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INVESTIGATIONS INTO TUBERCULOSIS AT ANGMAGSSALIK

BY

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WITH 12 FIGURES IN THE TEXT

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The investigations on which the present work is based were at Angmagssalik carried out during my appointment as acting district medical officer in 1948—1951, in the county of Viborg during my appointment as assistant physician to the Krabbesholm Sanatorium and the chest clinics of the counties of Viborg and Thisted.

The investigations at Angmagssalik were made in collaboration with my wife, Dr. Sara Helms (née Tønnesen), who during a previous stay at Angmagssalik had acquired a thorough knowledge of the whole population and mastered the language to such an extent that she could at once record all necessary anamneses.

All fluoroscopy was made by both of us simultaneously, tuberculin tests, sputum microscopy, and BCG vaccinations were made by us jointly.

The majority of the radiographs from Angmagssalik and all of those from the county of Viborg have been described by Chief Physician G. Bindslev, M.D., Krabbesholm Sanatorium.

The English translation has been done by Niels Haislund, M.A.

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LIST OF ABBREVIATIONS

Angmagssalik; when nothing else is stated, this denotes the whole District
e. n. = eryth. nod. = erythema nodosum
Hpt. = hemopt. = hemoptysis
Spt. = symptom
Pirq. = von Pirquet's reaction
t. p. = tub. pulm. = tuberculosis pulmonum
TB = tubercle bacilli
+++ TB = TB demonstrated by microscopy
++ TB = TB demonstrated by cultivation of sputum
— TB = negative microscopy of sputum
= TB = negative cultivation of sputum
≡ TB = negative cultivation of gastric lavage

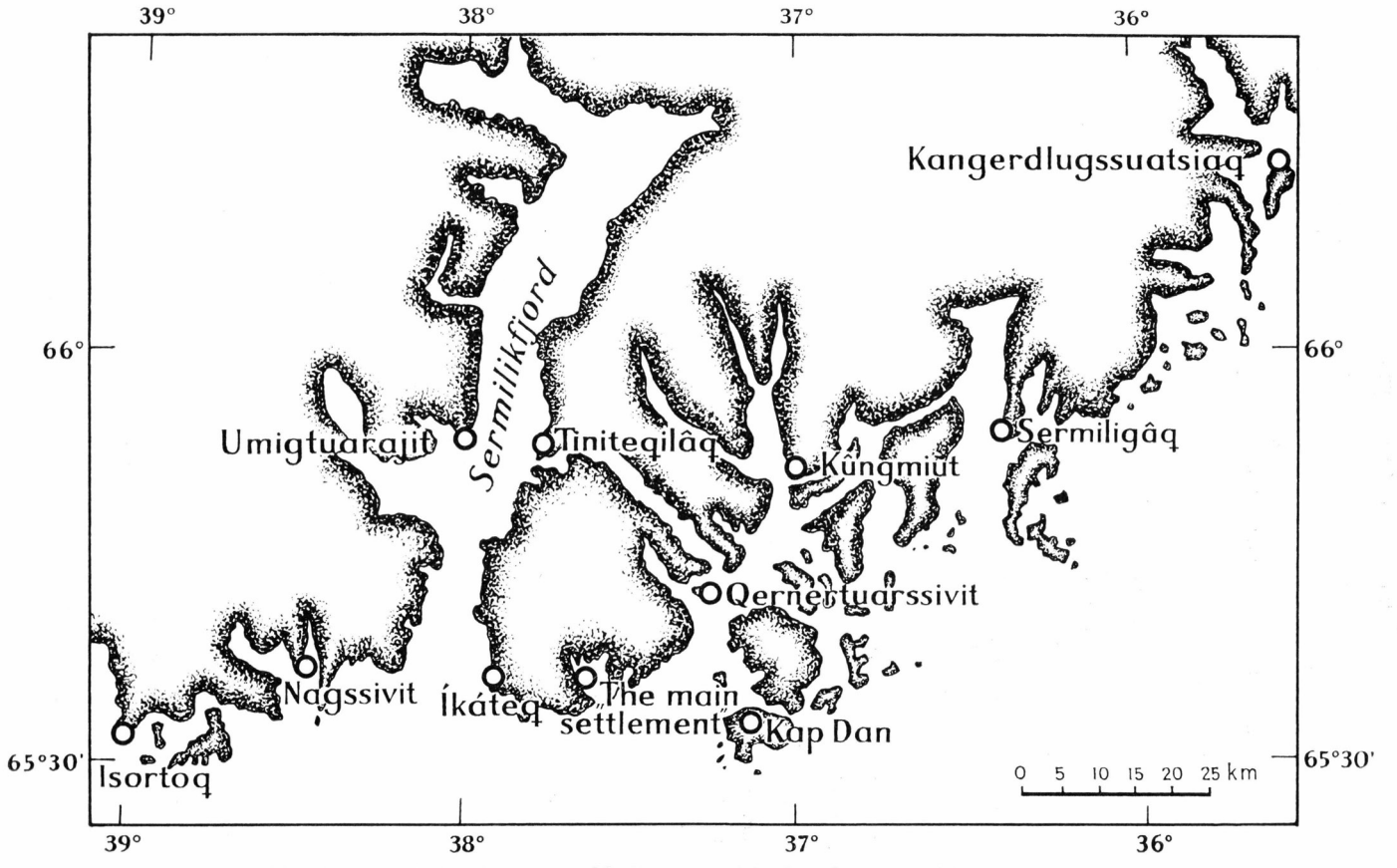

Fig. 1. Sketch map of the Angmagssalik District with the places inhabited in 1948—51.
Kolonistedet = the main settlement.

Part One. Tuberculosis in the Angmagssalik District.

I. THE ANGMAGSSALIK DISTRICT AND CONDITIONS OF DISEASE DOWN TO 1948

Topography. Climate.

The Angmagssalik District is situated on the east coast of Greenland and consists of a number of settlements on the coast of the mainland and on islands in an archipelago, grouped around a number of smaller and larger fjords debouching into the Denmark Strait. The Danish settlement (the main settlement) is situated on the largest island of the district, almost in the middle of the district, on long. 37°33′ W., lat. 65°36′ N. The places inhabited in 1948—1951 appear from the sketch map fig. 1.

The climate is subarctic with an annual average temperature of — 2.0° C., varying from — 10.4° C. in February to + 6.6° C. in July (Høygaard 1941, p. 7). The weather is very unsettled with sudden changes in all seasons.

The sea ice in winter forms an impenetrable zone and in summer drifts southwards along the coast, which for this reason during the greater part of the year only with great difficulty becomes accessible from outside. Furthermore, violent gales in the Denmark Strait are very frequent during the periods of late summer when the zone of ice is narrowest. These conditions have been of decisive importance for the natural isolation of the district right down to the present time, navigation from without being possible only by powerful engine-driven ships; sailing vessels of previous times who attempted to penetrate the barrier were unable to do so.

History.

According to Therkel Mathiasen's investigations (Mathiasen 1933, pp. 57—62) it seems substantiated that the population of the Angmagssalik District originate from the west coast of Greenland, from where in the 14th—15th century of our era they migrated by way of South Greenland along the east coast, which they then have inhabited

in scattered settlements between Cape Farewell and Kangerdlugssuaq (lat. 68° N.) (MIKKELSEN 1934, pp. 33—44).

The population can be divided into two groups: the southern and the northern East Greenlanders.

The southern East Greenlanders inhabited the coast between Cape Farewell and the region about Igdluluarssuq (lat. 63°40′ N.) and since the emigration from West Greenland have constantly kept in contact with the population of West Greenland through trading expeditions. The population was already known by Hans Egede (MIKKELSEN 1934, p. 34). The first Dane to visit East Greenland was Peder Olsen Walløe, who in 1752 travelled the southernmost settlements (STEENSTRUP 1889, p. 32). The next Danish expedition was that of W. A. Graah 1829—30 (GRAAH 1932). For the main purpose of finding remnants of a presumed Norsemen's settlement ("Østerbygden", 'the Eastern Settlement') he travelled the coast as far as the region south of the present Angmagssalik, which he did not reach; but he met with a native of Angmagssalik. According to Graah the population in southern East Greenland numbered 480 individuals. He stated that the population figure was said previously to have been considerably higher, but that it was constantly declining, partly because of starvation periods, partly because of emigration to West Greenland. The depopulation continued gradually afterwards, and in 1884 Gustav Holm's Expedition counted 135 inhabitants in the same tract (HANSEN 1888, p. 188). In the year 1900 the last southern East Greenlanders moved to West Greenland (MELDORF 1902, p. 23).

The northern East Greenlanders, the population that is chiefly settled round the Sermilik fjord in the Angmagssalik District, were first mentioned by Walløe (MIKKELSEN 1934, p. 36) in 1752.

The first accurate information about them originates from Gustav Holm's umiak expedition 1883—1885, which took the first Europeans to Angmagssalik. Johs. Petersen, the former factor, is the only surviving member of the expedition. After 10 months' stay and after thorough studies the expedition brought home a comprehensive and valuable material to illustrate the life and character of the tribe (HOLM and others 1888 and 1889).

In 1892 Ryder visited Angmagssalik (RYDER 1895), and in 1894 the Danish settlement was founded, which later has maintained regular communication with Denmark.

The purpose of the foundation of a Danish settlement at Angmagssalik was that of preserving the now only remaining East Greenland population in the place, of keeping it provided with supplies from without after the part of the coast farther south had been depopulated and the trading expeditions thus no more were possible, of introducing better hunting and sealing methods and keeping the population from

extermination, of directing the future development from the primitive stage to a level like that of West Greenland under necessary protection and gradual introduction of Christianity, and finally of securing the sovereignty of Denmark over East Greenland.

The development since 1894 has been studied and described by various people. The most important information about the history of the population is found in E. MIKKELSEN and P. P. SVEISTRUP, "The East Greenlanders' Possibilities of Existence, their Production and Consumption" (MIKKELSEN & SVEISTRUP 1944) and in "Grønlandskommissionens Betænkning" ('Report by the Greenland Commission'; 1950. Part 6).

Survey of the Development in the Angmagssalik District 1884—1950.

The aborigines of the Angmagssalik District in 1884 numbered 413 individuals of unmixed Eskimo race (HOLM 1888, pp. 17—82. — THALBITZER 1914, — THALBITZER 1941. — MIKKELSEN 1934. — MATHIASEN 1933. — MIKKELSEN & SVEISTRUP 1944).

The basis of the existence of the population was the catching of marine mammals, mainly seals, which besides food supplied all necessary garments, fuel for cooking, heating, and lighting, occupational implements, especially covers for umiaks and kayaks, material for skin tents, and other articles for everyday use.

The culture was a primitive, but highly specialized Eskimo culture. The community consisted of small, completely self-supporting units consisting of one or a few families, who in winter lived in one-roomed common houses situated in immediate proximity of the sea or the fjord, built of turf and stones over a framework of driftwood and roofed with skins. Each settlement in 1884 on an average had 32 inhabitants, who in winter lived in a common house, within which they to a wide extent shared the catch of animals. Each family had its own blubber lamp, and the houses were so warm that the inmates went about naked indoors. The space in the houses — in proportion to the number of inmates — was scanty; the inmates slept closely huddled together on plank beds common to them. There was little cleanliness and the domestic utensils were used by the inmates and possible visitors together.

From April to September the population lived in skin tents, which each of them would hold one family, on an average 10 people to one tent. In umiaks they went from place to place, in search of good catches. In summer there was contact between all the inhabitants of the district.

The inhabitants were not attached to any definite settlement. Generally they lived at most for two winters in the same place, and

then they built new houses where they advanced, generally within the area of the present district, but often far from it, between Umîvik in the south (lat. 64° N.) and Kangerdlugssuaq (lat. 68° N.) in the north. Beyond these limits trading expeditions were made to regions farther south (Tingmiarmiut, lat. 62° N.), where skins from Angmagssalik were bartered for commodities from West Greenland, with which there was thus indirect contact. Journeys as far as West Greenland were extremely rare.

The population figure of the Angmagssalik District is supposed to have been about 500 down to the middle of the 19th century, when it began decreasing because of reduction of the catching of seals due to European sealers' ruthless exploitation in the waters off East Greenland, which especially affected the big migratory seals, which during the months of summer passed Angmagssalik and which were of very great importance for the production of preserved food to secure nourishment during the months of winter, when the occurrence of the local seals often fails. During unfortunate conditions of weather and ice the catch in winter was always insufficient, and periodically starvation was general. Particularly unfortunate circumstances set in during the winters of 1881 and 1883, when between 53 and 70 people starved to death. This left its mark on the composition of the population in 1884, as appears from Table 1, which shows the abnormally low representation of the youngest age-classes as compared with simultaneous conditions in the more southerly East Greenland, where the starvation had not been so pronounced.

After the starvation periods the population figure in 1884 was reduced to 413, and it is justifiable to assume that the population at that time had the choice of two possibilities: emigration to West Greenland or spreading over a larger area, if their number was not to continue being reduced by staying in the place. — In 1894 an appreciable emigration towards West Greenland had already started, about one third of the population already travelling towards this goal. After the foundation of the Danish settlement many of the emigrants returned, and in 1900 the population figure was again about 400.

On the basis of Ryder's counts in 1892 it can be calculated that the birth rate since 1884 had been on an average 29 per thousand a year, the death rate 33 per thousand. The high death rate may be explained by the fact that there had been many kayak accidents, some cases of suicide, and five murders. There had been no starvation.

The Danish colonization conditioned storage of food to meet periods of starvation, firearms were introduced, the possibilities of existence of the population thus being increased so much that solely on the basis of the improving hunting technique, it could begin increasing. Till the

population in 1915 had increased to a number of about 600 individuals, they could in reality manage on their original basis of existence. Since then the population has constantly increased, but now on the basis of increasing imports of European provisions and on the basis of fishing, which has developed gradually since 1915, when cod for the first time appeared in the fjords. Since then fishing has become of increasing importance for the nourishment.

The catching of big seals has been decreasing during the whole period of colonization, while the catching of small (local) seals has been increasing till in 1938 it reached a number of 6,000 seals annually, a number which has not since then been increased, but which keeps rather constant from year to year.

It can be calculated that the district in 1950 still held possibilities of providing food on the original basis for about 500 people (45 per cent.

Table 1.

Distribution of the population according to age-classes at Angmagssalik in 1884 and 1950 and distribution for the southern east coast of Greenland and for Denmark 1945. (Figures for Denmark originating from the Medicinalberetningen for 1950, p. 15; figures for East Greenland from JOHANNES HANSEN 1888, p. 183).

Age	1884 SE Coast		1884 Angmagssalik		1950 Angmagssalik		1945 Denmark	
	Number	Percentage	Number	Percentage	Number	Pencentage	Number	Percentage
0— 4....	20	16 %	34	8 %	207	18 %	387900	9.6 %
5— 9....	21	17 %	60	15 %	192	17 %	315224	7.8 %
10—14....	16	13 %	73	18 %	169	15 %	294948	7.3 %
15—19....	10	8 %	29	7 %	130	11 %	303021	7.5 %
20—24....	7	6 %	37	9 %	121	10 %	326539	8.1 %
25—29....	10	8 %	38	9 %	72	7 %	316532	7.9 %
30—34....	15	12 %	38	9 %	66	6 %	323392	8.0 %
35—39....	12	10 %	43	10 %	60	5 %	311911	7.8 %
40—44....	7	5 %	19	5 %	35	3 %	283990	7.0 %
45—49....	5	4 %	13	3 %	42	4 %	257226	6.3 %
50—54....	1	1 %	12	3 %	21	2 %	222357	5.5 %
55—59....	0	0 %	9	2 %	9	0,8 %	195200	4.8 %
60—64....	..	..	4	1 %	8	0.5 %	168390	4.1 %
65—69....	..	..	3	1 %	8	0.5 %	137395	3.4 %
70—74....	..	..	0	0 %	2	0.2 %	96127	2.4 %
75—79....	..	..	..	..	0	0 %	60633	1.5 %
80—84....	..	..	..	..	..	..	29950	0.7 %
85 and more	..	..	..	..	..	..	14497	0.3 %
In all...	124	100 %	412	100 %	1142	100 %	4045232	100.0 %

of the population), while the rest must be fed partly by fish (corresponding to the consumption of calories for about 20 per cent. of the population) and by imported provisions (about 35 per cent. of the calorie requirement of the population).

As the occupation of the population in the present time cannot produce "currency" for the purchase of the necessary articles of food, the district must be said to be overpopulated. Through its own production of food it only offers a basis of feeding about two thirds of the population, and the productivity is low in proportion to the necessary expenditure of the population in other spheres. If we included the expenditure for the working of the school, the church, and the health services, we should arrive at a very low figure for the productivity of the population.

The administration tries to increase the productivity by introduction of new economic possibilities, especially shark fishing, but the population still have only a poor sense or understanding of the necessity of increased production, for which reason the Greenland Commission in 1950, indeed, decided to pursue a policy of protection and monopolistic trade at Angmagssalik with payment of the increasing deficit in the hope that the population will develop in the right direction. The transition from the original primitive economy to a future money economy is still at its first stage.

From 1900 to 1950 the population figure has increased from 411 to 1489, thus having been more than trebled in 50 years. In 1925 85 people were transferred from Angmagssalik to Scoresbysund, where 269 people lived in 1950. In 1938 some families were transferred to Skjoldungen, where there were about 80 inhabitants in 1950. In the Angmagssalik District proper the population in 1950 numbered 1142 persons.

The average annual birth-rate in the Angmagssalik District during the period 1911—36 was 50 per thousand, in 1937—1950 45 per thousand.

The average annual birth-rate correspondingly for the period 1911—36 was 26 per thousand, for the period 1937—50 20 per thousand.

The excess of births thus for the whole period after 1911 was about 25 per thousand annually.

The colonization — especially through the introduction of Christianity — has had the effect on the causes of death that cases of "violent death" have decreased very appreciably; there are now no more murders, mercy killings of sick or weakly persons, or killings of unwanted infants. The number of suicides which was not small before the colonization has also decreased appreciably. Furthermore, the number of kayak accidents is decreasing, as the sealers or fishermen are not now obliged to set out in all kinds of weather, and as the modern hunting and fishing methods make the work less dangerous.

The colonization has in many ways changed the mode of life of the population. The nomadic life has completely ceased; only in summer the people still travel somewhat. Building more and more concentrates on fixed and larger settlement, in which each family has its own house. The houses therefore are smaller than before, but otherwise they are built of the same material as previously, being turf-built houses with plank-beds common to all the inmates. The houses are still heated by blubber lamps, but they are colder than previously, and nobody now moves about undressed indoors.

The concentration of the population in comparatively large places is very unfortunate for sealing, but necessary for the development of fishing. The concentration has especially arisen because of the better possibilities of attending church and school obtained in this way, and because of possibilities of setting up shops. The development, which it was tried to counteract during the first year of the colonization, can no more be checked.

Finally it may be mentioned that the population of the Angmagssalik District is still very pure-blooded, below 2 per cent. being of mixed breed. On the whole the physical development of the population is good.

Survey of Conditions of Disease in East Greenland Down to 1936.

The earliest information about conditions of disease in East Greenland originates from W. A. Graah (GRAAH 1932, p. 136), who travelled the coast as far as immediately south of Angmagssalik in 1829—30. Graah writes: "the commonest complaints are weakness of the eyes, consumption, and the stitch . . . The stitch is the most dangerous disease; it frequently prevails in spring and autumn and snatches away many people, children as well as adults. It is without doubt a contagious disease due to a common cold, of which they would perhaps in part be relieved if in the autumn they took care to have their winter habitations ready before the weather sets in with snow and cold, and if they did not so early in spring move into tents . . . A kind of white rash, resembling the leprosy of the inhabitants of the Norwegian coast, which is also rather common on the west side of Greenland, is unknown to the Eastlanders . . . nor do they know of any kind of fever, which even among the Europeans in Greenland is of extremely rare occurence. . . ."

In 1859 Dr. Prosch, District Medical Officer of South Greenland, reported having treated a recently arrived East Greenlander, who consulted him for hemoptysis. The patient "had a phthisic habitus" (MELDORF 1904, p. 287).

Gustav Holm writes about the population of Angmagssalik: "The most frequent diseases are diseases due to a cold, eye diseases, skin diseases, and fever and stitch in the chest" (HOLM 1888, p. 104). He mentions one death from consumption (HOLM 1888, p. 108) and a family that "was consumptive" and one of the members of which spat blood (HOLM 1888, p. 118).

Johan Petersen, former factor, who accompanied Gustav Holm to Angmagssalik in 1884—85 (HOLM & GARDE 1889, p. 61), and who from 1894—1925 was factor at Angmagssalik, where — after taking a course in Copenhagen — he also was in charge of the health services, has stated that the East Greenlanders already before Gustav Holm's expedition knew hemoptyses and that it is his definite view that tuberculosis occurred at Angmagssalik before 1884 (personal communication 1952). Johan Petersen furthermore stated that a woman had died between 1884 and 1894 from violent hemoptysis after spitting blood for many years.

Between 1884 and 1894 the Angmagssalik people made several journeys to South Greenland. Many of them during these journeys died from starvation or diseases due to a cold, and influenza (MELDORF 1907, p. 169).

According to Johan Petersen none of the members of the umiak expedition suffered from diagnosed tuberculosis.

In 1894 O. Helms wrote: "Tuberculosis is very widely distributed among the population; it is found on the west coast . . . as well as on the east coast . . . Most frequently it occurs as pulmonary tuberculosis. Captain Gustav Holm, the well-known Greenland explorer, has informed me that on the east coast, at Angmagssalik, in a tribe of Greenlanders who previously had never been in contact with Europeans, he saw two cases who displayed completely the same symptoms as the pulmonary tuberculosis found among the Greenlanders on the west coast . . ." (HELMS 1894, p. 266).

K. Poulsen, the first physician to visit Angmagssalik, who wintered there in 1898—99, writes about lung diseases: ". . . Bronchitis as well acute as more chronic is a rather general illness both in children and grown-up people. If pulmonary inflammation in the form of our croupous pneumonia is found I don't know. Phthisis certainly appears. It have seen myself a female patient offering at any rate clinically undoubted signs of this illness, and according to what has been told to me, pulmonary suffering with hemoptysis, lingering cough, expectoration and emaciation is not rare. But its course seems to be milder than our phthisis generally is. It happens for instance that the Greenlanders the day after such a hemopthysis unpunished go to their kayaks, and the illness is said to pass often and relatively quickly into recovery. The patient I

saw, having clinically a rather extensive phthisis, had walked some miles in deep snow, having hemoptysis while walking, and returned the next day the same way. Half a year afterwards I heard that she had recovered. The illness having a fatal issue is not at all rare. I had unfortunately no opportunity of examining the expectoration microscopically. It might be interesting to see if the illness is really due to the same substance of infection as phthisis" (POULSEN 1909, pp. 148—49).

In 1900 Meldorf examined 37 East Greenlanders immediately after their arrival in Southwest Greenland. From the examination he concludes "on the basis of the stethoscopic findings and statements as to the frequency of the hemoptyses . . . that pulmonary tuberculosis is found on the east coast just as well as on the west coast of Greenland, indeed, that this disease is rather widely distributed among the East Greenlanders." There is little or no doubt that three of those examined "suffer from consumption." Five of those examined — all of them women — had had hemoptyses (MELDORF 1902, p. 30). None of those examined originated from the Angmagssalik District, but as there had been contact between the population of Angmagssalik and those examined — directly or indirectly — it may be assumed that conditions in the two places were fairly uniform.

In 1904 Angmagssalik was visited by Dr. Krabbe, from whom the following information originates: "The state of health has been less satisfactory because of diseases due to a cold, particularly in springtime" (Medicinalberetningen for 1905, p. 263). In 1906 Dr. Krabbe again visited Angmagssalik. "The doctor arrived . . . on September 1st and stayed there for 5 days. The state of health seemed good and seemed to have remained good since the same doctor's visit in 1904. The doctor succeeded in observing about 150 Eastlanders and visited the Greenland dwellings situated near the station. His impression of the economic and hygienic conditions of the population was good, as in 1904 . . . 16 patients consulted him; of these only one suffered from pulmonary phthisis . . ." (Medical Report for 1906, p. 269).

After that no physician visited Angmagssalik until 1927.

It appears from the annual information in the Medical Reports that there was an epidemic of whooping cough in 1915. — In 1918 the state of health is said to have been less good. There had been several cases of virulent pneumonia, various skin diseases and inflammations, which caused several deaths; ". . . furthermore tuberculosis appears to be more widely distributed than previously assumed, about one sixth of the population suffering from it." (Medical Report for 1918, p. 271). There is no further information in support of such an assertion, and during the following years, until 1925, it is only stated that the state of health is good, often very good.

In 1925 there was an epidemic with many deaths.

In 1927 Dr. Bentzen visited Angmagssalik from Aug. 5th to Aug. 8th. Of the 400 Greenlanders who had gathered at the main settlement, 55 were examined and questioned with special reference to tuberculous diseases; . . . "Of these, 18 stated having spat blood at a previous time in their life, and 3 of these were stated to have had at any rate one serious hemoptysis (about one cupful of blood or more). 7 of them by outward signs — scrofulous cicatrices, spondylitis, scars from cold abscesses or by their habitus appeared to have been attacked by tuberculosis. — In 13 of those examined, stethoscopical findings were suggestive of pulmonary tuberculosis; however, none of them suffered from any widespread or active complaint. No less than 34 out of the 555 patients mentioned presumed deaths after hemoptysis among the next of kin." — "I tried to get sputum for bacteriological examination, but did not succeed in getting any usable material. The reason why hemoptysis is mentioned so frequently is probably that it is such a conspicuous symptom, but as on the west coast it is probably doubtful whether all the many — often small — hemoptyses can be interpreted as sure signs of tuberculosis. In spite of the fact that thus there was no small number of signs of tuberculosis, I did not in any of those examined find any widespread active tuberculosis." — There were no cases of acute disease during Bentzen's stay, but ". . . indeed, — as is known on the west coast — slight epidemics of cold are every year carried to Angmagssalik by the ship, epidemics which no doubt play a part in animating the existing tuberculosis," which in Bentzen's opinion "is found at Angmagssalik in nearly the same proportion as and with a manifestation similar to that on the west coast." — Bentzen described the epidemic in 1925 as being poliomyelitis, 26 cases being fatal. There were still patients with paralyses, three of whom were seen by Bentzen (Sundhedsstyrelsens Årsberetning for 1927, p. 74).

In the same year (1927) Dr. Børresen visited Scoresbysund, to which 85 Greenlanders from Angmagssalik had been transferred in 1925. 80 of these were examined, and 4 typical cases of tuberculosis were found: 1 man and 3 women. Børresen found no tubercle bacilli in the sputum from those attacked. He concluded "that tuberculosis is found on the east coast and presumably even is rather widely distributed" (BØRRESEN 1931, p. 370).

It appears from the Medical Report for 1927 (p. 189) that Børresen found a total of 8 cases of tuberculosis at Scoresbysund (4 men and 4 women) and that the von Pirquet test showed positive reaction in 4 out of all children below 14 years of age. — In this connexion it may be stated that Johan Petersen, who continued his work as factor at Scoresbysund from 1925, reported that there were two cases of pul-

monary tuberculosis in one of the families that had moved to the place from West Greenland; furthermore, he maintains that one of the women from Angmagssalik suffered from pulmonary tuberculosis on her arrival in 1925, but that she survived for several years.

The Medical Report for 1928 (p. 165) mentions an epidemic of coryza at Angmagssalik in the month of August, during which 13 people died.

In 1929 and 1930 nothing in particular was reported about diseases at Angmagssalik.

In 1931 A. Bethelsen, Medical Adviser to the Department, visited Scoresbysund and Angmagssalik. He reports: "During my short stay at Scoresbysund I met with three patients with indubitable clinical signs of pulmonary tuberculosis"—"At Angmagssalik I saw some patients suffering from pulmonary tuberculosis and, partly by personal inspection, partly through communications from others, obtained information about 8 patients in all with active bone tuberculosis and joint tuberculosis or after-effects of it (4 cases of spondylitis, 3 cases of coxitis, and 1 case of arthritis cub. tub.)" (BERTHELSEN 1940, p. 65).

In 1932—33 the French physicians Le Mehaute and Tcherniakofsky stayed for 13 months at Scoresbysund, where, amongst other things, they investigated the occurrence of lung diseases by X-ray examinations of the whole population and by systematic examinations of sputum. They found diseases due to a cold to be frequent, but during their stay there were no complicated cases.

They describe a frequently occurring pulmonary disease which clinically resembles tuberculosis, but deviates from it by its much milder course and by longevity of the patients; hemoptyses are frequent, but not serious. The disease preferably attacked women, of whom nearly all adults were or had been attacked by it. If so, X-ray examinations nearly always showed hilar lymph-node changes, with or without irradiation to the lung tissue. Apices long remained unaffected; they were first affected terminally, and then with cloudy infiltrations. At the examinations of sputum tubercle bacilli were not demonstrated in any case.

About 40 smears of sputum after their return to Paris were examined microscopically by French specialists, who could neither find tubercle bacilli nor any cytological probability that the sputum originated from tuberculous patients. But in all cases they found filaments of *Oidium lactis* and actinomycosis-like fungous elements.

Le Mehaute and Tcherniakofsky discuss the problem whether the disease should be conceived as a mycosis and not as tuberculosis, but do not arrive at a final decision (LE MEHAUTE & TCHERNIAKOFSKY 1934, p. 491. TCHERNIA 1944, p. 50).

In 1934—35 the French physician Gessain stayed at Angmagssalik, where he examined 644 Greenlanders (TCHERNIA 1944, p. 53). He brought with him an X-ray equipment for lung examinations and examined a number of persons. Unfortunately he has not published the results of his investigations, but in answer to a personal inquiry he stated in 1952 that among 106 subjected to the von Pirquet test he found 9 reactors, that by X-ray examinations he found pictures of pulmonary sclerosis resembling tuberculosis ("image de sclérose pulmonaire semblables à celles vue des les cas de tuberculose") in an unspecified number of cases. He found no pulmonary calcifications ("calcifications pulmonaire: rien de net. En particulier pas d'image nette de chancre d'inoculation"). Gessain states that he has seen cases of hemoptysis recovering in some days and obviously without any fever. He has not seen Greenlanders coughing and spitting in the same way as tuberculous patients in Europe (GESSAIN, personal communication Oct. 27, 52).

During the years 1935—36 the Angmagssalik District was ravaged by a violent influenza epidemic of the same character as the epidemics in West Greenland 1934—36 (BERTHELSEN 1934, pp. 29—33). The epidemic caused 69 deaths in all among a population of 850 persons, particularly adults (Medicinalberetning for 1935, p. 235; Medicinalberetning for 1936, p. 245). The epidemic was mentioned by Høygaard (1939, p. 246).

The Medical Report for 1936 states about tuberculosis that at Angmagssalik there is a distribution corresponding to 6—7 per cent. of the population (Medicinalberetning for 1936, p. 215), without further particulars as to the basis of such a calculation.

This summary of the available information about conditions of disease in East Greenland down to 1936 shows that it is probable that tuberculosis occurred within the aboriginal population and that it has occurred ever since.

At excavations of settlements from before the colonization period, no skeletal remains with tuberculous changes have been found at Angmagssalik (BALSLEV JØRGENSEN 1953, p. 159; BALSLEV JØRGENSEN, personal communication Jan. 20, 1953), which could prove the "pre-existence" of tuberculosis.

Skeletal remains with tuberculous changes have been found at the Norse settlement Herjulfsnæs in Southwest Greenland (HANSEN 1924, p. 300). These remains originate from the 14th cent. (NØRLUND 1924, p. 252), thus from the very epoch in which the later East Greenlanders are supposed to have passed Southwest Greenland on their way towards the east (MATHIASEN 1933, pp. 60—61 and 145).

Later the population had direct and indirect contact with the population of West Greenland, at any rate in the 19th cent., when

it can be taken for granted that tuberculosis was found in West Greenland.

As to the clinical observations at Angmagssalik during the period after the colonization as late as 1936, it must be said that these are too scattered and defectively substantiated to be taken as final proofs that the observed diseases with tuberculous symptoms were actually tuberculosis.

It must be assumed that tuberculosis existed in the Angmagssalik district before the colonization, as there is a historical possibility that the population may have carried the disease with them from the very beginning, as there are sure channels for the dissemination of tuberculosis from West Greenland as long as the disease has been known there, and as there is a clinical probability of its existence in 1884 and later.

As to the tuberculosis morbidity it is impossible to form any estimate, both as regards the period before the colonization and the period from the colonization to 1936.

Tuberculosis in the Angmagssalik District 1936—1937.

From August 1936 to September 1937 a Norwegian medical expedition under the leadership of Arne Høygaard worked in the Angmagssalik District, investigating the nutrition, physical development, and conditions of disease within the population.

The only special equipment for investigations into conditions of tuberculosis which was available to the expedition, was tuberculin for von Pirquet tests (Tuberculin Behring). Such tests were made from the autumn of 1936 to the summer of 1937, when 563 individuals had been tested (70 per cent. of the total population, 82 per cent. of the population living within reach) (Høygaard 1938, p. 1648).

At the von Pirquet tests an average of 20 per cent. positives for the whole district and all ages was found. The percentage varied in the various parts of the district; it was highest at the main settlement (49 per cent. positive), lowest at the western settlements (4 per cent. positive). 40 per cent. of the men and 23 per cent. of the women examined reacted positively, while children below 13 had an average frequency of reaction of 9 per cent. (Høygaard 1938, p. 1651).

X-ray and bacteriological examinations were not made.

Høygaard found some cases of illness which by their clinic were considered "sure cases of tuberculosis". By "household examinations" he found in the environment of these cases a positive von Pirquet reaction in 65 per cent.

In houses in which "doubtful cases of tuberculosis" occurred, he found among the housemates 24 per cent. positive reactors, while among the inmates of houses without known cases of tuberculoses he found 5 per cent. reactors (HØYGAARD 1938, p. 1652).

In the autumn of 1936 Høygaard found 16 patients with clinical or anamnestic symptoms indicative of tuberculosis ("benign pulmonary tuberculosis"). All these reacted positively to tuberculin.

6 of these lived at the main settlement ("Handelspladsen"). In 4 there had been mild symptoms since the winter of 1934 or 1935, while 2 had not in recent years shown any symptoms.

In Januar 1937 there was an aggravation of the state of 5 of these 6, which developed into a progressive tuberculous disease of which 1 patient died in February 1937 with symptoms of meningitis, and 2 died in the autumn of 1937 after pulmonary symptoms.

In the environment of the patients with progressive tuberculosis at the main settlement 17 fresh cases of tuberculosis arose in previously negative persons during the months of January—May 1937. 9 of these were introduced by erythema nodosum, 8 developed symptoms of pleurisy (5 with exudates). 3 of the freshly infected patients died with symptoms of miliary tuberculosis with widespread glandular affections.

Outside the main settlement Høygaard in 1936 found 10 cases with symptoms of actual or healed tuberculosis in a mild form. In the spring of 1937 there were 5 fresh cases outside the main settlement, one of them fatal, but it was characteristic that the cases at the main settlement were much more violent than those in the rest of the district.

Høygaard is of opinion that this sudden local outbreak of tuberculosis at the main settlement may be explained as a consequence of a qualitatively poorer nutrition, which was particularly prominent in the winter of 1936—37, when the main settlement had very poor supplies of Greenland provisions and mainly was referred to nourishment by carbohydrates.

In 6 of the cases mentioned by Høygaard TB were demonstrated in the sputum in 1938. During the years after 1937 12 of the patients mentioned by Høygaard died of tuberculosis (see Table 4, p. 28), and of the others 11 in 1951 showed radiographic changes of the lungs indicative of previous tuberculous processes. Table 2 is a survey of the later fate of the patients described by Høygaard.

The table illustrates the distinct difference between the development at the main settlement and that in the rest of the district. While in 1937 23 cases of tuberculosis were known among the population of the main settlement, which numbers 106 individuals, only 15 cases were known from the rest of the district with 581 individuals. This may in

Table 2.

Survey of Høygaard's investigations into conditions of tuberculosis in the Angmagssalik District 1936—37. Follow-up examinations of the cases described by Høygaard.

	Høygaards' investigations					Follow-up examinations				
	Population figure 1936	Cases known 1936	Fresh cases 1937	In all in 1937	Died of tub. 9/37	Survivors in 9/37	Of these died of tub.	Died from other causes	Survivors in 1951 with radiographic changes	Survivors in 1951 without radiographic changes
The main settlement	106	6	17	23	5	18	10	0	6	2
The district	581	10	5	15	1	14	2	2	5	5
In all.....	687	16	22	38	6	32	12	2	11	7

part be due to the fact that the population at the main settlement was better examined, but later investigations show that the difference was and still is there.

Tuberculosis at Angmagssalik 1937—1939.

In the summer of 1938 the Greenland Department sent out Dr. Vibeke Fabricius Hansen to Angmagssalik, where she stayed for two months and examined about 90 per cent. of the accessible part of the population.

Unfortunately her report to the Department has been lost, but it was used by Berthelsen (1940, pp. 66—69) and by Ammundsen (1941, p. 483). Furthermore, Dr. Fabricius Hansen has kindly submitted to me some memoranda of certain clinical observations concerning her investigations into tuberculosis in the Angmagssalik District during her stay there in the summer of 1938.

Dr. Fabricius Hansen examined 622 persons (Berthelsen 1940, p. 67) with Mantoux tests with tuberculin 1—100 units (Ammundsen 1941, pp. 484 and 486). According to Berthelsen's statements the positive reactions were distributed as appears from Table 3.

Table 3.

Berthelsen's statements of tuberculin positivity in the Angmagssalik District in 1938 according to Fabricius Hansen's Mantoux tests.

Age	0—5	5—15	15—30	Above 30	All ages
Examined.....	79	219	193	151	622
Mantoux positive	38 %	53 %	60 %	68 %	56 % = 350 persons

It appears from Dr. Fabricius Hansen's memoranda that she examined sputum from about 45 persons with clinical symptoms and found TB in 7 (Table 4, p. 28, No. 10, No. 11, No. 12, No. 14, No. 16, No. 19, and No. 22).

This is the first time TB have been demonstrated in the Angmagssalik District.

Dr. Esther Ammundsen states that Dr. Fabricius Hansen found 25 "fresh infections", 12 of them with eythema nodosum, 10 with pleurisy, and 3 with adenitis febrilis. Furthermore, 93 were stated to have been found to be without symptoms (convertors) (AMMUNDSEN 1941, Table 1, p. 485), in all 118 "infected" since 1937.

In the summer of 1939 Esther Ammundsen stayed in the Angmagssalik District. She examined 550, or 80 per cent. of the population within reach (1941, p. 483), mainly stressing clinical examinations. By examinations of sputum she found TB in two besides those known in 1938 (Table 4, p. 28, No. 15 and No. 17). She found 11 "fresh infections" from after 1938, 4 of them with erythema nodosum, 6 with pleurisy, and 1 with pulmonary tuberculosis.

She examined part of the population with von Pirquet tests, but does not state how many, nor how many of those examined reacted positively. She calculated that in the Angmagssalik District there were in 1939 about 250 "infected" persons (i. e. tuberculin positive), which corresponds to Høygaard's 112 von Pirquet positives (HØYGAARD, p. 1652) + Fabricius Hansen's 118 "fresh infections". Hence she calculates the tuberculin positivity in 1938—39 at $\frac{250}{700} \times 100 =$ about 35 per cent.

It is difficult to decide what value should be assumed for the tuberculin positivity in the Angmagssalik District in 1938—39. Berthelsen's figures for tuberculin positivity stated on the basis of Fabricius Hansen's examinations with the Mantoux test seem to be too high, at any rate as regards the lowest age-classes, who are stated to be tuberculin positive in 38 per cent. of the cases below 5 years. At the examinations with Moro tests in 1949—50 (see p. 41) the average positivity in the age-classes below 5 years was 15 per cent., at the main settlement 17 per cent.

Because of the district population's often short stays at the main settlement, where Fabricius Hansen mainly was working, it was not possible for her in all cases to read the reactions personally, which may have given rise to misreadings.

Dr. Ammundsen states that one fourth of those examined did not react to Dr. Fabricius Hansen's tests until 1 mg tuberculin was ad-

ministered (AMMUNDSEN 1941, p. 486). Such reactions may have been unspecific and at any rate are not direct comparable to von Pirquet tests or Mantoux tests with up to 10 units (or Moro tests, respectively). If this fourth is deducted from Fabricius Hansen's 350 tuberculin positives, (table 3), we get about 250 tuberculin posisives, a figure which corresponds to 35 per cent. of the population examined.

As an increase in the tuberculin positivity in one year (1937—38) from 20 to 56 per cent. would correspond to an enormous dissemination (an annual frequency of infection per year of about 50 per cent. in the whole district), and as there does not seem to be any clinical basis on which to explain such a violent dissemination, it must be assumed that a value corresponding to 35 per cent. von Pirquet positives in 1938—39 is the most probable.

Tuberculosis at Angmagssalik 1939—1948.

Our knowledge of the occurrence and distribution of tuberculosis during the period of 1938—48 is mainly due to Miss Signe Vest, the trained nurse, who has held an appointment at Angmagssalik since 1933.

She assisted Gessain in 1934, Høygaard in 1936—37, Fabricius Hansen in 1938, and Esther Ammundsen in 1939 in their investigations into tuberculosis, and at a course at Statens Seruminstitut in Copenhagen in 1939 she learnt to examine samples of sputum for TB.

She has taken a lively interest in the problems of tuberculosis in the district. She has partly carried through von Pirquet tests in the various parts of the district, partly—by means of stethoscopy, examinations of sputum, and tests for erythrocyte sedimentation rate—checked persons whom she held under observation for tuberculosis, partly checked bacillary patients by repeated examinations of sputum. Furthermore she has endeavoured to communicate the fundamental hygienic principles to the population and tried to achieve isolation of patients, those demonstrated to be bacillary at the hospital, the others at home.

The results of her examinations have been entered by her in registers comprising the whole population. These registers have been of fundamental importance for the investigations in 1948—51, and the information for the period of 1939—48 is based on them and on a summary report submitted by Miss Vest to the Board of Health (VEST 1947).

By examinations of sputum Miss Vest during the period 1939—48 found TB in sputum in 13 persons who had not previously been known to be bacillary.

At von Pirquet tests of 467 persons in 1939—40 46 per cent. were found to be positive, at von Pirquet tests of 754 persons in 1945—46

39 per cent. were found to be positive. An examination of the information about the von Pirquet tests in 1945 and especially in 1946 as found in the registers shows that the tests gave many negative results in previous reactors, who later, again, have been tuberculin positive, and the figure for tuberculin positivity in 1945—46 therefore must be considered doubtful.

In 1945 Dr. Laurent Christensen, District Medical Officer (Julianehaab), visited Angmagssalik, where he discussed the problems of tuberculosis in the district with Miss Signe Vest and examined some of the negative reactors with Mantoux test. He subjected 31 persons to BCG vaccination on September 20, 1945, using the intracutaneous technique and vaccine made on August 8, 1945. This was the first time that BCG vaccination was performed at Angmagssalik. By re-examination with von Pirquet tests of those vaccinated in November 1945 all of them showed a negative reaction.

Even though some of those vaccinated with BCG might be supposed to have been found tuberculin positive as a consequence of the vaccination at later control tests, this vaccination cannot have had any practical influence on the tuberculin positivity in the district as a whole, for which reason they will be disregarded in the account of the examinations of tuberculin positivity during 1948—51.

In 1946 the first District Medical Officer to Angmagssalik was appointed, Dr. Vinten Johansen. He especially went in for the combating of gonorrhoea, which in 1944 had been introduced into the district and then had spread widely. He stayed in the district until 1948 and did not manage to go into the problems of tuberculosis, about which he did not leave any notes.

II. INVESTIGATIONS INTO TUBERCULOSIS MORTALITY AT ANGMAGSSALIK 1937—1951

Investigations into Tuberculosis Mortality at Angmagssalik 1937—1951.

Before 1937 no deaths from tuberculosis in the Angmagssalik District have been recorded.

It has not been possible to ascertain causes of all deaths since 1937, but through Høygaard's information (HØYGAARD 1938), Miss Signe Vest's notes, and my own investigations information has been found about a total of 48 persons dying of tuberculous disease during the years 1937—51. These persons have been listed in Table 4, where they have been arranged chronologically according to date of death. The number must be considered a minimum number, particularly as regards the younger age-classes. Cases under observation for tuberculosis, but without any sure objective basis of such a diagnosis, have not been included. It appears from the table that tubercle bacilli have been ascertained to occur in 33 of the 48 persons (69 per cent.). If we deduct the 10 persons who died before it—in 1938—was possible to make bacteriological examinations at Angmagssalik, tubercle bacilli have been found in 33 out of 38, i. e. 87 per cent.

The patients have been listed with consecutive numbers, to which reference is made in what follows. Patients mentioned by Høygaard (1938) have been listed with Høygaard's number in a special column.

The patients have been listed under the name of their settlement even if they died at the hospital.

Under the head of "first symptom" the clinical symptoms are stated which led to the ascertainment of the disease, or the symptoms which after diagnosing of the disease have been considered the first symptoms of it. The date for these involves great uncertainty.

The head "clinical course" is mainly of importance for a distinction between pulmonary and extrapulmonary tuberculosis.

Table

Known deaths of diagnosed tuberculosis at Angmagssalik 1937—1951. "Høyg. No." refers
Hpt. = Hemoptysis. Hptt. = Hemo-

No.	Høyg. No.	Name	Date of birth	Settlement	First symptoms
1	8	♂ Paul	3/1910	Main Settlement	12/35 Hemoptyses
2	12	♀ Thala	2/1-1927	Main Settlement	1/37 Eryth. nod.
3	13	♀ Gunda	15/11-1928	Main Settlement	1/37 Eryth. nod.
4	14	♂ Assa	1933	Main Settlement	2/37 Eryth. nod.
5	9	♂ Josias	12/3-1920	Main Settlement	2/37 E. n. 4/37 Pleurisy
6	30	♂ Moses	17/8-1915	Kûngmiut	1/37 Hpt. Pirq. +
7	42	♂ Mikal	1907	Umigtuarajit	Sev. yrs Hpt. 9/36 C. + S.
8	4	♂ Jørgen	11/12-1923	Main Settlement	1935 Exudative pleurisy
9	43	♀ Felecia	9/9-1905	Umigtuarajit	1930-35 Hptt.
10	5	♂ Søren	1898	Main Settlement	1/37 C. + S. Pirq. —/+
11	3	♂ William	31/5-1918	Main Settlement	1935 Hpt., Emaciation
12	15	♀ Natalie	20/12-1916	Main Settlement	1/37 Eryth. nod.
13	—	♂ Joel	11/3-1925	Kûngmiut	10/37 Pleurisy
14	—	♂ Ole	ca. 1915	Main Settlement	1938 Return from W. Greenl. C. + S.
15	—	♀ Ane	30/10-1918	Main Settlement	1939 Pulm. symptoms
16	—	♀ Pauline	16/11-1918	Kap Dan	4/38 Eryth. nod.
17	—	♀ Bera	25/12-1928	Main Settlement	12/38 Hemoptyses
18	—	♀ Natalie	1/1940	Kap Dan	2/41 Adenitis colli
19	11	♀ Birte	24/6-1921	Main Settlement	2/37 Eryth. nod., C.
20	—	♂ Hans	1/1908	Umigtuarajit	10/38 Hemoptyses
21	—	♂ Derqe	2/1910	Tiniteqilâq	1/47 Hpt. C. + S.
22	1	♂ Henrik	4/3-1905	Main Settlement	1934 Pleurisy. 1935—36 Hptt.
23	—	♀ Arnaq	1900	Íkáteq	1940 Pleurisy
24	26	♀ Enika	1902	Main Settlement	1920 Hpt. 1943 C. + S.
25	—	♀ Teodora	3/1906	Main Settlement	5/40 "Influenza" (marr. 22)
26	—	♂ Søren	1/12-1924	Main Settlement	9/38 Eryth. nod.
27	—	♀ Rosine	ca. 1918	Umigtuarajit	10/43 C. + S.
28	—	♀ Anna	1889	Main Settlement	9/38 Hpt.
29	—	♀ Katrine	9/8-1925	Sermiligâq	4/43 Eryth. nod.
30	19	♀ Elise	16/6-1903	Main Settlement	6/37 Pleurisy, 6/39 E. n.
31	50	♀ Kristine	1896	Kûngmiut	10/37 Pulm. sympt.
32	—	♀ Juditte	22/7-1939	Kûngmiut	1945 Pirq. —, 1946 Pirq. +
33	—	♀ Dinna	3/4-1930	Kûngmiut	1945 Pirq. —, 1946 Pirq. +
34	—	♀ Martine	6/8-1928	Kap Dan	1947 Headache
35	18	♂ Peter	29/9-1921	Main Settlement	2/37 E. n., 4/37 Pleurisy
36	—	♀ Elisa	1896	Kap Dan	1948 Headache
37	—	♂ Ignatius	8/3-1918	Tiniteqilâq	1/38 Hpt.
38	—	♂ Abel	1898	Main Settlement	1948 Hpt.
39	—	♂ Eigil	1901	Kap Dan	6/49 Headache
40	—	♂ Solo	12/9-1947	Main Settlement	5/49 Convulsions
41	—	♂ Ignatius	20/9-1922	Íkáteq	6/47 Hpt.
42	—	♂ Mattias	17/9-1930	Main Settlement	3/40 Hpt., 2/49 Pulm. sympt.
43	—	♀ Justine	26/12-1913	Kap Dan	5/48 Hpt.
44	—	♂ Gaba	5/11-1922	Main Settlement	1/42 Hpt., Pulm. sympt.
45	—	♂ Evfa	19/4-1925	Sermiligâq	3/48 Hpt.
46	21	♂ Zakarias	28/8-1913	Main Settlement	5/37 Pleurisy. 1945 Hptt.
47	—	♂ Daniel	11/6-1922	Kûngmiut	6/47 Hptt.
48	—	♀ Dina	31/3-1930	Main Settlement	7/49 Hptt.

4.

to the numbers in question in HØYGAARD 1936. Eryth. nod. = E. n. = Erythema nodosum. ptyses. C. = Coughing. S. = Sputum.

Clinical course	TB first found	Died	Duration of illness after	
			First symptom	Finding of TB
Pulm. tub. — Meningitis	—	27/2-37	1 year	—
Adenitis colli — Miliary tub.	—	2/3-37	2 months	—
Adenitis colli — Miliary tub.	—	10/3-37	2 months	—
Adenitis — Keratitis — Mil. tub.	—	17/3-37	2 months	—
Pulm. tub. — Miliary tub.	—	17/8-37	6 months	—
Pulm. tub. — Fatal hemoptysis	—	18/8-37	8 months	—
Pulm. tub. — Pleural empyema	—	19/10-37	Some years	—
Pulm. tub. — Adenitis colli	—	22/11-37	2 years	—
Pulm. tub.	—	12-37	2 years	—
Pulm. tub.	8-38	1938	2 years	3 months
Pulm. tub.	8-38	1938	2 years	3 months
Pulm. tub.	5/8-38	2/9-38	18 months	1 month
Pulm. tub.	—	26/3-39	18 months	—
Pulm. tub.	8-38	24/9-39	?	1 year
Pulm. tub.	5/9-39	13/6-40	1 year	1 year
Pulm. tub.	8-38	12/7-40	2 years	2 years
Pulm. tub.	1/9-39	3/3-41	$2^1/_2$ years	18 months
Miliary tub.	—	7/5-41	3 months	—
Pulm. tub.	8-38	15/5-41	4 years	3 years
Pulm. tub.	2/2-41	28/8-41	3 years	6 months
Pulm. tub.	9/5-42	27/6-42	6 months	1 month
Pulm. tub.	8-38	10/3-42	8 years	4 years
Pulm. tub.	8/5-43	2/6-43	3 years	1 month
Pulm. tub. — Meningitis	—	15/6-44	1 year	—
Pulm. tub.	22/6-42	21/10-44	4 years	2 years
Pulm. tub.	29/8-41	28/12-44	6 years	3 years
Pulm. tub.	15/11-44	2/1-45	18 months	3 months
Pulm. tub.	21/11-44	8/6-45	6 years	6 months
Pulm. tub.	4/8-45	22/9-45	$2^1/_2$ years	1 month
Pulm. tub.	11/11-44	15/11-45	6 years	1 year
Pulm. tub.	29/6-42	1946	8 years	4 years
Pulm. tub.	—	6/10-46	6 months	—
Pulm. tub.	20/3-46	17/12-47	2 years	18 months
Meningitis	—	1947	1 month	—
Pulm. tub.	23/11-44	21/2-48	11 years	4 years
Meningitis	—	1948	1 month	—
Pulm. tub.	27/1-49	2-49	1 year	1 month
Pulm. tub.	3/7-48	10/2-49	1 year	6 months
Meningitis tuberculosa	12/7-49	25/7-49	1 month	$^1/_2$ month
Meningitis tuberculosa	25/5-49	1/6-49	1 month	$^1/_2$ month
Pulm. tub.	15/3-48	28/7-49	2 years	18 months
Pulm. tub.	26/3-49	26/8-49	6 months	6 months
Pulm. tub.	1948	8-49	3 years	1 year
Pulm. tub.	8/5-42	15/12-49	7 years	7 years
Pulm. tub.	4/11-48	5/1-50	2 years	18 months
Pulm. tub.	6/1-49	16/1-50	5 years	1 year
Pulm. tub.	15/10-48	17/7-50	3 years	2 years
Pulm. tub.	14/10-49	11-51	2 years	2 years

The Ratio of Total Mortality to Tuberculosis Mortality.

In Table 5 the total mortality per year is entered on the basis of the "Medicinalberetning for den danske Stat" ('Medical Report for the State of Denmark'), and the tuberculosis mortality on the basis of Table 4.

The tuberculosis mortality was highest in 1937 (10.4 per thousand); the next highest was found in 1949 (5.8 per thousand). The average annual tuberculosis mortality was 3.0 per thousand.

The average tuberculosis mortality for the whole period was 15 per cent. of the total mortality.

Table 5.

Total mortality and tuberculosis mortality in the Angmagssalik District 1937—1951.

Year	Population figure	In all		Tuberculosis		Relative tuberculosis mortality per cent.
		Deaths	per thousand	Deathts	per thousand	
1937.....	859	22	27	9	10.4	39
1938.....	872	11	13	3	3.4	27
1939.....	866	10	12	2	2.3	19
1940.....	940	10	12	2	2.2	20
1941.....	983	16	16	4	4.1	25
1942.....	1016	11	11	2	2.0	18
1943.....	1056	16	15	1	1.0	6
1944.....	1075	30	28	3	2.8	10
1945.....	1107	21	19	4	3.6	19
1946.....	1140	20	18	2	1.8	10
1947.....	1178	18	15	2	1.7	11
1948.....	1206	23	19	2	1.7	9
1949.....	1209	38	31	7	5.8	18
1950.....	1220	53	43	3	2.5	6
1951.....	1260	20	16	1	0.8	5
1937—51...		319		48		15
Average per year.....	1054	21	20	3	3.0	15

Fig. 2 is a graphical representation of conditions. It is seen that the total mortality varies very much and that epidemics highly characterize it, just as they characterize the curve of tuberculosis mortality.

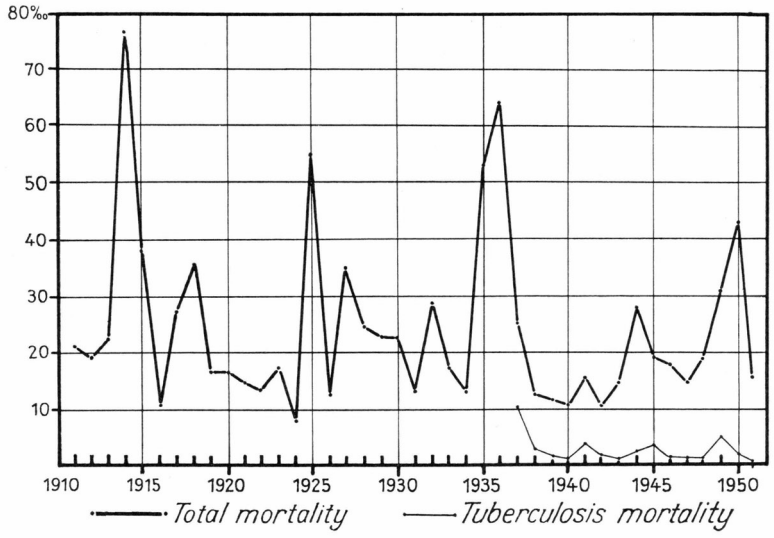

Fig. 2. Total mortality and tuberculosis mortality in the Angmagssalik District 1911—1951.

Deaths from Pulmonary Tuberculosis.

The deaths from pulmonary tuberculosis in the Angmagssalik District in 1937—1951 are distributed to 22 men and 18 women (55:45), in all 40.

Table 6.

Deaths from pulmonary tuberculosis in the Angmagssalik District 1937—51 distributed according to age-classes. The average annual mortality from pulmonary tuberculosis per age-class.

Age-class	Average population 1937—51	Deaths from pulm. tub.	
		Total number	Per thousand per year
0— 4	202	0	0
5— 9	182	1	0.4
10—14	149	3	1.3
15—19	117	4	2.4
20—24	106	9	5.7
25—29	74	5	4.5
30—34	74	6	5.3
35—39	43	4	6.2
40—44	43	4	6.2
45—60	64	4	4.2
In all...	1054	40	2.5

The distribution of the deaths within the age-groups appears from Table 6 and fig. 3. The calculation of the average annual mortality from pulmonary tuberculosis is based on an average population calculated from the figures for all the years. The distribution of individuals per age-class has been made from the age-classes' percentage share of the population as calculated from the censuses of 1933 and 1951.

The table shows that the highest absolute numbers of deaths from pulmonary tuberculosis are found within the age-classes of 20—24 years,

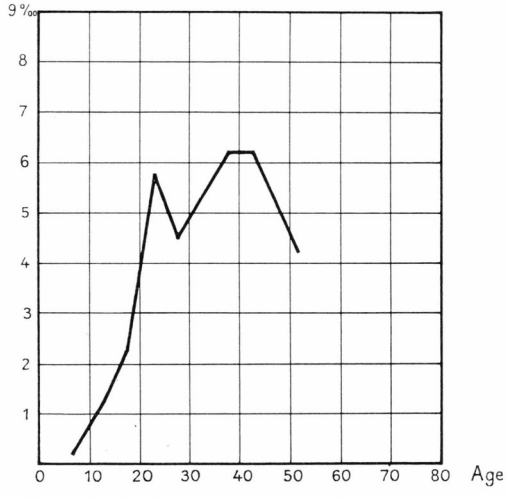

Fig. 3. Average annual mortality from pulmonary tuberculosis in the Angmagssalik District 1937—51, as expressed per 1,000 individuals in each age-class.

after which follows the age-classes 30—34 and 25—29 years. These groups—the ages of 20—35 years—had half of all deaths from pulmonary tuberculosis.

Fig. 3 is a graphical representation of the age mortality. The curve rises very steeply from the age of 5—9 to the age of 20—25, reaching its highest value about the age of 40.

For all age-classes the average annual mortality from pulmonary tuberculosis through the period of 1937—51 amounted to 2.5 per thousand.

Duration of Lethal Pulmonary Tuberculosis.

The duration of lethal pulmonary tuberculosis in the Angmagssalik District 1937—51 appears from Table 7, which shows that it generally amounted to three years. The calculations are based on the age at the first symptom. As mentioned above, this in most cases involves an uncertainty which is transferred to the statements on the duration of the disease.

Table 7.

Average duration of disease from first symptom to death in the 40 lethal cases of pulmonary tuberculosis in the Angmagssalik District 1937—1951. The material is divided into two groups: the patients whose illness began before, and those whose illness began after their 25th year.

	Illness begun		In all
	Before 25th year	After 25th year	
Number of patients	24	16	40
Average age at first symptom ...	18 years	36 years	25 years
Average age at death	21 years	39 years	28 years
Average duration of illness.....	3 years	3 years	3 years

The table shows that the symptoms in three fifths of the lethal cases were first observed before the 25th year, and that the average age at the beginning of the disease in these cases was 18 years.

While the statement of the time of first symptom is doubtful, the time of first demonstration of TB is certain, even though in many cases it has no direct bearing on the development of the complaint.—Table 8 shows the duration of the illness after demonstrating the presence of TB in 31 patients in whom TB were shown to occur in sputum.

It appears from the table that 74 per cent. of the patients died before the expiry of the second year after TB had been shown to be present. One patient survived for seven years after demonstration of TB in sputum.

Table 8.

Duration of illness in cases of lethal pulmonary tuberculosis calculated from duration between demonstration of the presence of TB and death in the 31 patients in the Angmagssalik District who during the years 1937—51 were found to be bacillary before death.

	Number	Percentage
Died in 1st year after demonstration of TB	12	39
— - 2nd — — — - -	11	35
— - 3rd — — — - -	3	10
— - 4th — — — - -	3	10
— - 5th — — — - -	1	3
— - 6th — — — - -	0	0
— - 7th — — — - -	1	3
In all...	31	100

Deaths from Extrapulmonary Tuberculosis in the Angmagssalik District 1937—1951.

During the years 1937—51 8 patients died from extrapulmonary tuberculosis.

4 of the 8 deaths were due to meningitis (Table 4, p. 28, Nos. 34, 36, 39, and 40). TB were found in 2 of these by cultivation of cerebrospinal fluid on Löwenstein's substratum. The other two died before the doctor managed to attend to them. The course of the disease in both cases was acute and with the same symptoms as in patient No. 39. Patient No. 34 was a daughter of patient No. 36, who was married to patient No. 39.

4 patients died with symptoms of generalized tuberculosis (Table 4, p. 28, Nos. 2, 3, 4, and 18).

In 3 patients included under pulmonary cases, death occurred after terminal symptoms of meningitis. If these cases (Table 4, p. 28, Nos. 1, 5, and 24) are included among the extrapulmonary cases, 11 patients in all died of extrapulmonary tuberculosis, corresponding to an average annual mortality of 0.7 per thousand. If the 3 cases are not included, the average annual mortality from extrapulmonary tuberculosis is 0.5 per thousand.

The ratio of deaths from pulmonary tuberculosis to deaths from extrapulmonary tuberculosis correspondingly is 37:11 (3.5:1) or 40:8 (5:1).

III. TUBERCULOSIS INVESTIGATIONS IN THE ANGMAGSSALIK DISTRICT 1948—1951

Survey of the Character and Extent of the Investigations.

The investigations into tuberculosis the results of which appear from the following chapters, were made during the period between September 21, 1948, and October 10, 1951.

Tuberculin tests were performed during the whole of this period, but mainly in 1949. In the summer of 1950 all parts of the district had been investigated and 96 per cent. of the population had been tested.

X-ray examinations were started in July 1949, when X-ray equipment was installed at the main settlement. As far as possible everybody who visited the main settlement was examined, whether they reacted to tuberculin or not. 75 per cent. of the total population (80 per cent. of the population over 5 years of age) were examined at least once.

Examinations of sputum consisted in microscopy and cultivation on Löwenstein's substratum. 75 per cent. of the persons with suspicious X-ray findings were examined by microscopy of sputum, 57 per cent. by cultivation. Besides, we examined sputum from persons with a cough and expectoration, and finally a number of "mass examinations" were made. From a total of 361 persons sputum was examined by microscopy at least once, corresponding to 32 per cent. of the total population or 55 per cent. of the population over 15 years.—From 217 persons sputum was cultivated at least once, corresponding to 19 per cent. of the total population or 33 per cent. of the population over 15 years.

Stethoscopy of lungs was performed to a wide extent, particularly on travels, but has not been especially summed up.

Tests for erythrocyte sedimentation rate were not made for the purpose of diagnosing tuberculosis.

Tuberculin Investigations in the Angmagssalik District 1948—1950.

Technique.

The tuberculin tests in the case of the age-groups up to 12 years were made with tuberculin jelly from Statens Seruminstitut, at most kept for one year at cellar temperature (4—8° C.). The jelly was placed on the chest under a plaster, which was removed after 24 hours. The reaction was read after 72 hours and compared with a plaster sample without jelly. The reactions were read as — and +, perhaps ++. By — reactions were understood such reactions in which less than 4 distinct papules had appeared, by + reactions such reactions in which 4 or more distinct papules had appeared.

In the case of adults and all persons over 12 years old intracutaneous tests with diluted purified tuberculin were performed according to the Mantoux method. For the injections we used partly ready-made dilutions from Statens Seruminstitut in Copenhagen, partly dilutions made at Angmagssalik from the stock solution of purified tuberculin of the Institute in diluents from the Institute. The stock solution and the diluent were kept at cellar temperature and used within 6 weeks from the day of preparation.

It had been planned to use 1 tuberculin unit as first test everywhere, supplemented by 10 units if the reaction to 1 unit measured less than 10 mm infiltration. This could be carried out in most cases, but in certain parts of the district it was because of difficult travelling conditions necessary to use 10 units as a first test.

Tests with 100 units of tuberculin were used in few cases, and only at the main settlement. They are not included in the statements.

Investigations into Tuberculin Sensitivity.

At the readings of the Moro tests the number of papules appearing was not noted, for which reason this test cannot be used as basis of the sensitivity to tuberculin.

In individuals over 12 years Mantoux tests with 10 tuberculin units were used as basis of the final decision whether an individual was to be characterized as "tuberculin negative" or "tuberculin positive".

72 hours after intracutaneous injection of tuberculin the reaction was read[1]). According to the character of the reading and on the basis

[1]) In some cases it proved necessary to read the reaction after 4, rarely 5 days. Such readings are not included in calculations of sensitivity to tuberculin.

Table 28.

Distribution of persons with active or potentially active radiographic changes into previously tuberculin positive persons and convertors within the groups of bacillary and non-bacillary persons with corresponding radiographical changes.

Radiographical change	Bacillary			Non-bacillary			In all		
	Number	Previously tuberculin positive	Convertors	Number	Previously tuberculin positive	Convertors	Number	Convertors	Percentage of convertors
Hilar enlargement ..	0	—	—	10	7	3	10	3	30
Exudative pleurisy .	0	—	—	3	1	2	3	2	67
Perihilar infiltr.	3	1	2	8	5	3	11	5	46
Solitary infiltr.....	6	6	0	23	12	11	29	11	38
Infiltr. $\leq 1/3$ lung ..	5	5	0	6	6	0	11	0	0
Cavernous	16	12	4	0	—	—	16	4	25
In all...	30	24	6	50	31	19	80	25	31
Percent. of convertors			20			38		31	

vertors. Among the bacillary persons there were 20 per cent. convertors, among the non-bacillary ones 38 per cent.

Table 29.

Average age of previously tuberculin positive persons and convertors within the various groups of radiographic changes.

Radiographic change	Previously tuberculin positive	Convertors
Hilar enlargement	14 years	7 years
Exudative pleurisn	24 —	21 —
Perihilar infiltration	9 —	9 —
Solitary infiltration	29 —	14 —
Infiltration $\leq 1/3$ lung	30 —	
Cavernous	29 —	18 —
In all...	25 years	14 years

Table 29 shows a distinct difference in the distribution according to age. The average age for all convertors with radiographic findings was 14 years, for "previously tuberculin positive" persons 25 years.

Among the convertors 24 per cent. were bacillary.

Appraisal of the Inactive Radiographic Changes.

It appears from Table 22, p. 57, and Table 23, p. 59, that "inactive radiographic changes" were found in a total of 188 persons or 22 per cent. of those examined in the Angmagssalik District.

"Obliteration of costophrenic angle" was found in 50 persons in all, 34 women and 16 men. As many persons were screened only once, and as the time of observation altogether was short, it is not possible to state in how many cases "obliteration of costophrenic angle" is expressive of permanent changes, and in how many cases it indicates a transient state, perhaps in connexion with unspecific complaints, and so this X-ray finding will not be discussed in more detail.

Pulmonary and hilar calcifications as the only finding occurred in 138 tuberculin positive persons. In another 3 persons (2 adult women and 1 boy) calcifications were recorded, but these 3 were all tuberculin negative at the time of the X-ray examinations and therefore will not be included in the survey.

In this connexion it may be mentioned that in the winter of 1950—51 intracutaneous Histoplasmin and Coccidioidomycin tests were made on 118 adults in the Angmagssalik District. None of these persons reacted to the tests and therefore these fungus infections can be excluded as the cause of calcifications in the Angmagssalik District.—Theoretically there was a possibility of such infections through the occupying troops in 1940—45, who consisted of Americans from all regions of U.S.A., and who in certain areas had contact with the population.

Table 30 shows the calcifications in the Angmagssalik District in the various age-groups, as compared with the tuberculin positive persons in the age-groups. It appears from the table that the percentage occurrence of calcifications was increasing from the age of 5. In the age-group of 15—20 years calcifications were the only findings in 27 per cent. of the tuberculin positive persons. After the age of 20 this percentage did not increase, but kept at an average of 24.

Table 30.

The number of tuberculin positive persons and the number of persons with pulmonary and hilar calcifications as only X-ray findings in the Angmagssalik District 1949—51, indicated for age-groups. The number of persons with calcifications in percentages of the tuberculin positive persons in age-groups.

Age	0	5	10	15	20	25	35	45	Above 45	In all
Number of tub. pos. persons	29	75	92	97	103	122	77	80		675
Number with calcifications	0	7	15	26	25	32	18	15		138
Percentage with calcifications of tuberculin positive persons	0	9	16	27	24	26	23	19		21
		11			24					21

The explanation of the high percentage occurrence of calcifications in tuberculin positive persons in the Angmagssalik District must be sought in the fact that practically all tuberculous infections in Greenland must be considered pulmonary (aerogenic).

Investigations in Denmark into primary infections show that calcifications are found in the same percentage ratio as in the Angmagssalik District in the cases in which it must be assumed that the primary infection was seated in lungs and hilus, thus being aerogenic. Thus Sigrid Holm (1947, pp. 102—103) found calcifications in 21 per cent. (36 out of 169) of children below 14 years at a two years' observation period after radiographically demonstrated intrathoracal primary processes and in 38 per cent. (28 out of 74) after an observation period of 4 years. Correspondingly Helweg-Larsen found calcifications in 21 per cent. (12 out of 56) of convertors with primary pulmonary changes after an observation period of 2 years in a material consisting of children and adolescents (1950, p. 56).

It appears from Table 30 that there is no sure increase in the occurrence of calcifications in the tuberculin positives after the age of 15—20 years. This may be considered to mean that the tendency or the power to form calcifications after tuberculous infections decreases after that age (cf. Høyer Dahl 1952, p. 142. — Sigrid Holm 1947, p. 104).

As the average age of primarily infected persons with radiographic changes in the Angmagssalik District is 14 years (Table 29, p. 69)—thus an age at which the tendency towards calcification is pronounced—it is natural to consider the pulmonary and hilar calcifications found to be remains after pulmonary (aerogenic) infections, particularly primary infections, acquired before the age of 20.

Table 31.

Diagnosed cases of pulmonary tuberculosis 1948—51 arranged according to sex. The numbers of the dead are the same as in Table 4, p. 28, the others arranged chronologically according to findings of bacilli. Cu. = Cultivation. A. = Angmagssalik. SS = Statens Seruminstitut. dir. = Demonstrated by direct microscopy.

No.	Name	Born	Settlement	Age at first sympt.	First sympt.	Demonstr. of TB in sputum	Radiogr.	Dead
37	♂ Ignatius	8/3-18	Tiniteqîlak	29	Hemoptysis	27/1-49 dir.	—	dead
38	♂ Abel	1898	Main Settlem.	50	Hemoptysis	3/7-48 dir.	—	dead
41	♂ Ignatius	20/9-22	Íkáteq	25	Hemoptysis	15/3-48 dir.	—	dead
42	♂ Matthias	17/9-30	Main Settlem.	18	Cold	26/3-49 dir.	—	dead
44	♂ Gaba	5/11-22	Main Settlem.	20	Hemoptysis	9/5-42 dir.	Cavernous	dead
45	♂ Evfa	19/4-25	Sermiligâq	23	Hemoptysis	4/11-48 dir.	Cavernous	dead
46	♂ Zakarias	25/8-13	Main Settlem.	32	Hemoptysis	6/1-49 dir.	Cavernous	dead
47	♂ Daniel	11/6-22	Kûngmiut	25	Hemoptysis	15/10-48 dir.	Cavernous	dead
49	♂ Sajoq	1/22-22	Kûngmiut	26	Hemoptysis	22/6-49 Cu. A.	Sol. Inf.	—
50	♂ Gideon	24/11-30	Main Settlem.	18	Cold	20/12-49 dir.	Cavernous	—
51	♂ Kaleraq	21/3-11	Main Settlem.	38	Hemoptysis	13/1-50 Cu. A.	Sol. Inf.	—
52	♂ Nathan	21/10-21	Main Settlem.	26	Cold	3/2-50 Cu. A.	Inf. $\leq 1/3$ Lg.	—
53	♂ Ole	6/10-11	Kap Dan	38	Hemoptysis	14/2-50 Cu. A.	Cavernous	—
54	♂ Nikolaj	17/1-13	Kap Dan	37	Hemoptysis	18/3-50 Cu. A.	Cavernous	—
55	♂ Josef	1910	Main Settlem.	40	Hemoptysis	1/8-50 Cu. A.	Inf. $\leq 1/3$ Lg.	—
56	♂ James	17/12-41	Qernertuarssivit	9	Hemoptysis	29/8-50 dir.	Perihil. Inf.	—
57	♂ Lazarus	31/7-15	Isortoq	35	Hemoptysis	15/10-50 Cu. SS	Inf. $\leq 1/3$ Lg.	—
58	♂ Pavia	14/2-37	Kap Dan	12	Pleurisy	13/7-50 Cu. A.	Perihil. Inf.	—
59	♂ Elias	9/2-29	Íkáteq	12	Hemoptysis	24/10-50 Cu. A.	Inf. $\leq 1/3$ Lg.	—
60	♂ Hosias	8/9-27	Kap Dan	23	Hemoptysis	6/3-51 Cu. A.	Sol. Inf.	—
61	♂ Harald	9/11-37	Kap Dan	13	Hemoptysis	10/3-51 Cu. A.	Cavernous	—
43	♀ Justine	25/12-13	Kap Dan	32	Hemoptysis	1948 dir.	—	dead
48	♀ Dina	31/3-30	Main Settlem.	19	Hemoptysis	14/10-49 Cu. A.	Cavernous	—
62	♀ Tabitta	17/8-35	Kap Dan	14	Hemoptysis	19/5-50 Cu. A.	Cavernous	—
63	♀ Minna	1910	Kûngmiut	40	Hemoptysis	15/10-50 Cu. SS	Sol. Inf.	—
64	♀ Charlotte	20/4-38	Kap Dan	10	Eryth. nod.	15/10-50 Cu. SS	Perihil. Inf.	—
65	♀ Katrine	30/1-31	Tiniteqîlak	19	Hemoptysis	25/6-51 dir.	Cavernous	—
66	♀ Ada	17/8-25	Íkáteq	25	Cold	28/6-51 Cu. A.	Sol. Inf.	—
67	♀ Malene	22/6-01	Isortoq	49	Influenza	17/8-51 Cu. A.	Inf. $\leq 1/3$ Lg.	—
68	♀ Else	2/2-99	Kap Dan	52	Hemoptysis	30/9-51 Cu. SS	Sol. Inf.	—

V. THE BACILLARY CASES OF PULMONARY TUBERCULOSIS AT ANGMAGSSALIK 1948—51

The Bacillary Cases of Pulmonary Tuberculosis in the Angmagssalik District 1948—1951.

In September 1948 there were in the Angmagssalik District 4 patients with bacteriologically diagnosed pulmonary tuberculosis. During the period down to September 1951 TB were found in sputum from a further 26, thus in all 30 patients, who are all listed in Table 31. The dead are entered with the same number as in Table 4, p. 28, the others are numbered chronologically according to the time when bacilli were found.

Distribution According to Sex of Bacillary Cases of Pulmonary Tuberculosis.

It appears from Table 31 that TB were found in sputum from 21 men and 9 women, i. e. 70 per cent. and 30 per cent., respectively.

Table 32 shows the percentage distribution of the sexes in the case of the other examinations.

Table 32.

Ratio of men to women at various examinations, as indicated in percentages of both sexes together.

Examination for	Men	Women
Tuberculosis mortality	55	45
Tuberculin positivity	48	52
Inactive radiographic changes	44	56
Active or potentially active radiographic changes	55	45
Cavernous cases (direct bacillary)	70	30
Bacillary cases in all	70	30

It appears from Table 32 that the ratio of men to women who died of pulmonary tuberculosis 1937—51 is 55:45. The same ratio is found for the two sexes in the case of radiographically diagnosed "active or potentially active" forms, and hence we should expect finding the same ratio as regards the bacillary cases of pulmonary tuberculosis. Starting

from the number of men found to be bacillary: 21, we should accordingly expect finding 17 women with excretion of bacilli, but only 9 were found.

That the explanation of this is not due to failing bacteriological diagnostics in the case of women, is supported by the fact that within the group of direct bacillary patients the same ratio of men to women was found as within the group of bacillary cases in all (70:30).

As mentioned above, women in the Angmagssalik District expectorate with the same ease as men and their sputum seems just as suitable for examination as the men's (p. 48). 370 of 633 samples of sputum examined microscopically originate from women, 263 from men; 269 of the 465 samples of sputum originated from women, 196 from men. Thus the women were examined more thoroughly than the men.

It appears from Table 32 that at the tuberculin tests the ratio of positively reacting men to positively reacting women was 48:52, a ratio that corresponds to that of the distribution of inactive radiographic changes on the two sexes (44:56). Thus the women are not less exposed to tuberculous infection than the men. The explanation of the fact that they still in fewer cases suffered from a severe pulmonary disease, may be that the women's resistance was greater than the men's—at any rate within the period of the examinations; but it cannot be excluded that fortuitousness may be involved, as even small variations in the number of bacillary cases will have a decisive influence in so small a material.

Distribution According to Age of Bacillary Cases of Pulmonary Tuberculosis.

Table 33 shows the distribution of the 30 bacillary cases of pulmonary tuberculosis within the various age-groups. On the basis of the

Table 33.

Distribution of bacillary cases of pulmonary tuberculosis at Angmagssalik from 1948 to 1951 inclusive according to sex and age and for both sexes. Morbidity per thousand within each age-group for both sexes.

Age	Population fig.	Bacillary cases of pulmonary tuberculosis			
		Men	Women	In all	Per thousand
0— 4.....	207	0	0	0	0
5—14.....	361	5	1	6	17
15—24.....	251	4	3	7	24
25—34.....	138	6	2	8	58
35—44.....	95	5	1	6	63
45—54.....	63	1	2	3	48
Above 55	27	0	0	0	0
In all...	1142	21	9	30	26

figures for both sexes it has been calculated how many per thousand were found among the member of each age-group, the results being

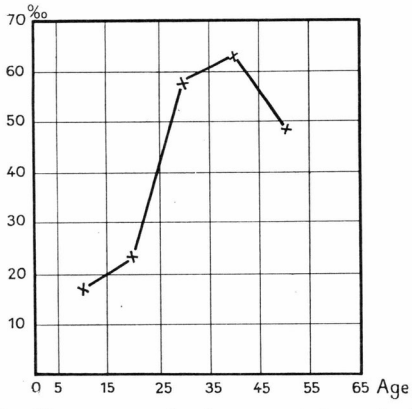

Fig. 10. Distribution of bacillary cases of pulmonary tuberculosis in the Angmagssalik District 1948—1951, as expressed per thousand of the individuals of the age-classes.

traced in fig. 10, which shows that the highest morbidity values were found in the age-groups of 35—45 years; under 5 years and after 55 years no bacillary cases were found.

The calculations according to age were in each case based on the age at the first symptom noticed during the illness during which the bacillary diagnosis was made.

The average age for all cases at the first symptom was 27 years, 26 years for men and 29 years for women.

Radiographic Changes in the Bacillary Cases of Pulmonary Tuberculosis.

In Table 31, p. 72, the radiographic changes are listed in the last column. The figures in all cases denote the "maximum" X-ray findings.

Table 34.

Ratio of maximum radiographic findings and maximum excretion of bacilli in the 30 bacillary cases of pulmonary tuberculosis.

Maximum radiographic findings	Men	Women	In all	Percentage	Maximum excretion of bacilli	
					+ TB by microscopy	+ TB only by cultivation
Perihilar infiltr.	2	1	3	10	1	2
Solitary pulm. infiltr.	3	3	6	20	0	6
Infiltr. $\leq 1/3$ lung	4	1	5	17	1	4
Cavernous processes	12	4	16	53	16	—
In all...	21	9	30	100	18	12

In the case of 5 patients there was no radiographic diagnosis, as these—now all dead—could not be X-rayed. As they were all "microscopically bacillary" and as they had all râles at stethoscopy, they will be considered "cavernous" cases and in what follows be included as such.

The distribution of the bacillary cases according to radiographic type will then be as indicated in Table 34, where the excretion of bacilli is the "maximum" one. It appears from the table that well over half of the patients with bacteriologically diagnosed pulmonary tuberculosis had cavernous processes.

Excretion of Bacilli.

Table 31, p. 72, shows at what examination TB were found for the first time. It appears that the diagnosis in 18 cases was first made by cultivation of sputum, in 12 cases by microscopy. During the course of the disease—the observation periods were from 1 month to at most 2 years—it proved possible to find TB microscopically in a total of 18 patients, while the bacilli in 12 could only be demonstrated to occur by cultivation of sputum.

Table 35 shows the excretion of bacilli in 16 patients who had not constantly been microscopically bacillary. The table only includes cultivations and the first positive microscopical finding. In one single case gastric washings were examined.

Table 35.

List of excretion of TB in patients who were not direct bacillary during the whole observation period.

+++ Finding of baccilli by direct microscopy.
++ Finding of bacilli by cultivation of sputum. col.—colony.
= Negative cultivation of sputum.
≡ Negative cultivation of gastric washings.
SS — Statens Seruminstitut. PAS — Pasido. DHS — Dihydrostreptomycin.

Patients with perihilar infiltration.

56	♂	James	19/3-50 =, 28/8-50 +++, 31/10-50 =, 4/11-50 =, 13/3-51 ≡.
58	♂	Pavia	13/7-50 ++ 8 col., 4/11-50 =.
64	♀	Charlotte	30/5-50 =, 15/10-50 (SS) ++ enk. kol., 9/1-51 =, 28/4-51 =, 19/5-51 =, 5/6-51 =.

Patients with solitary pulmonary infiltration.

49	♂	Sajoq	22/6-49 ++ 10. col., 19/10-49 =, 3/3-50 =, 14/4-50 =.
51	♂	Kaleraq	7/1-50 =, 9/1-50 =, 13/1-50 ++ 1 col., 15/6-50 =.
60	♂	Hosias	6/3-51 ++ 10 col., 29/3-51 =, 24/4-51 =, 4/5-51 =, (5/5—5/6-51: PAS og DHS), 5/6-51 =.

(To be continued)

63	♀	Minna	15/10-50 (SS) ++ 1 col., 29/3-51 =, 2/4-51 =, 5/5-51 =, 9/5-51 =, 5/7-51 =.
66	♀	Ada	30/6-51 ++ 8 col.
68	♀	Else	5/9-51 (SS) ++ a few col..
			Patients with infiltration $\leq$ $^1/_3$ *lung field.*
52	♂	Nathan	9/12-49 =, 22/12-49 =, 3/2-40 ++ 1 col., 31/5-50 ++ 1 col., 4/12-50 ++ 14 col., (12/50—1/51 PAS og DHS), 2—28—29/1-51 =.
57	♂	Lazarus	20/9-50 =, 15/10-50 (SS) ++ 10 col., 19/10-50 =, 20/7-51 =.
59	♂	Elias	30/7-50 =, 24/10-50 ++ 11 col., 18/1-51 =, 7/3-51 =, 17/7-51 =.
55	♂	Josef	1—4/8-50 ++ 50 col., 10/8-50 =, (11/50—12/50 PAS), 14/12-50 =, 9/1-51 =, 23/2-51 =, 23/4-51 =, 2/9-51 +++.
67	♀	Malene	15/8-51 ++ 1 col., 17/8-51 =.
			Patients with cavernous processes.
53	♂	Ole	14/2-50 ++ 2 col., 6/3-50 +++, (3—6/50 Pnth. art.), 26/4-50 = (10/50—11/50 PAS), 4/11-50 =, 7/12-50 =, 24/4-51 =.

The table shows that the excretion of bacilli is often intermittent and that it has often been necessary to cultivate sputum several times in order to find the bacilli.

On the Definition of Morbidity due to Pulmonary Tuberculosis in Greenland.

One of the purposes of the present work has been that of finding a rational basis of the calculation of morbidity due to pulmonary tuberculosis in Greenland so that it would be possible to find figures comparable partly within various districts in Greenland, partly as regards Greenland and the outside world.

In West Greenland various criteria have been used for statements on morbidity due to pulmonary tuberculosis. Before 1934 most investigations were based on lung stethoscopy, through which figures for morbidity due to pulmonary tuberculosis were found which corresponded to about 15 per cent. of the population (Berthelsen 1940, p. 45).

Later evaluations on the basis of radiographic examinations have given figures for "radiographically active pulmonary tuberculosis" between about 3 and about 9 per cent. (Svendsen 1936, p. 304. — Christensen 1941, p. 476. — Berg 1946, p. 54. — Fog-Poulsen 1951, p. 1236. — Gravesen 1952, p. 802. — Jensen 1954, p. 919).

The evaluation of tuberculosis morbidity on the basis of bacteriological examinations of sputum has given percentages of 2—5 found on the basis of direct microscopy (Svendsen 1936, p. 804. — Christensen 1941, p. 476. — Berg 1946, p. 54) and figures about 7 found on the basis of microscopy and cultivation of sputum (Jensen 1954, p. 919).

The majority of these figures have been obtained as results of "mass campaigns" and thus represent "situations" within an unspecified period.

According to the results of the radiographic examinations in the Angmagssalik District in 1949—51 a total of 265 persons with radio-

graphic changes was found. These changes have been divided into two main groups: (1) inactive and (2) "active or potentially active" radiographic changes.

At a calculation of the morbidity within the group of persons with "active or potentially active" radiographic changes—77 in all—the result will correspond to a morbidity—based on examination within a two-year period—of about 7 per cent. of the total population. A calculation with deduction of those who died within the period will give a remainder of 73 patients in September 1951, corresponding to 6.4 per cent. of the population. These 73 were persons with different X-ray findings, the activity of which can only be surely appraised by examinations for bacilli. If we deduct all those in which TB were not found, we find a number of 21 survivors, corresponding to a morbidity of about 2 per cent., calculated from the whole population. If the X-ray examinations are used as basis of the morbidity, this must thus be stated at a value between 2 and 6.4 per cent. The choice will depend on a subjective estimate except for the value of 2 per cent., which includes radiographic changes + findings of bacilli.

Table 25, p. 65, shows persons with "active or potentially active" radiographic changes divided into two main groups according to the examinations for bacilli, viz. "bacillary" and "non-bacillary" cases. If this division is used for a distinction between "active" and "potentially active" radiographic changes, we have a rational objective basis of an appraisal of the X-ray findings and a rational and objective basis of the calculation of the morbidity.

The condition of distinguishing between "active" = "bacillary" and "potentially active" = "non-bacillary" changes is that there are possibilities of a thorough bacillary diagnostics and that they are used.

The investigations in the Angmagssalik District have shown that possibilities of using thorough bacillary diagnostics are present (cf. p. 55).

By restricting the bacillary diagnostics to examinations of sputum we do not get all cases of pulmonary tuberculosis included in the calculation of the morbidity. For practical reasons comprehensive examinations of gastric washings are not possible in Greenland, but the group of patients whose excretion of bacilli can only be demonstrated by cultivation of gastric washings must be assumed to play a subordinate epidemiological part in a community in which tuberculosis is so wide-spread as in Greenland, and in a community in which the population's ability to expectorate is so well developed that it can be taken for granted that sputum can be obtained from all persons over 5 years old, if sputum is produced at all (cf. HOLM & JENSEN 1941, p. 58. — LASSEN 1946, p. 1524. — BLUHM 1947, p. 70. — HOLM 1950, pp. 170 and 172. — DIJKSTRA *et al.* 1954, p. 254).

By restricting the bacillary diagnostics to examinations of sputum we get a possibility of comparable calculations on the basis of Greenland material and material from the outside world.

As to the period within which a patient is to be included in the statistics of morbidity, it will be practical to use a three-year period, on lines similar to general practice in Denmark.

Morbidity due to pulmonary tuberculosis then can be defined as the number of living patients suffering from pulmonary tuberculosis in whom within a three-year period tubercle bacilli have been found in sputum by microscopy or cultivation at least once.

The calculation of the percentage value ought to be made on the basis of the total population figures at the end of the three-year period, as the total population figure—apart from periods in which "mass campaigns" are carried through—is the best defined figure for the evaluation of the morbidity.

Morbidity Due to Pulmonary Tuberculosis in the Angmagssalik District in September 1951.

9 of the 30 patients in whom TB in sputum were found during the period of 1948—51, died before September 1951.

In September 1951 there were thus in the Angmagssalik District 21 patients alive in whom excretion of TB in sputum was found within a three-year period.

With a population figure of 1142 this gives a morbidity due to pulmonary tuberculosis of 1.8 per cent. The calculation appears from Table 36.

Table 36.

The previously known and the newly diagnosed cases of bacillary pulmonary tuberculosis in the Angmagssalik District in September 1948—September 1951 and morbidity on the basis of the number of persons surviving in September 1951.

Cases known in September 1948	4
Fresh cases in 1948	2
Fresh cases in 1949	6
Fresh cases in 1950	12
Fresh cases down to September 1951	6
In all...	30
Died before September 1951	9
Alive in September 1951	21

Morbidity due to bacillary pulmonary tuberculosis: 1.8 per cent.

VI. EXTRAPULMONARY TUBERCULOSIS IN THE ANGMAGSSALIK DISTRICT 1948—51

List of Cases.

In September 1948 2 cases of extrapulmonary tuberculosis at Angmagssalik were known, both of them with bone tuberculosis (Table 37, Nos. 69 and 70) for several years. Down to 1951 another 5 cases were found.

Table 37.

List of patients suffering from extrapulmonary tuberculosis at Angmagssalik 1948—51. The numbers of those who died (39 and 40) are the same as those in Table 4, p. 28, the others are numbered in continuation of the numbers in Table 31, p. 72. Cu. = Cultivation. Ang. = Angmagssalik.

No.	Name	Born	Settlement	Diagnoses	Finding of TB
39	♂ Solo	12/9-47	Main Settlem.	Meningitis tuberculosa	1949 cerebrospinal fluid Cu. Ang.
40	♂ Eigil	1901	Kap Dan	Meningitis tuberculosa	1949 cerebrospinal fluid Cu. Ang.
69	♀ Teresia	13/7-39	Main Settlem.	Spondylitis lumbalis fistulosa. Adenitis colli & mediastini Otitis med. tuberc.	1948 pus, microscopy
70	♀ Marie	31/8-41	Main Settlem.	Tub. genus sin. fistulosa	TB not found
71	♀ Andrea	20/9-47	Main Settlem.	Otitis med. tuberc. Adenitis colli & mediastini	1950 pus Cu. Ang.
72	♀ Dagmar	6/1-12	Kap Dan	Tub. genus sin. Spondylitis lumbalis Infiltratio pulm. sin. Adenitis colli & axillae	TB not found
73	♂ Josef	13/6-42	Kûngmiut	Tub. renis dxt.	1951, urine, Cu. Ang.

The cases are listed in Table 37 and will not be discussed in detail. It appears from the table that tubercle bacilli were found in 5 of the 7 cases.

Morbidity due to Ekstrapulmonary Tuberculosis September 1951.

In September 1951 there were 5 survivors of the 7 patients suffering from extrapulmonary tuberculosis, corresponding to 4.4 per 1000 population.

Hence the ratio of pulmonary to extrapulmonary tuberculosis is about 5:1, the same ratio as was found for the mortality (p. 34).

VII. EPIDEMIOLOGICAL INVESTIGATIONS

Pathogenesis of Tuberculosis in the Angmagssalik District.

The Angmagssalik District is in many ways well suited for pathogenetic investigations. It is effectively naturally isolated from the outside world. The inhabitants do not travel outside the district to any appreciable extent and the "immigration" from outside is well controlled. The population is easily surveyed; in a year or so the physician can obtain personal acquaintance with all the inhabitants, and by travelling in the district he gets to know their environmental and housing conditions by personal inspection. He can roughly follow the various persons' removals and residences within the district (cf. POULSEN 1950, p. 314). Therefore it is possible with fair certainty to check the conditions of infection of the tuberculous patients.

Tuberculosis is not so wide-spread that all inhabitants can be considered exposed to an infection of such a constancy and intensity that one cannot for this reason distinguish between the various pathogenetic possibilities.

On the basis of investigations into the residences and conditions of exposure of the 37 tuberculous patients known within the period of 1948—51 and on the basis of tuberculin tests and X-ray examinations of these patients and their housemates, the following classification of patients in different pathogenetic groups has been made. With a special view to this classification a short case history of each individual patient is given.

Abbreviations.

fl. = flouroscopy.
n. a. = nothing abnormal.
p. st. = pulmonary stethoscopy.
(BCG) denotes that the person in question has been vaccinated with BCG in relation to the tuberculin test mentioned.
col. = colony of TB.

Primary Infection.

The following patients developed manifest pulmonary tuberculosis after checked primary infection:

Pt. No. 45, ♂ Evfa, born 19/4-25, Sermiligaq.
Tuberculin tests: 1945 Pirq. —, 4/48 Pirq. —, 8/48 Pirq. —, 1/49 Mantoux 1: 9 mm.

Exposure: unknown.
Case history: March 1948 minor hemoptysis. Autumn 1948 frequent hemopt. and pulmonary symptoms.
Exam. for bacilli: 4/11-48 +++ TB.
X-ray exam.: 5/9-49: large right-sided artificial pneumothorax. Cavity upwards in right lung.

Pt. No. 58, ♂ Pavia, born 14/2-37, Kap Dan.
Tuberculin tests: 1940 Pirq. —, 1946 Pirq. —, 3/49 Moro —, 6/50 Moro +.
Exposure: unknown.
Case history: Spring 1950 pain in right side of chest, tiredness, coughing.
Exam. for bacilli: 13/7-50 ++ 8 col.
X-ray exam.: 6/50 double pleurisy. 7/50 perihilar infiltration.

Pt. No. 61, ♂ Harald, born 9/11-37, Kap Dan.
Tuberculin tests: 1949 Pirq. —, 3/49 Moro —, 1/50 Moro ++.
Exposure: Father pulm. tub. Jan. 1950 (Pt. No. 53).
Case history: Well until January 1951, then hemoptyses, March 1951 again hemoptyses, coughing and a little expectoration.
Exam. for bacilli: 2/51: =, 3/51 ++ 10 col.
X-ray exam.: 4/51: cavernous process in right upper zone, bilateral infiltration with small spots.

Pt. No. 62, ♀ Tabitta, born 17/8-35, Kap Dan.
Tuberculin tests: 1938 Mantoux —, 1940 Pirq. —, 1946 Pirq. —, 3/49 Moro —, 3/50 Mantoux 10: 25 mm.
Exposure: unknown.
Case history: Nov.—Dec. 1949 repeatedly small hemoptyses, tiredness, loss of weight, coughing. Jan. 1950 slight attack of whooping cough. Since then coughing and expectoration.
Exam. for bacilli: 11/49 =, 12/1-50 =, 5/50 ++ 2 col.
X-ray exam.: 5/50: massive infiltration in left upper and middle zone with cavity.

Pt. No. 64, ♀ Charlotte, born 20/4-38, Kap Dan.
Tuberculin tests: 1940 Pirq. —, 1946 Pirq. —, 4/49 Moro +.
Exposure: unknown.
Case history: In the winter of 1949 erythema nodosum with seediness and left-sided pain. 26/4-49 p. st.: pronounced dullness and suppressed breath sounds upwards on the right side. — Later improved. — April 1950 influenza with pains in the right side of the chest.
Exam. for bacilli: 5/50 =, 10/50 ++ a few col.
X-ray exam.: 5/50: dense perihilar infiltration in right upper and middle zones.

Pt. No. 65, ♀ Katrine, born 30/1-34, Tineteqilâq.
Tuberculin tests: 1/49 Mantoux 1 —, 5/49 Mantoux 100 — (BCG), 12/49 Mantoux 10: 50 mm.
Exposure: Jan. 50—July 50 helped in the house of Pt. No. 55.
Case history: Jan. 50 whooping cough. July 50 bedridden with pain in right side of thorax and a cough. — (From July away from the Main Settlement). — Spring 1951 ailing with a cough and exp. and hemoptyses.
Exam. for bacilli: 6/51 +++ TB.
X-ray exam.: 12/49 fl. n. a. — 3/50 fl. n. a. — 7/50 fl.: walnut-sized infiltration over right diaphragm, right costophrenic angle blurred. — 6/51 cavity in right lower zone.

Endogenous Reactivation without Demonstrable Exposure to Infection.

In the case of the following patients we could not by inquiries in the environment demonstrate any possibilities of known exposure to infection in relation to the development of manifest pulmonary tuberculosis:

Pt. No. 49, ♂ Sajoq, born 1/12-21, Kùngmiut.
Tuberculin tests: 1940 Pirq. +, 3/50 Mantoux 10: 18 mm.
Exposure: Mother died of pulm. tub. 1942 (Pt. No. 31). Brother pleurisy 1941, since then no cases in the family and no known exposure.
Case history: In winter 1949 tired and having a cold, July 1949 hemoptysis during a severe cold. Since then perfectly well.
Exam. for bacilli: 6/49 ++ a few col. — 10/49 =, 3/50 —.
X-ray exam.: 7/50: mottling in left apex with calcifications. — 11/51 fibrous streaks in left apex, otherwise no change.

Pt. No. 51, ♂ Kaleraq, born 21/3-11, the Main Settlement.
Tuberculin tests: 1936 Pirq. +, 1948 Mantoux 1: 12 mm.
Exposure: Brother died 1937 of miliary tub. (Pt. No. 5). Sister died 1945 pulm. tub. (No. 30). Brother died 1949 after being hospitalized since 1942 (No. 44). — In wife's family several deaths from tuberculosis (Pt. No. 15, No. 26, No. 28, No. 35, and No. 42). The last died in hospital 8/49. — 4 children Moro negative 5/49 (BCG)
Case history: Well until Jan. 1950, when whooping cough with hemoptyses.
Exam. for bacilli: 7/1-50 =, 9/1-50 =, 13/1-50 + 1 col.
X-ray exam.: 12/49 fl. n. a. — 1/50 radiograph: small infiltration in left apex, blur along the right of the heart shadow.

Pt. No. 52, ♂ Nathan, born 21/10-21, the Main Settlement.
Tuberculin test: 12/48 Mantoux 1: 14 mm.
Exposure: Arrived from West Greenland in 1947. At Angmagssalik no demonstrable exposure, 3 children Moro negative 5/49 (all BCG).
Case history: 1937 prolonged pulmonary disorder, later he was well. 12/49 X-ray processes found at mass examinations. No symptoms.
Exam. for bacilli: 12/49 =, 2/50 ++ 1 col..
X-ray exam.: 12/49 radiograph: fibrous small infiltrations and calcifications in both apices and upper zones.

Pt. No. 53, ♂ Ole, born 6/10-11, Kap Dan.
Tuberculin tests: 1938 Mantoux +, 1949 Mantoux 10: 15 mm.
Exposure: unknown. Wife Mantoux 10 — 1949, daughter, born in 1935, Mantoux + 1949, 6 younger children all Moro — 1949.
Case history: 1946 slight hemoptysis. Jan. 1950 whooping cough with hemoptyses and prolonged pulmonary symptoms.
Exam. for bacilli: 2/50 ++ TB, 2 col. 3/50 +++ TB.
X-ray exam.: 4/50 fibro-cavernous right-sided process upwards.

Pt. No. 54, ♂ Nikolaj, born 17/1-13, Kap Dan.
Tuberculin tests: 1946 Pirq. + , 1949 Mantoux 10: 18 mm.

Exposure: before 1946 unknown. Foster-daughter died 1948 of chronic spinal complaint with sinuses (then living outside the district). Since then no known exposure.
Case history: Jan. 1950 whooping cough with hemoptyses and persistent, increasing pulmonary symptoms.
Exam. for bacilli: 3/50 ++ TB, 6 col.
X-ray exam.: 9/49 fl. interlobar pleural striae in right middle zone, otherwise n. a. — 5/50 radiograph: massive density in right upper and middle zone, under that and on the left side mottling.

Pt. No. 55, ♂ Josef, born 1910, the Main Settlement.
Tuberculin tests: 1936 Pirq. +, 1948 Mantoux 1: 10 mm.
Exposure: As a young man trained at Julianehåb. — Mother perhaps pulmonary tuberculosis, 1936 (HØYGAARD 1938, No. 25). Since 1948 no known exposure.
Case history: 1927 hospitalized at Julianehåb for a "boil in the lung". — July 1950 tired and having a cold, 1/8-50 hemoptysis.
Exam. for bacilli: 8/50 ++ TB, 50 col.
X-ray exam.: 12/9 n. a. — 3/50 n. a. — 8/50 radiograph: right apex and upper zone mottled.

Pt. No. 56: ♂ James, born 17/12-41, Qernertuarssivit.
Tuberculin tests: 1945 Pirq. —, 1948 Pirq. +, 1949 Moro +.
Exposure: unknown. Father had fibrous changes in the apex, but — TB at repeated cultivations.
Case history: Jan. 1950 whooping cough. — March hemoptyses without serious symptoms. — August—September 50 a chronic cold with repeated small hemoptyses.
Exam. for bacilli: 3/50 =, 8/50 +++ TB, since then — at cultivation.
X-ray exam.: 8/49 fl. n. a. — 7/50 radiograph: right hilus condensed downwards, streak from left hilus along the heart shadow. Small infiltration in left first intercostal space.

Pt. No. 57, ♂ Lazarus, born 21/7-15, Isortoq.
Tuberculin tests: 1945 Pirq. +, 1949 Mantoux 1: 10 mm.
Exposure: As a young man lived at the Main Settlement, has moved about somewhat. Since 1948 no known exposure. Wife and 4 children tuberculin negative in 1949 (BCG).
Case-history: 1941 bedridden with pain in the lower front part of the chest and with hemoptyses. Since then well. — Sept. 1950 hospitalized for pneumonia with hemoptyses; good effect of penicillin.
Exam. for bacilli: 9/50 =, 10/50 3 times — TB, 10/50 ++ TB, 10 col.
X-ray exam.: 1949 fl. n. a. 10/50 radiograph: right middle and lower zone blurred. — 11/50 fibrous inf. in right middle zone (7/51 thin interlobar streak in right middle zone; otherwise n. a.).

Pt. No. 59, ♂ Elias, born 9/2-29. Íkáteq.
Tuberculin tests: 1945 Pirq. +, 1949 Mantoux 1: 15 mm.
Exposure: Mother died of pulm. tub. in the home in 1943, since then no known exposure.
Case history: 1939 pleurisy. — 1942 a cold of long duration with hemoptyses and left-sided stethoscopic findings. Then well until Sept. 1950, when hospitalized for pneumonia, which was cured by penicillin treatment.

Exam. for bacilli: 1942 several times — TB. — 7/50 = TB, 9/50 and 10/50 three times — TB, 10/50 + TB, 11 col.
X-ray exam.: 7/50: massive infiltration in right apex and upper zone. — 10/50 infiltration in right apex and upper zone with small cavities.

Pt. No. 60, ♂ Hosias, born 8/9-27, Kap Dan.
Tuberculin tests: 1936 Pirq. —, 1938 Mantoux +, 1946 Pirq. —, 1949 Mantoux 1: 15 mm.
Exposure: Brother pulm. tub. spring 1950 (Pt. No. 53).
Case history: 3/51 small hemoptyses during slight symptoms of a cold; since then symptom-free.
Exam. for bacilli: 3/51 ++ TB, 6 col., since then four times = TB.
X-ray exam.: 4/51 farthing-sized infiltration in right apex. Calcifications in both hili and left upper zone (8/51 only a linear shadow in right apex).

Pt. No. 63, ♀ Minna, born 1910, Kûngmiut.
Tuberculin tests: 1940 Pirq. +, 1949 Mantoux 1: 20 mm.
Exposure: unknown. Since 1948 no known possibilities of infection.
Case history: 1947 hemoptyses. — September—October 1950 had a cold and was tired, now and then small hemoptyses.
Exam. for bacilli: 10/50 ++ TB, 1 col.
X-ray exam.: 9/49 fl. n. a. — 7/50 fl. n. a. — 10/50: small infiltration in left middle zone.

Pt. No. 66, ♀ Ada, born 17/8-25, Íkáteq.
Tuberculin tests: 1945 Pirq. —, 1949 Mantoux 1: 10 mm.
Exposure: unknown. No known possibilities of infection since 1948.
Case history: June 1951 had a cold of long duration.
Exam. for bacilli: 6/51 ++ TB, 8 col.
X-ray exam.: 6/50 fl. n. a. 6/51: infiltration in left apex.

Pt. No. 67, ♀ Malene, born 22/6-01, Isortoq.
Tuberculin tests: 1945 Pirq. +, 1950 Mantoux 10: 20 mm.
Exposure: 1942—43 contact with Pt. No. 23. — Since then no infectious contact. — 3 children tuberculin negative 1949 (BCG).
Case history: Spring 1951 influenza and psychogenic depression (son's death) with refusal to eat, enfeeblement, and loss of weight. Hospitalized in July 1951, after which quick improvement.
Exam. for bacilli: 8/51 ++ TB, 1 col.
X-ray exam.: 7/50 fl. n. a. — 5/51 radiograph: small infiltrations in right middle zone.

Pt. No. 68, ♀ Else, born 2/2-99, Kap Dan.
Tuberculin tests: 1936 Pirq. +, 1949 Mantoux 10: 15 mm.
Exposure: When young trained as a midwife at Julianehåb. Appointed midwife at Kap Dan and working as such until 1949. 4 children and one grandchild in the home, tuberculin negative in 1949 (all BCG).
Case history: Often minor hemoptyses; in 1936 "pronounced findings in right lung upwards" (HØYGAARD 1938, p. 1650, No. 36). — Sept. 1951 small hemoptyses during a slight cold.
Exam. for bacilli: 9/51 ++ TB, a few col.
X-ray exam.: 7/51 fl. showing calcification of right hilus, otherwise n. a. — 1952: infiltration in right upper zone.

Unexplained Pathogenesis.

In the case of the following patients it proved impossible to obtain information for the elucidation of the pathogenesis.

Pt. No. 37, ♂ Ignatius, born 8/3-18, Tiniteqilâq.
Tuberculin tests: 1938 Mantoux +, 1949 Mantoux 1: 3 mm.
Exposure: 1944—48 lived in the same house as Pt. No. 38.
Case history: January 1948 hemoptyses. Since then increasing pulmonary symptoms.
Exam. for bacilli: 1/49 +++ TB.
X-ray exam.: none.

Pt. No. 38, Abel, born 1898, the Main Settlement.
Tuberculin tests: 1936 Pirq. +, 1948 Mantoux 1 +.
Exposure: Wife died of pulm. tub. 1944 (Pt. No. 24). Since then no known contact. Hospitalized spring 1948.
Case history: Well until the spring of 1948, when hemoptyses and increasing pulmonary symptoms.
Exam. for bacilli: 7/48 +++ TB.
X-ray exam.: none.

Pt. No. 42, ♂ Mathias, born 17/9-30, the Main Settlement.
Tuberculin tests: 1936 Pirq. —, 1938 Pirq. —, 1940 Pirq. +, 1948 Mantoux 1: 15 mm.
Exposure: Sister died of pulm. tub. 1940 (No. 15), brother died of pulm. tub. 1944 (No. 26). — Mother died of pulm. tub. 1945 (No. 28). — Brother died of pulm. tub. 1948 (No. 35). Since then no known exposure.
Case history: 1940 small hemoptysis. — March 1949 ailing with pulmonary symptoms and loss of weight.
Exam. for bacilli: 3/49 +++ TB.
X-ray exam.: none.

Pt. No. 43, ♀ Justine, born 25/12-13, Kap Dan.
Tuberculin tests: 1946 Pirq. +.
Exposure: Sister died of pulm. tub. in 1938 (No. 12). Since 1946 in West Greenland.
Case history: 1946 repeated hemoptyses, hospitalized at Angmagssalik, sputum — TB. — 1948 hospitalized at Julianehåb with pulm. tub. Transferred to Angmagssalik 10/48.
Exam. for bacilli: 1946 — TB, 10/48 +++ TB.
X-ray exam.: none at Angmagssalik.

Pt. No. 41, ♂ Ignatius, born 20/9-22, Íkáteq.
Tuberculin tests: 1938 Pirq. +, 1948 Mantoux 1: 8 mm.
Exposure: unknown. Moved about somewhat as a young man.
Case history: In the summer of 1947 great hemoptysis, after which hospitalized.
Exam. for bacilli: 1947 — TB repeatedly, 3/48 +++ TB.
X-ray exam: none.

Pt. No. 44, ♂ Gaba, born 5/11-22, the Main Settlement.
Tuberculin test: 1948 Mantoux 1 +.
Exposure: Brother died of miliary tuberculosis 1937 (No. 5). Sister died of pulm. tub. 1945 (No. 30).
Case history: 1942 hemoptysis, later hospitalized.
Exam. for bacilli: 5/42 +++ TB.
X-ray exam.: 8/49 bilateral cavernous processes.

Pt. No. 46, ♂ Zakarias, born 25/8-13, the Main Settlement.
Tuberculin tests: 1936 Pirq. —, 1937 Pirq. +, 1948 Mantoux 1 +.
Exposure: unknown. Since 1937 several times hospitalized.
Case history: 1937 hospitalized for pleurisy. 1939 pulmonary symptoms with right-sided stethoscopic findings. — 1945 hemoptysis. — 1946—47 several times admitted to hospital for observation for pulm. tub. — Jan. 1949 hemoptysis and pulmonary symptoms.
Exam. for bacilli: 1945—48 repeatedly — TB. 1/49 +++ TB.
X-ray exam.: 8/49 wide-spread bilateral cavernous processes.

Pt. No. 47, ♂ Daniel, born 11/6-22, Kûngmiut.
Tuberculin tests: 1945 Pirq. +, 1949 Mantoux +.
Exposure: unknown. Has moved about very much.
Case history: July 1947 hemoptyses. — Spring 1948 hemoptyses and pulmonary symptoms, which persist.
Exam. for bacilli: 10/48 +++ TB.
X-ray exam.: bilateral processes with right-sided cavity.

Pt. No. 48, ♀ Dina, born 31/1-30, the Main Settlement.
Tuberculin tests: 1946 Pirq. +, 1948 Mantoux 1: 12 mm.
Exposure: Arrived from Scorebysund in 1946. — 1946—47 in the same house as Pt. No. 38. — 1949 in the same house as Pt. No. 42.
Case history: Spring 1948 ailing with a cough. Was pregnant. — Later she was fit. until July 1949 when hemoptyses and slight pulmonary symptoms.
Exam. for bacilli: 7/49 = TB, 8/49 — TB, 10/49 ++ TB, 14 col.
X-ray exam.: 8/49 small infiltrations in left upper zone, later cavernous processes.

Pt. No. 50, ♂ Gideon, born 24/11-30, the Main Settlement.
Tuberculin test: 12/48 Mantoux 1: 8 mm.
Exposure: Spring 1949 in the same house as Pt. No. 42, autumn 1949 in the same house as Pt. No. 48.
Case history: Spring 1949 a cough and tiredness. December 1949 whooping cough.
Exam. for bacilli: 12/49 +++ TB.
X-ray exam.: 12/49 cavernous process in right lung.

The Extrapulmonary Cases.

Pt. No. 39, ♂ Solo (Søren), born 12/9-47, the Main Settlement.
Tuberculin tests: 1/48 Pirq. —, 12/48 Moro —, 3/49 Moro —, 5/49 Moro ++.
Exposure: Spring 1949 mother's brother pulm. tub. (No. 42).
Case history: May 1949 symptoms of meningitis. Died 1/6-49.
Exam. for bacilli: 5/49 cerebrospinal fluid ++ TB, 5 col.
X-ray exam.: none.

Pt. No. 40, ♂ Eigil, born 1901, Kap Dan.
Tuberculin tests: 1936 Pirq. —, 1938 Mantoux —, 1946 Pirq. —, 4/49 Mantoux 10: 50 mm.
Case history: July 1949 increasing headache, psychical changes, symptoms of meningitis. Died 25/7-49.
Exam. for bacilli: Cerebrospinal fluid: 12/7-49 ++ TB, 1 col. 18/7-49 ++ TB, 3 col. Cultivation of lung tissue = TB.
X-ray exam.: none.

Pt. No. 69, ♀ Teresia, born 13/7-39, the Main Settlement.
Tuberculin tests: 1945 Pirq. +, 1948 Moro +.
Exposure: unknown.
Case history: 1944 pleurisy, later adenitis colli, otitis supp. chronica, spondylitis fistulosa.
Exam. for bacilli: 1948, pus from cold abscess +++ TB.
X-ray exam.: 1949 Adenitis mediastini, — Spondylitis lumbalis.

Pt. No. 70, ♀ Marie, born 31/8-41, the Main Settlement.
Tuberculin tests: 1943 Pirq. +, 1948 Moro +.
Exposure: Sister died of pulm. tub. 1941 (No. 17), father died of pulm. tub. 1942 (No. 22), mother died of pulm. tub. 1944 (No. 25).
Case history: 1944 swelling of left knee, later chronic fistula.
Exam. for bacilli: TB not found.
X-ray exam.: Lungs n. a. — Left thigh shortened, cavities in lower epiphysis.

Pt. No. 71, ♀ Andrea, born 20/9-47, the Main Settlement.
Tuberculin tests: 1/48 Pirq. —, 12/48 Moro ++.
Exposure: Spring 1949 (Pt. No. 42) and later mother's sister (Pt. No. 48) pulm. tub.
Case history: 12/49 whooping cough, later persistent pulmonary symptoms and otitis med. suppurativa chr. dupl.
Exam. for bacilli: 3/50 pus from right ear: ++ TB, 6 col.
X-ray exam.: Lungs: infiltratio perihilaris dupl., adenitis mediastini.

Pt. No. 72, ♀ Dagmar, born 6/1-42, Kap Dan.
Tuberculin tests: 1946 Pirq. —, 3/49 Moro —, 3/50 Moro ++.
Exposure: Father pulm. tub. Jan. 1950 (No. 53).
Case history: Winter 1951 ailing with pulmonary symptoms, loss of weight, pain in left knee, later swelling of it.
Exam. for bacilli: TB not found.
X-ray exam.: Lungs: infiltration in left upper zone. — Left thigh: cavity in condylus lateralis, exudate in the knee-joint.

Pt. No. 73, ♂ Josef, born 13/6-36, Kûngmiut.
Tuberculin tests: 1945 Pirq. —, 1948 Moro ++.
Exposure: unknown.
Case history: 1950—51 recurring symptoms in the urinary system.
Exam. for bacilli: 9/51 urine ++ TB by cultivation, numerous col.
X-ray exam.: Lungs: 7/50 fl. vigorous right hilar enlargement, 8/51 n. a. Urography: right pelvis of the kidney enlarged, right ureter dilated.

It appears from the case histories that 6 of the pulmonary cases and 6 of extrapulmonary ones (nos. 39, 40, 69, 70, 71, 72) can be explained as cases of progress after primary infections. They constitute 12 of the 37 cases, or about one third of the cases.

In 14 cases it was not in previously tuberculin positive patients possible to demonstrate any exposure to infection in immediate relation to the disease. In these cases the disease can be explained as an endogenous reactivation under the influence of various activating factors,

mainly in the form of unspecific disorders of the respiratory organs. These 14 patients constitute 38 per cent. of the cases or well over one third.

In the remaining 11 patients it is not possible to give particulars of the pathogenesis. In case No. 73 primary infection is possible. In cases No. 38 and No. 41 endogenous reactivation is most probable. Nos. 43 and 47 were too inadequately examined for further considerations. Among the remaining 6 patients 5 were known as tuberculin positive before the illness (Nos. 37, 42, 46, 48, and 50), one (No. 44) was not tuberculin tested before the illness. These 6 had all been exposed to infection by known bacillary patients, and thus superinfection (exogenous reinfection) may be considered a pathogenetic possibility.

If the tuberculosis morbidity in tuberculous patients' spouses in the Angmagssalik District is investigated, it is found that among 28 married couples tuberculosis occurred in both spouses in 3 cases. In one case both were primarily infected simultaneously, and the survivor developed active tuberculosis two years after her husband's death. Among the remaining 27 exposed spouses tuberculosis thus occurred in 2.

In the Angmagssalik District it has not, thus, been possible to ascribe any decisive pathogenetic part to superinfection, at any rate not the part maintained by Faber in the case of West Greenland (FABER 1941, p. 488, FABER 1940, p. 1659) or by Johannes Holm in his proposal for the fight against tuberculosis in Greenland (HOLM 1950, p. 168).

Dissemination.

In the Angmagssalik District the tubercle bacilli, which constitute the tuberculous infection, ultimately always originate from human beings. All strains determined as to type have been human; cattle does not occur there.

It has not been investigated whether the Greenland dogs can act as transmitters of tuberculous infection. Dogs with respiratory symptoms or with chronic wounds have not been observed. Investigations into canine tuberculosis in Stockholm show that tuberculous processes can be shown to occur in 5—7 per cent. of the dogs dissected (HJÄRRE 1939), that the frequency of canine tuberculosis increases highly in the environment of tuberculous patients (HERLITZ 1939, p. 159), and that the dogs mostly are infected by human bacilli (HJÄRRE 1939, p. 109. HERLITZ 1939, p. 140), which are excreted with high virulence, often through urine or through chronic wounds.

The dogs in the Angmagssalik District are nearly always underfed; they consume everything, thus also all human faeces and probably sputum as well. The East Greenlanders associate with their dogs in a

most unfriendly way and only allow them to enter the houses when they are going to whelp or if they are ill; in such cases they might very well be supposed to act as sources of infection, but the circumstances have not been investigated in detail.

Furthermore it must be taken for granted that the infection is chiefly transmitted by way of the sputum of the tuberculous persons, so it would seem obvious that the places where, above all, the transmission of infection takes place, would be the interiors of the Greenland houses.

The houses in the Angmagssalik District—outside the Main Settlement—almost exclusively are turf-built houses with one room and a common plank-bed on which all the inmates sleep. There is a wooden floor almost everywhere, and all houses have glass windows the relative space of which varies very much. The windows are preferably facing the water, therefore not always the south. Stoves are found in very few places, otherwise the houses are heated by primitive blubber lamps.

In 1948—51 the houses, if anything, corresponded to Berthelsen's Type Ib (Berthelsen 1937, p. 16). In the case of the Angmagssalik District they have been described in detail by Høygaard in 1938 (Høygaard 1938a, p. 79).

Since 1937 there has been a chance towards having better and smaller houses. The average number of inmates per house was 10—11 in 1936—37, 7—8 in 1950, as appears from the following table:

Number of inmates per house in the Angmagssalik District in 1884, 1936—37, and 1950.

	Total number of houses	Total number of inhabitants	Inmates per houses
1884	13	413	31—32
1936—37	73	756	10—11
1950	151	1142	7—8

As mentioned above, the East Greenlanders always try to expectorate when coughing. The sputum is collected in scanty containers, mostly old tins, but in an emergency it is collected in the hands, which then are wiped on the nearest serviceable thing available, mostly the clothes. Washing of hands is rare, and clothes are not boiled when being washed.—Through the clothes and the bedding it is thus possible to transmit TB partly by direct contact, partly by drying up with formation of dust containing bacilli.Some sputum will always hit the floor, which in turf-built houses is always cold, mostly damp and dark, thus offering good possibilities of preservation for a prolonged time of material containing bacilli. The area of the floor is small in proportion to the number

of people who walk on it, and dust will therefore easily be stirred up. Another mechanism by which particles from the floor which contain bacilli, can be atomized, no doubt also plays some part. The footwear in the Angmagssalik District almost exclusively consists of kamiks with soles of untanned hide, which in a moist state swells and has a high stickiness to particles of dirt. After use they are dried slowly above the blubber lamp and thus become stiff. Before they can be used again, they

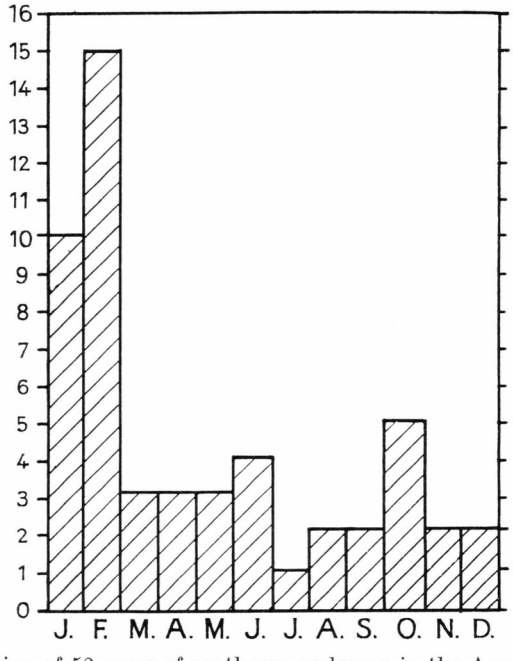

Fig. 11. Distribution of 52 cases of erythema nodosum in the Angmagssalik District 1937—1952, listed according to the months in which they occurred. (Abscissa: months. Ordinate: number of cases).

are rubbed soft against a sharp edge, a process which takes place indoors in winter, and dust containing bacilli thus have great possibilities of being spread in the room.—Like the kamiks damp clothes are also dried above the blubber lamp, which gives another possibility of formation of dust containing bacilli.

The fact that infection by dust (infection by inhalation) seems to be the predominant mechanism of infection in the Angmagssalik District, seems to be supported by the large number of calcified pulmonary primary complexes that have been found at the X-ray examinations. Clinical and X-ray symptoms of tuberculous adenitis colli have been found in 5 cases, only.

That infection is especially disseminated in the houses also appears from another circumstance, viz. the seasonal appearance of erythema

nodosum. Fig. 11 shows those cases of erythema nodosum in the Angmagssalik District during the years 1937—51, which have been noted with statement of the time of their occurrence, 52 in all.

It appears from the figure that most cases appeared in the months of January and February; if the incubation period for tuberculosis, as measured by the time of infection and the appearance of erythema nodosum is reckoned at 6 weeks (WALLGREEN 1941, p. 20. — POULSEN 1950, p. 345), it is found that the dissemination must have been greatest during the months of November—January, thus the darkest months, and the months when the population stay most indoors.—During the months of summer the population of the Angmagssalik District still mainly live in tents, partly as nomads. The tents mostly are made of white canvas, which admits the sunlight. In summer all activities mainly take place in the open, and if only for that reason the possibilities of infection are smaller than in winter.

Geographical Distribution of Tuberculosis in the Angmagssalik District.

Table 38 is a survey of available objective data to illustrate the distribution of tuberculosis in the various parts of the Angmagssalik District.

The statements for 1937 are based on Høygaard's figures (1938, pp. 1649 and 1652), an alteration, however, being made in the demarcation of the western groups of settlements. In Table 38 Isortoq-Nagssivit are isolated as a group apart (from Høygaard's group "E. Inner Sermilik and western settlements"), while the group "The Sermilik Fjord" in Table 38 includes Høygaard's "D. Outer Sermilik" + the rest of Group E. — The calculation of tuberculin positivity in 1937 according the altered division is based on Høygaard's statement that Group E by exclusion of the settlement Sarpaq (near the present Tiniteqilâq) had 1 per cent. Pirq. positives. In Table 38 Isortoq-Nagssivit then has been considered as having 1 per cent. Pirq. positives in 1937. There will then be 23 Pirq. positive persons among 124 persons examined = 18 per cent. positive persons in the present area of the "Sermilik Fjord".

It appears from the table that mortality as well as morbidity and the occurrence of persons with "active or potentially active" radiographic changes is higher at the Main Settlement than in the rest of the district, in which especially Isortoq-Nagssivit has low figures. Otherwise the settlement group of Kûngmiut-Sermiligâq is now highest as regards tuberculin positivity and tuberculin conversion rate per year, but the occurrence of manifest cases of tuberculosis in 1948—51 there is the lowest in the district.

Table 38.

Geographical distribution of tuberculosis in the Angmagssalik District and the development between 1937 and 1951. — The figures for von Pirquet positive reactors in 1937 originate from Høygaard (1938), the figures for 1939 from Ammundsen (1941, fig. 2, p. 485).

	The Main Settlement	Kûngmiut-[1] Sermiligâq	Kap Dan Quernertuarssivit	Sermilik Fjord	Isortoq Nagssivit	The whole district
Population figure 1937 (Høygaard)	106	182	192	155	52	687
Pirq. positive per cent. 1937	49	15	15	18	1	20
Pirq. positive per cent. 1939	74	28	26	27		35
Deaths of tuberculosis 1937—39	10	2	0	2	0	14
Deaths of tuberculosis 1940—42	4	0	2	2	0	8
Deaths of tuberculosis 1943—45	5	1	0	2	0	8
Deaths of tuberculosis 1946—48	1	3	2	0	0	6
Deaths of tuberculosis 1949—51	6	2	2	2	0	12
Total number	26	8	6	8	0	48
‰ per year	13.7	2.1	1.6	2.6	0	3.5
Population figure 1950	146	337	313	248	98	1142
Tuberculin positive 1950 all ages	71 %	76 %	59 %	62 %	17 %	61 %
Tuberculin positive 1950, 0—12 years	40 %	50 %	26 %	25 %	8 %	33 %
Annual tuberculin conversion rate 1950, 0—6 years	7 %	13 %	8 %	3 %	0 %	7 %
Radiogr. changes[2] Number	23	21	20	16	2	82
Radiogr. changes[2] %	16	6	6	6	2	7
Pt. with +TB in sputum 1948–51 Number	9	4	10	5	2	30
Pt. with +TB in sputum 1948–51 ‰ per year	21	4	11	7	7	8
Survivors among them in Sept. 1951 Number	5	2	9	3	2	21
Survivors among them in Sept. 1951 ‰	34	6	29	12	20	18

[1] Also includes the settlement Kangerdlugssuatsiaq with 30 inhabitants.
[2] Radiographic changes = "active or potentially active changes".

The Development of Tuberculosis 1937—1951.

The most remarkable change in conditions of tuberculosis in the Angmagssalik District through the year 1937—51 is an increase in the tuberculin positivity.

The total tuberculin positivity during the period 1937—39 for the district as a whole appears to have increased from 20 per cent. to 35

per cent. Pirq. positives, which corresponds to an annual tuberculin conversion rate of about 10 per cent.

Especially at the Main Settlement the development was violent, a development which is unrestrainedly explained on the basis of the fresh outbreak of tuberculosis ("epidemical appearance") in 1936—37, described by Høygaard (1938), in which 17 fresh cases of severe tuberculosis occurred among a population of 106 individuals. The tuberculin positivity increased from 49 to 74 per cent. of Pirq. positive reactors, which corresponds to an annual conversion rate of about 25 per cent., thus a very great dissemination.

If we deduct the Main Settlement, the tuberculin positivity in the district increased from about 15 per cent. in 1937 to about 27 per cent. in 1939, which corresponds to an annual conversion rate of 7—8 per cent., a figure which corresponds to conditions in the Angmagssalik District in 1949—51 (calculated from the youngest year-classes).

A constant conversion rate per year of 7 per cent. will raise the tuberculin positivity to a value corresponding to about 40 per cent. of the children below 13 years of age being positive. This value had not been reached in 1937, when Høygaard found that 9 per cent. of children below 13 years were positive reactors (corresponding to an annual conversion rate of about 2 per cent.). As long as the tuberculin positivity for the age-classes below 13 years has not reached a value of about 40 per cent. positive reactors, an annual conversion rate of 7 per cent. will mean that the tuberculin positivity in the population is increasing, as has actually been the case in the district outside the Main Settlement since 1937. The primary infections in 1950 took place at an earlier age than in 1937; in 1950 33 per cent. of children below 13 years in the district as a whole were positive, while only 9 per cent. were so in 1937. The increased conversion rate has also influenced the population above 13 years, who in 1937 showed a positivity of 23—40 per cent., in 1950 85 per cent.

The increase in the tuberculin positivity is a direct expression of increased possibilities of infection, which involve a danger to the tuberculin negative reactors. At the same time the increase in the tuberculin positivity means an increase in pulmonary processes which may be "reactivated" and which under the influence of factors weakening the resistance to TB may develop into manifest cases of tuberculosis.

Factors Weakening Resistance.

Among factors weakening resistance in the Angmagssalik District especially non-tuberculous diseases in the respiratory organs have been observed, partly in the form of an epidemic of whooping cough,

partly in the form of more endemically occurring disorders in the air passages.

The epidemic of whooping cough was transferred to the Angmagssalik District from West Greenland in the autumn of 1949 and then gradually spread to the whole district, the most distant settlements of which were reached in May 1950. It caused 35 deaths among children, 32 of them being below one year (in 1949 52 children had been born in the district).

Among adults the epidemic gave rise to a number of unspecific pulmonary complications and an aggravation in the conditions of 5 tuberculous patients (Table 31, p. 72, Nos. 44, 45, 46, 47, and 48), 3 of whom died during the epidemic (Table 4, p. 28 and Table 31, p. 72, Nos. 44, 45, and 46). 4 male adults contracted pulmonary tuberculosis without any of them having been in contact with known sources of contagion (Table 31, p. 72, Nos. 51, 52, 53, and 54; cf. case histories on pp. 84—85), while one man (No. 50) contracted tuberculosis, perhaps after contact with one of the patients whose state was aggravated (No. 48).—In connexion with the fresh cases of tuberculosis a number of primary infections arose, among which bacillary pulmonary tuberculosis developed in 4 persons (Table 31, p. 72, Nos. 58, 61, 62, and 64) and extra-pulmonary tuberculosis with pulmonary complications in 2 (Table 37, p. 80, Nos. 71 and 72).

Colds—from cases of catarrhal inflammation increasing to cases of bronchopneumonia—are frequent in the Angmagssalik District, a fact which was mentioned already before the colonization (GRAAH 1932, p. 136. — HOLM 1888, p. 104) and from the first years of the colonization (POULSEN 1909, p. 148). They especially make their appearance in the early months of spring, from February to April, at all settlements, independently of mutual contact between them, furthermore during the months of summer and autumn. In the months of summer epidemic colds appear, brought to the district by the ships from outside. The reactivation of tuberculosis in connexion with such disorders of the respiratory organs has been observed in the patients (Table 31, p. 72, and case histories on pp. 85—86, Nos. 59, 55 (?), 56, 57, 59, 60, 63, 66, 67, and 68). Among these there was a particularly distinct connexion between the unspecific disorders in the patients Nos. 56, 57, 59, and 63; in the other cases the possibility cannot be ruled out that the preceding colds were the first symptoms of tuberculosis.

It is difficult to demonstrate what rôle is played by the diet as regards the resistance to tuberculosis in the Angmagssalik District. According to Høygaard's investigations the original East Greenland diet was composed as indicated below (HØYGAARD 1941, p. 55.—The calculations of vitamins are adduced partly from Høygaard's statements, partly from SCHULERUD et al. 1945).

Original East Greenland diet/2800 cal.

Protein g	Fats g	Carbo-hydrates g	Vitamins A I. u.	Vitamins B_1 I. u.	Vitamins C mg	Vitamins D I. u.	Calories
300	170	20	15,000	400	52	1200	2800

The food eaten by the Greenlanders when they are reduced to getting their supplies only from the shop ("shop food") may roughly be indicated as composed of sugar 1/5, hulled grain 1/5, flour 3/5 (MIKKELSEN & SVEISTRUP 1944, pp. 168—179); if we add margarine corresponding to 5 g per 100 g of the other products, we fairly get what the Greenlanders notoriously buy. This diet consists of the following items per 2800 cal.

"Shop food"/2800 cal.

Protein g	Fats g	Carbo-hydrates g	Vitamins A I. u.	Vitamins B_1 I. u.	Vitamins C mg	Vitamins D I. u.	Calories
63	46	529	350	200	0	55	2800

Between these two extremes the diet may vary and be composed in numerous ways, in certain parts of the district (particularly Kûngmiut and Qernertuarssivit) it is supplemented considerably by fishery produce. —As a whole the food is best and most copious and varied during the months of (May—)June—November. In the months of winter, more especially after the end of January, the diet is often insufficient in respect of calories, so that periods of starvation still occur.—During the months of summer the population eat plenty of green vegetable matter and berries, in the months of winter often seaweed (cf. HØYGAARD 1941, p. 63). Cases of scorbutus were not observed during 1948—51.

In the settlement group Isortoq-Nagssivit the inhabitants still almost exclusively live on a diet composed as the original one, and sealing and hunting are good the whole year round.

At the Main Settlement the possibilities of sealing and hunting are very poor and fishing is possible only during a short period in the autumn. During the months of winter the Greenlanders there often subsist on a diet which approaches nearly to mere "shop food". Caries of teeth is widespread at the Main Settlement, the children there often being badly attacked before the age of five. This disease is still little distributed outside the Main Settlement.

As nutrition is the only direct demonstrable condition in which the Main Settlement is in a poorer situation than the rest of the district, it is natural to consider that there is a relation between this factor and the wider distribution of tuberculosis at the Main Settlement, an explanation which already Høygaard (1938, 1941) considered the most probable one. Possible effects of the altered mode of life at the Main Settlement as compared with the rest of the district cannot be made the subject of a closer evaluation.

Effects of Danish Colonization.

Tuberculosis in the Angmagssalik District has increased during the Danish colonization. It is impossible on the basis of the available information and investigations to decide which effects of it should especially be put in relation to the increase of tuberculosis, but it seems that the colonization involves possibilities of greater dissemination of tuberculosis, as appears, among other things, from the fact that tuberculosis is more widely distributed in West Greenland than in the Angmagssalik District, which has only been under the influence of colonization for well over fifty years. The proportion between Angmagssalik and West Greenland appears from Table 39, which shows figures for tuberculin positivity, tuberculosis-morbidity and -mortality.

Table 39.

Comparisons between Angmagssalik and West Greenland as regards tuberculin positivity, tuberculosis-morbidity and -mortality.

	Angsmagssalik District		West Greenland
	The district apart from the Main Settlement	The Main Settlement	
Moro positive 0—12 years ...	32 %	37 %	58 %[1]
Tuberculin positive 0—20 years	42 %	52 %	62 %[1]
Tuberculosis morbidity 1951..	1.6 %	3.4 %	7.1 %[2]
Tuberculosis mortality (Angm. 1937—51, Julianehaab 1951)	1.6 ‰	13.7 ‰	11.2 ‰[2]

[1] From Beretninger vedrørende Grønland (1950 No. 1, p. 23).
[2] From Julianehaab 1951 (JENSEN 1954, p. 919).

It appears from the table that the Main Settlement holds an intermediate position between conditions in the rest of the district and in West Greenland.

The circumstances under which the colonization may be supposed to further the increase of tuberculosis, may be divided into circum-

stances with relation to dissemination and circumstances with relation to the resistance of the population.

Circumstances which may promote dissemination are especially characterized by a tendency towards the concentration of the population in a few permanent settlements, especially in winter, in contrast to the previously usual scattered and changing settlement. A fact which may also indirectly get a promoting effect on the dissemination is that the introduction of new concepts of humaneness has involved that chronically diseased people survive longer than before the colonization, while such people previously often committed suicide or were assisted to do so if the disease was considered fatal, of which there are a number of examples in the reports on conditions in the original population (Graah 1932, pp. 136—39. — Holm 1888, pp. 104 and 181).

Among effects which may be supposed to influence the resistance of the population, the fact should be especially emphasized that there is no selection of the fittest to the same degree as before the colonization. The population figure is no more a function of the country's own resources, but is increasingly maintained by means of imported nutrients of a quality inferior to the original ones, and at present there is a development during which the population figure rises to a higher degree than the productivity and the standard of living, which may result in decrease of the natural resistance.

Finally it may be mentioned that the colonization through increased contact with the outside world creates possibilities of the introduction of epidemic diseases which may have a reactivating effect on latent tuberculous processes and in this way give rise to greater possibilities of infection in a situation in which the resistance in non-tuberculous persons, too, is reduced.

The Danish colonization, however, has also brought about that the population, without expenditure of any kind, can benefit by modern examinations and treatment of tuberculosis as well as other diseases, through which it ought to be possible to make up for the negative effects of the colonization.

VIII. COMBATING OF TUBERCULOSIS AT ANGMAGSSALIK

General Lines.

The combating of tuberculosis in the Angmagssalik District must in the main be done on the same lines as in Denmark:

(1) Isolation and treatment of sources of infection.
(2) Chest-clinic work with control of latent cases and exposed persons.
(3) BCG vaccinations.

(1) *Isolation and Treatment of Sources of Infection.*

The isolation must take place at the hospital at Angmagssalik. This has hitherto been insufficient; but a modern hospital is now in course of erection.

The treatment ought, as far as possible, to be given at Angmagssalik, but to be supplemented by treatment in Denmark (or Godthaab) of cases which by modern, special treatment have a possibility of definitive elimination of the excretion of TB.

(2) *Chest-Clinic Work.*

Because of local conditions this must be done on other principles than in Denmark.

Systematic X-ray examinations are only possible during the months of summer except in the case of the inhabitants of the Main Settlement and cases hospitalized for observation. The control must therefore be based on bacteriological examinations. Such examinations are practicable all the year round as regards practically the whole district and—if combined with cultivation of sputum—are effective, as the bacillary persons thus found can be transported to the hospital for treatment except in the months of November—January.

(3) *BCG Vaccinations.*

BCG vaccinations of tuberculin negative persons can be carried through during the months of summer, when the population to a wide

extent travel to the Main Settlement, and when the physician can go everywhere in the district. The rest of the year there is no communication with Denmark by ship, but vaccinations can then be made with dried BCG vaccine, as was possible in the Angmagssalik District in 1949 and 1950.

The population are well-disposed towards the BCG vaccinations and all ages willingly submit to the process of vaccination.

Tuberculin Sensitivity and Positivity after BCG Vaccinations in the Angmagssalik District 1949—1950.

BCG vaccinations of tuberculin negative persons were in 1949—51 performed to the widest extent possible.

The short observation period for those vaccinated does not permit an evaluation of the effects of the vaccinations on the tuberculosis morbidity. Therefore only experiences as to the effect of the vaccinations on the tuberculin sensitivity in the vaccinated, originally tuberculin negative persons will be communicated.

For the vaccinations partly dry vaccine which had kindly been placed at our disposal by Laboratory Director K. Tolderlund, Statens Seruminstitut, in the autumn of 1948, partly various liquid vaccines sent from Statens Seruminstitut when there was communication by ship, were used. Of these liquid vaccines we especially used vaccine No. 851, which in 1949 was submitted to the whole of Greenland. The vaccines used later were used to a smaller extent, the last ones in the summer of 1951.

The majority of the tuberculin negative reactors found were vaccinated in 1949. In 1950 vaccinations had been made in all settlements in the district.—Table 40 shows the extent of the vaccinations down to August 1, 1950.

Table 40.

Extent of BCG vaccinations in the Angmagssalik District down to 1/8-1950 after Moro and Mantoux tests.

	After Moro test	After Mantoux 10 units	In all
Number of tuberculin negatives	322	103	425
Number of BCG vaccinated persons	291	84	375
Percentage of BCG vaccinated persons	89	82	88

The table shows that 88 per cent. of the tuberculin negative persons at all ages had been BCG vaccinated in the summer of 1950.

Table 41 shows the results of vaccination with dry vaccines and with vaccine No. 851, appraised by tuberculin positivity according to the definitions of the latter with Moro plaster and with Mantoux 10 units given on p. 38.

Table 41.

Positive reactors to tuberculin tests about one year after vaccinations with dry vaccines and with vaccine No. 851 in the Angmagssalik District.

Vaccine	Date of use	Number of vacc.	Number of retested	Tuberculin reaction after about one year		
				—	+	Percentage + of retested
Dry-63	28—29/5-49	98	73	47	26	65
Dry-60	17/3-50	71	64	38	26	59
Dry-62	12—13/4-50	28	17	11	6	65
Dry vaccines	..	197	154	96	58	62
No. 851	July-Aug. 49	162	141	101	40	72

The table shows that the positivity with dry vaccine No. 63—used 8 months after delivery—and the positivity with dry vaccine No. 62—used 19 months after delivery—are alike, viz. 65 per cent. tuberculin positive reactors. The positivity after vaccinations with vaccine No. 60—used 18 months after delivery—is a little lower. The vaccines were all kept at cellar temperature (4—8° C.) and suspended immediately before use. In connexion with the use a small, not measured amount of vaccine was sown from all the three vaccines on Löwenstein-Jensen culture medium. All dry vaccine gave ample growth.

A comparison of the tuberculin positivity obtained after dry vaccines with the positivity obtained after ordinary vaccine (No. 851) shows that there was a somewhat lower positivity after dry vaccines, but the difference is not great.

In those vaccinated who were above 12 years of age tuberculin tests before and after vaccination were made with Mantoux 10 units.

Table 42.

Distribution of tuberculin tests with Mantoux 10 units in persons vaccinated with vaccine No. 851 tested about one year after vaccination. Those vaccinated were all above 12 years of age.

Infiltration	0	2	4	6	8	10	12	14	16	18	20 mm	In all
Number of reactions	13	2	4	5	16	13	5	3	0	7		68
Percentages	19	3	6	7	24	19	7	5	0	10		100 %

The reactions were measured in mm infiltration after 72 hours. Table 42 shows the percentage distribution of these reactions according to the size of the infiltration in 68 vaccinated persons above 12 years of age.

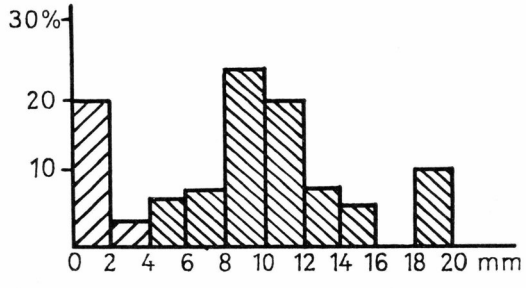

Fig. 12. Percentage distribution of reactions to the Mantoux test, 10 units, in mm infiltration in 68 BCG vaccinated persons over 12 years of age; tested about 1 year after the vaccination.

Fig 12 shows the percentage distribution graphically.

It is seen that most reactions occurred between 8 and 10 mm infiltration. Next follow reactions between 10 and 12 mm. No reactions above 20 mm were observed.

Table 13, p. 41, shows that the settlement group Isortoq-Nagssivit has a remarkably low tuberculin positivity. The conversion rate per year, measured from children below 6 years, was 0 per cent. as against some 7 per cent. in the district as a whole. The majority of the tuberculin negative persons at Isortoq-Nagssivit were vaccinated in the summer of 1949 with vaccine No. 851 and retested in 1950 and 1951. The table shows how the tuberculin positivity after BCG vaccination held out at this settlement group as compared with conditions in persons vaccinated in the rest of the district vaccinated with the same vaccine.

Table 43.

Checking of tuberculin reactions in persons vaccinated with vaccine No. 851, one and two years, respectively, after vaccination. The figures apply to the same persons at the two tests.

	Tuberculin tests					
	Tested one year after vaccination			Tested two years after vaccination		
	Number	Positive	Percentage	Number	Positive	Percentage
Isortoq-Nagssivit	34	30	88	23	8	35
Rest of district.....	73	53	73	44	29	66

The figures are small, especially as regards persons tested both one and two years after vaccination, but they seem to show that the tuberculin positivity after vaccination is lost more quickly at a settlement where there is no spontaneously developed tuberculin positivity.

Furthermore, the investigations show that it is necessary to retest the vaccinated persons annually. In 1950 and 1951 numerous revaccinations were made after ordinary as well as dry vaccine. Several persons were vaccinated 4 times and 2 vaccinations were frequent.

Other Measures.

On the long view the combating of tuberculosis must be aimed at supporting all endeavours towards an improved standard of living, which in the Angmagssalik District will only be possible with increased production, in part on a different basis from the traditional one. The inhabitants themselves have not yet any sense of this necessity, but it must be supposed that the measures taken by the administration for this purpose will gain increasingly great support.

Secondarily a change in housing conditions must take place. A change of the dwelling houses from turf-built houses to wooden houses will require expenditure which the present level of production of the population cannot bear. It will also require a change in the dwelling habits in order to become an effective measure against tuberculosis. The East Greenlanders decidedly feel most comfortable when all inmates of a house stay in the same room.

Better (changed) dwellings ought to be a consequence of an improved (changed) standard of living. The opposite cannot with any degree of certainty be expected to be the case at Angmagssalik.

Meanwhile it must be tried through instruction to restrict the danger of infection in the houses. The instruction should first of all exclusively aim at making the population realize that the danger of infection is inseparably bound up with the sputum. Simple, cheap, and practicable methods to meet this danger of infection by providing suitable means to collect sputum and render it harmless must be found, while the population are simultaneously taught that these and only these means may and must be used for the collection of any clot of sputum which is coughed up indoors.

The population in the Angmagssalik District are very willing to be instructed and implicitly obey the doctor's directions. So there is a positive basis of an effective propaganda.

The population are afraid of illness and fear tuberculosis, so we may count on their support and collaboration in any practicable work at combating it.

Part Two. Investigations into Hemoptyses.

INVESTIGATIONS INTO HEMOPTYSES

Discussion of the Literature.

In West Greenland it has since the first days of the colonization been known that Greenlanders often suffer from hemoptyses. A detailed discussion of the pertinent literature as regards West Greenland is outside the scope of the present work. Surveys are found in Meldorf's book on tuberculosis in West Greenland (MELDORF 1904) and in Berthelsen's nosography (BERTHELSEN 1940, pp. 50—54). From recent times there is a statement of the frequency of hemoptyses at Julianehaab, in which Laurent Christensen finds that 11 per cent. of the population at some time have spat blood (CHRISTENSEN 1941, p. 477). A frequency of that order of magnitude fairly corresponds to what has been found by others in West Greenland.

The occurrence of hemoptyses in East Greenland was first recorded by Gustav Holm, who mentioned a boy belonging to a consumptive family and suffering from hemoptysis, against which he wore an amulet (a clot of seal blood sewn into his anorak in the front of his chest) (HOLM 1888, p. 118).

Johan Petersen, who participated in the umiak expedition to Angmagssalik in 1884—85 has stated that the East Greenlanders—before the colonization—used a special vocable for hemoptysis (personal communication), that the phenomenon was frequent, and that the Greenlanders stood in awe of this as of every symptom of any internal disorder.

Poulsen mentioned the occurrence of hemoptyses at Angmagssalik in 1898—99 (POULSEN 1909, pp. 148—149).

By examination of 37 East Greenlanders in the year 1900 Meldorf found hemoptyses in the anamnesis of 5 of them (MELDORF 1902, pp. 24—29).

In 1927 Bentzen examined 55 Greenlanders at Angmagssalik with a special view to tuberculous diseases. 18 of them in a previous period of their lives had spat blood (3 a large amount), and 34 of the 55 persons mentioned deaths after hemoptyses among their nearest relations (BENTZEN 1928, p. 75).

Le Mehaute & Tcherniakofsky mention hemoptyses as being frequent at Scoresbysund 1932—33 (LE MEHAUTE & TCHERNIAKOFSKY 1954, p. 491).

Høygaard in 1936—37 examined a total of 40 patients suffering from hemoptyses (HØYGAARD 1938, pp. 1649—1653).

In 1938 Fabricius Hansen at Angmagssalik found 15 hemoptysis patients more than those recorded by Høygaard (personal communication).

Esther Ammundsen mentions hemoptyses as being frequent at Angmagssalik (AMMUNDSEN 1941, p. 484).

Previous Investigators' View of the Etiology of Hemoptyses in Greenland.

As regards West Greenland, there have been changing views of the etiology of the hemoptyses, the general view being that all hemoptyses are due to tuberculosis. Some physicians, however, have maintained that it cannot be the cause in all cases.

As regards East Greenland, the same views have been prevalent.

Poulsen's statements on hemoptyses at Angmagssalik have been quoted above (p. 16). He regrets that he has been unable to examine samples of sputum from patients suffering from pulmonary diseases and hemoptysis. Because of his clinical experiences he is not, however, of opinion that the hemoptyses of all Greenlanders can be due to tuberculosis (POULSEN 1909, p. 49).

Meldorf supposed that the hemoptyses in the patients from East Greenland seen by him were due to tuberculosis (MELDORF 1902).

Le Mehaute and Tcherniakofsky, who stayed at Scoresbysund in 1932—33, were directly interested in the hemoptyses of the Greenlanders, which they found to be frequent and common, especially in women. They examined a number of samples of sputum from patients suffering from hemoptyses without in any case being able to demonstrate the occurrence of TB.

Some of their smears of sputum were later examined in Paris by Dr. Macheboef, head of a department at the Institut Pasteur, who could not in any of the preparations examined find TB. He declared that the contents of cells in the preparations did not resemble what is found in tuberculous patients (LE MEHAUTE & TCHERNIAKOFSKY 1934, p. 492).

Some of Le Mehaute and Tcherniakofsky's smears of sputum then were examined by the director of the Laboratoire de Parasitologie de la Faculté de Médicine in Paris, Dr. Langeron, who in Gram-stained preparations found filaments of *Oidium lactis* in all patients examined. Furthermore, he found elements which looked like parts of fungi be-

longing to the Actinomyces group ("celle de filaments fins non cloisonnés à contenu fragmenté ayant l'allure des filaments des champignons du groupe des Actinomycés") (*loc. cit.* p. 492).

Le Mehaute and Tcherniakofsky then discuss the possibility that the diseases observed might be mycoses and not tuberculosis. In a later work (TCHERNIA 1944, p. 50) the problem is very briefly discussed, the author expressing his regret that it had not been possible to investigate the problem of mycosis : tuberculosis in more detail. After the authors' return to France it has not been investigated more closely what part might be played by fungi in cases of hemoptysis.

Høygaard mentions a total of 40 patients with previous or fresh hemoptysis (HØYGAARD 1938).

29 of these cases were Pirq. positive and the etiology in all of them was considered tuberculous, without Høygaard, however, having examined samples of sputum for TB.

11 of the patients examined were Pirq. negative. One of these died of an illness which by postmortem examination was proved to be an organic heart disease (aortic stenosis) with endocarditis and myocarditis. Stasis was found in the trachea and the bronchiae, and the hemoptyses were assumed to originate from there. In two cases the hemoptyses appeared in connexion with clinical symptoms of pneumonia, in three cases during bronchitis, in two cases during a cold, while in the remaining three cases it was not possible to find any cause.

Høygaard discusses C-vitamin deficiency as etiology of the hemoptyses. On the basis of his investigations into diet and vitamins (HØYGAARD 1941, p. 95) he rejects such a possibility, as he found only slight degrees of C-avitaminosis at Angmagssalik.

Høygaard explains the East Greenland hemoptyses on the assumption that the East Greenlanders' mucous membranes, particularly in the air passages, are especially vulnerable. He supposes that the hemorrhages to a greater extent originate from the air passages than from the lungs themselves, respectively tuberculous cavities.

Høygaard discusses Le Mehaute and Tcherniakofsky's theory of fungi as the cause of the hemoptyses (HØYGAARD 1938, p. 1654, HØYGAARD 1938b, p. 758). He interprets the French authors' statements to the effect that they should have thought that the pulmonary diseases should be actinomycoses, remarking that such an assumption does not correspond to the radiographic and clinical results found. He says, "I do not pay very much attention to this work" (that of the French authors) "because the numbers were too small and there are a lot of other diseases which give Eskimos hæmoptysis" (HØYGAARD 1938b, p. 758), and ". . . the fact that these investigators did not find tbc. by no means tell against tuberculosis. The material was small, and all

clinical experience indicates that phthisis among the Eskimos takes a course with fibrous pulmonary changes and rarely gives rise to excretion of bacilli" (HØYGAARD 1938, p. 1654),—a very bold assertion considering that Høygaard did not himself examine one sample of sputum or one radiograph, and considering that by Pirq. tests he has shown that the tuberculin positivity is 65 per cent. in houses with "sure pulmonary tuberculosis" as against 5 per cent. in houses without tuberculous patients.

In 1938 Fabricius Hansen found hemoptysis in 7 patients who were tuberculin negative reactors to Mantoux 1 mg (AMMUNDSEN 1941, p. 484).

Esther Ammundsen discusses the Greenland hemoptyses on the basis of the reports quoted above, concluding that it is not possible to make any decisive statement on the etiology of the hemoptyses. In her opinion the question ought to be taken up when there is a possibility of X-ray examinations at Angmagssalik (AMMUNDSEN 1941, p. 484).

IX. INVESTIGATIONS AT ANGMAGSSALIK 1948—51

Definition of the Concept of Hemoptysis.

At the investigations into hemoptyses at Angmagssalik the aim was that of registering and examining all persons who presented this symptom.

As the physician at Angmagssalik has daily contact with only about 15 per cent. of the population, it was possible only in a few cases to ascertain that a patient actually spat blood.

The diagnosis of "hemoptysis" thus in the great majority of cases were made anamnestically.

As far as possible, all Greenlanders above 10 years of age were asked whether at some time they had spat blood. If the answer was in the affirmative, the person in question was asked about the amount and character of the sputum, about the circumstances of the hemoptysis, how many days the hemoptysis lasted, and about possible attending symptoms of illness.

As it will consequently be difficult to define the term of "hemoptysis", it has been chosen to understand it as expectoration of any sputum which by the patient is considered to contain blood, whether this blood has occurred in a pure state or as an admixture to phlegm, whether it was a question of a single blood-tinged clot of sputum or greater amounts of fresh blood.

The Number of Patients with Hemoptyses.

By questioning of the population at Angmagssalik in 1948—51 a total of 134 persons with recent or earlier hemoptyses have been registered. A number of them had spat blood more than once under different circumstances independent of one another, but such persons have been counted as one patient only.

Table 44 shows the time of the first hemoptysis in the 134 persons. According to the table the years 1951, 1950, and 1949 display a remarkably large number of cases as compared with the previous years. This can only be explained on the assumption that a large number of minor

hemoptyses occurring some years back were forgotten. That this was actually the case can be seen directly from the fact that among the 30 persons who had hemoptyses before 1945, there were 22 who by Høygaard had been stated to have had hemoptyses. 10 of these persons denied this at the questioning in 1948—51.—By later examination of Fabricius Hansen's notes from Angmagssalik taken down in 1938 the names of 4 persons were found who at that time had hemoptyses, but who in 1948—51 had forgotten this.

The 134 correspond to 12 per cent. of the total population, but according to the considerations above, the figure is too low. It cannot be stated how large a number of members of the population at some time in their lives spat blood, apart from the fact that it can be estimated as corresponding to at least 12 per cent. of the population.

In the following sections an account will be given of investigations into the etiology of the hemoptyses, i. e. investigations into the problem what diseases are attended by hemoptysis according to the definition given above. In these investigations only patients with hemoptysis within a limited period will be considered.

Table 44.

Distribution of the 134 patients with hemoptyses after the calendar year within which the first hemoptysis occurred.

Calendar year	1951	1950	1949	1948	1947	1946	1945	Before 1945	In all
Number of pts. with hpt.....	21	51	19	6	3	3	1	30	134

Etiology of the Hemoptyses.

The Material of Patients.

As was shown in Table 44 it was not possible to obtain any reliable figure for cases of hemoptysis before 1948, as many people forget the hemoptyses, at any rate minor ones. The high increase in the number of hemoptyses after 1948 is furthermore due to the fact that this symptom has aroused particular interest after that time, a circumstance which the local midwives in the district as well as the ordinary population gradually became aware of.—Only from 1949 we can therefore count on having had the majority of the hemoptyses occurring registered.

In July 1949 an X-ray equipment was installed at Angmagssalik, and therefore it has been chosen to reckon the investigation period from July 1, 1949. On the other hand, hemoptyses occurring after July 1,

1951, are not included, as the observation period (down to October 1951), especially as regards the cultivations of sputum, after that time is too short.

The number of patients who in what follows will be made the subject of etiological investigations, thus is constituted by the cases of hemoptysis occurring within the two years between 1/7-49 and 1/7-51.

This number of patients is 89, 37 men and 52 women.

The 89 patients correspond to an annual frequency of hemoptysis in the total population of 4 per cent.

Methods of the Examinations and the Extent of the Latter.

Anamnesis.

In each case it was tried to obtain a thorough anamnesis, including the size, character, and frequency of the hemoptyses, the time of the hemoptyses and possible attending symptoms.

Investigations into the Milieu.

In each case the result of investigations into the patient's family and household formed part of the diagnostic considerations. Particular weight was attached to the tuberculin tests on the housemates, especially conversion in previously tuberculin negative reactors within the same period as the patient's hemoptysis. Furthermore, importance was attached to the question whether other members of the family simultaneously with the patient's hemoptysis suffered from diseases with similar symptoms and whether among the patients relatives there had previously or simultaneously been cases of hemoptysis.

It was found to be of interest to inquire into the question whether a tendency towards hemoptysis might be considered hereditary. Only within one family many cases of hemoptysis occurred under different diagnoses; otherwise there was nothing to indicate any hereditary predisposition.

Objective Examinations.

Table 45 is a survey of the general and special examinations made for the diagnosing of hemoptysis and the extent of these examinations as regards the 89 patients.

Intracutaneous tests with Histoplasmin and Coccidioidomycin were made on 118 individuals in all, among them 25 of the hemoptysis patients. In no case reactions of more than 5 mm infiltration were found, hence all cases must be considered negative.

Table 45.

Methods of the examinations and the extent of the latter in the 89 patients with hemoptyses.

	Patients examined	
	Number	Percentage
Stethoscopy of lungs and heart	89	100
Tuberculin tests	88	98
Histoplasmin and Coccidioidomycin tests	25	28
Microscopy of sputum for TB	89	100
Cultivation of sputum for TB	87	98
Examination os of sputum for fungi	69	77
Fluoroscopy and radiography	89	100
Laryngoscopy	48	54
Bronchoscopy	7	8
Capillary resistance tests	25	28
Measurement of blood pressure	51	57

Microscopy of sputum for TB. Here only diagnostic examinations are included (for patients suffering from tuberculosis only examinations until finding of the first bacillary sample). From the 89 patients a total of 352 preparations were examined, on an average 4 for each patient, but in the case of patients with symptoms suspicious of tuberculosis more samples were examined, at most 13. From 6 patients only one sample was examined.

Cultivation of sputum for TB. Here only samples cultivated for diagnostic purposes are included (cf. above). A total of 236 samples from 87 out of the 89 patients were examined, i. e. on an average between 2 and 3 samples from each. From patients with symptoms suspicious of tuberculosis an average of 4 samples, the maximum being 9 cultures from one patient.

Examinations of sputum for fungi. Examinations for fungi were made from October 1950 to the summer of 1951.

The examinations consisted partly in microscopy, partly in cultivation. Microscopy was made partly of Gram-stained preparations or preparations stained with methylene blue, partly of unstained preparations of untreated sputum. From March 1951 microscopy was made of the sediment of sputum treated with 4 per cent. sodium hydroxide and centrifuging (as for Löwenstein cultures).

Cultivation was made on media prepared at Angmagssalik. The media were made of fish soup (cod, divided into fine particles), which had been boiled for half an hour (100 g cod in 1000 g water). After

filtration 4 per cent. glucose (Dextropur) and 1.5 per cent. agar (Danagar, pulverized) were added. This was boiled for another half hour and then distributed to test tubes free from alkali, which were pasteurized for an hour at 85° C., sloping.

The samples of sputum were collected in sterile tubes. From each samples 2—4 "lugfuls" of sputum were used, after which the media were placed in a thermostat at 38° C.

41 samples of sputum were examined at Statens Seruminstitut.

369 samples were examined at Angmagssalik.

Thus 410 samples of sputum from a total of 296 individuals were examined.

A total of 69 out of the media on which growth of colonies appeared were sent to Statens Seruminstitut for "fungus diagnosis". 37 of them were lost at the loss of M/S Amdrup; the other 32 were all examined by Dr. Per Holm, Laboratory Director at Statens Seruminstitut, who thus made fungus diagnoses from 73 samples of sputum.

The following species of fungi were found by Dr. Per Holm in sputum from Angmagssalik:

Aspergillus glaucum
Aspergillus niger
Candida albicans
Candida pseudotropicalis
Candida tropicalis
Cryptococcus, species variae
Mucor racemosus
Penicillium
Rhizopus
Saccharomyces, species variae
Ustilago zeae
Some indeterminable species.

Of these species *Candida albicans* was considered to be of special interest. It will be mentioned below, pp. 129—130.

Fluoroscopy and radiography. All the 89 patients examined were screened several times. All were X-rayed at least once. All X-ray pictures have been described by Chief Physician G. Bindslev, M.D.

Laryngoscopy was made in 48 cases; in 25 of these, laryngoscopy was made within 10 days after the hemoptysis.

Bronchoscopy was attempted in 7 patients. Because of poor anaesthesia and lack of skill, it proved only possible in 3 cases to inspect the aperture of the main bronchi, in the others it was necessary to

interrupt the examination before the bronchoscope had reached the carina. In no case did it prove possible to obtain a sufficiently comprehensive view of the section of the mucous membranes that had been passed, for a statement on the findings.

Capillary resistance tests. For examination of possible vascular fragility in patients with hemoptyses, all "fresh" cases were examined with capillary resitance tests by means of a cuff for measuring blood pressure placed on the upper arm with a pressure of 80 mm Hg. for 3 minutes. Only in one out of 25 cases examined did the test produce a few petechiae.

Measurement of blood pressure was performed in 51 cases. Abnormal values were not found in any of these cases, the values being found to be between 100 and 135 mm Hg. systolic.

Diagnosis.

The most important diagnostic decision in each case was the distinction between tuberculosis and non-tuberculosis.

Pulmonary tuberculosis. This term is only meant to denote cases in which examinations in relation to hemoptysis or within a period after the hemoptysis have shown contents of TB in sputum from the patient.

Cases of hemoptysis with the diagnosis of pulm. tub. only include those in which the hemoptysis was "primary", not patients with previously diagnosed tuberculosis who during the further course of the illness had spat blood. The cases included are only such in which the hemoptysis occurred within the period 1/7-49 to 1/7-51 (and therefore do not include all the cases of tuberculosis listed in Table 31, p. 72).

Observation for pulmonary tuberculosis includes cases in which the hemoptysis introduced a disorder which showed radiographic and clinical symptoms of tuberculosis, but in which it was not possible to make a diagnosis on the basis of bacilli after cultivations of sputum.

Pneumonia. This diagnosis was made in cases in which there were transient coughing, expectoration, a temperature above 38° C. for several days, a weakened general condition, perhaps transient X-ray changes, perhaps pain in the thorax.

All cases of pneumonia were considered to be cases of bronchopneumonia. During 1948—51 stethoscopically or radiographically determined lobar pneumonia was not found in patients with symptoms of pneumonia.

Chronic bronchitis and bronchiectasis. Persistent and frequently recurring coughing and abundant expectoration without findings of of TB (in the cases of 17 patients with these disorders a total of 106 microscopic examination and 74 cultivations for TB were made). By stethoscopy numerous rhonchi were observed in all cases and in many cases râles in acute phases. By X-ray examinations reticulation or infiltration in the bases of the lungs, perhaps with small cavities were found in some cases, but the material has not been divided into groups with chronic bronchitis and bronchiectasis, as the diagnostic aids were not sufficient for a sure distinction.

Some of the patients in this group had spat blood in acute phases with a fever, which thus ought to be included in the group with bronchopneumonia, but if there were otherwise chronic coughing and expectoration, the cases were registered as chronic bronchitis or bronchiectasis, which was considered the basic disorder.

Acute bronchitis. Cases of transient coughing and expectoration of more than a week's duration, perhaps with a fever of short duration and stethoscopic findings (rhonchi), but without radiographic changes and without appreciable weakening of the general condition.

Whooping cough. Cases during the epidemic in 1949—50, the patients all being above 10 years of age, in which the illness took a course like violent cases of acute bronchitis, often with a transient weakening of the general condition, but without attacks of cyanosis and generally without a rise in temperature.

Epistaxis. The patients had bled from the nose in connexion with the hemoptysis, which consisted of pure blood followed by blood-free clots of sputum from the chest. In one of the cases rhinoscopy could be made immediately after the hemoptysis and there proved to be a bleeding spot in the nose.

Uncertain cases include such cases in which it was not possible to find any explanation of the hemoptysis.

Among the above-mentioned diagnoses of non-tuberculous diseases it was in some cases possible radiographically to make the diagnosis of "calcified lesions" (fairly large calcified areas in the apices or lung fields). In some of these cases information was available about previous illness to which the radiographic changes could be ascribed, but in none of them it was possible to demonstrate radiographic or clinical signs of activity, and none of the patients in question were known to have been bacillary within a preceding period of at least three years.

The diagnosis has not been set up as an independent diagnosis, but in Table 46 it has been added as a "secondary diagnosis" in a column apart, off the actual diagnosis.

Table 46.

Diagnoses for the 89 cases of hemoptysis in Angmagssalik 1/7-49—1/7-51, distributed according to sex. — Within each sex the diagnoses' percentage share in the total number is indicated. Cases of calcified tuberculous lesious are added as "secondary diagnosis".

Diagnosis	Men		Women		Both Sexes		Calcifled tub. lesions		
	Number	%	Number	%	Number	%	M.	W.	Both s.
Pulm. tuberculosis.....	9	24	5	10	14	16	—	—	—
Obs. for pulm. tub.	3	8	1	2	4	5	—	—	—
Pneumonia	6	16	11	21	17	19	1	1	2
Chronic bronchitis + bronchiectasis	4	11	13	25	17	19	2	2	4
Acute bronchitis	5	14	3	6	8	9	1	1	2
Whooping cough	4	11	4	8	8	9	1	—	1
Catarrhal inflamm.	5	14	12	23	17	19	1	2	3
Epistaxis	1	3	1	2	2	2	—	—	—
Uncertain cause.....	—	—	2	4	2	2	—	1	1
In all...	37	99	52	101	89	100	6	7	13 = 15%

It appears from Table 46 that cases of pulmonary tuberculosis + cases of "obs. for pulm. tub." constitute 18 persons, corresponding to 20 per cent. of all cases of hemoptysis. Certain tuberculosis occurs in 16 per cent. of the cases, only.

Calcified tuberculous lesions were found in 13 of the 71 patients with non-tuberculous disorders, corresponding to 18 per cent. of these. It cannot be decided on the basis of the material whether there is any connexion between the healed tuberculosis and the actual diagnosis. There seem to be most cases of calcified tuberculous lesions within the groups with bronchitis (chronic bronchitis + bronchiectasis + acute bronchitis), as there were there 6 out of 25 cases, while out of the 47 patients with other diagnoses there were 7 with old pulm. tub. In order to decide the question it would be necessary to examine all patients with the same non-tuberculous complaints (without hemoptysis), but such a material is not available.

80 per cent. of the patients with hemoptysis had suffered from complaints in the case of which tuberculosis could be excluded. These complaints mainly were bronchial diseases, increasing from cases of catarrhal inflammation to cases of bronchopneumonia and bronchiectasis,—diseases which are extremely widespread in the Angmagssalik

District, and which all give rise to diffential diagnostic considerations in respect of tuberculosis.

Hemoptysis in cases of heart disease did not occur in the Angmagssalik material.

As regards the distribution by sex of hemoptyses in Angmagssalik, it appears from Table 46 that hemoptyses occurred in 37 men as against 52 women. As the district is inhabited by equal numbers of the two sexes, there is thus actual preponderance of hemoptyses in the case of the women.

As to the individual diseases, it appears that the difference according to sex is the reverse as regards the tuberculous diseases, with which there are twice as many men as women. This ratio is also found as regards the total number of cases of pulmonary tuberculosis within the period investigated (see Table 32, p. 73) and thus is not a feature which is characteristic of tuberculous hemoptyses.

The total preponderance of the women is conditioned by their larger number of cases of chronic bronchitis + bronchiectasis and catarrhal inflammation, during which disorders obviously more women spit blood than men. Hemoptysis during pneumonia is somewhat more frequent in women, while hemoptysis during acute bronchitis it is more frequent in men.—Unfortunately there are no figures available for the occurrence of these complaints in the two sexes, but the frequency is supposed to be fairly the same.

A tuberculin test after hemoptysis was negative in 5 patients:

In one case (woman, 40 years of age) with a diagnosis of bronchitis there had been several occurrences of hemoptysis between 1945 and 1950. Repeated tuberculin tests, the last being made in 1951, were all negative.

In 4 cases (women, 11, 21, 24, and 34 years of age), all with a diagnosis of pneumonia and hemoptysis, a tuberculin test some time after the hemoptysis was negative. The women had all been BCG vaccinated in 1949. In 1950 3 of them showed positive reaction to Mantoux 10 units, but in 1951—after the cease of the illness—they all reacted negatively to Mantoux 10 units.

Character of Hemoptyses at the Various Diagnoses.

Table 47 shows the size and frequency of the hemoptyses at the various diagnoses.

It appears from the table that great hemoptyses (more than half a cupful) only occurred in 16 cases or 18 per cent. of the patients. The group within which the greatest hemoptyses occurred was that of pneumonia.

It is characteristic of the patients with chronic bronchitis and bronchiectasis, that in many cases they had repeated hemoptyses for a lengthy period.

Besides, the table shows that it is not possible to draw any diagnostic conclusions on the basis of the size and frequency of the hemoptysis, especially not in the differential diagnosis between tuberculosis and non-tuberculous diseases.

Table 47.

Size and character of hemoptyses within the various diagnoses in the Angmagssalik District.

Diagnosis	A single bloody clot of sputum	Several bloody clots within 24 hours	Several bloody clots within 2-10 days	Periods with bloody clots within a month	Periods with bloody clots within a year	Several periods with bloody clots within a number of years	Half a cupful and more, once	Half a cupful and more, several times	Periods with alternating major and minor hemoptyses	In all
Pulm. tub.	..	2	3	5	3	..	1	..	..	14
Obs. for pulm. tub.	..	2	1	..	..	..	1	..	..	4
Pneumonia	..	5	5	..	..	..	4	3	..	17
Chronic bronchitis + bronchiectasis	1	4	..	3	1	6	1	..	2	17
Acute bronch.	2	4	2	..	..	..	..	..	..	8
Whooping cough	1	3	2	1	..	..	1	..	..	8
Catarrhal inflamm.	4	6	4	1	..	..	1	..	1	17
Epistaxis	..	1	..	..	..	..	1	..	..	2
Uncertain cases	..	..	1	..	..	..	1	..	..	2
In all...	8	27	18	10	4	6	11	3	3	89
Percentage	9	30	20	11	5	7	12	3	3	100
	Minor hemoptyses: 82 %						Major hemoptyses: 18 %			

Distribution of Hemoptyses by Age-Groups.

Table 48 shows the distribution of hemoptyses by age-groups in the Angmagssalik District, classed according to the various diagnoses.

It appears from the table that there is no demonstrable difference between the distribution by age for tuberculosis patients and the distribution for patients with non-tuberculous complaints.

Under the age of 5 years, one case of hemoptysis occurred. In the age-groups about 5 years the frequency increased. The maximum was reached in the age-group of 20—25 years, with 19 per cent. of the cases

Table 48.

Distribution of hemoptyses by age-groups within the various diagnoses in the Angmagssalik District 1949—51. Percentage distribution of hemoptyses on age-groups.

Age-group	0	5	10	15	20	25	30	35	40	45	Above 45	In all
Pulm. tub.	—	1	2	2	2	1	..	4	2	..		14
Obs. for pulm. tub.	..	..	3	..	..	..	1	..	..	..		4
Pneumonia	..	..	3	2	4	3	1	1	3	..		17
Chronic bronchitis + bronchiectasis	..	..	..	..	3	3	2	2	1	6		17
Acute bronch.	..	..	1	..	3	1	1	..	..	2		8
Whooping cough	..	..	1	1	1	1	2	1	1	..		8
Catarrhal inflamm.	1	1	1	3	4	3	..	3	1	..		14
Epistaxis	..	1	..	1	..	..	..	..	..	..		2
Uncertain cause	..	..	..	..	..	1	..	1	..	..		2
In all...	1	3	11	9	17	13	7	12	8	8		89
Percentage	1	3	12	10	19	15	8	14	9	9		100
	16 %			44 %			31 %			9 %		

discussed; then the frequency gradually falls to 9 per cent. in the age-groups above 40 years.

Tuberculosis is evenly distributed on the age-groups.

Distribution of Hemoptysis According to Season.

Table 49.

Distribution of hemoptyses within the months of the year in the Angmagssalik District 1949—1951, grouped according to diagnoses.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Several months	In all
Pulm. tub.	3	..	1	..	1	1	1	1	1	1	1	1	2	14
Obs. for pulm. tub.	..	1	..	..	1	..	..	..	..	2	..	..	..	4
Pneumonia	..	1	2	..	2	2	1	1	1	5	2	..	..	17
Chronic bronchitis + bronchiectasis	..	..	..	2	1	1	1	..	1	..	2	..	9	17
Acute bronch.	1	..	..	1	2	..	..	..	3	..	..	1	..	8
Whooping cough	4	1	1	1	..	..	..	..	..	..	..	1	..	8
Catarrhal inflamm.	1	3	2	1	1	..	1	..	1	4	3	..	..	17
Epistaxis	..	..	..	..	1	..	1	..	..	..	..	..	..	2
Uncertain cause	..	..	..	1	..	..	1	..	..	..	..	..	..	2
In all...	9	6	6	6	9	4	6	2	7	12	8	3	11	89
Quarters	21			19			15			23				

Summer half: 34 hemoptyses. Winter half: 44 hemoptyses.

Table 49 shows the occurrence of the hemoptyses within the months of the year. There is a maximum in October, when the autumn colds often are virulent. Cases of catarrhal inflammation and pneumonia together constitute 75 per cent. of the hemoptysic diseases in the month of October.

Tuberculosis is often attended by hemoptyses, which are evenly distributed on the months of the year. There is an uncertain maximum in January when 3 cases of tuberculosis with hemoptysis occurred, all of them activated by whooping cough, which in itself may have been the cause of the hemoptyses. Whooping cough, which during the months of December 1949—April 1950 was epidemic in the Angmagssalik District, in itself characterizes the cases of hemoptysis in January. Without complications it gave rise to 4 of the 9 cases of hemoptysis in January.

The winter half of the year shows more cases of hemoptysis than the summer half, but the difference is not great.

Hemoptysis as a Differential-Diagnostic Symptom.

It appears from the preceding sections that it has not been possible to demonstrate anything characteristic of hemoptyses in connexion with tuberculosis as compared with hemoptyses connected with non-tuberculous disorders of the respiratory tract.

82 per cent. of all hemoptyses were small, producing bloody clots or sputum with an admixture of blood and occurring during periods of changing length. 18 per cent. of all hemoptyses were greater, i. e. producing more than half a cupful. Within the group of pulmonary tuberculosis only one of the 14 patients (7 per cent.) had great hemoptyses.

The present investigations do not permit direct conclusions as to the origin of the hemoptyses. The fact that they are frequent even in connexion with slight affections of the mucosae (catarrhal inflammation and acute bronchitis) makes it probable that hemoptyses during these affections consist in hemorrhages of the mucosae. The hemoptyses of the tuberculosis patients discussed were not demonstrably distinct from the others, and it must be assumed that the tuberculous hemoptyses may consist in hemorrhages of the mucosae of the same origin as those occurring during the slighter diseases, probably the bronchial mucosae.

Even though it is not possible to indicate in figures how frequently the non-tuberculous diseases considered are attended by hemoptysis, it must be assumed that tuberculosis in the Angmagssalik District is the disease which most frequently includes hemoptyses among its symptoms. It was shown above (p. 67, Table 26) that 77 per cent. of the bacillary tuberculosis patients had hemoptyses during the illness. Considering the high frequency of the unspecific diseases of the respiratory tract at

Angmagssalik, we should at a similar frequency of hemoptyses in these diseases find a much larger number of cases of hemoptysis.

Tuberculosis in its manifest form is the rarest of the severe pulmonary diseases which are attended by hemoptyses. Even though it highly manifests itself by this symptom, the tuberculous hemoptyses will in absolute figures be much fewer in number than the non-tuberculous ones. If we are faced with a case of hemoptysis in connexion with a non-diagnosed disease, the greatest probability is that the disease is not tuberculosis (80 per cent. of the hemoptyses are due to unspecific diseases).

The character of the hemoptysis is not decisive.

In the majority of cases the attending symptoms are not decisive.

X-ray examination is an important aid in the differential diagnosis, but cannot make a sure diagnosis. Table 25, p. 65, shows that within the radiological groups of "perihilar infiltration" + "solitary infiltration" + "infiltration of up to 1/3 lung" there were 9 bacillary cases with hemoptysis. With the very same radiographic changes there were 8 non-bacillary cases with hemoptysis, which according to the definition of morbidity given on p. 79 ought not to be registered as tuberculosis.

The bacillary diagnosis is the only decisive one; so examination of sputum for TB by microscopy and cultivation should be made in all cases of hemoptysis (particularly when X-ray examination cannot be made). Without such diagnostics many wrong diagnoses will easily be made, which especially may indicate a higher tuberculosis morbidity than the actual one.

Especially difficult from the point of view of differential diagnostics are patients suffering from chronic bronchitis or bronchiectasis attended by hemoptyses. There is hardly any doubt that many such cases in Greenland have been considered cases of pulmonary tuberculosis, especially when the diagnosis had to be based on stethoscopy, but even by X-ray examinations one may often in such cases find changes which are difficult to interpret. Therefore bacillary diagnostics are particularly important and ought to be decisive.

No value for a differential diagnosis can be attributed to hemoptysis.

X. INVESTIGATIONS IN THE COUNTY OF VIBORG 1952–1953

Investigations into Hemoptyses in the County of Viborg $^{1}/_{1}$ 1952—$^{31}/_{12}$ 1953

For a comparison of the hemoptyses in the Angmagssalik District with a material from Denmark, appraised on the same lines, all cases of hemoptysis referred to the chest clinic of the County of Viborg for examination have been made up for a two-year period, from 1/1-1952 to 31/12-1953.

The Material of Patients.

The patients include all cases referred to the clinic with hemoptysis within the two-year period, provided that the hemoptysis occurred within that period.—Patients under current control who had hemoptyses within the period were only included in so far as they applied to the clinic especially for that occasion.

The material consisted of 88 men and 81 women, 169 patients in all.

As there is no standard for judging to how great an extent patients with hemoptysis are referred to the clinic for examination, it is not possible to give any figure for the frequency of hemoptysis in the population apart from a statement how many of the patients referred to the clinic presented this symptoms.

During the years 1952 and 1953 a total of 9,547 persons were referred to the chest clinics in the County of Viborg. 3,547 of these were referred to the clinic because of symptoms. Of persons referred to the clinic with symptoms, the 169 hemoptysic patients constitute 5.4 per cent., which thus corresponds to the annual rate of hemoptysis among the clientele of the clinics with symptoms.

The symptom of hemoptysis thus is not rare in Denmark. A fairly large number of the patients only gave information about the hemoptysis on direct questioning. Many were anxious about disclosing the symptom, which consequently may be still more frequent than indicated by the 5.4 per cent.

Methods of Examination.

The patients were all subjected to the routine examinations of the chest clinics.

Beyond this it was intended to radiograph all hemoptysic patients, which we succeeded in doing in 88 per cent. of the cases.

Furthermore, it was intended to examine sputum for TB by microscopy and cultivation and for fungi by cultivation (all at Statens Serum-institut). Not all patients were able to deliver samples of sputum, but about 70 per cent. sent in samples. Some of the samples were unfit for detailed examinations. Cultivation of gastric washings was only performed when indicated by the X-ray findings.

All patients were controlled at least once after the first examination.

Special examinations (heart examinations, oto-rhinological examinations, bronchography and bronchoscopy) were not made except in very few cases, and then only if the patients were hospitalized for closer examination.

Diagnosis.

All radiographs were described by Chief Physician G. Bindslev, M.D.

The diagnosis of pulmonary tuberculosis was only applied to those cases in which demonstrated TB were excreted within the examination period.

Table 50.

Cases of hemoptysis in the County of Viborg in 1952 and 1953 arranged by diagnosis and sex.

Diagnosis	Men		Women		In all		Calcified tub. lesions
	Number	%	Number	%	Number	%	
Pulm. tuberculosis	5	5.7	4	4.9	9	5.3	—
Calcified tub. lesions	—	—	2	2.5	2	1.2	2
Pneumonia	13	14.8	9	11.1	22	13.0	4
Chronic bronchitis + bronchiectasis	15	17.1	13	16.1	28	16.6	5
Acute bronchitis	14	15.9	16	19.8	30	17.7	3
Corrosive bronchitis (Chlorine corrosion)	1	1.1	—	—	1	0.6	—
Whooping cough	—	—	3	3.7	3	1.7	—
Catarrhal inflamm.	16	18.2	22	27.3	38	22.6	6
Epistaxis	9	10.2	6	7.3	15	8.9	—
Cancer of the lung	1	1.1	—	—	1	0.6	—
Heart disease	6	6.8	—	—	6	3.5	—
Thoracal trauma	3	3.4	—	—	3	1.8	—
Uncertain cause	5	5.7	6	7.3	11	6.5	—
In all	88	100.0	81	100.0	169	100.0	20 = 12 %

While the diagnoses of tuberculosis thus must be considered to be certain, this applies to a smaller extent to the others.

The other diagnoses were made on the same lines as for the Angmagssalik material p. 114), but in the present material it proved necessary to a higher degree to base them on the patient's anamnesis and the referring physicians'—mostly scanty—information. It has proved that a thorough anamnesis is extremely important; if such an anamnesis was missing, it proved impossible to classify the patients with only fair certainty.

Table 50 is a list of the diagnoses for the diseases which must be assumed to underlie the hemoptysis, arranged by sex and total number. Within each sex and for the total group the percentage share of the diagnoses in the total number of cases is indicated.

Furthermore, cases of "calcified tuberculous lesions" are indicated as secondary diagnosis in addition to the other diagnoses.

Character of Hemoptyses, their Distribution by Age and their Occurrence Within the Months of the Year in the County of Viborg in 1952 and 1953.

Tables 51, 52, and 53 show the material as made up on the same lines as the Angmagssalik material.

On the basis of this survey conditions at the two investigations will be appraised.

Table 51.

Distribution of hemoptyses on age-groups within the various diagnoses in the County of Viborg in 1952 and 1953. Percentage distribution of hemoptyses on age-groups.

Age-group	0	5	10	15	20	25	30	35	40	45	60	>60	In all
Pulm. tub.	..	..	..	..	1	..	2	2	1	..	3		9
Calcified tub. lesions ..	..	..	..	..	..	..	1	..	..	1	..		2
Pneumonia	..	..	1	4	..	1	2	4	1	6	2		22
Chronic bronchitis + bronchiectasis	..	1	..	2	3	2	..	..	3	10	7		28
Acute bronchitis	..	..	..	1	3	1	5	5	6	5	4		30
Catarrhal inflamm.....	..	..	2	7	3	8	3	3	2	9	1		38
Epistaxis	..	..	..	5	1	1	1	2	..	1	4		15
Heart disease	..	..	..	1	..	..	..	1	..	2	2		6
Others	..	1	..	2	3	2	5	2	1	3	1		20
In all...	0	2	3	22	14	15	19	19	14	37	24		169
Percentage	0	1	2	13	8	9	11	11	8	22	14		100
		3 %			30 %			30 %		22%	14%		

Table 52.

Size and character of hemoptyses within the various diagnoses in the County of Viborg.

Diagnosis	A single bloody clot of sputum	Several bloody clots within 24 hours	Several bloody clots within 2–10 days	Periods with bloody clots within amonth	Periods with bloody clots within a year	Several periods with bloody clots within a number of years	Half a cupful and more, once	Half a cupful and more, several times	Periods with alternating major and minor hemoptyses	In all
Pulm. tub.	..	2	4	..	..	..	..	1	2	9
Calcified tub. lesions	..	..	..	..	..	..	..	..	2	2
Pneumonia	..	5	16	1	..	..	..	..	..	22
Chronic bronchitis + bronchiectasis	2	5	5	3	3	10	..	..	..	28
Acute bronchitis	2	5	9	9	2	2	..	1	..	30
Corr. bronchitis	..	..	1	..	..	..	..	..	..	1
Whooping cough	..	1	1	1	..	..	..	..	..	3
Catarrhal inflamm.	5	7	10	8	2	4	1	..	1	38
Epistaxis	1	3	3	7	..	1	..	..	..	15
Cancer of the lung	..	..	..	1	..	..	..	..	..	1
Heart disease	..	1	1	1	2	1	..	..	..	6
Thoracal trauma	..	1	2	..	..	..	..	..	..	3
Uncertain cause	1	5	1	1	1	1	..	..	1	11
In all...	11	35	53	32	10	19	1	2	6	169
Percentage	6	21	31	19	6	11	1	1	4	100
	94 %						6 %			

Table 53.

Distribution of hemoptyses on the months of the year in the County of Viborg in 1952—53.

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Several months	In all
Pulm. tuberculosis	..	1	1	..	..	..	1	..	..	3	1	2	..	9
Pneumonia	1	3	2	3	5	1	2	..	..	1	2	2	..	22
Chronic bronchitis Bronchiectasis	1	1	1	1	..	1	..	1	1	3	1	3	14	28
Acute bronchitis	4	4	5	3	4	1	..	..	1	1	3	3	1	30
Catarrhal inflamm.	4	5	3	..	5	1	..	1	1	3	2	6	7	38
Others	4	3	1	3	1	3	3	4	2	3	3	2	10	42
In all...	14	17	13	10	15	7	6	6	5	14	12	18	32	169
Quarters	44			32			17			44				

Summer half 49 hemoptyses. Winter half 88 hemoptyses.

XI. COMPARISON BETWEEN HEMOPTYSES IN THE ANGMAGSSALIK DISTRICT AND IN THE COUNTY OF VIBORG

Table 54 shows a comparison between the diagnoses of cases with hemoptysis in the Angmagssalik District and the County of Viborg. The table shows the percentage of diagnoses constituted by the two materials.

While 16 per cent. of the cases at Angmagssalik were due to manifest pulmonary tuberculosis, only 5 per cent. of the cases in the County of Viborg were due to pulmonary tuberculosis. Considering the morbidity of pulmonary tuberculosis in the two districts, it is remarkable that the difference is no greater.

The morbidity of pulmonary tuberculosis at Angmagssalik is about 2 per cent., while in the County of Viborg at the time of investigation it was about 0.2 per cent. (estimated from the total number of patients in whom TB was found within a three-year period). The reason why the tuberculosis patients constitute 5 per cent. of the hemoptysis diagnoses of the chest clinic, is that the clientele of the clinic is selected with reference to tuberculosis as distinct from other diseases.

Table 54.

Comparison between the shares of the most important diagnoses in the cases of hemoptysis in the Angmagssalik District and the County of Viborg, indicated in percentages.

Diagnosis	Angmagssalik Percentage		County of Viborg Percentage	
Pulmonary tuberculosis	16		5	
Obs. for pulm. tub.	5		—	
Pneumonia	19		13	
Chronic bronchitis Bronchiectasis	19		17	
Acute bronchitis	9	75 %	18	73 %
Whooping cough	9		2	
Catarrhal inflammation	19		23	
Heart disease	—		4	
Pulmonary cancer	—		1	
Epistaxis	2		9	
Other causes	2		8	

Apart from the difference in the share of tuberculosis in the hemoptyses, it is remarkable how much the two materials resemble each other as regards the diagnoses and their share of the cases. The infectious, non-tuberculous diseases of the respiratory organs (pneumonia + bronchitis + whooping cough + catarrhal inflammation) in the Angmagssalik district constituted 75 of the diagnoses, in the County of Viborg 73 per cent.).

At Angmagssalik heart diseases were not attended by hemoptyses in the present material.

Pulmonary cancer was not diagnosed at Angmagssalik.

Table 55 shows the size and character of the hemoptyses in the two materials. There is here a considerable difference in the occurrence of "major" hemoptyses (more than half a cupful), which at Angmagssalik occur in 18 per cent. of the cases as against 6 per cent. in the County of Viborg. Otherwise there is great similarity between the two materials.

Table 56 shows the distribution by age compared in the two materials. While at Angmagssalik there were hemoptyses before the age of 5 years, the first cases in the County of Viborg occurred after that age. At Angmagssalik 16 per cent. of the hemoptyses occurred in the age-groups below 15 years, while in the County of Viborg there were only 3 per cent. in that age-group.—There was a great difference in the age-groups above 45 years. in which at Angmagssalik there were only 9 per cent. of all hemoptyses as against 36 per cent. in the County of Viborg. Conditions cannot be compared directly, as there are very few people above 45 at Angmagssalik; cf. Table 1, p. 13). Table 48 and 51 show that the figures in the elderly age-groups particularly denote cases of

Table 55.

Comparison between sizes of hemoptyses in the Angmagssalik District and the County of Viborg, indicated by the percentage occurrence of the various types.

	Angmagssalik Percentage	County of Viborg Percentage
A single bloody clot of sputum	9	6
Several bloody clots within 24 hours	30	21
Several bloody clots within 2—10 days	20	31
Periods with bloody clots within 1 month	11	19
Periods with bloody clots within 1 year	5	6
Periods with bloody clots through a series of years	7	11
1/2 cupful and more, once	12	1
1/2 cupful and more, several times	3	1
Alternating periods with major and minor hemoptyses through a number of years	3	4

Table 56.

Distribution of hemoptyses by age-groups, in percentages of all patients, for Angmagssalik and the County of Viborg.

Angmagssalik Percentage	Age-groups	County of Viborg Percentage
16 % { 1	0— 4	0 } 3 %
3	5— 9	1
12	10—14	2
44 % { 10	15—19	13 } 30 %
19	20—24	8
15	25—29	9
31 % { 8	30—34	11 } 30 %
14	35—39	11
9	40—45	8
9 % 9	45—60	22 } 36 %
	above 60	14

bronchitis, in the County of Viborg cases of catarrhal inflammation as well.

The distribution of the cases of hemoptysis on the months of the year—Table 67—show rather homogeneous conditions in the Angmagssalik District and the County of Viborg. In both cases there is some preponderance in the number of hemoptyses in the winter half, a preponderance which is more pronounced in the County of Viborg than at Angmagssalik.

Table 57.

Percentage distribution of hemoptyses on the months of the year in the Angmagssalik District and in the County of Viborg.

Angmagssalik Percentage	Month	County of Viborg Percentage
28 % { 12	January	10 } 32 %
8	February	12
8	March	10
24 % { 8	April	7 } 23 %
11	May	11
5	June	5
20 % { 8	July	4 } 12 %
3	August	4
9	September	4
29 % { 15	October	10 } 33 %
10	November	10
4	December	13

XII. INVESTIGATIONS INTO THE OCCURRENCE OF *CANDIDA ALBICANS*

Investigations into the Occurrence of *Candida Albicans* in Sputa.

296 persons at Angmagssalik and 122 persons in the Counties of Viborg and Thisted were examined for occurrence of fungi in sputa. All examinations in the Counties of Viborg and Thisted were made at Statens Seruminstitut, 41 samples of sputum and 32 cultures from Angmagssalik were also examined at the institute (Dr. Per Holm). At Statens Seruminstitut occurrence of Actinomyces or "known pathogenic fungi" was not found in any sample of sputum, neither from Angmagssalik not from the Counties of Viborg and Thisted.

Candida albicans was found in about 15 per cent. of those examined at Angmagssalik, in about 76 per cent. of those examined in the Counties of Viborg and Thisted.—As this fungus is very easy to cultivate, and as its colonies are big and rather characteristic on ordinary culture media, it must be concluded from the examinations that there is an actual difference between the distributions of this fungus at Angmagssalik and in Denmark, even though the special technique of the Statens Seruminstitut will reveal more cases than that used at Angmagssalik. An exact ratio between the occurrences in the two places cannot be stated, as the examinations were not made in the same place, but we must content ourselves by stating that the fungus is more widespread in Denmark than in the Angmagssalik District.

As it appears from the literature (Ikeda 1936, Carter 1936, Stovall & Greeley 1928, Bonnevie 1944) that this fungus can be pathogenic, that it can give rise to diseases of the respiratory organs, and that it can cause hemorrhagic expectoration, it has been examined whether the fungus occurred more frequently in sputa from hemoptysic patients than in sputa from other patients with symptoms in the respiratory tract or without acute symptoms. Table 58 is a survey of the cases examined. The survey shows that the occurrence—in the Angmagssalik District and in the Counties of Viborg and Thisted—is quite the same in patients with and patients without hemoptysis.

Table 58.

Examinations of the occurrence of *Candida albicans* (*C. a.*) in sputa from patients with hemoptysis and from patients without hemoptysis (Controls) in the Angmagssalik District and in the Counties of Viborg and Thisted.

Diagnosis	Angmagssalik				Counties of Viborg and Thisted			
	With hemoptysis		Controls		With hemoptysis		Controls	
	Number of pts. examined	Number + C. a.	Number of pts. examined	Number + C. a.	Number of pts. examined	Number + C. a.	Number of pts. examined	Number + C. a.
Pulmonary tub. ..	7	0	×	×	4	2	3	3
Pneumonia	14	1	×	×	19	17	4	4
Chronic bronchitis + bronchectasis.	13	3	×	×	33	22	27	18
Acute bronchitis ..	7	0	×	×	20	15	15	12
Catarrhal inflamm.	15	4	×	×	25	20	6	5
Epistaxis	2	0	—	—	6	4	—	—
Heart disease	—	—	—	—	3	3	—	—
Others	11	2	×	×	12	8	13	11
In all...	69	10	227	35	122	91	68	53
Percentage of pts. with *Candida alb.*	14		14		75		78	

The examinations thus have shown that it cannot be supposed that *Candida albicans* plays any role for the etiology of hemoptysis in the two materials.

It cannot be decided whether the fungi mentioned by Le Mehaute and Tcherniakofsky (*Oidium lactis*) as occurring in sputa from Angmagssalik may have been *Candida albicans*, but it seems very probable. Thus it has not been possible to corroborate their hypothesis of fungi as etiology of the frequent tuberculosis-like diseases at Scoresbysund.

XIII. RESULT OF THE INVESTIGATIONS INTO HEMOPTYSES

The investigations into hemoptyses in the Angmagssalik District have shown that the majority of them, in the years 1949—51 80 per cent., occur in cases of non-tuberculous complaints. Tuberculous hemoptyses are not in any clinically diagnosable way distinct from non-tuberculous ones. Only by examinations of sputum for TB is it possible to distinguish surely between specific and unspecific hemoptyses.

The majority (82 per cent.) of the hemoptyses were "small", consisting of separate bloody clots of sputum or admixture of blood to mucous or mucopurulent sputum, which appeared in periods of varying length, mostly below ten days.

In the majority of the cases the hemoptyses—the tuberculous ones as well as the others—must be assumed to be due to hemorrhages in the mucosae of the air passages (the bronchi).

By examinations of sputum for contents of fungi no known pathogenic fungi were found, but colonies of *Candida albicans* were found in 15 per cent. of those examined. The same percentage was found in controls, so this fungus may be excluded as a substantial cause of hemoptyses at Angmagssalik.

By investigations into hemoptyses in patients referred to the chest clinics in the County of Viborg, non-tuberculous hemoptyses were found in 95 per cent. of those examined.

A comparison between the two materials examined shows that the most frequent unspecific colds with transition to acute and chronic bronchitis or pneumonia, contribute about 75 per cent. of all cases of hemoptysis in both materials.

The investigations into hemoptyses made at the chest clinics in the County of Viborg could not give any figures for the frequency of hemoptysis in a group of the Danish population suitable for comparison with the frequency at Angmagssalik. At Angmagssalik an annual number of persons corresponding to about 4 per cent. of the total population suffer from hemoptysis. In the County of Viborg the annual number of patients with hemoptysis referred to the chest clinic because of symptoms constitute 5.4 per cent. of all persons referred to the clinic because of symp-

toms; but this figure must be considered much higher than the frequency of hemoptysis in the normal population. An inquiry into the number of hemoptysic patients examined annually at the clinic in proportion to the total number of persons referred to the clinic for the first time gives a figure of 1.8 per cent., a value which is undoubtedly closer to the true one.

Hemoptyses thus must be considered to occur with higher frequency at Angmagssalik than in Denmark (the County of Viborg).

The investigations have shown that the higher tuberculosis morbidity cannot explain this fact, as the tuberculosis at most gives rise to 20 per cent. of the hemoptyses at Angmagssalik.—The fact that the unspecific complaints of the respiratory tract occur with the same percentage value in the Angmagssalik District and Denmark also tells against such an assumption.

The explanation may be that these unspecific infections of the respiratory organs are more frequent in the Angmagssalik District than in Denmark, which seems to be so, though it cannot be demonstrated in figures.

Another explanation which seems the proper one and which perhaps is the correct one, is that the East Greenlanders expectorate to a much greater extent than Danes. Expectoration is practised from an early age, which is illustrated by the difference in number between hemoptysic patients below 15 years at Angmagssalik (16 per cent.) and in the County of Viborg (3 per cent.). It seems that East Greenlanders never "swallow" sputum, not even if this is quite a small clot coughed up during a slight cold.—Just as the East Greenlanders always expectorate actively, they closely examine each clot they cough up, and even a slight tinging of blood in the clot therefore does not escape their attention.

The East Greenlanders regard the spitting of blood with anxiety. Before the colonization the symptom was treated with strict "confinement to bed" in severe cases, and amulets were used "prophylactically".

Today the East Greenlanders apply to the doctor for examination and treatment, and "prophylactically" willingly submit to examination both when ill and when well.

It has not been the purpose of the present investigations into hemoptyses to study the relation to the various non-tuberculous diseases with which they were found. Neither at Angmagssalik nor in the County of Viborg the investigations were directed towards more refined diagnostics in this field. In both places the purpose was that of distinguishing between tuberculosis and non-tuberculous diseases by means of sure

differential diagnostics and then appraising the symptom of hemoptysis and its value as a differential-diagnostic means.

In both places the investigations have shown that only bacillary diagnostics are decisive in the differential diagnostics, and on this basis they have shown that hemoptysis as a symptom is unsuitable for differential diagnostics.

Thus, the investigations into hemoptyses have further emphasized what it has repeatedly been tried to show in the section on tuberculosis in the Angmagssalik District, viz. that the combating of tuberculosis in Greenland—as elsewhere—ought to be based on consistent bacillary diagnostics. Only in this way the correct diagnosis can be made, and only in this way a rational basis of an appraisal of the morbidity and of prophylaxis and treatment can be obtained.

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