 2 wives, 2 children
120	3	—	3	1	Tradesman	a) 0, b) 0
121	4	1	5	—	Farmer's widow	b) husband
122	3	1	4	1	Farmer	a) 0, b) 0
123	2	5	7	1	Workman	a) 0, b) mother
124	1	—	1	—	Tailor (unmarried)	0
125	2	4	6	1	Farmer	a) 0, b) father, mother
126	4	—	4	2	Farmer (widower)	a) wife, 8 children
127	5	6	11	—	Farmer	a) 0, b) ?
128	4	2	6	—	Blacksmith	a) 0, b) 0
129	3	1	4	2	Farmer	a) mother, b) 1 brother
130	1	—	1	—	Worksman's widow	b) father, 2 brothers or sisters
	362	243	605	78		
					ALVIK	
1	5	1	6	—	Farmer	a) mother, 1 brother, b) mother, 1 sister
2	3	1	4	—	,,	a) mother, 1 brother, 6) ?
3	5	1	6	—	Farmer's widow	b) 0
4	2	1	3	—	Farmer	b) 0
5	2	2	4	—	Tradesman	a) 0, b) 1 brother or sister
6	3	3	6	—	Farmer	a) 2 sisters, b) 1 brother
7	4	—	4	—	Workman	a) 1 brother, b) 0
8	2	4	6	—	Farmer	a) 0, b) 2 sisters
9	2	1	3	—	,,	a) 0, b) o
10	2	4	6	—	,,	a) mother, b) mother
11	4	3	7	1	Farmer (widower)	a) wife, 1 child
12	2	3	5	—	Farmer	a) 0, b) 0
13	2	2	4	—	Workman	a) ?, b) mother, 2 brothers or sisters

Table 6 (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
14	2	4	6	1	Workman	a) 0, b) mother, 2 brothers or sisters
15	6	—	6	—	Farmer	a) 1 brother, b) mother, 1 sister
16	1	—	1	—	Teacher (woman)	1 brother
17	2	1	3	—	Workman	a) 0, b) mother, 2 brothers or sisters
18	3	—	3	—	Farmer	a) 0, b) mother, 1 sister
19	5	—	5	—	,,	a) 1 sister, 2 children, b) 1 brother, 2 children
20	1	2	3	—	,,	a) ?, b) 0
21	6	—	6	1	,,	a) 1 sister, b) 0
22	3	1	4	—	,,	a) mother, b) father
23	3	—	3	—	Farmer (widower)	a) 3 children
24	3	—	3	—	Farmer	a) mother
25	4	—	4	—	,,	a) 0, b) 0
26	2	1	3	—	,,	a) 0, b) 0
27	2	1	3	—	,,	a) 0, b) 1 brother
28	3	3	6	2	,,	a) 0, b) 0
29	1	—	1	1	Workman (unmarr.)	a) father, mother
30	2	2	4	2	Farmer's widow	b) 5 brothers or sisters, husband
31	1	—	1	—	Farmer (unmarried)	a) 1 brother
32	2	2	4	—	Farmer	a) 2 sisters b) 3 sisters
33	3	—	3	—	,,	a) 1 daughter b) 1 daughter
34	3	3	6	—	,,	a) 0, b) 0
35	4	2	6	1	,,	a) mother, 1 sister, b) mother, 1 brother
36	2	—	2	—	,,	a) father, b) 3 brothers or sisters
37	4	1	5	—	,,	a) 0, b) 0
38	2	1	3	1	Workman's widow	b) husband, 2 children
39	4	1	5	—	Workman	a) 1 brother, b) father, mother, 1 sister
40	5	—	5	—	Soldier	a) mother, 2 brothers, b) 0
41	4	2	6	2	Farmer	a) mother, grandfather (mother's father) grandmother(mother's mother),5 brothers or sisters
42	2	2	4	—	Teacher	a) 0, b) 0
43	2	2	4	—	Farmer	a) 0, b) 0
44	3	—	3	—	Farmer's widow	b) mother
45	2	1	3	—	Workman	a) mother, b) sister
46	2	3	5	1	Farmer	a) 1 brother, b) father
47	2	4	6	—	Workman	a) 2 brothers or sisters, b) father, uncle (father's brother)

Table 6 (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
48	2	2	4	1	Farmer (widower)	a) wife
49	2	1	3	—	,,	a) wife
50	1	—	1	—	Dressmaker(unmar.)	?
51	5	1	6	—	Farmer	a) 0 b) 1 son
52	1	1	2	—	Workman	a) ?, b) mother
53	2	5	7	—	,,	a) ?, b) mother, 2 uncles (mother's brothers), 3 aunts (mother's sisters)
54	2	4	6	—	Farmer	a) 2 brothers or sisters, b) father
55	3	2	5	1	Farmer (widower)	a) 1 sister, wife, 1 child
56	2	3	5	—	Farmer	a) 1 brother, b) 0
57	2	3	5	—	,,	a) 1 brother, b) 1 brother or sister
58	2	3	5	1	,,	a) 1 brother, b) 0
59	2	4	6	—	Farmer (widower) (married again)	a) wife, 6 children, b) 1 child
60	3	1	4	—	Farmer	a) 0, b) 0
61	4	—	4	—	,,	a) mother, b) 0
62	2	1	3	—	,,	a) mother, b) 0
63	2	1	3	—	Workman	a) mother, b) mother
64	3	1	4	—	Farmer (widower)	a) wife, 1 son
65	4	3	7	—	Workman	a) mother, b) 0
66	2	—	2	—	Farmer	a) mother, b) 0
67	1	4	5	—	Workman	a) ?, b) 0
68	4	4	8	1	Farmer	a) mother, 1 sister, b) 1 brother
69	2	1	3	1	,,	a) 0, b) ?
70	4	3	7	—	,,	a) 0, b) 0
71	3	1	4	—	Workman	a) 0, b) mother
72	2	5	7	—	Farmer's widow (married again)	a) mother, 1 sister, wife, b) mother, 1 sister
73	1	—	1	—	Unmarried woman	0
74	3	1	4	—	Farmer	a) 0, b) ?
75	3	1	4	1	,,	a) 0, b) 1 sister
76	1	—	1	1	Workman (widower)	a) mother, wife, 5 children
77	2	2	4	—	Farmer	a) 0, b) 0
78	2	3	5	—	,,	a) ?, b) 0
79	3	4	7	—	Soldier	a) ?, b) 0
80	4	6	10	—	Workman	a) 0, b) 1 sister
81	4	2	6	—	Farmer	a) ?, b) 1 sister

Table 6 (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
82	1	—	1	—	Workman (widower)	a) wife
83	6	5	11	3	Farmer	a) 1 sister, b) 0
84	2	—	2	1	,,	a) 1 sister, b) mother, 1 sister
85	3	—	3	1	,,	a) 2 sisters, b) 0
86	1	—	1	1	Unmarried woman	1 sister
87	3	3	6	—	Farmer	a) 1 sister, b) 0
88	4	4	8	2	,,	a) 1 sister, b) mother, 6 brothers or sisters
89	2	4	6	1	,,	a) mother, b) 0
90	3	—	3	1	Farmer (widower)	a) father, 2 brothers or sisters, wife, 2 children
91	4	2	6	—	Farmer	a) 1 sister, b) 0
92	3	2	5	—	,,	a) father, 2 brothers or sisters, b) 0
93	4	—	4	1	,,	a) 0, b) 0
94	2	—	2	—	Farmer (unmarried)	a) father
95	1	—	1	—	Farmer's widow	b) mother, 1 brother or sister
96	2	2	4	—	Farmer	b) father, mother, 2 brothers or sisters, the husband, 2 children
97	4	5	9	—	,,	a) 2 brothers or sisters, b) 0
98	3	3	6	—	,,	a) 0, b) 0
99	6	1	7	—	,,	a) mother, b) father
100	3	—	3	1	Joiner	a) father, b) 0
101	1	4	5	—	Farmer	a) ?, b) 0
102	4	6	10	1	,,	a) 0, b) 0
103	1	4	5	1	Workman's widow	b) husband
104	5	1	6	—	Farmer	a) 0, b) 0
105	3	—	3	—	,,	a) 0, b) 1 sister
	290	184	474	34		

LÅNGNÄS

1	4	—	4	2	Farmer (widower)	a) mother, daughter
2	3	—	3	—	Workman's widow	b) 0
3	6	3	9	—	Farmer	a) ?, b) 1 sister
4	3	—	3	1	,,	a) father, b) 0
5	3	4	7	—	Workman	a) 0, b) 0
6	1	—	1	—	Shopman	0

Table 6 (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
7	1	4	5	—	Workman's widow	b) husband
8	3	—	3	1	Farmer	a) grandmother (mother's mother), mother
9	3	—	3	—	Workman	a) mother, 1 brother, b) 0
10	2	2	4	—	Farmer	a) 0, b) 1 brother
11	3	4	7	1	,,	a) 2 sisters, b) 0
12	3	2	5	1	,,	a) 2 sisters, b) ?
13	3	5	8	—	,,	a) father, b) mother, 1 sister
14	3	4	7	—	,,	a) ?, b) mother, 2 brothers or sisters
15	3	2	5	1	,,	a) mother, b) father, mother, 2 brothers or sisters
16	4	2	6	1	,,	a) 0, b) father
17	2	2	4	1	Farmer's widow	b) 0
18	3	2	5	—	Farmer	a) 0, b) 0
19	3	—	3	1	Farmer (unmarried)	a) mother, 1 sister
20	2	—	2	1	Farmer	a) 5 brothers or sisters, b) father
21	5	1	6	—	,,	a) 1 brother or sister, b) ?
22	1	—	1	1	Unmarried woman	0
23	2	—	2	—	Crofter	a) mother, b) 0
24	3	—	3	1	Farmer	a) 1 sister, b) father
25	3	1	4	1	Farmer (widower) (married again)	a) mother, 1 sister, 2 wives, 5 children
26	2	1	3	—	Shoemaker	a) mother, 1 sister, b) 0
27	3	7	10	—	Farmer	a) mother, 1 sister, b) sister
28	5	1	6	—	,,	a) father, b) mother, 1 sister
29	4	1	5	—	,,	a) mother, 1 sister, b) 1 sister
30	3	3	6	2	Workman	a) 0, b) 0
31	4	5	9	1	Farmer	a) 0, b) 0
32	5	1	6	—	,,	a) ?, b) ?
33	4	1	5	1	,,	a) mother, 1 sister, b) mother, 2 brothers or sisters
34	3	1	4	—	,,	a) father, mother, 1 sister, b) 2 children
35	7	1	8	2	Farmer (unmarried)	a) 2 brothers or sisters
36	3	—	3	—	Farmer	a) father, b) 0
37	3	2	5	1	,,	a) father, b) brothers or sisters
38	2	4	6	1	,,	a) father, b) 0
39	5	—	5	1	Crofter	a) 0, b) 1 brother
40	3	1	4	1	Farmer	a) ?, b) 0

Table 6 (cont.).

N:o	Number of members			Cases of pul. tub.	Occupation of head of the family	Deaths from pulm. tub. a) in the husband's family b) in the wife's family
	Adults	Children	Total			
41	2	1	3	—	Workman	a) 0, b) 0
42	2	5	7	1	Farmer	a) mother, b) 0
43	1	—	1	—	Workman (unmar.)	a) father, 1 brother
44	2	3	5	1	Painter	a) 0, b) 2 brothers or sisters
45	3	—	3	1	Workman	a) 0, b) mother
	138	76	214	27		

As will be gathered from the table, the head of each family was questioned at the examination with regard to the occurrence of consumption among his near relatives. The great majority were able to give satisfactory answers, as, owing to the wide dissemination of consumption, the people are fairly well acquainted with the nature of that disease. Thus out of 579 persons to whom such enquiries were addressed, 520, or approximately 90 %, gave definite replies to the question whether any of their parents or brothers or sisters had died from consumption.

Table 7.

The number of individuals examined and the number of cases of pulm. tuberculosis, arranged according to age.

Age	Number examined			Cases of pulm. tub.			Age	Number examined			Cases of pulm. tub.		
	Men	Women	Total	Men	Women	Total		Men	Women	Total	Men	Women	Total
0 year	27	24	51	—	—	—	46 years	6	4	10	1	—	1
1 „	25	26	51	—	—	—	47 „	3	5	8	1	3	4
2 years	26	26	52	—	—	—	48 „	11	14	25	3	2	5
3 „	31	20	51	—	1	1	49 „	6	4	10	1	2	3
4 „	22	24	46	—	—	—	50 „	12	12	24	3	3	6
5 „	17	23	40	—	1	1	51 „	8	8	16	3	1	4
6 „	33	22	55	1	1	2	52 „	9	15	24	3	4	7
7 „	17	17	34	—	—	—	53 „	7	10	17	1	2	3
8 „	19	31	50	—	2	2	54 „	8	4	12	1	1	2
9 „	18	27	45	—	1	1	55 „	6	5	11	—	1	1
10 „	20	25	45	2	2	4	56 „	5	6	11	—	2	2
11 „	15	13	28	3	2	5	57 „	4	6	10	1	1	2
12 „	24	21	45	1	3	4	58 „	8	3	11	4	1	5
13 „	19	13	32	1	—	1	59 „	9	4	13	1	2	3
14 „	13	16	29	2	1	3	60 „	4	6	10	2	2	4
15 „	20	12	32	—	—	—	61 „	6	3	9	1	—	1
16 „	14	16	30	—	1	1	62 „	5	4	9	3	1	4
17 „	18	14	32	1	3	4	63 „	8	7	15	—	3	3
								5	7	12	—	3	3

20 „	14	12	26	2	2	4	66 „	4	3	7	1	2	3
21 „	15	19	34	1	3	4	67 „	2	8	10	—	1	1
22 „	10	12	22	1	1	2	68 „	2	2	4	1	—	1
23 „	10	15	25	—	3	3	69 „	3	3	6	—	1	1
24 „	8	7	15	—	1	1	70 „	2	1	3	1	—	1
25 „	8	10	18	1	1	2	71 „	—	2	2	—	—	—
26 „	13	12	25	2	—	2	72 „	2	2	4	—	—	—
27 „	4	19	23	—	1	1	73 „	—	2	2	—	—	—
28 „	4	16	20	1	3	4	74 „	1	3	4	—	1	1
29 „	15	8	23	3	2	5	75 „	1	—	1	—	—	—
30 „	13	11	24	3	1	4	76 „	3	3	6	2	1	3
31 „	9	14	23	2	1	3	77 „	2	3	5	—	—	—
32 „	5	13	18	1	3	4	78 „	2	1	3	1	—	1
33 „	11	14	25	3	3	6	79 „	1	1	2	—	—	—
34 „	7	11	18	3	3	6	80 „	—	1	1	—	—	—
35 „	10	8	18	3	3	6	81 „	1	—	1	—	—	—
36 „	14	6	20	2	1	3	82 „	—	1	1	—	—	—
37 „	9	5	14	1	1	2	83 „	—	—	—	—	—	—
38 „	7	8	15	2	2	4	84 „	—	—	—	—	—	—
39 „	8	7	15	2	—	2	85 „	—	—	—	—	—	—
40 „	3	9	12	—	1	1	86 „	—	—	—	—	—	—
41 „	4	5	9	1	1	2	87 „	—	—	—	—	—	—
42 „	10	7	17	2	2	4	88 „	—	—	—	—	—	—
43 „	5	8	13	—	2	2	89 „	—	—	—	—	—	—
44 „	6	10	16	3	2	5	90 „	1	—	1	—	—	—
45 „	11	9	20	3	1	4		800	852	1,652	93	106	199

The data thus obtained from the 520 persons may be tabulated as follows: —

Death from consumption of father or mother, or both	81	cases	= 16 %
" " " " " " " " " and one or more brothers or sisters	82	"	= 16 %
Death from consumption of one or more brothers or sisters	119	"	= 23 %
No death from consumption among parents or brothers or sisters	238	"	= 45 %

These results may be summarized as follows: — Approximately one-third (32 %) stated that one or both their parents had died from consumption, whilst half of that number (16 %) knew of deaths from consumption also among their brothers or sisters. Nearly one-fourth stated that one or more of their brothers or sisters, but neither of their parents, had died from consumption. Thus more than half knew of deaths from consumption among their near relatives.

In 38 cases the persons questioned stated that a husband or wife had died from consumption, in 50 cases that they had lost one or more children from that disease.

These statements, of course, have only a relative scientific value, but they nevertheless serve to bring into further relief the immense dissemination of tuberculosis among the population of these parts.

Table 7 (pp. 52—53) shows the number of cases of tuberculosis arranged according to the ages of the persons examined. The figures for men and women are given in separate columns. The table is graphically illustrated by the chart in fig. 12.

(b) *Outside the experimental area proper.*

As previously stated, the experimental area proper consisted of the four villages of Antnäs, Ersnäs, Långnäs and Alvik. In these villages the scheme of work outlined in preceding pages was carried out during the following years. The details will be reported in the sequel.

It so happened, however, that the work which was being done in the experimental area aroused great interest also in the

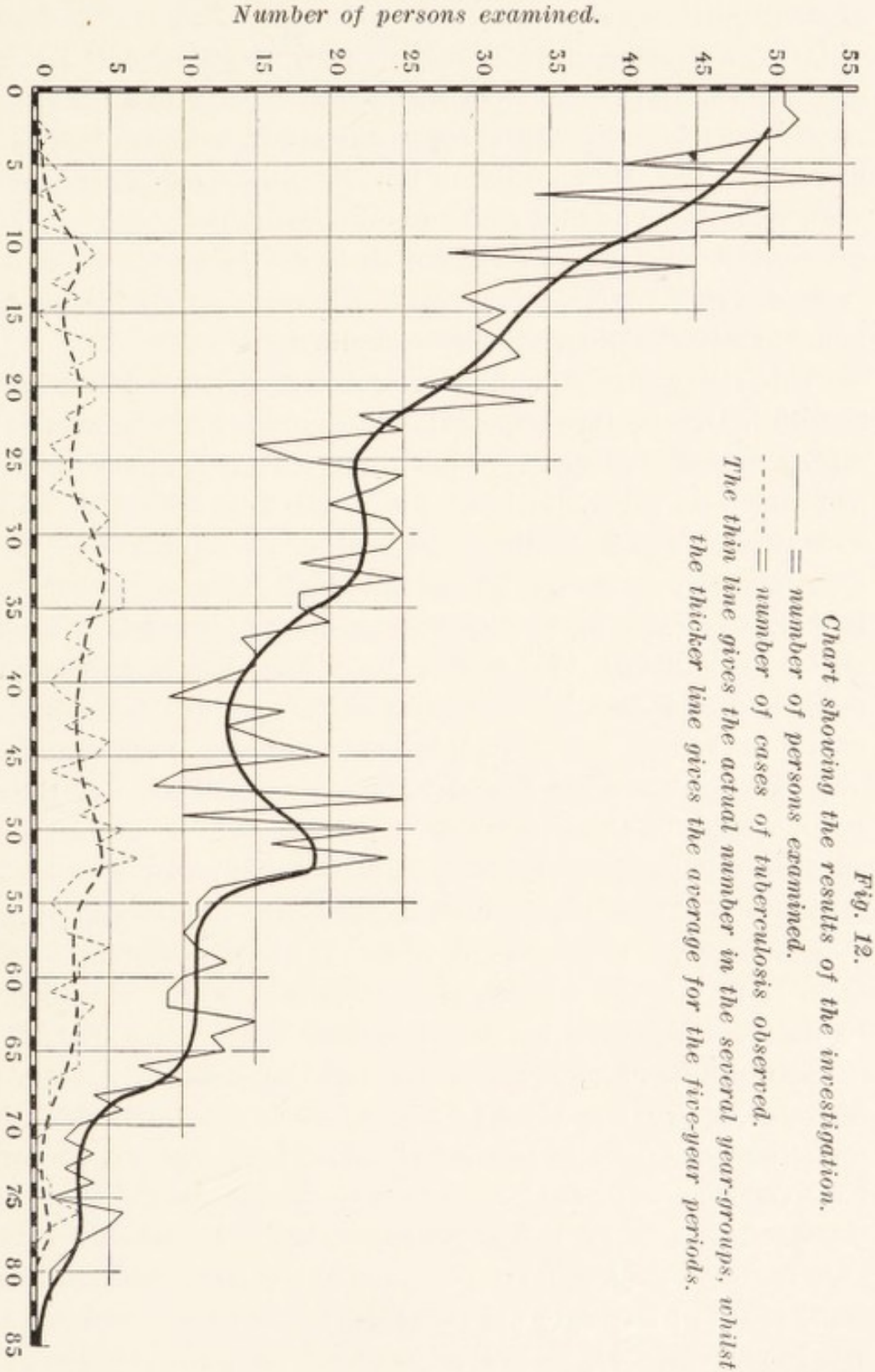


Fig. 12.

Chart showing the results of the investigation.

——— = *number of persons examined.*

- - - - - - = *number of cases of tuberculosis observed.*

The thin line gives the actual number in the several year-groups, whilst the thicker line gives the average for the five-year periods.

surrounding district, and desires were expressed that the investigation should be extended beyond that area. In compliance with these wishes, the Author, in accordance with the plan pre-

viously outlined, examined the entire population of the small villages of *Måttsund, Alvikträsk* and *Gäddvik,* which are situated immediately on the borders of the experimental area.

Måttsund is situated close to the coast, 4 kilometres south-east of Antnäs. Its population live, broadly speaking, under the same conditions as that of Antnäs, except that fishing is carried on more extensively, and that fish is a larger item in the dietary. *Botriocephalus latus* appears here to be still more common than in the other villages examined.

This village has a population of 439 persons, and 76 separate families. Out of this population I examined 374 persons (216 adults and 158 children), belonging to 71 families. Undoubted symptoms of tuberculosis of the lungs were found in 21 persons, that is 5.6 % of the total number examined.

Alvikträsk is a tiny village situated along the shores of a little forest-lake of the same name, approximately 6 English miles to the north of Antnäs. The village has a very isolated situation, and especially in summer is very difficult of access owing to the lack of practicable roads. Most of the dwellings are old and defective. Cupboard beds were found at that time in the majority of the homes.

This village has a population of only 68 persons and 13 families. I examined 54 of these persons (36 adults and 18 children), being all those who were at the time resident in the village. Here I found 4 cases of tuberculosis, which is equivalent to 7.5 % of the total number examined.

The village of *Gäddvik* is situated about 6 kilometres south of Luleå, approximately 6 English miles to the north of Antnäs, on either side of the River Lule. The bulk of the population consists of small holders, most of whom have large, well-managed homesteads. The village moreover possesses salmon fisheries of considerable importance in the River Lule, which in some years at any rate are considered to yield a very good profit. It may be said, generally speaking, that this village as an whole is in a considerably better economic situation that the other villages examined.

The dwellings, with a few exceptions, are very spacious, and

no fault could be found with them in regard to cleanliness and tidiness. It was not so usual here for the whole family to live in the kitchen. Cupboard beds existed only in a few homes, and ventilators for winter use occurred in approximately two-thirds of the dwelling-houses.

The village of Gäddvik was formerly notorious as a veritable hot-bed of cosumption. In previous generations deaths from consumption had occurred in well-nigh every home. There were a couple of families in particular that seemed marked out for consumption, exceedingly numerous deaths from that disease having occurred among their members. In recent years, however, cases of consumption in the village had been very few and far between.

In the course of the investigation, which comprised 201 persons (134 adults and 67 children), belonging to 59 families, I found only 3 cases of tuberculosis of the lungs, which is equivalent to 1.5 % of the total number examined. This figure, it will be observed, is considerably lower than that found in any of the previously examined villages.

A characteristic feature of this village was the relatively small number of children. The birth-rate of recent years especially was remarkably low, as is indicated by the fact that the number of children of five years or under at Gäddvik was only 6 % of the popylation, whereas in the other villages it was 18 %.

The village of Gäddvik thus serves as a typical example of an area which some generations previously had been stricken with tuberculosis in an unusally marked degree, but which was on the way to emancipate itself from the disease. Latterly moreover considerable changes have taken place in regard to the conditions of life of the people and in the relative proportions between the age-groups.

In glancing at the following figures from seven villages within a relatively small area, one cannot but be struck by the considerable differences in the frequency of the occurrence of tuberculosis in the villages. It should, however be, borne in mind

Table 8.

Tabular survey of all the villages examined.

	Number of persons examined	Number of cases of tuberculosis of the lungs	Percentage
Antnäs	359	60	16.7
Ersnäs	605	78	12.9
Alvik	474	34	7.2
Långnäs	214	27	12.6
Måttsund	374	21	5.6
Alviksträsk	54	4	7.5
Gäddvik	201	3	1.5
Total...	2281	227	9.95

that these villages*), though situated within a small area, were in former times rather isolated from one another, each of them forming a well deliminited unit.

This gives us the impression that in the coastal district of Norrbotten, where tuberculosis, generally speaking, is very prevalent, the frequency of the occurrence of that disease is very unevenly distributed and ranges between great extremes.

VI.

BOVINE TUBERCULOSIS.

In a district like this, where tuberculosis was disseminated on such an immense scale in the human subject, it was obviously of great interest to ascertain what the conditions were with regard to tuberculosis among cattle.

Upon the proposal of the Swedish National Association against Tuberculosis, the Royal Board of Agriculture in 1907 instituted an investigation of the stocks of cattle at Antnäs and Ersnäs. This investigation was carried out by the State Advisor on tuberculosis, Dr. *Olof Stenström,* veterinary surgeon.

The results of this investigation were published in 1909

*) *Alvik & Långnäs* are regarded as a single village.

in »Meddelanden från Kungl. Landtbruksstyrelsen«, No. 141. The following is an extract from the report: —

»It may be said, generally speaking, that agriculture in these parts is on a relatively low level. This is due partly to climatological conditions — the short summers and the long, cold and windy winters — and partly to the lack of acquaintance with modern methods of agriculture.«

»The fodder for the cattle is largely taken from natural vegetation, that is from bogs, banks of brooks, meadows and clearings in the forest. It varies considerably both in amount and nutritive value: for example, the hay taken from inferior marshy ground scarcely repays the costs of harvesting. Pasture-grounds, like those further south, do not exist here, at any rate only sparsely. The cattle are pastured instead on so-called »*lindor*«, that is, waste lands where the grasses and plants are self-sown.«

The stocks consist chiefly of a native country breed, the so-called »Norrland breed«, and are recruited almost solely by inter-breeding. Now and then, however, a few breeders are purchased from Finland to bring in fresh blood. The external appearance of these cattle is by no means prepossessing: as a rule, they are small and frequently devoid of horns, a feature which in many places is deliberately perpetuated by selection. Since time immemorial they are accustomed to a severe climate and scanty feeding, whence they are very hardy. The yield of milk is rather copious considering the meagreness of the food, and it is rich in fat.«

»The cow-houses are built in a rough-and-ready fashion. The entrance is often so low that the incomer has to bend down. They are usually made of wood; here and there, however, one sees a cow-house built of stone, with thick fortress-like walls. The windows are low and nailed down, and a person standing on the floor can almost touch the roof. The ventilation is extremely defective; that the atmosphere is not of the best will be understood when it is pointed out that the pigs and poultry are also inmates of the cow-house. Almost every cow-house has a fireplace with a walled-up boiler for the boiling of the hay; the

steam from this boiler renders the air damp, and especially during the winter, water drips from the walls and roof. The urine passes down through the floor into a receiver placed under it, the so-called »al-lår«. The dung is thrown out through an aperture in the wall and is left in situ, close to the cow-house. The construction of the cow-house buildings is in general of uniform type, a so-called porch in the middle separating the cow-house proper from the hay-house.

»It is noteworthy that in many places there are special cow-houses for the summer. The winter cow-houses are cleaned at the end of the season when the cattle are fed indoors, and are then left unused till the autumn.«

»The cattle are tended by the women, the men evidently regarding this work as beneath them. The work is of such a heavy nature — involving the carrying of firewood and water — that only strong women can be employed in it. Children and men are not often seen in the cow-house.«

The report then gives tables showing the records of temperature made at the time when the tuberculin tests were taken, as well as data with regard to the occurrence of tuberculosis in families whose stocks of cattle had been subjected to such tests.

Dr. Stenström then proceeds: »As is shown by the appended tables, 20 stocks of cattle were examined at Antnäs and 22 at Ersnäs. The data with regard to the families indicate the extent to which tuberculosis is disseminated among the people, as well as the opportunities for the transmission of the infection from human subjects to cattle. It has already been mentioned that the work in the cow-house in these northerly regions is entrusted almost solely to the women. It will be seen from the summary that in the families inhabiting the examined farms at Antnäs there were 5 demonstrable cases in which pulmonary tuberculosis occurred among the women, and 3 suspect cases, thus 8 in all. At Ersnäs there were likewise 3 certain cases of pulmonary tuberculosis and 2 suspect cases, being 5 in all. It was thus conceivable that these persons, in visting the cow-house, might have deposited and spread the infectious matter. Tuberculosis moreover occurred in different forms among the

other members of the family, there being several cases of pulmonary tuberculosis in the men. The women working in the cow-houses thus had possibilities of carrying into them infectious matter also from these sources of infection. Moreover occasional visits to the cow-house may be paid by members of the family other than the women, and these members may themselves deposit bacilli there.«

»It may therefore be definitely stated that *there were abundant opportunities for the introduction of anthropogene bacilli into the cow-houses: nevertheless, none of the 263 animals examined in 42 stocks were found to be tuberculous, that is, reacted to the subcutaneous injection of tuberculin.*«

»Some general conclusions may obviously be drawn from these investigations. The material, it is true, is comparatively small; but it was selected without special reference to the occurrence of tuberculosis among the stock-owners: it includes families severely and generally affected with tuberculosis, families only slightly affected, and healthy families. It must therefore be regarded as a good average material which serves as a basis for general conclusions of considerable value. The results may be summarized as follows: —«

The investigations showed that the stocks of cattle in these parts of Norrbotten are *free from tuberculosis,* and that this applies also to stocks owned by families severely affected with tuberculosis; and this, despite the fact that tuberculosis had occurred among the people in a severe form for a long period of time, whence there were abundant opportunities for the transmission of the infection into the cow-houses during that lengthy period. This again bears out the well-known view that *tuberculosis in the human subject, caused by anthropogene bacilli,is not transmitted, under natural conditions, to cattle.* From these investigations it is moreover possible to infer that *the tuberculosis which occurs among the people in this parts of Norrbotten is not derived from cattle but is of anthropogene nature.*«

Tables 9 and 10 (pp. 62—65) give a survey of the occurrence of bovine tuberculosis in all the counties of Sweden during the years 1908—1925 according to data furnished by the

Ta

Cases of tuberculosis among domestic animals during

(act

	1908	1909	1910	1911	1912	19
City and County of Stockholm	148	174	157	122	134	14
County of Uppsala	118	135	111	73	125	14
„ Södermanland	202	164	185	230	215	23
„ Östergötland	203	321	200	252	209	2
„ Jönköping	32	25	40	54	39	4
„ Kronoberg	9	11	12	22	12	1
„ Kalmar	38	82	71	43	54	6
„ Gotland	2	3	1	4	1	
„ Blekinge	2	62	10	10	3	1
„ Kristianstad	248	665	341	328	472	40
„ Malmöhus	383	527	594	515	466	39
„ Halland	40	47	60	52	29	5
„ Göteborg and Bohus	49	101	85	48	52	3
„ Älvsborg	88	76	196	94	87	8
„ Skaraborg	308	394	198	230	209	17
„ Värmland	50	72	56	117	44	10
„ Örebro	124	150	172	172	145	16
„ Västmanland	95	123	95	73	106	11
„ Kopparberg	16	79	74	28	53	4
„ Gävleborg	34	47	53	28	68	5
„ Västernorrland	58	67	23	54	58	1
„ Jämtland	49	75	3	2	6	
„ Västerbotten	46	13	55	14	3	
„ Norrbotten	2	—	2	—	—	
The whole of Sweden	2344	3413	2794	2565	2590	258

s 1908—1925 in Sweden, arranged according to counties
bers).

4	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
3	125	156	102	656	538	376	336	331	271	170	468
2	185	86	194	296	145	232	302	372	121	342	256
2	147	166	284	579	633	509	472	450	406	486	534
2	212	285	247	663	382	632	774	695	1290	857	609
2	28	544	97	264	214	242	200	364	249	287	237
7	8	124	42	46	86	106	168	93	—	43	117
9	40	170	25	257	191	516	230	521	435	604	731
2	2	50	80	48	2	49	89	79	87	103	114
9	—	211	84	150	166	204	364	388	215	234	202
3	302	259	247	180	293	272	299	232	313	317	367
4	367	401	254	849	966	643	629	887	804	791	698
	52	41	46	111	172	153	270	422	289	248	445
9	26	160	72	140	163	126	169	132	129	185	133
7	112	142	116	291	209	311	203	279	253	318	282
9	181	174	154	317	412	365	299	434	433	444	474
9	64	459	97	317	258	375	258	296	688	354	263
9	139	247	79	552	290	128	625	387	244	225	492
1	76	244	325	412	463	410	549	279	317	276	343
3	20	24	108	185	177	101	264	287	230	175	135
9	43	132	68	111	97	219	163	205	148	141	104
4	74	689	121	68	11	25	52	130	16	26	22
9	3	35	10	21	5	28	10	21	78	78	46
	10	11	11	26	12	31	341	32	12	32	22
	—	5	20	10	30	10	9	9	9	16	15
	2216	4815	2883	6549	5915	6063	7075	7325	7037	6752	7109

Ta

Cases of tuberculosis among domestic animals during
(per 10,

	1908	1909	1910	1911	1912	19
City and County of Stockholm	14	17	15	12	13	1
County of Uppsala	14	16	13	9	15	1
„ Södermanland	19	14	16	20	18	2
„ Östergötland	11	18	11	14	11	1
„ Jönköping	2	2	3	4	3	
„ Kronoberg	0,7	0,9	1	2	1	
„ Kalmar	2	5	4	3	3	
„ Gotland	0,6	0,8	0,3	1	0,3	
„ Blekinge	2	12	2	2	1	
„ Kristianstad	17	45	23	22	32	3
„ Malmöhus	18	23	25	22	20	1
„ Halland	4	4	5	5	3	
„ Göteborg and Bohus	7	13	11	6	7	
„ Älvsborg	6	5	12	6	5	
„ Skaraborg	15	19	9	11	10	
„ Värmland	5	7	5	13	5	
„ Örebro	12	14	16	18	15	
„ Västmanland	10	13	10	8	11	
„ Kopparberg	2	9	9	3	6	
„ Gävleborg	4	6	6	3	8	
„ Västernorrland	7	8	3	7	7	
„ Jämtland	8	12	0,5	0,3	1	
„ Västerbotten	6	2	7	2	0,4	
„ Norrbotten	0,4	--	0,4	—	—	
The whole of Sweden	9	12	10	10	10	

rs 1908—25 in Sweden arranged according to counties
tle).

14	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925
–	12	15	10	74	62	44	39	38	31	19	54
9	21	10	22	39	19	31	40	49	16	45	34
6	12	14	23	56	63	51	47	45	40	48	54
1	11	15	13	41	24	39	48	43	80	53	38
2	2	35	6	20	16	18	15	27	18	21	17
1	0,7	11	4	5	9	11	17	9	—	4	12
3	2	10	1	18	13	35	16	35	29	41	49
0,5	0,5	11	18	13	0,6	14	25	22	25	29	32
1	—	39	15	31	34	42	75	80	45	48	42
0	20	18	16	14	23	21	23	18	24	25	29
3	16	19	12	48	53	35	34	48	44	43	38
3	4	4	4	12	20	18	31	48	33	28	51
5	3	18	7	16	21	16	22	17	17	24	17
9	7	8	6	17	13	19	13	17	16	19	17
9	9	8	7	17	22	20	16	23	23	24	25
7	6	30	6	22	18	24	18	21	49	25	19
3	14	21	7	53	29	13	63	39	25	23	49
0	8	27	35	50	59	52	69	36	40	35	44
0	2	3	11	20	19	11	28	31	25	19	15
9	5	15	7	12	11	24	18	23	16	16	12
2	9	61	11	7	1	2	5	13	2	3	2
	0,5	5	1	3	0,7	4	1	3	11	11	6
	1	1	1	3	1	3	37	3	1	3	2
0,4	—	0,6	3	2	5	2	1	1	1	2	2
0	8	16	9	25	23	25	27	29	27	26	28

Royal Medical Department and the Royal Board of Agriculture. This survey is based on the new cases of bovine tuberculosis annually diagnozed by the veterinaries of this country, either clinically or by means of tuberculin tests, and reported to the Medical Department.

It will be seen from these tables that bovine tuberculosis was formerly extremely rare in the County of Norrbotten, but that during the past ten years it has begun to increase somewhat.

Dr. *E. Wallquist,* county medical officer in the Arjeplog district, has furnished some very interesting information with regard to the occurrence of bovine tuberculosis in that district, where the increase in the dissimination of that disease has been most marked.

In recent years tuberculosis appears to have been introduced among the cattle on quite a considerable scale. For example, in 1926 1 195 tuberculin tests were made on 356 stocks, and 144 of the animals showed a positive reaction. The people have voluntarily slaughtered the infected animals en masse with a view to the eradication of bovine tuberculosis. Curiously enough, the disease apparently occurs only in the southern and western parts of the district, but not in other parts, nor at Arvidssjaur.

Apparently the disease has been transmitted to this district by cattle imported from the south of Sweden for the purpose of improving the Norrland breed. Thus the same breed of cattle which proved to be unsusceptible to infection from tuberculous human subjects has proved to be very susceptible to infection from tuberculous cattle.

Dr. Wallquist moreover points out that, in the opinion of the veterinaries, tuberculosis is readily transmitted to the previously healthy cattle, and that the process is often rapid and malignant, all of which goes to show that cattle of the old Norrland breed make but a poor resistance to tuberculosis.

VII.

THE WORK AT THE INSTITUTE.

During the first few months of the experimental period the doctor and nurses were fully occupied with the general exami-

nations above reported. When these had been terminated and a general survey of the dissemination of tuberculosis and the conditions in the homes had thus been obtained, the next step was to endeavour, as far as possible, to carry out the programme for the projected experiment in social hygiene. The Author was engaged on this work without intermission for nearly five years after the termination of the general examination.

I shall now proceed to give a brief report on the work carried on by the Institute: —

The morning hours were usually reserved for the reception of out-patients at »Hälsan«. Any person who desired to consult the physician with regard to tuberculosis, or a disease of a tubercular character, was entitled to do so free of charge. Families in which one or more members had been found to be affected with tuberculosis were urged to come to the Institute at regular intervals and, if possible, in full numbers, for examination.

The people availed themselves eagerly of these free medical consultations, which averaged from 1 500 to 2 000 per annum. The physician was thus enabled to follow attentively the development of the cases, and often to detect symptoms of new diseases at an early stage.

Owing to the then insufficient number of practitioners in this part of the country, the physician to the Institute was, however, obliged to act as the people's doctor for all manner of diseases. This, of course, sometimes encroached too much upon the time which should have been devoted to his proper duties. On the other hand, it conduced to bring the physician into closer touch with the people, and contributed to his success in persuading them to adopt certain desirable changes in habits of life, etc.

After the termination of the consultation, the physician, usually accompanied by the nurse, visited some of the homes. During these visits he not merely attended to patients suffering from tuberculosis, but also took the opportunity to urge the necessity of certain reforms in hygiene. As a rule four or five homes were visited daily. After sitting down to a quiet talk

on a variety of general topics, he gradually turned the conversation to matters such as cupboard beds, ventilation, baths, cleanliness, etc. These conversations sometimes gave rise to quite animated discussions.

The enlightenment of the people was carried on chiefly in this personal way, by frequent visits to the homes and repeated talks on matters of hygiene. In addition, numerous lectures were held in the villages on subjects relating to prophylactic measures against tuberculosis. Moreover, a number of popularly written pamphlets were distributed when visiting the homes. These pamphlets often gave rise to enquiries and discussions at one of the next visits. On certain occasions all the homes in the area received a greeting from »Hälsan«, to which were added some rules of health. For example, in 1910—1911, Christmas and New Year cards were sent to every family. On the back of these cards was printed the following memento: —

»*Clenanliness and fresh air are enemies of consumption.*«

Remember in 1911:

To put in ventilation-windows in the kitchen and »chambers« (small rooms), and to open them daily even during the winter.

To remove the cupboard bed, if you still have one, or, at any rate,

Never to let the children sleep in cupboard beds: light and air are better for the children's health than »lollipops«.

To air the bed-clothes frequently.

Never to let the children sleep in the same bed as a consumptive.

To pay regular visits to the vapour-bath: this will make you hardy, and less liable to colds and also to consumption.

To consult the doctor without delay, if you have a cough or suspect that you have a disease of the lungs.

Cleanliness and fresh air are enemies of consumption.«

At Christmas in another year we sent out a booklet, entitled »Some words from the Hälsan Institute«, containing rules of health and advice, with special reference to local and personal conditions in the area.

The card with the above-quoted rules could be found many

years afterwards decorating the walls of many homes, and presumably still remains here and there down to the present day. And the booklet was treasured for years in the scanty library of these peasant homes. Perhaps few of the great masterpieces of literature have been so well thumbed as these little prints.

The hygienic conditions in the dwellings improved, but not always as rapidly as might have been desired. A vigorous campaign was carried on against the cupboard beds. Out of the existing 158 beds of this kind nearly half disappeared almost immediately after the experimental work had been started, and a few more were removed every year. At the end of the experimental period only some 30 of these beds remained, but few of them were actually in use. Most of the people had been convinced as to the unsanitary character of these beds; but some few obstinately defended them. An elderly peasant, in reply to my enquiry whether he had retained the cupboard-bed, invariably answered as follows: »Yes, I have! In that bed my father and grandfather died at a good old age, and in that bed I shall die; my son may then do as he pleases«. Another replied: »Am I to throw out the most beautiful piece of furniture I possess? Never!«

The removal of the cupboard beds presented the least difficulty in homes which were severely stricken with consumption: it was by no means so easy in those which were exempt from that disease. The young people, however, refuse to sleep in these beds. Their time is at an end, and in the next generation they will have become a curiosity.

Ventilation-windows for use in winter were gradually introduced, in some cases at the expense of the Institute, though by no means in all homes. At the end of the experiment they were found in about 40 percent of the dwellings. In view of the severe cold in winter, it was often difficult to get this novelty adopted. But whenever a new house was built, windows of modern construction were put in. In this respect also the rising generation, in contradistinction from the old folks, showed a keen interest in modern improvements.

The people also began to utilize the available accomodiation in a more rational way than before, that is, to use rooms other

than the kitchen for sleeping in. In many cases the first step taken was that a consumptive who was being nursed at home was given a room of his own. It gradually became usual for several of the small rooms in the large farm-houses to be provided with fireplaces and used as bedrooms.

With a view to inducing the people to take regular baths, a so-called Finnish vapour-bath was established at »Hälsan«. It was kept open two days a week, one of the days being reserved for men, and the other for women. On these days any person in the experimental area was entitled to take a bath free of charge. The people eagerly availed themselves of this opportunity, and the bath was much frequented.

Some 2 000 baths were taken per annum. The village of Ersnäs moreover established a bath-house of their own, towards the erection and maintenance of which grants were made by the Institute. In former times the practice of taking regular baths appears to have been general throughout the country. The facts reported above indicate that there is little difficulty in reviving this practice, which had fallen into desuetude for several generations.

The Institute was always prepared to give advice and instructions with regard to the rational nursing of children. The parents took the greatest interest in matters relating to the care and protection of their children. Many of the people who came to »Hälsan« to consult the doctor did so on behalf of their children. The Institute supplied cod-liver oil free of charge, when it was considered necessary. Approximately 20 000 grammes of cod-liver oil in portions of 300—400 grammes were thus dispensed.

In the kitchen department of the Institute instruction in cooking was imparted free of charge to young women from the district. A considerable number of them, especially at certain periods, availed themselves of this opportunity.

It has already been mentioned that arrangements had been made at »Hälsan« for the nursing of consumptives. The Institute thus served also as a little sanatorium of an unpretentious character. The wards consisted of two rooms, with four beds in

each. There was also a separate loggia. Endeavours were made, as far as possible, to arrange the treatment and the dietary on lines similar to those of a real sanatorium.

The idea of hospital nursing for consumption was at this time almost unheard-of in these parts. In the entire County of Norrbotten there was not a single nursing home for consumptives, and in the country at large sanatoria were still rather few and far between.

At first it was by no means easy to induce consumptives from the experimental area to remove to »Hälsan«, despite the fact that the nursing there was entirely free of charge. But when one or two persons had accepted the offer of admission, others followed, and in course of time most of the consumptives lost their aversion towards removing to the Institute. Nevertheless there were still a good many who not prevail upon themselves to leave their homes and families in order to undergo sanatorium treatment at »Hälsan«.

A nursing institution of this simple character could obviously not be expected to show any wonderful results from the treatment given there. In the selection of consumptives for admission to the Institute, primary consideration was invariably given to prophylactic principles. In other words, the aim in view was to protect the homes and especially the children, by isolating sources of infection and rendering them innocuous. Consequently the great majority of the patients were cases which, from a prognostic point of view, must be regarded as more or less hopeless.

At the end of the experimental period, 75 patients from the area had been nursed at the Institute and discharged. With regard to these patients the following records were made at the time: —

Subjectively healthy, with complete capacity for work	26	34.7	%
Relatively healthy, with some capacity for work	8	10.7	%
Confined to bed at home	6	8	%
Died at the Institute	35	46.6	%

The number of deaths from consumption within the area during the experimental period totalled 80. Thus somewhat less than half that number had died at the Institute.

In addition, another form of treatment was given at »Hälsan«, for the benefit of those affected with tuberculous disease of a less serious character. This treatment was in the nature

Fig. 13.
Healthy children at »Hälsan«.

of an open-air rest cure, combined with free board. That is, the patients, after spending the night at home, came in the morning to the Institute, where they had their meals and took a rest cure. In the evening after supper they returned to their homes. This form of treatment was at times adopted on a rather considerable scale. It was particularly well adapted for those consumptives who felt that they were in need of a rest for some time, but could not be induced to leave their homes entirely.

But the form of treatment most generally adopted was nursing in the diseased person's own home, under the superintendence of the doctor and nurses. When a consumptive became

so weak that he or she was practically confined to bed and was unable to go to the Institute for the rest-cure, and when the offer, which was then invariably made, to move to »Hälsan«, was definitively refused, this was the only expedient left. Endeavours were then always made, in almost all cases with success, to get the consumptive moved to a separate room. A small room was arranged, and provided, if necessary, with a fireplace and ventilation-windows. Spittoons, thermometers and any other requisites for nursing were supplied by the Institute. The most careful instructions were given in regard to the destruction of the sputum, the vital importance of keeping the children apart from the consumptive was emphasized, advice was given with regard to diet, etc., etc.

These homes were visited at regular intervals, daily, or, if necessary, several times a day, by the nurses of the Institute; they were moreover frequently visited by the doctor. After a death, the dwelling-house was always thoroughly disinfected at the expense of the commune.

The most difficult task of all was to protect those children who were exposed at home to manifest risk of infection from consumptive members of the family.

As previously mentioned, the Institute had a separate department for the reception of healthy children from tuberculous homes. This department consisted of a large bedroom and a nursery, which also did duty as a dining-room. It was on the first floor, and entirely separate from the department where the tuberculous patients were nursed.

But, as a rule, it proved to be a very difficult matter to induce the parents to give up their children and let them stay at the Institute, no matter how unsatisfactory the conditions were at home. These endeavours, however, were not entirely abortive: during the experimental period 22 children in all were thus taken charge of at the Institute. All of them came from very poor homes, where they were exposed to every imaginable risk of infection with tuberculosis. At the end of the experimental period all of the children were in the most excellent health. None of them had been obliged to return to the same

hot-bed of infection as that from which they had come. In some cases the conditions in the home had in the meantime improved, in other cases the children were boarded in healthy families.

But the boarding-out of children exposed to the risk of infection with tuberculosis was an expedient which could be resorted to only on a minor scale in this district. For, in the first place, the parents, as a rule, were still more reluctant to commit their children to the care of another family than they were to hand them over to the Institute, and, secondly, as may be inferred from the above reports on the dissemination of tuberculosis, the number of suitable, healthy families within the area was very limited.

As has already been indicated, the expedient most widely adopted was to remove the source of infection from the home. Where these endeavours failed, and both the germ-carrier and the children remained at home, it was necessary to make the best of the difficult situation. The family were induced to give the consumptive a separate room, and received reiterated advice, warnings, and instructions. It must unfortunately be admitted that in many cases the children were nevertheless inadequately protected from infection. But in this respect difficulties were encountered which it was impossible to surmount with the available resources.

The introduction of hygienic reforms in regard to dwellings, habits of life, etc., was not an easy task. Now and then we met with encouragement and sympathy, but only too often with the reverse. It was by no means a simple matter for a stranger arriving in these parts to reform deeply-rooted habits and customs, many of which had been sanctified by immemorial tradition. In such circumstances rapid progress could not be expected, and any signs of good-will must be gratefully accepted.

The young people naturally adopted a more sympathetic attitude towards the so-called »novelties«. There is thus reason to hope that the seeds sown will bear fruit in the future when the rising generation have grown up and come to power.

VIII.

SUBSEQUENT INVESTIGATIONS IN THE EXPERIMENTAL AREA.

The question whether any positive results of the experimental work have manifested themselves in the shape of a reduced frequency of tuberculosis or mortality from tuberculosis must, of course, be answered with great caution. Temporary variations in both respects may easily occur in such a small area.

Naturally, it could not be expected that the work would lead to rapid results in the respects above indicated. The work as a whole had a distant aim in view. Not until the lapse of a score of years or so, when a new generation had grown up, was it conceivable that the educative work, on the lines of social hygiene, which had been carried on could show tangible results.

A complete and thorough general examination of the entire population of the experimental area was made by the Author in November 1926, that is, 20 years after the preliminary examination instituted by Dr. Danielsson and 18 years after that made by the Author (see Chapter V). Twelve years had then elapsed since the termination of the experimental work proper.

This examination was carried out in the same manner as the preliminary examinations previously reported. The Author was assisted by one of the nurses, *Clara Bengtsson,* who had been employed at »Hälsan« during part of the experimental period. In addition, the present superintendent of the dispensary at »Hälsan« furnished the Author with information regarding all the homes where tuberculosis was then known to occur. Moreover Dr. *Byttner* of Luleå, who in recent years has been physician to the Institute and superintendent of the dispensary, and had thus acquired an intimate knowledge of practically the entire population of the area, supplied valuable information with regard to existing cases of tuberculosis. Furthermore, the Author was able to confer with the present physician to the Institute and district, Dr. *Wadenius,* with regard to fresh cases of tuberculosis that had been observed.

The examination showed that the frequency of the occurrence of tuberculosis was considerably less than in 1908, and

that the mortality from tuberculosis had diminished in an approximately corresponding degree. The Author is well aware how unsafe it would be to assert categorically that this decrease is indubitably the result of the work done by the Institute. But, as will be shown in the sequel, the Author has very good reasons for presuming that these active measures, rather than any other conceivable factors, were the principal cause of the improvement.

In the general investigation in 1926, altogether 1 834 persons were examined, 562 of which were children under the age of fifteen and the remaining 1 272 above that age. The corresponding figures for the general examination in 1908 were 1 652, 649 and 1 003.

It will be observed that there has been a distinct change in regard to the proportion of the lower age-groups. In the earlier investigation the groups under the age of fifteen formed 39 percent of the total number, in the later examination 31 percent. Thus during this period there was a marked diminution in the number of children, that is a decrease of the birth-rate.

The number of cases of pulmonary tuberculosis observed amounted in 1926 to 147, *corresponding to 8 percent of the total population,* as compared with 12 percent in 1908. The figures for the different villages were as follows: —

Antnäs	36	cases	= 9.4 %	(1908	60	cases	= 16.7	%)
Ersnäs	57	»	= 8.5 %	(»	78	»	= 12.9	%)
Alvik	29	»	= 5.7 %	(»	34	»	= 7.2	%)
Långnäs	25	»	= 9 %	(»	27	»	= 12.6	%)
	147	»	= 8 %	(»	199	»	= 12	%)

Thus the number of cases of pulmonary tuberculosis observed was *33 percent less* in the later investigation than in that of 1908. The diminution in frequency appears to be more marked in the villages of Antnäs and Ersnäs than in Alvik and Långvik.

In this examination also the Author endeavoured, similarly as in that of 1908, to determine whether the cases of pulmonary tuberculosis were to be regarded as active or inactive. In this

respect he received very valuable assistance from his above-mentioned colleagues, who were well acquainted with most of the existing cases, especially, of course, those which were at the time »active«.

Out of the 147 cases of pulmonary tuberculosis observed, 45, that is *nearly one-third* (31 percent) were considered to be active, thus making 2.5 % of the total number of persons examined. In 1908 the active cases were 68, that is 4.1 % of the total number examined.

The 45 cases considered to be active were distributed as follows: —

Antnäs	.....	8	cases	= 2.1 %	(1908	20	cases	5.6	%)
Ersnäs	.....	22	»	= 3.3 %	(»	24	»	4	%)
Alvik	.....	12	»	= 2.3 %	(»	15	»	3.2	%)
Långnäs	.....	3	»	= 1.1 %	(»	9	»	4	%)
		45	»	= 2.5 %	(»	68	»	4.1	%)

It is of some interest to observe that the proportion between the number of cases regarded as active and as inactive respectively in both these general examinations, held at an interval of 18 years, is approximately the same: about one-third of the cases of consumption diagnozed were regarded as active.

Although it is possible that a more delicate method of diagnosis might have shown a somewhat different proportion, it is nevertheless of interest that the proportion in these two investigations proved to be so constant.

As regards tuberculosis in other forms than consumption, the number of cases observed in this subsequent examination was 27, viz.:

in the cervical lymph-glands (lymphomata)	13
in the knee-joint	1
in the hip-joint	3
in the elbow-joint	1
in the ankle-joint	2
in the vertebrae	3
in the ribs	1
in the finger-joints (Spina ventosa)	1
lupus	2
	27

If these 27 cases of tuberculosis in other organs, being equivalent to 1.5 % of the total number of persons examined, are added to the above-mentioned 147 cases of pulmonary tuberculosis, the total number of tuberculous cases will be found to be 174, that is, *9.5 % of the total number of persons examined,* as against 14 % in 1908.

The number of cases of pulmonary tuberculosis was thus 84.3 % of the total number of cases of tuberculosis, and other forms of tuberculosis 15.7 %. About half the latter consisted of cervical lymphomata.

In this examination also the occurrence of swollen cervical lymph-glands was recorded similarly as in the preceding examination. The frequency of the latter appeared in the subsequent examination to be considerably lower than in that of 1908. In children under the age of fifteen such swellings were now found only in 27.3 percent of those examined, as against 45.4 % in 1908.

It may also be mentioned that at an investigation made in 1914, which was not carried to completion, such glandular swellings were found in 38.8 percent of 702 children under fifteen examined.

At the general examination in 1926 the population examined consisted of 363 families; one or more cases of tuberculosis were found in 121 families, that is in 31 percent of the total number.

The differences in this respect between the two examinations in the various villages are shown by the subjoined summary: —

Antnäs	1926	79	families,	tuberculosis	in	28	= 37 %
Ersnäs	»	126	»	»	»	38	= 30 %
Alvik	»	106	»	»	»	25	= 24 %
Långnäs	»	52	»	»	»	21	= 38 %
		363	»	»	»	112	= 31 %

Antnäs	1908	75	»	»	»	44	= 59 %
Ersnäs	»	130	»	»	»	60	= 46 %
Alvik	»	105	»	»	»	28	= 27 %
Långnäs	»	45	»	»	»	24	= 53 %
		355	»	»	»	156	= 44 %

The subjoined table shows the number of cases of consumption in both the examinations, arranged according to age-groups: —

Table 11.

Age groups	1926			1908		
	Number of pers. examined	Number of cases of pulm. tub.	Percentage	Number of pers. examined	Number of cases of pulm. tub.	Percentage
under 10 years	365	5	1.4	475	7	1.5
10—20 „	405	19	4.7	336	28	8.3
20—30 „	331	31	9.4	231	28	12.1
30—40 „	203	22	10.8	190	40	22
40—50 „	176	18	10.2	140	31	22.1
50—60 „	151	22	14.6	149	35	23.5
60—70 „	110	19	17.3	95	24	25
70— „	93	11	12	36	6	16.6
	1834	147	8	1652	199	12

The decrease in the frequency of tuberculosis of the lungs thus appears to be most marked in the groups 10—20 and 30—50 years.

The figures for the frequency of tuberculosis in the experimental area thus obtained in the two general examinations should, of course, be compared, as far as possible, with the mortality from tuberculosis during the period intervening between these examinations.

An improved system of mortality returns from the rural districts of Sweden was introduced in 1911. As mortality statistics are available up to 1925 inclusive, it is thus possible to obtain a reliable survey of the mortality for a period of 15 years. I have found it expedient to divide this space of time into three periods of five years, 1911—1915, 1916—1920 and 1921—1925, and to compare the averages for those periods. The following table gives the figures thus obtained (1) for Sweden as a whole, (2) for the entire County of Norrbotten, (3) for the district of Neder-Luleå, and (4) for the experimental area.

Table 12.

Mortality from tuberculosis	1911—1915	1921—1925	Decrease
in Sweden	1.94 ‰	1.46 ‰	25 %
in the County of Norrbotten	3.29 „	2.93 „	11 „
in the district of Neder-Luleå ...	3.99 „	3.97 „	0.5 „
in the experimental area	8.3 „	6.0 „	28 „

This tabular summary shows firstly that the mortality from tuberculosis in the experimental area was extremely high throughout, and indeed considerably higher than that of the surrounding district, which in turn exhibits a greater mortality than the county as a whole. The mortality of the county is again considerably higher than that of the country at large. These statements are applicable throughout to the three periods.

Secondly it will be seen that during this period tuberculosis has been diminishing, although in very unequal degrees, in these four areas. The decrease for the country as a whole is no less than 25 percent. In the County of Norrbotten (as in the north of Sweden in general) the decrease of the morality from tuberculosis is much slower and less marked, not being more than 11 percent. In the district of Neder-Luleå the mortality from tuberculosis during that period was extremely high during that period, and indeed almost stationary.

The experimental area, which is situated in the above-mentioned parochial district of Neder-Luleå, and the population of which is approximately one-sixth of that of the entire district, shows for the period 1921—1925, as compared with 1911—1915, a decrease in the mortality of 28 percent.

Seeing that the mortality from tuberculosis in the district during the fifteen years period had been almost stationary, there is reason to presume that the mortality from that disease in other parts of the district had actually *increased* during that period. The practitioners in the district are in fact inclined to take this view.

To recapitulate, the tuberculosis morbidity in the experimental area at the general examination in 1926 was 33 percent lower than at the examination in 1908, and the mortality from

tuberculosis for the period 1921—1925 was 28 percent lower in that area than for the period 1911—1915.

If the mortality from tuberculosis during the period 1911—1915 is compared with the frequency of tuberculosis in 1908, and the mortality from tuberculosis during the period 1921—1925 with the frequency of tuberculosis at the subsequent examination in 1926, the proportion between mortality and morbidity may be expressed by 1:17 for the former period and by 1:16 for the latter. The proportion between the number of deaths and the number of *active cases of consumption* is found in both examinations to be about 1 : 5.

It would, of course, be unfair to compare this relatively unpretentious experiment under the charge of a single doctor with that magnificent experiment which was made ten years later (from 1917 to 1923 inclusive) at *Framingham* in Massachussetts, U. S. A. It was carried on by a whole staff of specially trained doctors, who had every modern resource at their disposal.

It is nevertheless of interest to take note of the conclusions reached at Framingham on the interesting question of the relation between mortality and morbidity.

At the very outset of the Framingham experiment the proportion between mortality and morbidity, on the basis of the known number of consumptives (active cases) and the number of deaths from consumption, was reckoned at 1:3, whereas after a thorough investigation in the course of the same year the proportion was found to be 1:9 to 1:10.

It is, of course, conceivable that with greater resources in the way of diagnostic apparatus, such as Röntgen rays, it might have been possible to show a considerably larger number of cases of consumption in the Antnäs area, and that the proportion would then have been quite different. It is nevertheless very interesting to note that the two general examinations in the Antnäs area apparently indicate that a more or less constant relation between the mortality from tuberculosis and the morbidity actually exists, at any rate within that area.

To what extent this proportion may be applicable to other

parts of Sweden or to the country at large is, of course, an open question. Let it, however, be assumed that this proportion holds good for *the whole of Sweden.* The number of cases of tuberculosis in this country can then be approximately calculated in the following manner: — The number of deaths from tuberculosis amounted during the period 1921—1925 on an average to 8 760 per annum. This sum multiplied by 16 makes somewhat more than 140 000 cases, which figure is an index of the number of cases which can be diagnozed with ordinary appliances.

If the cases of consumption, as seems to be the fact in the experimental area, are assumed to be approximately 85 percent of the entire number of cases of tuberculosis, the number of cases of consumption in the entire country may be estimated at approximately 120 000.

According to our previous estimate of the proportion between the number of active and inactive cases of consumption, the number of active cases, that is, those which, generally speaking, require special nursing, should amount to one-third of that number, which makes approximately 40 000 cases.

Taking the population of Sweden to average 6 000 000, the number of cases of consumption would thus amount approximately to 20 per mille.

It may be mentioned here that the Committee on Tuberculosis appointed by the Government in 1905, in a report published in 1907, endeavoured to estimate the number of cases of consumption in Sweden, and came to the conclusion that the number should be three times the number of deaths from that disease. At that time the number of deaths from consumption was approximately 10 000 per annum. On this basis, the number of consumptives should amount approximately to 30 000, which is equivalent to 5.7 per mille. It seems, however, to have been the general opinion of specialists on tuberculosis that the number must in reality have been much larger.

A detailed investigation into the mortality in the experimental area during the same period yields the following results:

During the 15 years period 1911—1925 the total mortality

in the area was 593 persons: out of these 219 died from tuberculosis. On the basis of the average population of the area, the total mortality is 20 and the mortality from tuberculosis 7.3 per mille. The mortality from tuberculosis is thus approximately 37 percent of the total mortality.

Out of the deaths from tuberculosis, 187 (85 %) were due to pulmonary tuberculosis and 32 (15 %) to other forms of tuberculosis, viz. 20 cases of tuberculous meningitis in children under the age of ten, 3 cases of meningitis in persons above that age, 1 case of spondylitis, 6 cases of peritonitis, 1 case of coxitis, and 1 case of miliary tuberculosis.

The mortality from tuberculosis is distributed over the three five-years periods as follows: —

In 1911—1915: 183 deaths, whereof 77 from tuberculosis = 42 %
„ 1916—1920: 232 „ „ 82 „ „ = 35 %
„ 1920—1925: 178 „ „ 60 „ „ = 34 %

The subjoined table shows the number of deaths during the entire 15 years period, arranged according to age-groups: —

Table 13.

Age-group	Total number of deaths	Deaths from tuberculosis			Deaths from tuberculosis in percentage of the total number of deaths
		Pulm. tub.	Other forms of tub.	Total	
Under 10 years	131	6	23	29	22
10—20 „	72	49	9	58	80
20—30 „	71	49	3	52	73
30—40 „	40	31	—	31	78
40—50 „	34	15	1	16	44
50—60 „	42	12	1	13	31
60—70 „	78	13	—	13	17
70— „	125	7	—	7	6
	593	182	37	219	37

The above figures strikingly show the leading part played by tuberculosis as a cause of death in this area. If those age-groups which represent youth and early middle age, that is the groups 10—40 years, are reckoned together, it will be found that no less

than 77 percent of the deaths in those groups have been caused by tuberculosis.

As a basis of comparison, I give below a similar tabular summary showing the part played by tuberculosis in the mortality at *Stockholm* for the years 1916—1925.

Table 14.

Age-group	Total number of deaths	Deaths from tuberculosis	Deaths from tuberculosis in percentage of the total number of deaths
Under 10 years	6 403	980	15
10—20 „	2 019	885	44
20—30 „	4 730	2 210	47
30—40 „	4 738	1 737	37
40—50 „	4 451	1 025	23
50—60 „	5 889	697	19
60—70 „	7 946	523	7
70 „	14 646	247	2
	50 822	8 304	16

It will be seen from the above figures that in the age-groups 10—40 years taken together, 42 percent of the deaths at Stockholm during this period were caused by tuberculosis.

A comparison between the first of the two periods (1911—1915) and the last (1921—1925) in regard to the mortality at different ages in the experimental area would obviously be of interest. Though the figures thus obtained are relatively small, they are nevertheless given here (table 15), as indicative of the change in the mortality from tuberculosis which appears to have occurred in the course of the fifteen years period.

It may be left to the reader's judgment to determine whether any conclusive value can be attached to these small figures. They seem, however, to indicate that the change has manifested itself in a diminution of the mortality from tuberculosis among children of under ten years, as well as in the age-groups over 20

years, whereas there is no marked change in the age-groups 10—20 years.

The great majority of the deaths from tuberculosis in children under the age of ten are due to tuberculous meningitis. It is particularly interesting to note that a distinct decrease in the number of deaths from cases of tuberculous meningitis can be established. During the first period they numbered 11 (out of 44 deaths) = 25 %, in the later period 5 (out of 38 deaths) = 13 %; also in the intervening period, 1916—1920 the number of deaths from meningitis was relatively low, being 5 cases out of 49 = about 10%. It is tempting to conclude that this decrease in the number of deaths from meningitis, as well as the diminution in the number of swollen cervical lymph-glands, is indicative of improved hygienic conditions and the greater care taken in protecting the children against infection.

The immense dissemination of tuberculosis in the experimental area afforded abundant opportunity for studying variations in the course of the disease.

It was particularly interesting to note the remarkably large number of extremely chronic cases, that is, those in which the general state of health was, relatively speaking, tolerable and sometimes fairly satisfactory, and the consumptives, though continuously troubled by cough and breathlessness, and at times by rather profuse, bacilliferous expectorations, might reach a high age. The majority of these typically chronic cases of consumption were apparently found in families where the occurrence of tuberculosis could be traced back to several generations, usually in a surprisingly large number of cases. The people were well aware that these chronic cases of disease were connected with consumption and occurred chiefly in consumptive families; but they were distinguished from the more formidable, acute consumption by a special name, being usually called »chest disease«.

It was a matter of general knowledge that several families had been in a particularly marked degree exposed to the ravages of consumption. It seems probable that during the immediately preceding and next preceding generations consumption had

Tabl
Mortality in

Age-group	Total number of deaths		Death	
			Pulmonary tuberculosis	
	1911—15	1921—25	1911—15	1921—25
Under 10 years	44	38	2	—
10—20 „	16	22	13	15
20—30 „	20	20	15	13
30—40 „	16	10	13	7
40—50 „	9	11	5	4
50—60 „	15	11	6	3
60—70 „	27	24	6	3
70—— „	36	42	2	2
	183	178	62	47

been still more common among the population of the area, and there were reports of families with a large number of members that had been entirely wiped out by consumption.

A statistical genealogical investigation into the mortality from tuberculosis some generations back, on the basis of the records in the parish register, is being planned. By way of example, I give here the records for a very typical consumptive family from Ersnäs, here called the W—m family (see the genealogical table on p. 88).

In this family, of which 7 generations are known, the two first generations appear to have free from tuberculosis, and its members attained a high age. The grandson of the first ancestor J. P. (1802—1885) himself reached the age of 83 and was free from consumption, whereas his wife died from that disease at the age of 47. All their seven children died from tuberculosis, most of them at an early age. The only one of the children that left descendants, J. P., whose wife likewise died from consumption, had seven children, all of whom died from tuberculosis. Out of the following generation two sons, aged 38 and 40, are alive and healthy; one son, aged 31, has a benignant, inactive pulmonary tuberculosis; one son died from that disease at the age of 23; and one girl baby died, probably from meningitis, at

15.
experimental area.

from tuberculosis				Deaths from tuberculosis in percentage of the total number of deaths		Average mortality from tuberculosis per mille in the several age-groups	
Other forms of tuberculosis		Total					
1911—15	1921—25	1911—15	1921—25	1911—15	1921—25	1911—15	1921—25
13	7	15	7	34	18	6	4
1	4	14	19	88	86	8	9
—	1	15	14	75	70	13	8
—	—	13	7	81	70	14	7
1	—	6	4	67	36	9	5
—	1	6	4	40	36	8	5
—	—	6	3	22	13	13	5
—	—	2	2	6	5	11	4
15	13	77	60	42	34		

the age of 5 months. During the four generations since the first case of consumption appeared in the family, only four out of twenty-two descendants have escaped tuberculosis. — Apparently, however, in the last two generations the intensity of the disease was less marked than during the two preceding generations.

But, in addition to the previously mentioned typically chronic cases of consumption, we occasionally find cases where the disease is extremely acute, with a surprisingly rapid and malignant course, which is apparently unamenable to any treatment. Occasionally such extremely acute cases occur within a brief space of time in the same family, and not seldom in families where consumption had not occurred during the present generation nor, so far as was known, in that immediately preceding.

I shall now report a striking example of a family (which we may call H.), at Ersnäs, in which no case of consumption in previous generations, either on the father's or mother's side, had been known. In July 1924 a daughter of 14 years of age was attacked by an extremely acute and violent fever, which after a few weeks was found to be tuberculosis of the lungs in an advanced stage, and led to her death in December of that year. Immediately after her death an elder sister, 17 years of

GENEALOGICAL TABLE

The family W—m from Ernäs

——— under the name = died from tuberculosis
– – – " " " = alive, suffering from tuberculosis.

Johan Person † at age of 67
1731—1798
W. Anna Olofsdotter † at age of 79
1730—1809

1) Olof Johansson
1785— emigrated

2) Per Johansson † at age of 83
1759—1842
W. Stina Eliædotter † at age of 57
1768—1825

3) Jacob Johansson † at age of 83
1761—1844

Johan Petter Persson † at age of 83
1802—1885
W. 1) Anna Kajsa Olofsdotter † at age of 47
1803—1850
W. 2) Brita Greta Hansdotter † at age of 85
1805—1890

1) Anna Brita † at age of about 40 1835— about 1875

2) Johannes † at age of 55 1838—1893
W. Anna Elisabeth Nilsdotter † at age of 49 1839—1888

3) Maria † at age of 3
1841—1844

4) Nils Petter † at age of 16
1842—1858

5) Greta Stina † at age of 2
1843—1845

6) Lisa Lena † at age of 2 months 1845
1845—

7) Isak † at age of 2 months 1847—1847

1) Johan Petter † at age of 28
1863—1891

2) Nils Anton Wikström † at age of 40
1865—1905
W. Anna Karolina Johansson 1861—

3) Anshelm † at age of 28
1870—1898

4) Maria † at age of 18
1876—1894

5) Ida Antonia † at age of 13
1879—1892

6) Lina Elisabeth † at age of 26
1881—1908

7) Anna Viktoria † at age of 12
1883—1895

1) Nils Artur W.
1867—
h. Hildegard Maria
– – – – – – – – –
1892—

2) Johan Axel W.
1889—

3) Sven Algot. W. † at age of 23
1892—1915

4) Simon Antonius W.
– – – – – – – – –
1896—

5) Hulda Elisabeth W. † at age of 5 months
1901—1901

1) Nils Alvar
1918—

2) Ingeborg Maria † at age of 2
1921—1923

3) Dagny Maria
1925—

age, was similarly attacked by an acute fever and died on April 1925. The following May a third daughter, 11 years of age, succumbed in the same manner and died in June 1926. All three girls, before they fell ill, had been unusually strong and in flourishing health, and had never before shown any sign of disease.

The inquiries which were made with a view to detecting the source of this intensive infection, showed that the girl who first fell ill had for some months previously stayed in the church village for the purpose of a confirmation course, and had daily been in close touch with a girl of her own age, who was afterwards believed to have been suffering from consumption. At the general medical examination in 1926 this girl was found to be affected with manifest, though fairly benignant, consumption of the lungs. She came from a family with a very marked hereditary tendency towards tuberculosis and in which several benignant, chronic cases of tuberculosis were known.

This case, as well as others of a typical character, seems to indicate that the resistance offered to tuberculosis in the population of the area varies greatly, but apparently shows some uniformity in members of the same family. Members of families who for several previous generations has exhibited more or less numerous cases of consumption seems to have greater prospects of escaping, or being more mildly, attacked than members of families which had previously been exempt from tuberculosis.

Further, experience seems to indicate that intercourse with persons affected with tuberculosis in an infectious stage may involve great risk to those who have passed their childhood; in other words, exposure to infection from tuberculosis is even for adults a factor which, at any rate in many cases, ought not to be underrated.

IX.

THE TUBERCULOSIS PROBLEM OF NORRBOTTEN AND THE COURSE OF DISSEMINATION OF TUBERCULOSIS IN SWEDEN.

That tuberculosis occurs on an immensely greater scale in the County of Norrbotten than in any other part of Sweden is incontestable. At the present time the mortality figures for

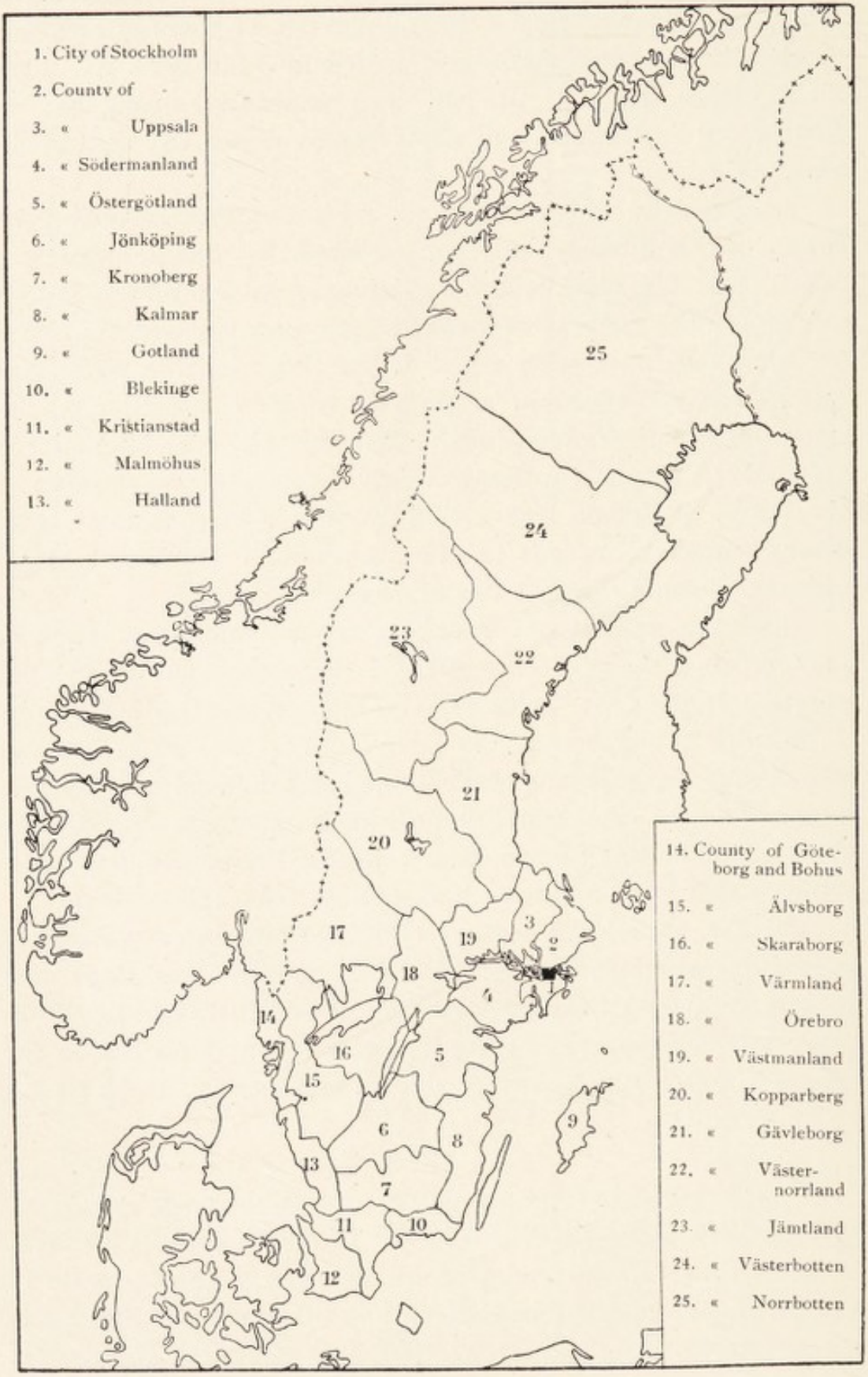


Fig. 14.
Outline map of the counties of Sweden.

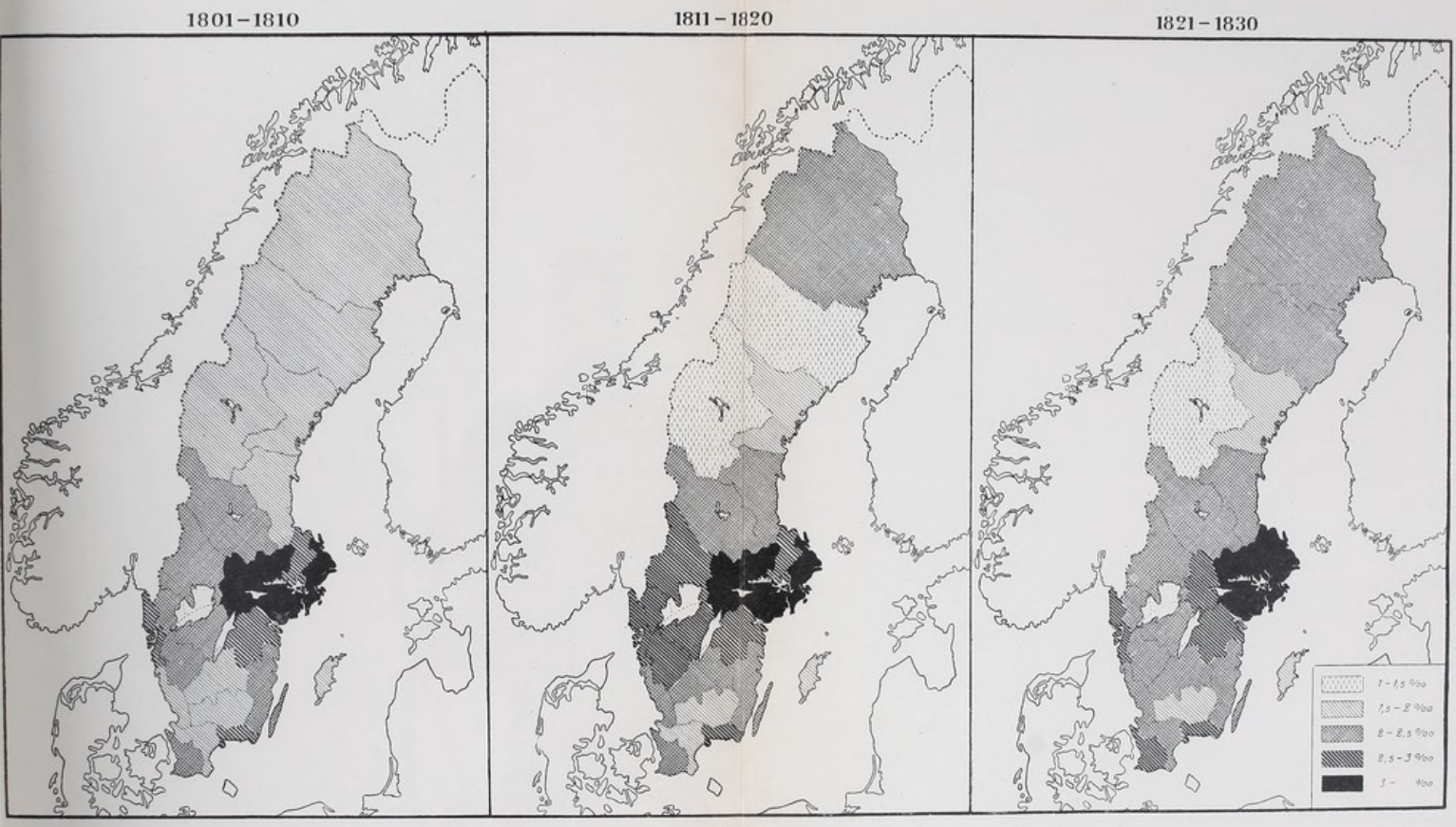


Fig. 15.
Mortality from tuberculosis in Sweden during the periods 1801—1810 (combined figures for the five counties of Norrland) 1811—1820 and 1821—1830. According to figures compiled by Gustav Sundbärg.

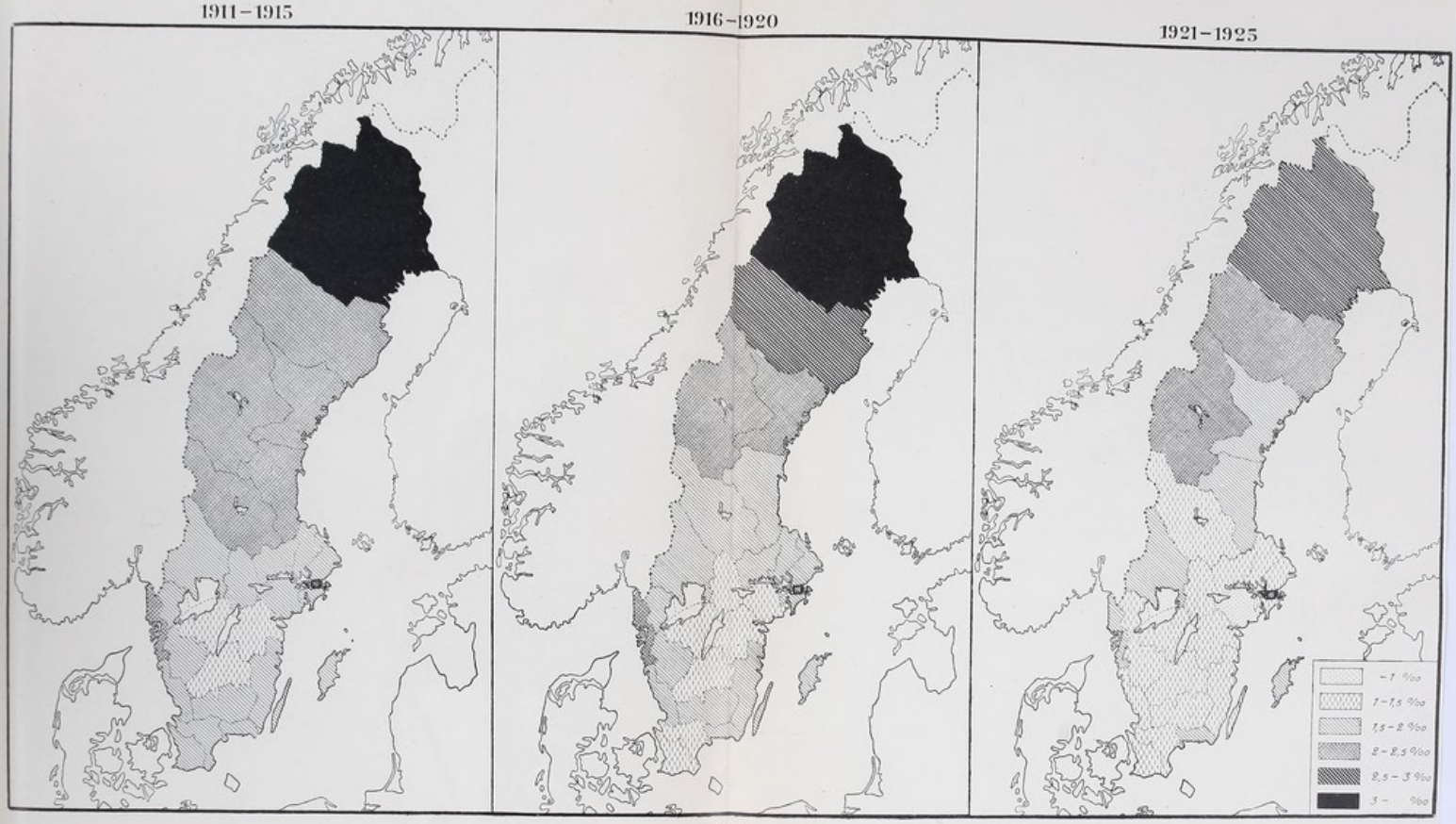


Fig. 76.
Mortality from tuberculosis in the counties of Sweden during the periods 1911—1915, 1916—1920 and 1921—1925.

tuberculosis in that county are approximately twice as high as the average for Sweden at large.

The question naturally presents itself: what is the reason of the enormously high frequency of tuberculosis in that part of the country?

In endeavouring to answer this question, the first ideas that suggest themselves are such obvious factors as the unfavourable climatic conditions and particularly the long, almost sunless winter, unsanitary habits of life (such as overcrowding, or the violation of rules of hygiene in the arrangement of dwellings and the care of the person), the neglect of proper precautions in intercourse between the sick and healthy, an insufficiency of doctors, and lack of other facilities for the treatment of the diseased.

Moreover certain investigators, more especially the exponents of racial research, consider that the exceptionally poor resistance made by the population of Norrland to tuberculosis is in part esplained by the greater intermixture of races in that part of the country.

Doubtless all these factors are deserving of consideration. But the question is whether, even when working in united force, they suffice entirely to explain the quite exceptionally unfavourable position which the County of Norrbotten holds at present with respect to the occurrence of tuberculosis.

A more thorough study of the tuberculosis problems of a certain part of the country, such as Norrbotten, will doubtless be greatly facilitated if an attempt be first made to form some conception as to the course of the dissemination of tuberculosis in Sweden in former times.

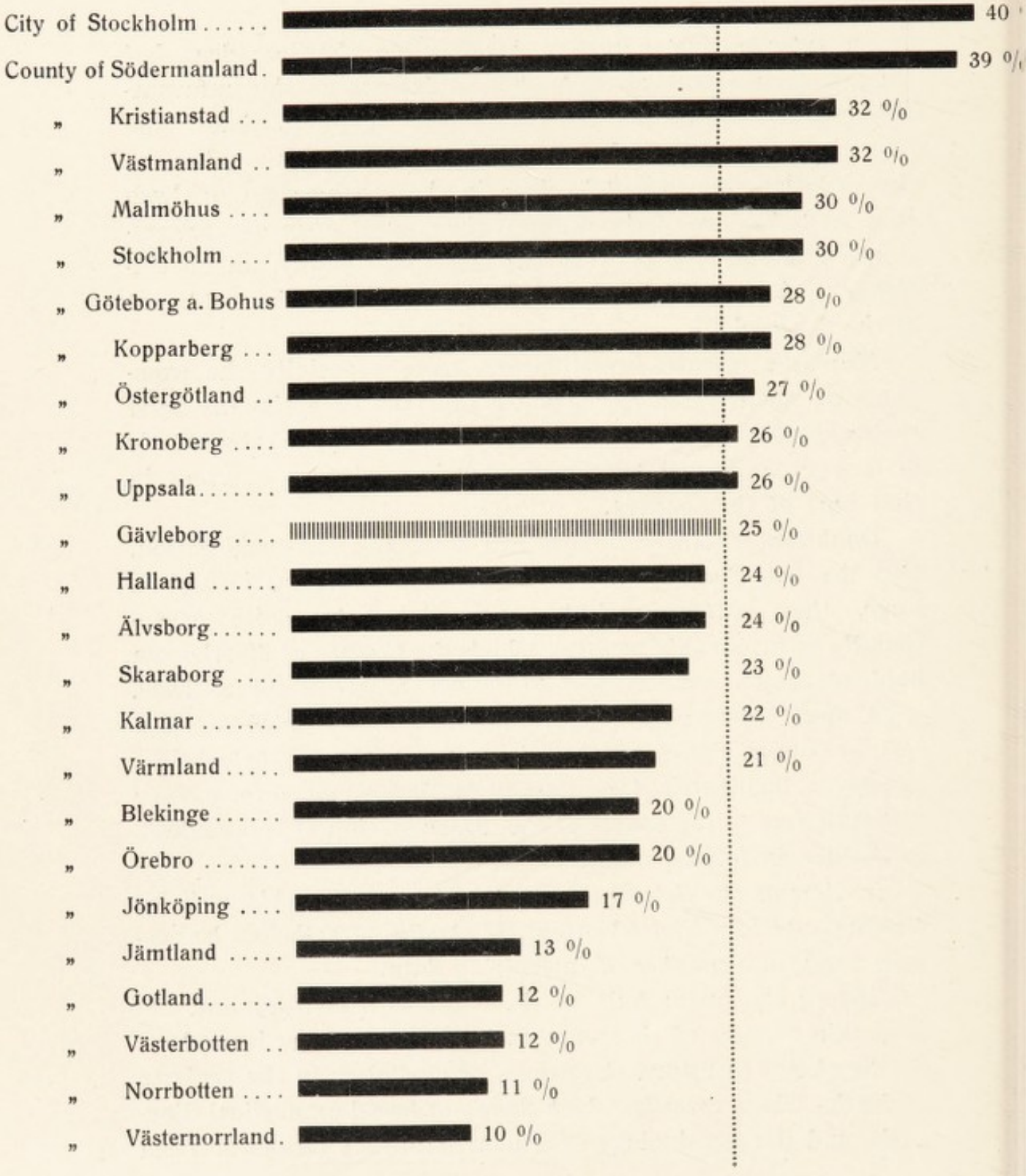
In view of the defectiveness of early records, this will be feasible only to a limited extent. It should nevertheless be possible to glean a number of interesting data.

During the latter half of the eighteenth century and the first thirty years of the nineteenth century it was incumbent on the clergy to record the causes of mortality in the register of deaths. These records, which were not based on medical diagnosis, and the terminology of which was by no means uniform

Fig. 17.

Decrease in the Mortality from Tuberculosis, according to Counties.

From 1911/15 to 1921/25.



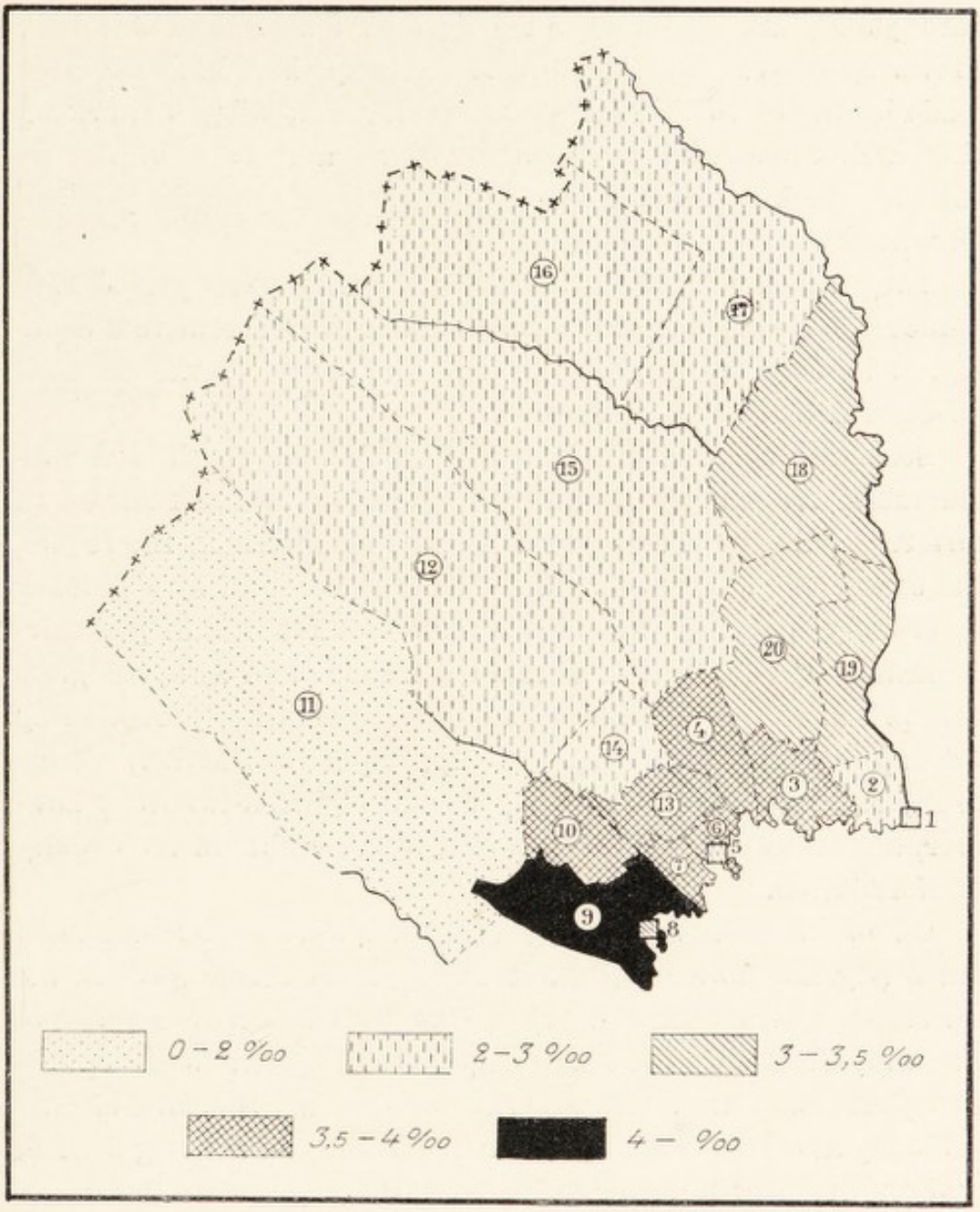


Fig. 18.

Mortality from Tuberculosis in Norrbotten.

Average 1911—1922.

1 Haparanda	8 Piteå	15 Gällivare
2 Karungi	9 Öjebyn	16 Kiruna
3 Neder-Kalix	10 Älvsbyn	17 Vittangi
4 Råneå	11 Arjeplog	18 Pajala
5 Luleå	12 Jokkmokk	19 Över-Torneå
6 Gammelstad	13 Boden	20 Över-Kalix
7 Antnäs	14 Edefors	

throughout, are obviously most defective, as indeed has been shown by several investigators. An attempt has, however, been made by the Swedish statistician *Gustav Sundbärg* to work up this earlier material on scientific lines, and some of the results at which he arrived seem to have a bearing on the problem on which we are now engaged.

They indicate firstly that during the fifty years period 1780—1830 tuberculosis shows a considerable increase in this country. It is tempting to conclude that this period marks the first onset of tuberculosis in Sweden.

Secondly, Sundbärg considers himself able to show a considerable irregularity in the dissemination of tuberculosis in different parts of the country. As will be shown in the sequel, the course of the spread of the disease as sketched by Sundbärg is, broadly speaking, the exact reverse of what it is at present.

Sundbärg finds that tuberculosis has far and away its greatest prevalence in Stockholm and in the counties surrounding the capital, whilst Norrland (the upper part of Sweden) shows relatively low figures. As early as the eighteen-twenties, however, a marked change for the worse is noticeable in the County of Norrbotten.

On the basis of Sundbärg's figures, I have complied shaded maps (fig. 15) indicating the mortality from tuberculosis in the different counties (cf. fig. 14) during the first three decades of the nineteenth century. These maps seem to point to the spread of tuberculosis from its central hot-bed at Stockholm, and probably also from subsidiary centres in the Gothenburg district and in the provinces of Skåne and Blekinge, over the entire south and centre of Sweden, with a continual northward trend.

The impression given by these maps is that tuberculosis, proceeding from the most thickly populated centres, being also those places which were in busiest communication with the outer world, had spread, as it were by a process of infiltration, to the surrounding parts in ever-widening circles.

Norrland holds throughout a relatively favoured position, but even here tuberculosis appears to be slowly increasing, and the County of Norrbotten ere long exhibits a higher frequency than the other counties of Norrland.

As for the period 1830—1860 we unfortunately have no statistics for the mortality in Sweden, either in towns or in the country. Hence, in endeavouring to form an opinion as to whether the mortality from tuberculosis increased or decreased during these thirty years, or as to the changes that may have occurred in different parts of the country, we are thrown back on mere conjecture.

From 1861, however, we possess, as regards the Swedish towns, statistical data of the causes of death, based on doctor's certificates. This valuable material enables us to follow the changes which have taken place in the mortality of the towns, and moreover to draw some conclusions as to the course of dissemination of tuberculosis.

We find that some of the towns, including, Stockholm, Norrköping, Uppsala, Västerås and Nyköping, show a continuously *diminishing* mortality from tuberculosis from 1861 onwards. All these towns are in the areas which, according to the earlier records, exhibited the highest frequency of tuberculosis before 1830. We get the impression that in these towns the mortality from tuberculosis had culminated during the period 1830—1860, and had then begun to recede.

In regard to other towns we find that the mortality from tuberculosis had *increased* after 1861 for one or more decades, and had then again begun to decrease. Among them we find almost all the towns of Norrland. For example, Piteå and Haparanda reach their maxima during the period 1871—1880, and Luleå during the period 1881—1890. The culmination of the mortality from tuberculosis and the incipient regression thus come one or more decades later as regards the towns of Norrbotten than in the case of Stockholm and the towns of central Sweden.

From 1911 statistics of the causes of mortality are available also for the rural districts of Sweden. Though it must be admitted that the records for the country districts are still rather defective, they nevertheless give us a fairly good idea of the differences in the mortality of different parts of the country, and as to whether the mortality shows a rising or falling tendency.

The period of 15 years — from 1911 to 1925 —, for which

statistical material with regard to the mortality from tuberculosis is available both from town and country, is marked by *a continuously diminishing mortality from tuberculosis.*

The shaded maps in fig. 16 illustrate these facts in a very striking way, showing how the areas with a lower death-rate from tuberculosis have been extended from one period to another, and that during the latest period (1921—1925) one county, that of Södermanland, has brought down its mortality to 1 per mille. If *the mortality from consumption solely* were illustrated in the same manner, the Counties of Skaraborg, Östergötland, Jönköping, Kristianstad and Malmöhus would also have been similarly marked for the latest period.

It will be recalled that at the beginning of the nineteenth century tuberculosis in Sweden was greatly on the increase. Thus nearly a century — or at least three generations — lies between these two periods (1801—1830 and 1911—1925), the earlier one being characterized by a great increase, the later one by an equally marked regression of tuberculosis.

The extent to which the mortality from tuberculosis diminished during the later period is best shown by comparing the averages of that mortality during the first and last five years of the fifteen years period. It will then be found that, whereas the mortality figure for the whole of Sweden was 1.94 $^{0}/_{00}$ during the period 1911—1915, it was only 1.46 $^{0}/_{00}$ during the period 1921—1925. The latter figure is 25 % lower than the former. *Thus during the last fifteen years the mortality from tuberculosis in Sweden has diminished by 25 percent.*

A more detailed study of the changes in the mortality from tuberculosis during that period shows that the regression was very irregular in different parts of the country. Broadly speaking, it may be said that the most marked decrease is to be found in Stockholm and its environs, and in the south of Sweden: thus in those parts of the country which a century ago showed the highest mortality. With a few exceptions, these parts of the country also show the lowest mortality from tuberculosis. On the other hand, we find the least decrease and the highest mortality from tuberculosis in those counties of Norrland which a century ago were in a particularly favoured position.

The very considerable variations in the decrease of the mortality from tuberculosis in the different counties are shown by the following summary of the percentage decrease from 1911—1915 to 1921—1925 (see also the chart in fig. 17).

City of Stockholm	40 %	County of Halland	24 %
County of Södermanland ...	39 %	County of Älvsborg	24 %
County of Kristianstad.....	32 %	County of Skaraborg	23 %
County of Västmanland ...	32 %	County of Kalmar	22 %
County of Malmöhus	30 %	County of Värmland	21 %
County of Stockholm	30 %	County of Blekinge	20 %
County of Göteborg and of Bohus	28 %	County of Örebro	20 %
County of Kopparberg	28 %	County of Jönköping	17 %
County of Östergötland	27 %	County of Jämtland	13 %
County of Kronoberg	26 %	County of Gotland	12 %
County of Uppsala	26 %	County of Västerbotten.....	12 %
County of Gävleborg	25 %	County of Norrbotten	11 %
		County of Västernorrland...	11 %

The relatively slight diminution in the mortality from tuberculosis in the counties of Norrland, which is found concurrently with the continuance of a remarkably high frequency of the mortality from that cause, leads us to suspect that tuberculosis is not diminishing *throughout* these counties, but that in some parts it may actually be on the increase.

A detailed analysis of the mortality from tuberculosis in different of parts the County of Norrbotten yields very interesting results.

We find, to begin with, that the extent of the mortality from tuberculosis shows great variations in different parts of that county. This is made clear by the subjoined summary, which gives the average mortality from tuberculosis per mille in 1911—1922 for the rural districts* and towns of Norrbotten (see also the chart in fig. 19). For the purpose of comparison, the averages for the whole of Sweden and for the County of Norrbotten during the same period are first given: —

Average for the whole of Sweden .. .. 1.8 ‰
Average for the County of Norrbotten ... ... 3.25 ‰

*) Strictly speaking, the districts allocated to the county medical officers.

District of Arjeplog	1.3 ‰
» » Arvidsjaur	2.0 ‰
» » Gellivare	2.1 ‰
» » Jockmock	2.4 ‰
» » Vittangi	2.7 ‰
» » Haparanda	2.8 ‰
Town of Luleå	2.8 ‰
» » Boden	3.0 ‰
District of Edefors	3.0 ‰
» » Över-Kalix	3.1 ‰
Town of Haparanda	3.1 ‰
District of Över-Torneå	3.2 ‰
» » Pajala	3.4 ‰
Town of Piteå	3.4 ‰
District of Älvsby	3.6 ‰
» » Råneå	3.6 ‰
» » Neder-Kalix	3.9 ‰
» » Neder-Luleå	4.0 ‰
» » Öjebyn	4.8 ‰

If, turning to the map in Fig. 18, we look up the position of the above districts and towns, we shall observe that the highest mortality from tuberculosis is to be found in the maritime districts, whereas the interior of the country shows a lower death-rate and the southern part the lowest of all. Many people may be surprised to find in the County of Norrbotten with its enormous mortality from tuberculosis a district, that of Arvidsjaur, the mortality of which barely exceeds the average for Sweden as a whole, and another, that of Arjeplog, which actually falls below that average. The two extremes, Arjeplog, which, in respect of the mortality from tuberculosis, is 28 % below the average for the country at large, and Öjebyn, which is 167 % above that average, illustrate the striking irregularities in the dissemination of tuberculosis in the different parts of the County of Norrbotten.

Further, if we compare the mortality from tuberculosis in the rural districts and towns of the County of Norrbotten during the two five years periods 1911—1915 and 1921—1925, we shall find great, and very interesting, variations between the different areas.

It will be recalled that the county as a whole shows a de-

crease of 11 %, and that this decrease is very considerably lower than that for Sweden as a whole, which is 25 %.

The changes in the various districts and towns in Norrbotten are shown by the subjoined summary, where the plus sign designates increase and the minus sign decrease in 1921—1925 as compared with 1911—1915.

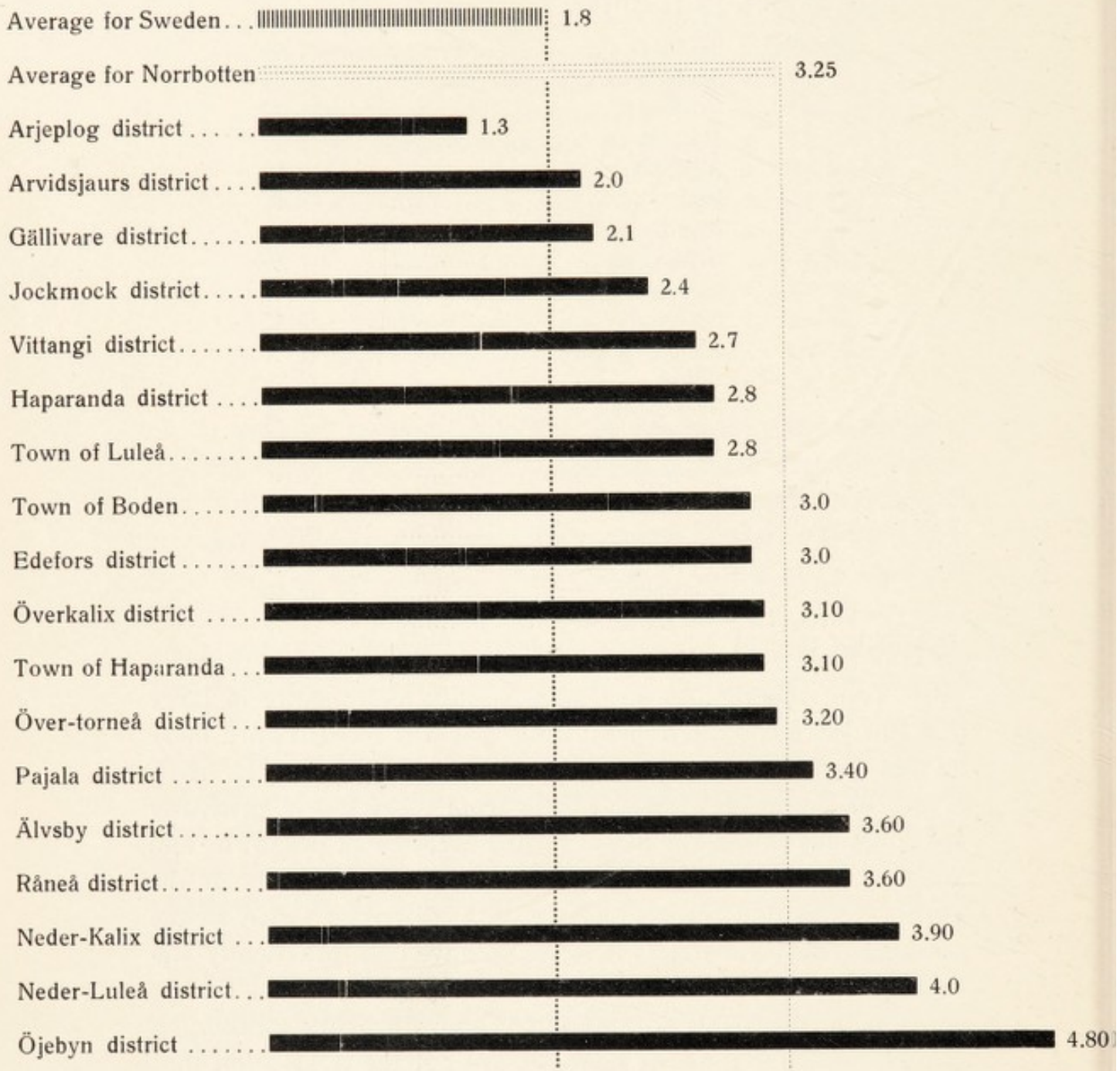
District of Gellivare	+ 47 %
» » Arvidsjaur	+ 42 %
» » Edefors	+ 25 %
» » Haparanda	+ 12 %
» » Arjeplog	+ 10 %
» » Boden	+ 6 %
» » Älvsbyn	+ 6 %
» » Neder-Luleå	— 0.5 %
» » Öjebyn	— 0.8 %
» » Över-Kalix	— 5 %
» » Jockmock	— 12 %
» » Råneå	— 13 %
» » Över-Torneå	— 30 %
» » Vittangi	— 31 %
» » Neder-Kalix	— 32 %
» » Pajala	— 36 %
Town of Luleå	— 30 %
» » Piteå	— 35 %
» » Haparanda	— 42 %
The entire county	— 11 %

It is thus evident that during the period in question the mortality from tuberculosis has been rapidly diminishing in large parts of the county, whilst in other parts it has shown a more or less marked tendency towards continued increase. In brief, it may be a said that the mortality from tuberculosis, generally speaking, has shown the most marked decrease in the towns and a more or less marked decrease in the rural districts of the Torneå valley and the northerly coastal districts, whilst in the southerly coastal districts it seems to have been practically stationary or to have shown a slight tendency to regression. On the other hand, the areas in the interior show, broadly speaking, a general tendency towards increase. We get the impression that in the coastal districts tuberculosis has already reached its culmination and is now either at the turning-point, or already shows a distinct tendency towards decrease, and that moreover

Fig. 19.

The mortality from tuberculosis in the towns and rural districts of Norrbotten.

Average for the years 1911—1922 per mille.



it is spreading inwards towards those parts of the county which had formerly been almost exempt from tuberculosis.

Of very special interest are the conditions in the two districts of Arvidsjaur and Arjeplog (see Fig. 20), which, as above indicated, had previously shown a mortality from tuberculosis which must be regarded as very low for Norrbotten. Dr. E. Wallquist, the county medical officer in the Arjeplog district, who has devoted special attention to the question of the occurrence of tuberculosis in these areas, has furnished some interesting information on this subject, which may be summarized as follows: —

In these two districts tuberculosis appears to have been very rare 50 to 60 years ago. Very few indeed of the now surviving adult inhabitants know of cases of tuberculosis in the preceding generation. Both these districts were formerly greatly isolated from the rest of the county. But, in connection with improved communications and greater mobility of the population, tuberculosis has been transmitted from the infested coastal districts. It appears to have followed the main thoroughfares and to have first reached Arvidsjaur, where it is now spreading with alarming rapidity.

From Arvidsjaur tuberculosis was transmitted somewhat later to Arjeplog, where it now likewise appears to be on the increase. Dr. Wallquist has shown that at the present time tuberculosis at Arjeplog is apparently localized chiefly in three centres, all of which are points in very close communication, via the high roads and river valleys, with the adjacent district of Arvidsjaur.

A Pirquet examination of children under ten years of age — which was in progress at the time of writing —, appears to indicate that a large number of the children in the above-mentioned centres react positively, whereas the children in isolated villages in the forest almost always give a negative reaction.

Another observation made by Dr. Wallquist is that the number of acute, rapidly progressing and very malignant cases of tuberculosis is very large in these parts. Only too often the cases are surprisingly unamenable to sanatorium treatment, and

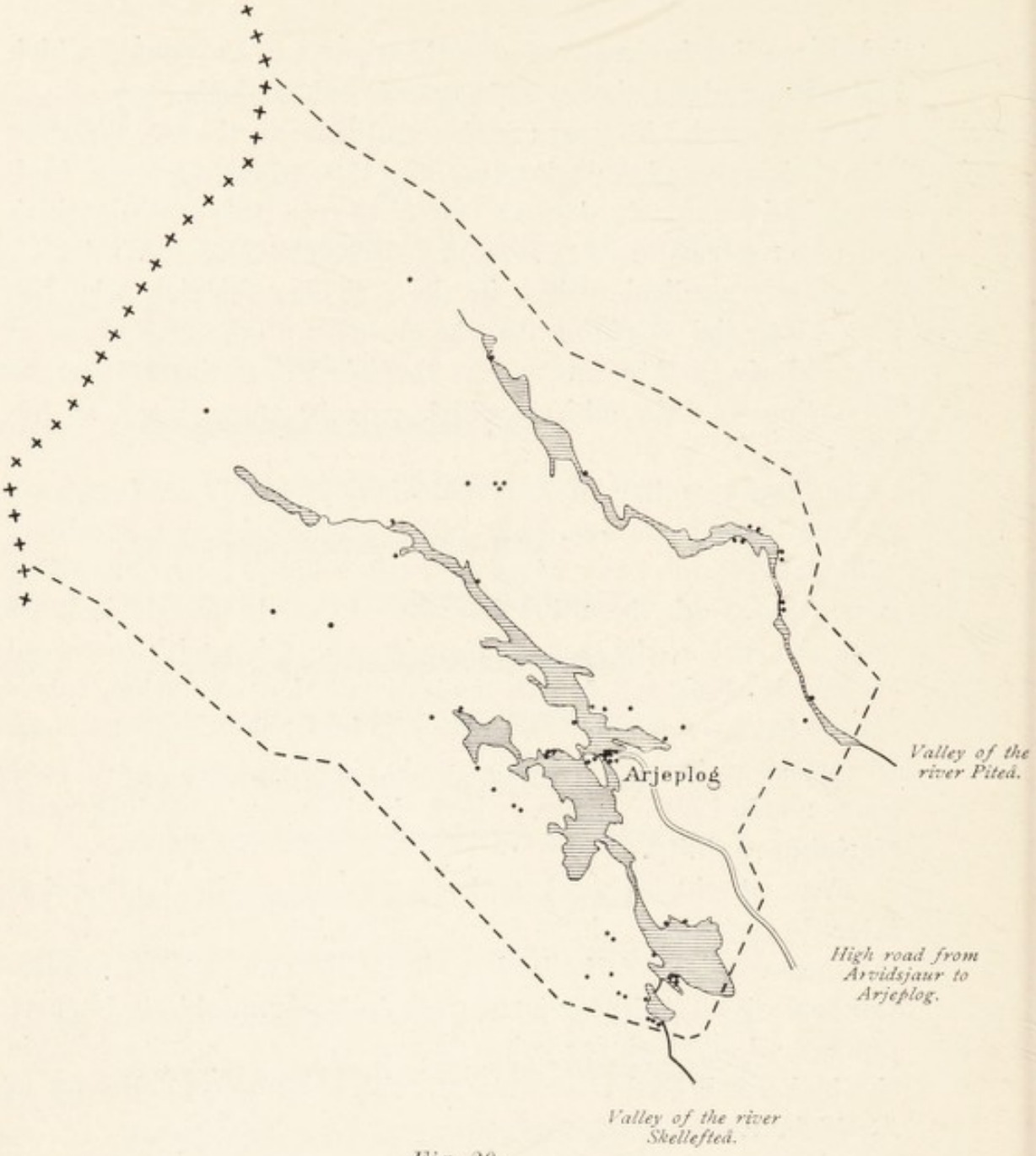


Fig. 20.

Tuberculosis at Arjeplog.

Each dot denotes a case of tuberculosis. The areas lying between the shaded parts are almost as thickly populated. In the mountainous districts near the Norwegian frontier a few cases of tuberculosis among the nomad Lapps. (According to Dr. Wallquist).

very frequently patients who have improved at a sanatorium rapidly get worse and soon die after their return home.

It is evident that in this district an opportunity will be afforded to study the onroads of tuberculosis among a popu-

lation dwelling in scattered village communities, and previously but little affected by the disease. And it is probable that valuable contributions to our knowledge of tuberculosis may be obtained by a thorough scientific observation of the conditions in these parts during the next twenty or thirty years.

The comparatively low figure for the decrease in the mortality from tuberculosis in the County of Norrbotten during the past fifteen years is partly explained by the fact that the disease, as the detailed figures show, is still on the increase in certain parts of the county. It should be noted, however, that the areas in which an increase has thus been shown comprise only one-third of the population of the county, whereas two-thirds of the population inhabit areas in which there has been a more or less marked decrease.

In order to throw further light on this question, we shall now similarly compare the two five-years periods with respect to the mortality from tuberculosis in another county where not only has the decrease been remarkably great, but also the actual mortality from tuberculosis is very low, indeed the lowest in Sweden. We are referring to the County of Södermanland. It will be recalled that during the first few decades of the nineteenth century this county was one of those which exhibited the highest mortality from tuberculosis in Sweden.

Similarly as in the case of the County of Norrbotten, we subjoin a summary showing the changes which have occurred in the mortality from tuberculosis in the rural districts and towns of the County of Södermanland, the plus sign signifying increase and the minus sign decrease: —

District of Eskilstuna	— 43 %
» » Strängnäs	— 40 %
» » Vingåker	— 22 %
» » Malmköping	— 16 %
» » Nyköping	— 42 %
» » Trosa	— 40 %
» » Björkvik	— 51 %
» » Björnlunda	— 26 %
» » Julita	— 24 %
» » Aspa	— 51 %
» » Gnesta	— 44 %
» » Kungsör	— 14 %

Town of Nyköping	— 49 %
» » Eskilstuna	— 41 %
» » Torshälla	— 41 %
» » Strängnäs	— 56 %
» » Mariefred	+ 74 %
» » Trosa	— 11 %
» » Katrineholm	— 25 %
The whole county	— 39 %

The County of Södermanland, in contradistinction from that of Norrbotten, shows, broadly speaking, a fairly uniform and marked decrease in the mortality from tuberculosis throughout. The only exception, that of Mariefred (a small »town« with a population of about 1 500), is due to a temporary crop of deaths from tuberculosis in the two years 1921—1922, whereas the mortality during the period 1911—1915 was very low: during the years 1923—1925 no cases of death from tuberculosis occurred in the little town.

The data and observations above reported may serve to throw some light — at any rate as regards Swedish conditions —, on the much discussed question: What are the factors that most effectively conduce to the decrease of tuberculosis?

We have seen that towards the end of the eighteenth century and the beginning of the nineteenth tuberculosis was apparently advancing at a rapid pace in Sweden, and that it seems to have gradually spread from certain thickly populated centres in ever-widening circles, reaching the counties of Norrland last.

It seems, however, that the mortality from tuberculosis, after rising and culminating in the several districts, had gradually begun to recede. As regards Stockholm and several other towns in central Sweden this turning-point came before 1861: in the case of other towns, especially those in the north of Sweden, it arrived several decades later. This apparently spontaneous regression can scarcely be explained otherwise than by a gradually increasing resistance, or diminished susceptibility, to the disease. The human organism seems to acquire some kind of capacity for defending itself against tuberculosis. Whether this is due to powers that have been transmitted by heredity or acquired during childhood, must here be left an open question.

At any rate this capacity is apparently in some way acquired by a population in an area where tuberculosis has been prevalent for several generations. This defensive power of the organism against tuberculosis, which is thus gradually established, may be termed *biological defence*. It is evident that the general tuberculization of a population proceeds more rapidly, and that the opportunities for acquiring »biological defence« are increased, according as the density of the population is greater, whilst the process is slower and more irregular according as the population is more scattered and isolated. This protective power has thus been most rapidly acquired in towns and urban communities, more slowly in the rural areas in general, and most slowly in the remotely situated parts of Norrland. In these regions we can still find whole districts e. g. those of Arvidsjaur and Arjeplog, where this power is almost entirely non-existent.

It should be observed, however, that biological defence evidently does not suffice to eradicate tuberculosis. In fact all experience goes to show the extremely close connection of tuberculosis with the milieu. The decrease of tuberculosis, which began and continued long before any special measures were adopted against the disease, has been favoured by all the steps taken to improve the conditions in the milieu. Everything that has been done to raise the standard of life, to improve hygiene in dwellings and habits of life, to improve the sanitation and care of the sick, and to promote enlightenment and education, has contributed to create a milieu which is unfavourable to tuberculosis and indeed may instead serve as a defence against it. The progress of civilisation has been, and is, a bulwark against tuberculosis. The defensive power thus acquired against tuberculosis may be termed *cultural defence*.

Direct measures against tuberculosis, *an organized anti-tuberculosis campaign,* consisting in the hospital or sanatorium treatment of the diseased, the isolation of sources of infection, and prophylactic measures of various kinds, have in recent years been pursued with increasing intensity in all parts of Sweden, as in other civilized countries. Now what value must be attached to these measures? Is is conceivable that biological

and cultural defence solely would have sufficed to reduce tuberculosis to its present level without its being necessary to adopt special measures at great cost?

It is scarcely possible to give an exact reply to this question. Moreover the entire problem of tuberculosis is so complicated that such a blunt way of presenting the question is hardly justified. We do not know, nor can we ever know, how far the mortality from tuberculosis would have receeded, had no direct measures whatsoever against tuberculosis been taken. Nor is there any possibility of statistically calculating how far the diminution of the mortality from tuberculosis within a certain area at a certain period is due to one or another of the factors which may conceivably have conduced to the decrease.

And yet a reply to this question — even though merely in the form of a surmise —, would be of the very greatest value, especially from the point of view whether we are warranted in recommending and advocating the very considerable expenditure which will continue to be demanded for the combating of tuberculosis.

In the Author's opinion, the experience drawn from the experiment at Antnäs contributes towards our possibilities of replying to this question, and in a more convincing and striking way than any other facts within his knowledge.

What has previously been reported in detail regarding the work carried on by the Hälsan Institute, may be recapitulated as follows: — An organized campaign against tuberculosis, comprising the isolation and care of the diseased, and measures for the protection of healthy persons, especially the children, was pursued within a limited area; and at the same time the enlightenment and education of the population in matters of hygiene was carried on with the greatest possible intensity. Some twenty years after the commencement of this work we find that both the tuberculosis morbidity and the mortality from that disease have very considerably diminished, — by no less than 33 % and 28 % respectively.

In the surrounding district the mortality from tuberculosis during the same period did not show any diminution, and

indeed in some parts probably an increase. In these parts of Norrbotten there is no trace of any spontaneous regression of tuberculosis owing to biological or other causes.

Among the population of the experimental area there have occurred no striking changes (such as possibly in the village of Gäddvik) which could explain the decrease of tuberculosis. The only thing of note that happened in these villages, as distinguished from the other villages in the parochial district, was the work carried on by the Hälsan Institute. It is therefore scarcely possible to deny that the experience drawn from the experimental area in Norrbotten proves the value of direct measures against tuberculosis at an early stage of the progress of that disease among a population where neither biological nor cultural defence had developed to any considerable extent.

The considerable disparities in the regression of tuberculosis during the past fifteen years in different parts of the country can be quite naturally explained by the great variations in the force of the contributing factors.

The most rapid regression of tuberculosis is presumably to be expected among a population where all the factors mentioned are allowed to cooperate to the fullest extent, that is, where tuberculosis has been generally prevalent for several generations, where the general standard of life and general hygiene have reached a certain level, and where direct measures against tuberculosis are vigorously pursued. The regression may be expected to proceed more slowly among a population where the two first-mentioned factors are as yet insufficiently developed, even if a well-organized campaign against tuberculosis is carried on.

The value of the direct measures apparently lies in the fact that they serve to *accelerate* that regression of tuberculosis which also other forces in the community are striving to bring about. In fact an essential part of an anti-tuberculosis campaign consists precisely in the promotion of those factors which conduce to bring about what we have termed cultural defence, that is, improved hygiene in persons and dwellings.

Anti-tuberculosis work in general is presumably of a similar value for the community as sanatorium treatment for the individual patient; that is, it stimulates and promotes the development of the healing tendency inherent in the organism.

Finally, as regards the probable reasons of the exceedingly high frequency of tuberculosis, and the small decrease hitherto observed, in the County of Norrbotten, the conclusions at which the Author has arrived may be inferred from the above reasoning. They may be summarized as follows: —

Tuberculosis in Norrbotten is of comparatively recent date: it has not yet had time to permeate the entire population of the county; among a third part of the population it is still increasing; and moreover in Norrbotten it has encountered such climatic, hygienic and racial conditions as to render the milieu very favourable for its development. The biological defence which is being gradually established is still in many quarters defective and inadequate, and the same applies to what we have termed cultural defence. For financial and other reasons, it has not been possible to conduct a direct campaign against tuberculosis on the necessary scale and with the required intensity.

The tuberculosis question in Norrbotten is a grave problem, which, of course, is a source of grave anxiety to the inhabitants themselves. Nevertheless, it does not seem to give occasion for discouragement. The situation is not so inexplicable, nor so hopeless, as people sometimes suppose. It seems reasonable and natural that the part of the country at which tuberculosis last arrived should also be last emancipated. The county which now has the lowest mortality from tuberculosis in Sweden once had a higher mortality than Norrbotten has at present. That tuberculosis in the greater part of Norrbotten is already receding is incontestable. This is a great encouragement to continued endeavours and a good omen for the future. When the enemy positions begin to totter, the main resistance has been broken, and we are justified in hoping for a final victory.

Appendix.

X.

METEOROLOGICAL DATA FOR THE YEARS *1908—1913.*

The following meteorological survey has been compiled by Dr. *Einar Petri*, State meteorologist, and is based mainly on records from the meteorological station at Piteå, some 24 English miles south of Antnäs. From the viewpoint of the Hälsan Institute, this is the nearest completely equipped meteorological station.

The following meteorological data are given for each of the years in question: —

1. A summary of the atmospheric pressure conditions in the north of Norrland. This summary is based on a study of the synoptic charts for all the days of the year.

It should perhaps be pointed out that »settled atmospheric conditions« are not necessarily attended by light breezes, and vice versa, though, generally speaking, the weather is more windy according as the atmospheric pressure is more variable.

2. A tabular summary of the principal meteorological elements, except atmospheric pressure, for the Piteå district (see pp. 116—127). The data are taken from the publications of the Meteorological Central Institute, with the exception of the figures for the number of windy days. As in these publications the estimates of the force of the wind at Piteå are not entirely reliable, the figures have been based instead on the observations of winds at the Swedish lighthouse stations in the Gulf of Bothnia, from Malören in the north to Holmögadd in the south. The figures thus show the number of days on which at any of these lighthouse stations (twelve in number) a wind's force of 7 or more was recorded, in accordance with Beaufort's scale from 0 to 12.

A day of »frost« signifies a day on which the temperature has fallen below zero.

In regard to the figures for the observations of winds, it should be noted that three observations were made daily. Actually, 16 different directions were observed. In compiling the summary, however, a wind from, say, NNE was taken as half N, half NE, and so forth.

3. The dates on which the port of Luleå was freed from ice and again became ice-bound.

4. Notes as to any striking peculiarities in regard to temperature or rainfall, as well as some reports from observers in the district regarding phenomena in the vegetable and animal world.

1908.

1. *Atmospheric pressure.* In January and February, generally speaking, low atmospheric pressure and unsettled conditions prevailed; a very

marked barometric depression passed on the 8th February. During the months March to October inclusive settled conditions on the whole prevailed, with occasional minor disturbances. Thus barometric minima passed on the 15th June, and the 27th and 28th August. On the 19th—23rd April north wind was caused by barometric minima passing in the East. Also at the beginning of July north winds were blowing, owing to low atmospheric pressure in the East. On the 23rd May a minimum passed in the North. The first half of September was somewhat unsettled, likewise the first half of October, whilst the end of October was marked by an unusually high atmospheric pressure. During the latter half of November and the greater part of December the atmospheric conditions were rather unsettled, but a very high atmospheric pressure prevailed during the last few days of the year.

3. The port of Luleå was freed from ice on the 25th May and became ice-bound on the 9th November.

This year the rainfall was on the whole very small: in June, however, it was considerably above normal.

The starling arrived at Piteå on the 5th April, the wagtail on the 11th, the chaffinch on the 15th of that month. The pine-finch was seen at Lövånger on the 31st October.

1909.

1. *Atmospheric pressure.* At the beginning of the year the atmospheric conditions were rather unsettled. A very marked barometric minimum with very low pressure passed on the 12th January. Also on the 14th February, when a minimum passed in the North, the atmospheric pressure was very low. From the end of February down to the beginning of July the atmospheric pressure was high or medium and the conditions were on the whole settled: the middle of May, however, was rather unsettled. In the first part of July the atmospheric pressure fell, and the latter part of that month as well as the whole of August was somewhat unsettled. Marked depressions passed on the 13th August and 1st September. During the rest of September medium atmospheric pressure prevailed without any marked variations. The last three months of the year were more unsettled, and especially in December the atmospheric pressure was rather variable.

3. The port of Luleå was freed from ice on the 7th June and became ice-bound on the 9th November.

4. January was unusually mild, the spring (April and May) rather cold. The rainfall in May and June was small, whereas July was rainy.

The starling was observed at Piteå on the 9th April, the wagtail and chaffinch on the 28th of that month.

1910.

1. *Atmospheric pressure.* During the first two months of the year the atmospheric pressure was, generally speaking, low. In January rather

unsettled atmospheric conditions prevailed. During the greater part of February the atmospheric pressure was high in the East and low in the West, entailing the prevalence of southerly winds. During the months of March to July inclusive there were, on the whole, no violent variations. A marked depression passed on the 17th March. The atmospheric pressure was high on the first few days of April and very high on the 12th May, but in the latter part of that month settled atmospheric conditions prevailed. During the month of August and the first half of September the atmospheric pressure was, generally speaking, high or medium and the weather was settled, whereas towards the end of September and at the beginning of October it was rather unsettled. The latter half of October was marked by a high and steady atmospheric pressure. November and December were on the whole rather unsettled: at the end of November, however, the atmospheric pressure was rather high. A pronouncedly marked depression passed on the 24th December.

2. The part of Luleå was freed from ice on the 18th May and became ice-bound on the 25th October.

4. February and March were marked by an unusually high temperature. The spring and early summer were very rainy, whilst the rainfall in August was very slight.

The starling arrived at Lövånger on the 20th March, the chaffinch and green-finch on the 27th, and the crow on the 28th of that month. The lark arrived at Boden on the 10th April, the chaffinch on the 12th, the wagtail on the 15th and the starling on the 20th of that month. At Boden the trees were in leaf »considerably earlier than last year«. At that place the spring-sowing had been practically terminated at the end of May, and new potatoes were available for consumption on the 20th July. It was reported from Lövånger that the »grass-worm« (larva of *Charaeas graminis*) had made serious ravages during the early summer. From Örträsk it was reported at the end of September that wells had dried up. Similar reports in October from Kullbäcksliden.

1911.

1. *Atmospheric pressure.* During the first four months of the year the atmospheric conditions were mostly rather unsettled. In January and especially in February several markedly pronounced barometric depressions passed. There were, however, intervening periods with high atmospheric pressure; for example, the barometer was very high on the 5th January. In May high atmospheric pressure and settled conditions prevailed; also the month of June was on the whole settled, though the atmospheric pressure was then somewhat lower. A somewhat unsettled period in July was succeeded during the last few days of the month by high and steady atmospheric pressure, which lasted during the first half of August. After that time the atmospheric conditions became more unsettled. A very marked depression passed on the 6th November. More settled periods with

high atmospheric pressure occurred, however, on the 12th—22nd October and the 24th November—10th December. At the beginning of December a barometric maximum lay in the East, entailing southerly winds. This maximum then passed southwards, and towards the end of the month became less and less marked, whilst the air-pressure conditions became more unsettled.

The port of Luleå was freed from ice on the 29th May and became ice-bound on the 25th October.

4. The month of December was distinguished by its abnormal warmth (the medium temperature being 7 degrees above normal), June and September by their heavy rainfall.

The first butterfly was seen at Boden on the 31st March, the crow arrived on the 8th April, the lark on the 13th, the chaffinch on the 21st, the wagtail and the wren on the 22nd of that month. At the end of May the trees and bushes at that place were almost in full leaf and the spring-sowing has been nearly terminated. New potatoes were lifted om the 18th July, at which time the hay-making was in full swing. Wild straw-berries were picked on the 21st July.

1912.

1. *Atmospheric pressure.* During the first eight months of the year the atmospheric conditions were, generally speaking, very settled. At the beginning and end of January, however, there was some disturbance, as also at the beginning of April, when a marked barometric depression passed on the 5th (a very marked minimum passed over the south of Sweden on the 9th). Depressions passed also on the 3rd and 12th May and 16th June. An unusually high atmospheric pressure occurred on the 18th January; also on the 21st April the barometer was very high. A stable maximum lay in the East on the 15th—25th March. August was not quite so settled as the preceding months, and the first part of September was rather unsettled, but high pressure prevailed at the end of September. After some disturbance at the beginning of October, a period of high pressure again set in on the 9th of October, lasting during the greater part of that month. On the 15th—26th October a maximum lay in the North-East. During the last two months of the year unsettled conditions prevailed. Marked depressions passed on the 25th—28th November.

3. The port of Luleå was freed from ice on the 20th May and became ice-bound on the 28th October.

4. The year was distinguished by a very heavy rainfall, which, however, was very unevenly distributed; thus, in April and July there was scarcely any rain, whereas the rainfall was extremely heavy in May, June and September. In January and February unusually severe cold prevailed.

The following report was received from Boden: — The crow was observed on the 20th March, the lark on the 18th April, the yellow-hammer on the 20th, the wagtail on the 25th, and the chaffinch on the 26th

of that month. Salix was in bloom on the 20th April, the violet and Caltha palustra on the 23rd May. The swallow and redstart were seen on the 18th May; potatoes were planted on the same day. At the end of December: »An unusually large amount of snow for this early part of the winter, the forests almost impassable, the ground slightly frozen«. From Myrheden in August: »The barley harvest began about the 1st August. No cloudberries or whortleberries. Oats rather plentiful, the supply of game scanty. The cuckoo was heard for the last time on the 22nd August.«

1913.

1. *Atmospheric pressure.* During the first few days of the year the atmospheric conditions were rather unsettled. From the 8th January to the end of that month a high or medium pressure and rather settled conditions prevailed. The atmospheric pressure was very high on the 10—11th January. Likewise on the 17th February the pressure was very high; otherwise the month of February was on the whole characterized by unsettled atmospheric conditions, which applies in a still greater degree to March, especially the first half of that month. More settled conditions, however, set in at the end of March, when the barometer rapidly rose. The following months were on the whole rather settled; in August, however, the atmospheric conditions became somewhat more unsettled. In September high pressure, generally speaking, prevailed, with rather slight variations, and the beginning of October was likewise rather settled. But on the 14th October a sudden change set in, and after that time the atmospheric conditions were unsettled till the end of the year. The last few days of November (on the 30th of that month the atmospheric pressure was very low) and the first few days of December were particularly unsettled. A markedly pronounced barometric depression passed on the 5th December.

3. The port of Luleå was freed from ice on the 11th May and became ice-bound on the 8th November.

4. During this year, broadly speaking, the medium temperature and the total rainfall for all the months corresponded rather closely with the medium figures for a long series of years, which happens rather rarely.

On the 25th April it was reported from Hapranda that the crane, lark, wagtail and thrush has arrived, and moreover wild-duck, sea-gulls and terns. At that place wild geese on their way northward were seen on the 7th May, the spring-sowing began on the 21st, and the first swallows were observed on the 22nd of that month. At Boden the spring-ploughing everywhere began on the 20th May, the swallow was observed on the 28th of that month, the bird-cherry was in bloom on the 6th June and the lilac on the 8th of that month.

The following report was received from Lövånger: In September the twinflower, the cornflower and the oxeye daisy bloomed for the second time, a thing that seldom happens in these parts. From Boden: »The potato crop abundant and everywhere terminated by the 24th September.«

SUMMARY OF THE METEOROLOGICAL ELEMENTS IN 1908.

	Jan.	Febr.	March	Apri
Average temp. C	— 7.3	— 8.4	— 6.9	+ 1
Maxim. temp.	+ 4.0	+ 3.5	+ 7.5	+ 11
Minim. temp.	— 28.0	— 24.5	— 29.0	— 10
Relative humidity %	87	86	87	76
Rainfall m/m	i 35.0	37.3	15.1	14
				Number
Rainfall ≦ 0.1 mm	14	17	7	5
Snow ≦ 0.1 mm	14	17	7	3
Mist	0	1	3	0
Ground covered with snow	31	29	31	26
Thunder	0	0	0	0
Clear sky	1	0	9	8
Partially overcast sky	12	10	8	1
Overcast sky	18	19	14	5
Frost	31	29	31	28
Wind (7 Beaufort and above) in Gulf of Bothnia	8	7	3	
				Number of w
Calm	44	37	42	2
N. wind	10.5	14	5	1
N E. „	0	3.5	5.5	
E. „	0	8	8	1
S. E. „	1.5	6	1.5	
S. „	14	10	18	1
S. W. „	5.5	4	5.5	
W. „	12	3	5	
N. W. „	5.5	1.5	2.5	

logical Elements in 1908.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 6.1	+ 11.4	+ 15.3	+ 14.3	+ 7.7	+ 4.3	— 7.5	— 5.3	+ 2.09
+ 26.0	+ 24.5	+ 26.0	+ 25.0	+ 18.5	+ 15.5	+ 7.0	+ 5.0	+ 26.0
— 8.0	+ 0.5	+ 4.5	+ 3.5	— 3.5	— 3.5	— 25.5	— 26.5	— 29.0
59	61	64	71	79	82	80	82	76
2.3	53.1	26.3	32.4	41.4	11.7	23.3	26.5	318.4
days with								
3	7	7	7	10	7	9	8	101
2	0	0	0	0	1	8	8	60
0	0	0	0	2	3	1	0	10
0	0	0	0	0	0	12	31	160
0	0	1	1	0	0	0	0	2
4	4	8	4	4	5	5	2	54
22	20	14	22	9	11	17	13	175
5	6	9	5	17	15	8	16	137
16	0	0	0	4	11	29	31	210
1	13	4	6	7	8	13	8	82
observations showing:								
26	0	2	4	8	25	33	38	288
12	22	10.5	14	18.5	14	21.5	7.5	161
2	4	6.5	9.5	8	1.5	0	4.5	50
9	9.5	12.5	15	7	2.5	0	1	84
2	3.5	5.5	8	1	1	0	0	35
10	22.5	28	16	13.5	7.5	6.5	14	175
2.5	10.5	15.5	5.5	7.5	14.5	9	9	92.5
18.5	14.5	7.5	7	16	20	14	15.5	140
11	3.5	5	14	10.5	7	6	3.5	72.5

2. Summary of the Mete

	Jan.	Febr.	March	Ap
Average temp. C	— 4.4	— 8.9	— 7.9	—
Maxim. temp.	+ 4.5	+ 6.0	+ 3.0	+
Minim. temp.	— 25.5	— 26.5	— 27.0	—
Relative humidity %	86	84	88	
Rainfall m/m	24.8	16.2	46.8	
				Numbe
Rainfall ≦ 0.1 m/m	11	5	16	
Snow ≦ 0.1 m/m	11	5	16	
Mist	0	2	4	
Ground covered with snow	31	28	31	
Thunder	0	0	0	
Clear sky	10	6	4	
Partially overcast sky	11	17	8	
Overcast sky	10	5	19	
Frost	31	28	31	
Wind (7 Beaufort and above) in Gulf of Bothnia	7	3	2	
				Number of
Calm	18	32	29	
N wind	3.5	7	18.5	
N. E. „	1.5	2	4.5	
E. „	2	2.5	16	
S. E. „	3	0.5	4.5	
S. „	11	11	14.5	
S. W. „	19.5	2.5	0	
W. „	29	14	5	
N. W. „	5.5	12.5	1	

logical Elements in 1909.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 3.2	+ 12.2	+ 15.0	+ 12.5	+ 8.8	+ 4.9	— 7.9	— 6.5	+ 1.47
+ 15.5	+ 24.0	+ 25.0	+ 20.0	+ 18.5	+ 13.5	+ 3.0	+ 6.5	+ 25.0
— 5.0	+ 2.5	+ 5.5	+ 5.5	± 0	— 5.6	— 21.5	— 18.0	— 26.5
65	60	71	75	79	86	84	84	79
7.8	10.2	63.6	95.0	56.8	72.8	67.7	40.1	525.8
days with								
3	7	12	12	10	18	11	15	127
2	0	0	0	1	2	10	15	69
0	0	0	2	5	1	0	0	16
12	0	0	0	0	2	26	31	191
0	0	1	1	0	0	0	0	2
5	5	5	2	6	1	5	1	57
22	19	18	15	17	16	14	17	181
4	6	8	14	7	14	11	13	127
27	0	0	0	0	10	29	28	214
5	1	4	6	3	11	13	11	67
observations showing:								
15	16	5	2	8	4	11	6	173
12.5	16.5	13	13.5	9	11	20	8.5	145.5
9	10.5	10.5	5.5	5	9	4.5	10.5	90.5
11	9	16.5	7	6	6	0	4.5	97
4.5	11	17.5	20	11	8.5	4	11	102.5
22.5	15	14	12	11	19.5	3	7.5	147.5
2	3.5	1	4	8	12	9	9	71.5
7	4	8.5	16	19.5	12	14.5	24	153.5
9.5	4.5	7	13	12.5	11	24	12	114

2. Summary of the Mete

	Jan.	Febr.	March	Ap
Average temp. C	— 8.1	— 3.1	— 3.8	+
Maxim. temp.	+ 3.5	+ 4.8	+ 10.0	+
Minim. temp.	— 26.5	— 19.0	— 15.5	—
Relative humidity %	87	91	88	8
Rainfall m/m	46.5	21.2	19.9	5
				Numbe
Rainfall $\leqq 0.1$ mm	15	8	5	
Snow $\leqq 0.1$ mm	15	8	5	
Mist	2	1	4	
Ground covered with snow	31	28	31	
Thunder	0	0	0	
Clear sky	6	3	6	
Partially overcast sky	10	9	13	
Overcast sky	15	16	12	
Frost	31	28	31	
Wind (7 Beaufort and above) in Gulf of Bothnia	5	8	1	
				Number of w
Calm	21	9	36	
N. wind	16	1.5	7.5	
N. E. „	2.5	3	8	
E. „	8.5	8	7.5	
S. E. „	10	16.5	4	
S. „	11.5	23	4.5	
S. W. „	4.5	11.5	3	
W. „	5.5	9	8.5	
N. W. „	13.5	2.5	14	

logical Elements in 1910.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 6.5	+ 11.8	+ 14.3	+ 12.1	+ 8.2	+ 1.4	— 4.2	— 8.9	+ 2.23
+ 20.0	+ 25.5	+ 23.0	+ 20.5	+ 17.0	+ 12.0	+ 4.0	+ 1.5	+ 25.5
— 0.5	+ 2.0	+ 6.5	+ 5.0	— 1.0	— 14.0	— 23.6	— 24.0	— 26.5
72	62	71	68	73	79	92	96	80
48.2	51.3	66.9	6.5	51.0	22.6	92.4	25.7	511.4
days with								
9	10	12	4	9	6	24	14	132
0	0	0	0	0	3	23	14	79
1	0	1	3	2	0	1	3	21
0	0	0	0	0	15	30	31	195
0	0	3	0	0	0	0	0	3
4	5	3	9	8	7	0	4	60
23	15	19	19	12	15	2	13	162
4	10	9	3	10	9	28	14	143
1	0	0	0	2	19	29	30	193
2	1	5	5	8	6	13	2	60
observations showing:								
3	3	6	8	12	13	18	38	181
15	11.5	32.5	12.5	15	12	22	12.5	179.5
9	4	6	14.5	5	5.5	9	6	81.5
23.5	18	14.5	18	2	3	12	2.5	123.5
9.5	11.5	14	8	7.5	2.5	10	0.5	101.5
12	14	7	8.5	11.5	8	14.5	5.5	132
6.5	2.5	3	7	15.5	15.5	1	2.5	78.5
6.5	10	4	6.5	11	12	1	13.5	91
8	15.5	6	10	10.5	21.5	2.5	12	126.5

	Jan.	Febr.	March	Apr
Average temp. C	— 8.1	— 9.2	— 4.6	+
Maxim. temp.	+ 5.5	+ 3.0	+ 8.0	+ 11
Minim. temp.	— 27.0	— 29.5	— 14.0	— 1
Relative humidity %	88	90	82	66
Rainfall m/m	13.1	17.0	12.2	22
				Numbe
Rainfall ≦ 0.1 mm	8	7	6	
Snow ≦ 0.1 mm	8	7	6	
Mist	1	1	4	
Ground covered with snow	31	28	31	3
Thunder	0	0	0	
Clear sky	11	6	11	
Partially overcast sky	15	11	12	1
Overcast sky	5	11	8	
Frost	31	28	31	2
Wind (7 Beaufort and above) in Gulf of Bothnia	6	11	2	
				Number of w
Calm	29	22	33	2
N. wind	7	13.5	10	
N. E. „	0.5	1	0.5	
E. „	2	1	2	
S. E. „	1	6.5	4.5	
S. „	13	20.5	8	
S. W. „	15	8.5	3.5	
W. „	12	5	15	
N. W. „	13.5	6	16.5	

logical Elements in 1911.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 6.7	+ 11.5	+ 14.3	+ 14.2	+ 8.7	+ 0.8	— 4.5	— 1.9	+ 2.33
+ 23.0	+ 27.5	+ 26.5	+ 32.0	+ 15.0	+ 13.0	+ 4.5	+ 2.5	+ 32.0
— 1.6	+ 0.5	+ 6.0	+ 4.5	+ 1.5	— 9.5	— 18.0	— 15.0	— 29.5
64	72	73	77	87	81	92	94	81
10.8	62.7	52.6	55.5	85.6	68.1	63.8	14.6	482.4
days with								
3	13	10	13	18	10	12	11	116
1	2	0	0	0	10	7	11	55
0	0	0	2	0	1	2	1	13
3	0	0	0	0	15	19	31	188
0	1	1	3	0	0	0	0	5
8	3	5	8	2	7	6	1	77
18	19	18	16	13	16	12	5	171
5	8	8	7	15	8	12	25	117
7	0	0	0	0	23	27	31	201
2	4	3	4	12	12	7	1	65
observations showing:								
19	8	14	21	16	26	26	29	263
9.5	16	17	17	14.5	17	14.5	1.5	146
8.5	8	2	1.5	3.5	2.5	4	1	40
9.5	10.5	5.5	11	6.5	0	0	4	57
15.5	9.5	5.5	4	9.5	3.5	6	7.5	76.5
14.5	19	13	15.5	29	5	12.5	24	181
3	3	4.5	2	3.5	12	11.5	13.5	84
4.5	7	15.5	5	5.5	9	6.5	7.5	111
9	9	16	16	2	18	9	5	136.5

2. Summary of the Meteorc

	Jan.	Febr.	March	April
Average temp. C	— 14.4	— 14.8	— 4.9	— 0.6
Maxim temp.	+ 2.0	+ 1.0	+ 6.5	+ 16.0
Minim. temp.	— 32.0	— 32.0	— 25.0	— 22.0
Relative humidity %	84	82	84	59
Rainfall m/m	16.6	16.9	42.5	4.1
				Number co
Rainfall ≦ 0.1 m/m	4	12	12	1
Snow ≦ 0.1 m/m	4	12	12	1
Mist	0	2	3	0
Ground covered with snow	31	29	31	24
Thunder	0	0	0	0
Clear sky	4	7	3	11
Partially overcast sky	22	12	9	15
Overcast sky	5	10	19	4
Frost	31	29	30	23
Wind (7 Beaufort and above) in Gulf of Bothnia	9	3	3	3
				Number of wir
Calm	50	50	29	11
N. wind	7	11.5	13.5	29.
N. E. „	3.5	6	13.5	5.
E. „	0.5	1	8	2.
S. E. „	2.5	1	8.5	4
S. „	11.5	8	18	4.
S. W. „	9	3.5	0	9.
W. „	2.5	2.5	1	10
N. W. „	6.5	3.5	1.5	13.

logical Elements in 1912.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 5.3	+ 13.1	+ 16.1	+ 13.8	+ 7.3	+ 0.8	— 4.6	— 7.4	+ 0.77
+ 15.5	+ 25.5	+ 27.0	+ 26.0	+ 16.0	+ 12.0	+ 4.0	+ 1.0	+ 27.0
— 4.5	+ 2.5	+ 7.0	+ 0.5	— 1.5	— 14.0	— 21.0	— 21.0	— 32.0
68	66	59	77	74	81	87	91	76
57.8	80.0	1.2	41.7	111.3	34.8	60.4	71.2	538.5
days with								
12	12	1	13	9	9	14	15	114
2	0	0	0	0	5	11	15	62
0	0	0	0	0	0	1	1	7
0	0	0	0	0	8	30	31	184
0	2	1	2	0	0	0	0	5
4	6	8	4	6	3	2	1	59
15	18	21	9	15	6	17	8	167
12	6	2	18	9	22	11	22	140
8	0	0	0	5	17	27	31	201
6	3	2	10	11	3	8	5	66
observations showing:								
15	7	12	7	14	21	19	32	267
20.5	11.5	8	17	23	19	14	10.5	185
10.5	9	5	14	3	3.5	1.5	2	77
25.5	17.5	7.5	32	8	5	7.5	5.5	120.5
7	13.5	11	7	2.5	12.5	4.5	11.5	85.5
7.5	17.5	25.5	10.5	8	15.5	13	11.5	151
1	2	5	1	6.5	5	13.5	2	58
2	3	10	1.5	11.5	7.5	9.5	6	67
4	9	9	3	13.5	4	7.5	12	87

2. *Summary of the Meteor*

	Jan.	Febr.	March	April
Average temp. C	— 13.0	— 7.1	— 4.5	+ 0.8
Maxim. temp.	+ 2.0	+ 5.0	+ 8.0	+ 12.4
Minim. temp.	— 30.0	— 21.0	— 29.0	— 14.0
Relative humidity %	87	82	74	75
Rainfall m/m	20.6	18.9	11	30.8
				Number
Rainfall ≦ 0.1 m/m	7	6	9	8
Snow ≦ 0.1 m/m	7	6	8	2
Mist	4	0	1	0
Ground covered with snow	31	28	31	27
Thunder	0	0	0	0
Clear sky	5	8	12	4
Partially overcast sky	14	10	13	15
Overcast sky	12	10	6	11
Frost	31	28	30	14
Wind (7 Beaufort and above) in Gulf of Bothnia	3	2	5	3
				Number of wi
Calm	59	35	26	19
N. wind	14.5	6	11	15
N. E. „	0.5	0.5	6	8
E. „	1	5	0.5	10
S. E. „	0	3	2.5	7
S. „	6	7.5	23.5	16
S. W. „	3	3.5	4.5	3
W. „	3.5	13.5	14	5
N. W. „	5.5	10	5	5

logical Elements in 1913.

May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
+ 6.3	+ 12.5	+ 16.7	+ 13.5	+ 8.7	+ 1.4	— 0.8	— 9.5	+ 2.1
+ 15.0	+ 25.0	+ 26.0	+ 22.0	+ 17.0	+ 13.5	+ 5.0	+ 5.0	+ 26.0
— 4.0	+ 2.0	+ 4.0	+ 6.0	— 3.0	— 11.5	— 11.0	— 24.0	— 30.0
63	64	65	75	77	81	92	83	77
16.9	21.6	28.0	63.7	42.9	40.5	64.0	32.3	391.2
days with								
7	8	8	12	10	10	19	8	112
0	0	0	0	0	4	11	8	46
1	0	0	0	2	4	3	0	15
0	0	0	0	0	10	24	31	182
1	0	1	0	0	0	0	0	2
8	9	6	8	11	5	0	8	84
16	16	20	18	12	16	11	13	174
7	5	5	5	7	10	19	10	107
7	0	0	0	5	23	24	31	193
1	5	0	8	6	8	8	9	58
observations showing:								
20	10	5	8	26	33	25	36	302
10.5	17	18.5	10	13	10	10	13.5	149.5
4	6.5	4.5	15	3.5	3.5	9	3.5	65
19	19.5	31	14.5	2.5	3.5	5.5	1.5	114
10	7	11	4.5	2	1	3	1	52
10.5	11	7.5	11.5	17	10	14	3.5	138
1.5	4.5	3	7	7.5	7.5	14	4.5	63.5
6	11.5	5.5	18.5	7.5	16.5	5	10	117
11.5	3	7	4	11	8	4.5	19.5	94

TABLE OF CONTENTS.

VALD. PEDERSENS BOGTRYKKERI
KØBENHAVN