

A
SURVEY OF
PULMONARY TUBERCULOSIS
IN THE
OUTER HEBRIDES

by

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OLD TYPE DWELLING HOUSE.

CROFT HOUSE SHOWING STRIP CULTIVATION
IN MID. DISTANCE.

PREFACE

During a period of two years spent in general practice in Lewis the author was impressed by the high incidence of pulmonary tuberculosis which he encountered, and this together with the observation made by authorities on the Island's history that the problem of consumption had only appeared within the last hundred years, provided the impetus to investigate first the local history of the disease and examine the present form of the disease. The problem of the recent introduction of the tubercle bacillus appeared to him unique and provided a possible explanation for the suggestion which he had heard in the industrial area of central Scotland that when a native of the Isles contracted tuberculosis the disease was apparently of an acute nature. The results of his examination of the subject matter at his disposal during the period from 1950 onwards when he was employed as Medical Officer at the County Hospital Stornoway, are recorded in the pages which follow, and are his evaluation of the present trend of the disease.

His thanks are due to Dr. J.H. Harley Williams, the Secretary General of N.A.P.T., for his attentive encouragement in the preparation of this thesis and for his introduction to Dr. Sinclair R. Wilson, Consultant Chest Physician, Kingston-upon-Thames whose suggestions of several references were most helpful and whose elucidation of queries most lucid.

The author is also indebted to Dr. R.S. Doig the Medical Officer of Health in Lewis for the informative tables relative to the present incidence of tuberculosis in Lewis and for permission to include the results of his Mantoux tests, carried out in Lewis schools, and finally to the Physician Superintendent of the County Hospital, Stornoway, Dr. F.A. Paul for granting the facilities for carrying out this survey.

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R.M.L.W.

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INTRODUCTION.

This investigation, which was conducted in Lewis, deals with the type and incidence of pulmonary tuberculosis there during the period 1940 - 1951 and includes a consideration of the contributory factors involved therein.

The Outer Hebrides consist of a chain of islands situated off the northwest coast of the Scottish mainland and separated from it by the Minch - a stretch of sea varying from 50 miles at its broadest to 23 miles at its narrowest part. Their geographical location lies between 57° and $58^{\circ} 35'N$ and between $6^{\circ} 15'$ and $7^{\circ} 30'W$.

The largest island in the chain is that of Lewis - with - Harris, of which Lewis forms the northern and major portion and covers an area of 770 sq. miles inhabited by a population of 23732. South of Harris and separated each by a narrow sound lie in succession the islands of North Uist, Benbecula, South Uist and Barra. The administration of this group of islands is divided between two County Councils; - the region of Lewis falling under the jurisdiction of Ross & Cromarty, while the remaining islands, including Harris, are attached to Inverness-shire.

With the exception of the northern part of Harris and of South Uist, the terrain consists of low rolling moorland of which the monotony is unrelieved by woodland or mountain. Trees are rare. Everywhere the flat depressions in the predominating glacial deposits have filled out into innumerable small lochs. The geological formation, which is regarded as among the most ancient in Britain, consists for the most part of gneiss. Centuries of glacial action, erosion and botanical decomposition have resulted in a deep deposit of peat being superimposed on the impermeable boulder clay. This peat, which is the main source of fuel for the islanders, also provides an agricultural problem of the first magnitude. Boggy and boulder-strewn, it is unsuitable for the use of mechanical implements; drainage is difficult and costly; reclamation is a process both protracted in time and prohibitive in expense. Good agricultural land is scarce and consequently at a premium. An aerial view reveals a vast panorama of peat bog with an isolated cottage or maybe a small hamlet whose inhabitants seek to exploit the alluvial deposits on the banks of the many small rivers that intersect the moor, or a clachan clustering close to the shores of the innumerable glinting lochs that dot the landscape - the close striations of the strip farming of these riparian and lacustrine settlements lending a rather quaint relief to the

monochrome of the island brown.

The climate of the Long Island may be described as maritime. The general mean range of temperature is small - 14° F.; temperatures are low and equable. Proximity to the sea and the moderating influence of the Gulf Stream bring a comparative warmth to the winters and prolong the springs. In any year, Stornoway, situated on the East coast of Lewis and the one sizeable town in the Outer Hebrides, can claim only four months (June - September) with temperatures exceeding 50°F. Although the annual rainfall (40" - 50") cannot be considered excessive, dry spells are as rare as they are unpredictable. No month can pass without the expectation of 17 days on which rain will fall. Attendant clouds will occlude the sun and deprive both the earth and its inhabitants of the beneficent effects of its light and heat. Apart from their obvious relation to health, these climatic conditions have equally important repercussions on the life and work of the crofter. Inclement weather will delay the ripening and ingathering of his crops and in a particularly severe spell may result in almost total loss. Serious though these conditions are, the troubles of the Islander are rendered still more trying by the recurrence of gales. Exposed to the full force of the Atlantic blasts, his country flat and unprotected, he faces the hazards of devastation and destruction, as in

the recent catastrophe of the winter of 1950. At the Butt of Lewis the average number of recorded "gale force" winds is in the region of twenty per annum. Here again the severity of the limitations imposed by climatic conditions on the livelihood of the Islander, be he crofter or fisherman, is only too obvious.

THE EVOLUTION OF SOCIETY ON THE ISLAND.

The antiquity of the habitation of the islands is established by the considerable number of existing Pictish remains. Of these the most famous is undoubtedly the Druid Circle of Standing Stones at Callernish. The first invaders to make incursions into the primitive community were probably the Irish Celts followed by the Vikings whose landings seem to have been frequent and in considerable strength. Evidence of the presence of the Norsemen is easily recognisable in many of the place-names throughout the islands. Following the Norse invasions the isolation of the community appears to have remained practically undisturbed until 1598 when an abortive attempt at colonization and development was made by the "Fife Adventurers". Local resentment of the intrusion of these "foreigners" took the form of burning down the houses built by these protégés of James VI, a drastic but apparently effective type of discouragement, since, after the expulsion of the incomers, contact with outside communities seems to have been on a very reduced scale. The Dutch Fishery Expedition of 1628 and the English Fishing Settlements of two years later were minimal in numbers and left no lasting effects on the island community.

A lack of natural resources, other than inexhaustible supplies of peat for which there was no external market,

and a dearth of industry other than fishing on which the isolation of the islands imposed severe limitations were the main reasons for the static economic conditions persisting throughout the 18th century. Early, however, in the 19th century an increase in population led to an encroachment on the common grazings by bands of squatters whose inroads on the available arable land strained productivity to its limits, with the natural consequence that one unfavourable season could disrupt the economic balance of the island, while a succession of bad summers would result in chaos. A premonition of this is written in the annals of the island when in 1773 and again in 1774 the oat crop failed and the famine years were followed by a pestilence in the form of a putrid fever. So it was that in 1846 - 1850 the failure of the subsidiary industry of Kelping brought destitution to the islands and resulted in large scale emigration - an event of considerable significance to the theme of this investigation. For, and the author would stress the fact, it will be evident that up to this period there had been a strongly marked seclusion of the island folk, who had had but limited intercourse with the outer world. But, dating from 1846, however, comes that contact between the local population of the island and the masses in the rapidly developing cities and towns - the centres of activity of the Industrial Revolution - and that contact was made by emigration from the Hebrides.

The significance of the date is noted here and will be referred to later in the section on the History of Tuberculosis in the Outer Hebrides (p.14) where it is shown that from these years dates the introduction of the disease of T.B. into the community.

OCCUPATIONS

Crofting, weaving and fishing sum up the entire activities of this area, but these terms require some elucidation.

The croft of the Western Isles is small in comparison with that on the mainland and often extends to no more than 4 acres of arable land, but it also carries the right to the use of the common grazings or communal upland pastures. These, as has already been remarked, are limited in extent and do not easily support large herds of animals (and, in the case of the summer grazings are occasionally situated at considerable distances from the croft). The livestock of a croft consists usually of one cow, some thirty sheep and a number, not usually large, of domestic fowls. Horses are rare. Only on the larger holdings does one find any modern agricultural machinery; the prevailing lay-out of the croft with its narrow strips separated by broad open drains makes the employment of mechanical devices impossible. It is still not uncommon to find a harrow drawn by a human being in harness.

As the croft provides only the barest of necessities - mainly oats and potatoes - some means is usually sought of

supplementing the family income. Nearby, or even attached to, the croft-house there is usually a small weaving shed where a handloom laboriously "clacks" out a length of tweed, the product finding a ready and ever-increasing market and providing a substantial addition to the meagre earnings of the crofter.

Another common combination of occupations is that of crofter-cum-fisherman. A small number of boats are engaged on the inshore whitefishing or in lobster catching, but the fishermen in the main concentrate on herring and operate chiefly on the east side of the islands. Here in the herring drifters we find men living in close contact in confined spaces and although it is mentioned in the evidence of Medical Services in the Highlands and Islands Committee as a possible cause of the increase in the number of tuberculosis patients, the author can lead no evidence to support the contention.

Faced with the prospect of such a lifetime of ceaseless hardship and relentless toil, is it surprising that, in a society where the labour supply exceeds the demand, the adolescent so readily responds to the allurements of the city and the amenities of life on the mainland?

DIET

The frugality of the crofter's fare has already been mentioned. The staple articles of his diet are the produce of his land and the sea - oats, potatoes,

and herring (fresh or salted). Sheep are available but the claims of the shearing for the weaving industry conflict with the call for mutton for the meat market. Even such necessary commodities as bread, milk and beef are in such short supply that large quantities must be imported from the mainland. While the calories are thus adequately supplied there is however, a deficiency of vitamins which might be avoided if the crofter overcame his reluctance to cultivate the ordinary horticultural vegetables :- cabbage, lettuce, carrots, parsnips, peas etc. These, like all the luxuries of life, imported also, bear the additional burden of heavy transport charges.

It is the author's opinion that the diet, although lacking somewhat in variety, is adequate and balanced, except for a shortage of vitamins, and he feels that evidence of this deficiency can be seen in the mouths of many patients where, although the teeth are strong, the gum margins are soft and frequently infected.

HOUSING

The traditional dwelling of the Northwest corner of Scotland is the so called "Black House", a type of dwelling that is fast being replaced by modern domiciles. This metamorphosis is the result of energetic action by the Department of Agriculture, which by means of interest-free grants is assisting the crofter to build and equip a healthier habitation. This change, however, is of comparatively recent date (circa 1914) and thus the old

type of house warrants consideration as a factor in the propagation of tuberculosis.

These 'black houses' as they were called made no special demands on architects, builders or contractors. The materials to be used were at hand. The walls, formidable in thickness - they might even be as much as six feet - were of gneissic boulders removed from the surface of what was to become the cultivated land. If necessary they were split to workable shape and size over a peat fire. Once in situ the stones were bound with clay. The structure was not carried beyond the height of the access door, approximately 6 feet. Provision was occasionally made for a window, which consisted of one pane set deep in the recess, and fixed immovably. The roof was of turf and thatch, low in pitch and carefully secured to withstand the ravages of the frequent gales. No provision was made for a chimney, the smoke from the fire being left to find its way through a hole in the roof or open doorway. Gibson (1924).

The building so formed was long and narrow, its interior being partitioned off into sleeping room, living quarter and live-stock accommodation, access to this last being through the same door as to the living-room. In the middle of the earthen floor was the peat fire which was kept burning constantly and formed the centre of the family life. The occupants slept and ate together. There was obviously no provision possible for the segregation of a victim suffering from an

infectious ailment. Sanitary arrangements were either most primitive or non-existent. An open well, always liable to contamination, was the usual source of water supply. With rapidly improving modern conditions, provision is being made in housing schemes for an adequate supply of gravitational water and an efficient sanitary system of sewage disposal, and many of even the remote districts are already enjoying the advantages of adequate electrical supplies and modern domestic appliances.

HISTORY OF TUBERCULOSIS ON THE ISLANDS.

It might appear somewhat remarkable that a community living on a soil of unquestionable antiquity should have remained up to the middle of last century immune from a disease so universally prevalent as Tuberculosis, yet, such is the contention of the authorities on contemporary island history. Phthisis, the disease described by Hippocrates and known to have existed 3,000 years earlier was not introduced to the Western Isles till about 1850 A.D., and for this the reason alleged lies in the almost complete isolation of the population. As has been mentioned previously, the two main infiltrating incursions from the Celts of Ireland on the one hand and the Noresemen from Scandinavia on the other have probably been from lands where, too, tuberculosis was a rarity.

Martin Martin writing at the end of the seventeenth century describes his itinerary through the Islands of the west coast of Scotland. His observations on the various aspects of the communities through which he passed he recorded meticulously, and it is interesting to observe, that whereas in his discussion of the endemic ills in the Island of Skye he mentions that consumption is not frequent. A similar paragraph devoted to the diseases met with in Lewis contains no mention of tuberculosis or allied ailment.

The twin problems of the original local immunity to the disease and the ravages following its subsequent

introduction attracted the attention and exercised the minds of many of the contributors to the medical literature of the middle of the 19th Century.

The reasons adduced for the immunity of the Islanders were remarkably varied and in an annotation the Editor of the British Medical Journal in 1869 summarised the assertions of three medical practitioners regarding the cause :- (1) Dr. MacCormack alleges that the cause of phthisis is re-breathed air; (2) Dr. Leared quoting conditions applicable to Ireland mentions that there the worst possible conditions of ventilation of houses exist, and nevertheless, the inhabitants enjoy a remarkable immunity from the disease (This may be taken as evidence supporting our previous contention that the Celts did not import tuberculosis because it was non-existent in their country); (3) Dr. MacNab, a practitioner in the West Highlands, attributes the absence of tuberculosis in the Hebrides to a preponderance of marine algae.

Dr. J.E. Morgan (1872) seems to have pursued assiduously his investigations into the incidence and causation of tuberculosis throughout the Hebrides, Inner and Outer, and referring to Lewis he quotes (1) a personal communication from Dr. Millar of Stornoway : "The medical gentlemen who practised in this island before me used when filling up schedules of insurance, where the question occurred : "Did your parents or any of your relatives die from phthisis?" invariably to

answer : "No such disease known in the Island", and (2) from Dr. Clark of Harris : "In 32 years' practice in Harris I can recall not more than half a dozen deaths from pulmonary tuberculosis and of these at least two contracted the disease in Greenock!"

Dr. Morgan's discussion of the immunity ranges over such items as climate, out-of-doors employment, woollen clothing, diet, and finishes with the suggestion that, as discovered by Admiral Fitzroy in his Survey, the ozone concentration around these shores is higher than elsewhere in the Atlantic and that this may be a contributory factor.

Mr R. Smith F.R.C.S. (1872) opens his paper with the statement that the natives of these parts can claim exemption from endemic infection of pulmonary tuberculosis so long as they remain in their native haunts. The reasons he advances for the exemption are :- (1) peculiarity of the atmosphere, (2) equability of climate, (3) habits of the people, (4) fuel used - (here he maintains that peat smoke has antiseptic properties). He sums up the incidence of tuberculosis by saying that few cases develop endemically but remarks on the common occurrence of a girl proceeding south to Glasgow and in the course of a year or two returning home having contracted the disease. From this statement he goes on to define a predisposition presumably inherited carrying a liability to tuberculosis, which takes the form of a rapid

attack with no remissions.

Such was the theory of the epidemiology of tuberculosis at that time and the statement: "Consumption is seldom or never found in natives who have always remained in Lewis" occurs in a book "Lewisiana", by Anderson Smith (1874).

The immunity theory of Smith was attacked by Dr. K.N. Macdonald (1872) but in his reply the only noteworthy feature he produced was that consanguinity - a common characteristic to this day - should be considered and concludes that this has no relationship to tuberculosis incidence.

The numbers of pulmonary tuberculosis deaths by the final decade of the last century was causing concern to the medical authorities of the county of Ross & Cromarty and it is interesting to compare the insular with the mainland statistics given in the Medical Officer of Health's reports for this period.

YEAR	ESTIMATED POPULATION		DEATHS from PHTHISIS		MORTALITY per 1,000	
	Mainland	Lewis	Mainland	Lewis	Mainland	Lewis
1892	48,108	28,097	26	38	.54	1.35
1898	40,566	26,857	45	47	1.11	1.75
1902	38,548	25,298	31	45	.80	1.77

Table (1) A comparison of the mortality from respiratory tuberculosis in the mainland part of the County of Ross & Cromarty and the Island of Lewis fifty years ago.

Some valuable information on the history of the disease

in the Outer Isles is contained in the evidence minuted by the "Medical Services in the Highlands & Islands Committee" in 1912. There the acting M.O.H. Dr. Donald Murray is recorded as stating that the disease was increasing. He gave as the average death rate per thousand then 1.80 which, he remarked, compared unfavourably with the prevailing figure for England and Wales of 1.14. In substantiation of his assertion he quoted his predecessor Dr. Macrae as saying that in his early days pulmonary tuberculosis was practically unknown in the Island and he accounted for the apparent increase by mentioning the original importation of the disease by persons returning from the Mainland. He drew attention also to the fact that those who had become afflicted by the disease had often, while living outwith the island, enjoyed housing conditions superior to those of their own homes and that once the disease was introduced into a family everything was favourable to its spread.

The evidence of Dr. Victor Ross who was then in practice on the West coast of the Island supports the contention of an increase in the numbers stricken by the disease and he also remarks on its importation from the South and of the subsequent infection of other members of the family. He makes an interesting observation on the attitude of the villagers to the disease by recalling that where a family had been exterminated by Phthisis it was the common practice to burn all the household effects. To this day can be seen the rough stone shells of black houses fired by the neighbours

after the last of the family had been buried. One can still pass a gaunt windowless house of quite modern build and enquiry into the reason for its derelict condition will elicit the reply: "An tigh air fhasachadh le caitheamh" (The house had consumption). A similar state of affairs is reported by Dr. M. Mackenzie as having occurred in North Uist and he also emphasises the fact that the disease is propagated by domestic servants who have contracted the trouble in the South returning home to the parent community.

Dr. Harley Williams (1931) discusses the origin of tuberculosis in ^{these} islands and draws attention to the fact that Hebrideans are fundamentally different from the population of the rest of the Country being unique culturally and economically. They are, apart from tuberculosis, resistant to disease. Tuberculosis, he maintains, follows the usually accepted type, of human origin, although it is often acute.

The author feels satisfied that the foregoing evidence justifies the contention that the tuberculosis problem of these islands is of recent origin as the disease may well not have been cast on these shores by the rising tide of developing civilisation till the closing years of the decade ending in 1850 since prior to that date there had been little traffic with the disease-laden cities of the mainland. Further, he is convinced that here one finds a community lacking in its genetic constitution any inherited resistance to tuberculosis that might eventuate from successive

generations of contact with the bacillus and that consequently one may expect an onset of the disease more acute in character than that which prevails in more populous centres. This variation in the form of the disease among persons coming from the Hebrides is commented on by Dr. Stuart Laidlaw (1951).

TUBERCULOSIS AS AN IMPORTED DISEASE.

An oft-recurring phrase in the references quoted above is : "The disease is originally contracted in the cities of the South!" A measure of the continuing validity of this assertion can be derived from the medical histories of the Lewis Notified List. In 265 cases evidence was forthcoming as to the prior movements of the patients, and although the establishment of criteria by which to categorise these patients involves complex considerations of occupation and contact with known cases - data for which are often ~~lacking~~ - they have been divided into :-

(a) Those possibly having contracted the disease while away from their homes - the criterion here being a period of absence exceeding six months succeeded by the emergence of disease symptoms not later than three months subsequent to their return and (b) all others who do not conform to these requirements - These being classed as unknown or locally infected.

Of the 265 patients 103 fall into the former group (a) which gives a percentage of 39 where the disease contraction is possibly of "foreign" origin.

The reasons for such a high percentage are to be found in (a) the vulnerable age of the adolescents compelled by economic circumstances to seek employment outwith the islands; (b) the high incidence of a Mantoux negative state in the 15 - 20 age group (47%) as discovered by the Medical Officer of Health (vide infra); and finally (c) the inclusion

of the war period with its subsequent invaliding from the Services of tuberculosis patients in our period of survey.

MILK AS A POSSIBLE DISSEMINATOR OF TUBERCULOSIS IN THE HEBRIDES.

This was the subject matter of an investigation undertaken by Dr. Harley Williams (1931), where, after extensive sampling and analysis had been carried out, he expressed the view that as a source of infection milk in the Hebrides was minimal in its effect. The conclusions he arrived at remain unaltered today. Of the milch cows in the area the disease incidence rate is less than 1% as evidenced by positive reactors found in a survey of the herds carried out by the Veterinary Officers of the Ministry of Agriculture in the summer of 1952 (Weir J. (1952)). In addition to this a large proportion of the islands' milk supply is imported by train and boat from the Milk Marketing Board's centre at Inverness where it is pasteurised.

	1937	'38	'39	'40	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50
Scotland	74	69	70	79	81	78	77	76	74	78	80	-	-	-
County of Ross & Cromarty	84	65	61	44	69	49	47	67	67	69	80	82	63	29
Mainland Portion	43	57	29	13	57	27	46	65	49	54	54	29	38	11
Lewis	105	79	108	92	87	83	50	71	96	92	121	162	104	58

Table 2. Mortality from tuberculosis - all forms.

A comparison of the rates per 100,000 of the population returned for Scotland, Ross and Cromarty County, mainland portion, and the Isle of Lewis.

MORTALITY FROM TUBERCULOSIS - (All forms)

The toll of human lives exacted by the tubercle bacillus remains high in the Outer Isles. For the years 1947 - 1950 inclusive it represented a figure of 111 per 100,000 of the population. This is a higher rate than that recorded for Scotland as a whole, which in 1947 was 80 per 100,000, which in turn was 25 per 100,000 higher than the figures for England and Wales of that year, (Macdougall 1949). This high mortality rate for Lewis represents a peak over the last 15 years. Although the figures returned for Lewis since 1937 maintain a higher average than those for Scotland as a whole, similarly they show a much higher rate in the insular part of the County of Ross and Cromarty, than do those of the mainland portion. The comparative figures are given in Table 2 where they are expressed per 100,000 of the population:

See Table 2 (page 22) Mortality from Tuberculosis - all forms.

From these figures it would appear that the death rate from tuberculosis is some two to three times greater in the Island than the Ross-shire mainland and this, for a community whose social standing is similar to that of the mainland portion of Ross-shire, is significant as it indicates a continuation of the circumstances prevailing at the turn of the century (vide supra). The trend of the mortality figures for the last few years is downwards - a satisfactory state of affairs probably attributable to the use of antibiotic therapy.

DEATH RATE FROM RESPIRATORY TUBERCULOSIS (LEWIS)

During the twelve years, 1940 - 1951 (incl), there were for the Island of Lewis 252 certified "Deaths from Pulmonary Tuberculosis", giving an average death rate of 84 per 100,000 for the island over that period. The mean death rate is therefore higher here than for the county as a whole by almost one third.

The national mortality rate for Scotland for Pulmonary Tuberculosis in 1948 was 66 per 100,000 of the population, and this figure was made up by a lower return of 46 per 100,000 from the County districts and a higher average of 83 per 100,000 from the larger burghs. Consequently we find the figures for Lewis are approximately equal to those of the larger industrial areas rather than, as might naturally have been anticipated, to the rural ones. The Highlands & Islands as a whole, with a death rate of 67 in 1947 reflect an average comparable to the national statistics but still higher than a similarly constituted population in the north-eastern part of the country.

(Scottish Health Services, Council Report, Tuberculosis 1951).

With a small community such as this the considerable fluctuation which occurs from year to year in the recording of disease statistics precludes any accurate estimation of the degree of correspondence between the trends of pulmonary tuberculosis locally and nationally in the war and post-war years, but the impression is reached from a review of the mortality figures that, from the year 1947

onwards, the respiratory tuberculosis death rate is at a higher level than in the immediate pre-war years. The actual percentage increase is inestimable with any semblance of statistical accuracy although the rate is probably higher by over 25% than in the pre-war era. Such a figure (25%) is the percentage by which the pulmonary death rate for Scotland in 1948 was in excess over the 1937-39 figures. (MacInlay 1949).

The suggestion is that here in Lewis the disease has probably observed the recent trend of tuberculosis throughout Scotland, and the probable accounting factor is the large proportion of persons who left the Island to engage in the national war effort.

AGE AT DEATH (LEWIS).

The overall average at death for the 12 years ending 31. 12. 51 is 36.2.

Some considerable fluctuations are observed in the yearly average at death which are given in the following table. These are attributable to the restricted numbers from which the figures have been computed. This factor precludes any statistical observations on alterations met with although it would seem to suggest that the age of death in the female is lower than in the male and that in the male tuberculosis patient there is a tendency towards a later age of decease especially in the last three years

YEAR	MALE	FEMALE	M. & F.
1940	34	37	36
41	36	34	35
42 *	28	29	29
43	45	33	42
44 *	32	30	31
45	41	30	36
46	35	34	35
47	36	37	36
48	36	31	33
49	47	28	43
50 *	47	28	41
51	51	41	47

Table 3 Lewis: Average Age at Death according to year of Death.

* Full details are not available for years marked * but

the figures quoted in these years have been supplied for the Parish of Stornoway by the Registrar of Deaths.

THE TIME INTERVAL BETWEEN NOTIFICATION AND DEATH.

A comparison is made in the following table of the interval elapsing between the establishment of the diagnosis of pulmonary tuberculosis and its fatal result. As has been mentioned previously as the area under survey falls within the jurisdiction of two County Health Authorities it has not been possible to produce figures for the Inverness-shire portion of the Outer Isles but the author has been furnished by the M.O.H. for the County of Inverness with the relevant statistics for that county (excluding the Burgh of Inverness).

See Table 4 (page 30) A comparison of the time interval between notification and death.

From these figures it may be noted that the percentage escaping notification in Lewis lies close to that for Scotland as a whole. Divergence does occur in the lower columns of the table, especially where a significantly higher percentage is seen in Lewis to live for over two years after notification. It seemed advisable to investigate the possibility that the discrepancy might be attributable to the introduction of antibiotic therapy on an extensive scale from the year 1949 onwards, thereby contributing, to some significant degree, to the seeming chronicity of the disease. Statistics, however, show that in the years prior to 1949, out of 169 patients dying from pulmonary tuberculosis 79 were known by notification to have had the disease for over 2 years, i.e. for the years 1940 - 48 a

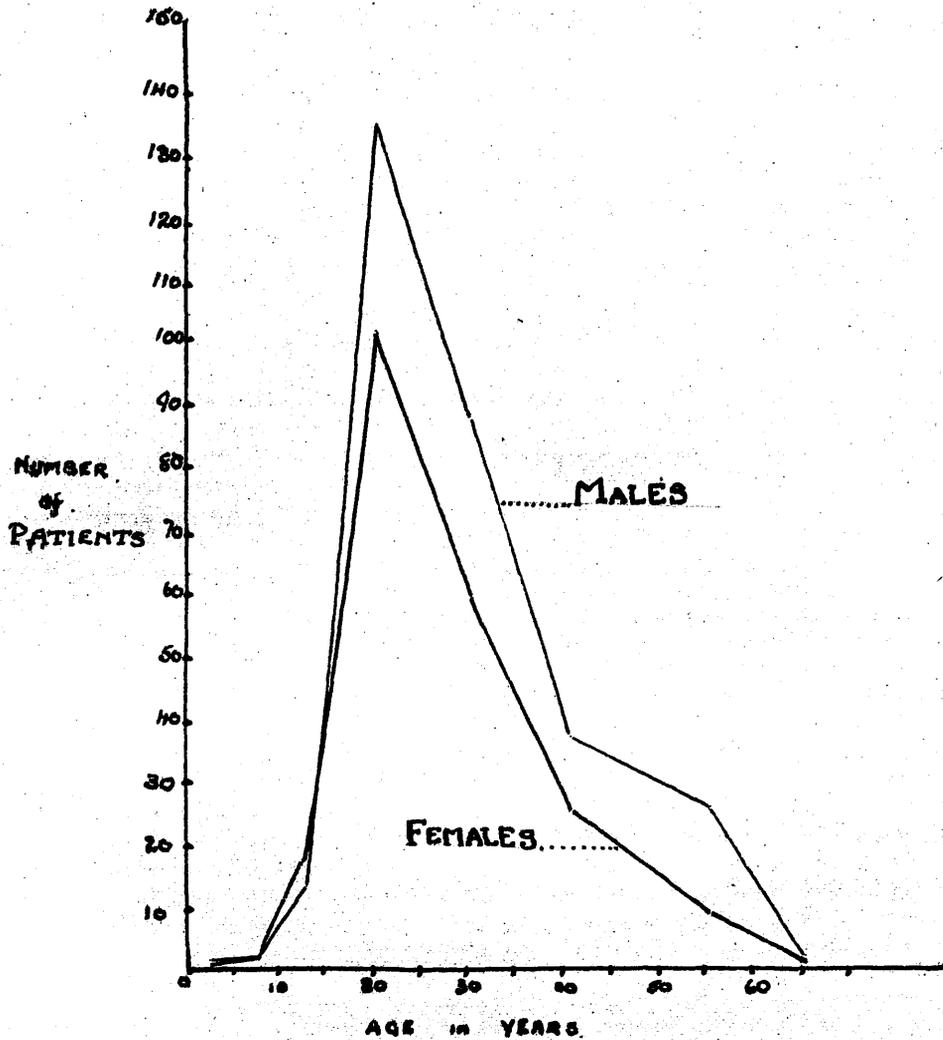
percentage of 46 dying over two years from notification. It would thus appear unlikely that the figures were influenced by antibiotic therapy.

Another factor to be taken into account is the possibility that a large proportion of newly diagnosed cases might be suffering from lesions of a very minor extent thereby leaving adequate time for the disease process to maintain its steady progression to death. Such an assumption is hardly tenable when one considers that the deaths in this group (over 2 years from notification) amount to almost one half of the total recorded. (vide infra p99)

Thus the likelihood would appear to be that in Lewis the type of disease met with is not of a rapidly progressive nature with early supervision of death. Further evidence of this is to be found in Lewis where of those dying one in less than six (18%) does so five years and over after notification.

	LEWIS		INVERNESS COUNTY Excluding Burgh.		SCOTLAND 1947	
	1940	51. %		%		%
Total Deaths	201		388		3472	
Not Notified	27	14	81	21	530	15
Notified 3 Months or less from Death	29	14	37	10	582	17
3 months to 2 years	46	23	122	31	1123	32
Over 2 years	99	49	148	38	1237	36

Table 4. A comparison of the time interval between notification and death for Lewis, for the landward area of Inverness-shire, and for Scotland.



Age Group in years.	Under 5 yrs.	5-9	10-14	15-24	25-34	35-44	45-64	65+
MALES	2	3	16	132	88	38	27	2
FEMALES	1	3	18	101	58	25	11	1

Table 5: Sex and Age Groups at notification.

The foregoing table and graph do not represent the full notification figures for the Outer Hebrides as they are compiled only from the lists of patients still alive at 31. 12. 51 who were notified subsequent to 1939.

It is noticeable that in both males and females the peaks occur around the "20 year old" age groups. The highest point occurs probably just after the 20 years are completed, for on a separate computation by 10 year periods, it is found that the frequency for the two decades ages "10 - 19" and "20 - 29" gives the following figures:-

	AGE 10 - 19	AGE 20 - 29
Males	90	123
Females	66	105

Table 6 Sex & Age group relationships of those notified in the second and third decades of life.

The graph in Figure 2 does not reveal any acute ascent in the 'female' graph to a figure in excess of the male notification rate as is recorded in the Specific Notification Rates Graphs (Scott. Health Serv. Council Rep. 1951) nor are the broader based male statistics evidenced here. The divergence from the national trend may be partly explained by the selective nature of the material under consideration (no deceased register is included) and by the fact that the hostilities of 1939 - 45 brought considerably more men from the comparative immunity of the islands into contact with Tuberculosis.

The Notification Rate for the area has remained high as is shown in the table covering the quinquennium 1947 - 51 for the Island of Lewis:

YEAR	RESP.	NON RESP.	TOTAL	RATES per 100,000	RATES CORRECTED for YEARS 1949-51
47	35	12	47	188	
48	49	17	66	264	
49	34	6	40	160	248
50	75	9	84	336	264
51	73	7	80	320	265

Table 7 Tuberculosis Notification Rate - Lewis 1947 - 51

The figures for the last three years of this table have required adjustment as a result of the discovery in reviewing the present position of the disease that 30 patients who were known to suffer from pulmonary tuberculosis previous to 1950 had in fact escaped notification. These 30 patients, although notified - 18 of them in 1950 and 12 in 1951, should in fact have swollen the figures of previous years, 22 of them having been diagnosed in 1949.

Consequently in Lewis the Notification Rate for the last five years has been around 250 per 100,000 of the population.

INFECTION RATES.

Discussed in another paragraph (vide para. on Sweden (p.146) is the influence of immunity in altering the trend of the disease. Statistics for an estimation of the previous infection as is found in schoolchildren in Lewis have been provided by the Medical Officer of Health. His figures are given in the following table.

See Table 8 (p.35) Infection Rates as demonstrated by reaction to O.T.

The columns of the above table consist of Nicolson Institute - the school providing education for the children of Stornoway Burgh and later (in the post-qualifying age) for selected numbers from the rural schools; the other columns, as indicated, referring to the schools of the various parishes, of which Uig is the most isolated.

Evidence of previous infection is highest in the town child of school leaving age, while for the rural areas it would appear to be at a suprisingly low level. Thus from these rural areas the majority of children reach adolescent age without the protection of an acquired immunity.

A further significance of this last statement may be found in considering the table giving the relationship between tuberculin sensitivity and mortality in the various parts of Lewis. (Table 9 p.38).

Age in years	Nicolson Institute.		Stornoway Landward		Barvas		Lochs		Uig						
	Pos.	Neg. % Pos.	Pos.	Neg. % Pos.	Pos.	Neg. % Pos.	Pos.	Neg. % Pos.	Pos.	Neg. % Pos.					
0 - 1	6	0	0	7	0	1									
1 - 4	3	49	6	37	14	227	1	36	3	48	9	3	19	14	
5 - 9	135	277	33	141	28	362	69	317	18	35	167	17	32	147	18
10 - 14	324	227	59	121	31	271	90	296	23	43	139	24	23	104	18
15 - 20	112	100	53	5		18	1	5		1	1				

Table 8. Infection rates among Lewis school children as demonstrated by reaction to Old Tuberculin.

	STORNOWAY BURGH	STORNOWAY LANDWARD	BARVAS	LOCHS	UIG
POPULATION	6250	8750	4984	2637	2295
% Tuberculin positive 5-12	50	25	20	20	15
Total Tb Deaths 1945-50 5 years	23	79	35	27	23
Death rate per 1,000	0.72	1.8	1.4	2.0 20	2.0 20

Table 9: Relation between Tuberculin Sensitivity and Mortality in different parts of Lewis.

While admitting that the statistical material is numerically limited, the higher mortality figures for the areas with the lower infection rates at ages 5 - 12 would appear noteworthy.

Possible explanations of the low infection rates are:-

- (a) The absence from tuberculosis from cattle in the islands.
- (b) The relative isolation of houses in rural communities where each house is built on its own separate croft.
- (c) The tendency of neighbours to eschew the society of the tuberculosis family.

Against the background of the introduction of the disease into an isolated community within the last hundred years, the author decided to investigate the present trend of pulmonary tuberculosis in the Outer Hebrides. Therein he was favourably situated, being Medical Officer at the County Hospital, Stornoway, where he had access to all the records and radiographs of the patients attending there or at the subsidiary chest clinic at Daliburgh in South Uist. The County Hospital of 88 beds is almost entirely devoted to the investigation and treatment of phthisis and special facilities are available in the form of a modern X ray unit incorporating fluoroscopic and tomographic attachments.

For the survey the period selected was the twelve years ending 31. 12. 51, this limitation being determined by the fact that only at the beginning of 1940 was the X ray unit installed in the hospital. The filing system there contains all the radiographs of the patients who have attended the hospital, the only exception being in the cases of patients deceased where the radiographs have been removed and destroyed.

It was decided that the material for the investigation should include all patients whose names appeared on the live notified register at 31. 12. 51 and who had been notified subsequent to 1939. As no revision of the list

had been carried out for some years previous, it was decided about December, 1951 that a revision of the register was desirable as there might probably be a considerable number of patients appearing on the notified list who conceivably were no longer suffering from active pulmonary tuberculosis. Arrangements were therefore made to summon all the patients to attend for consultation and/or examination at the dispensary and it is on the data revealed by these consultations and examinations that the conclusions expressed here regarding the present condition of the disease are based.

Since no observations could be included regarding those patients whose death had occurred subsequent to notification during the period, it was immediately obvious that there must be a considerable discrepancy in the numbers under review. In an endeavour to remedy this defect, the list of names of those who had died from pulmonary tuberculosis up to 1952 was obtained from the Medical Officer of Health in Lewis and a search of the X ray register was instituted to discover any relevant information regarding the patients at the date of their notification, together with any subsequent observations. It was possible to discover details in only 126 cases and these have been included in a special section at the end of the main body as they do not represent a personal interpretation of the radiological features.

The method of study developed was the incorporation on

a card index system of the patient's name, address, age, hospital record number and year of notification, followed by a report on the original X ray and a summary of the serial film appearances together with notes on treatment and observations on the present condition such as sputum or gastric juice reports. Where the presenting symptom was included in the record, it has been noted; where it was absent no attempt was made to elicit it by questions at later examinations as it was felt the lapse of time clouding the patient's memory was liable to introduce a certain element of unreliability into the answers.

A system of classification was adopted under which the lesions were grouped :- (a) according to the extent and (b) according to the predominant type of disease seen in the original film. Thus the X ray reports were grouped according to the number of zones involved, the delineations considered being those recommended in the pamphlet on Standardization of Radiological Terminology in Pulmonary Disease, viz:- The upper zone is that area above a straight line running through the lower borders of the anterior ends of the second ribs ; the middle zone is that area bounded by the above line and by one running through the lower borders of the anterior ends of the fourth ribs and the lower zone is the remainder of the lung field below the middle zone.

Any opacity noted in the lung fields was therefore assessed according to the above criteria and included in the total number of zones which showed involvement.

The extent of the lesions being relatively easily assessed, left however, in each group a multiplicity of type of lesion which very obviously required a further subdivision.

The most significant feature on which a start to this subdivision could be made was obviously the presence or otherwise of Cavitation. That Cavitation in a pulmonary lesion may be present and yet not obvious in the straight P.A. film or even in a lateral, has to be admitted, so that at the outset it may be possible that certain lesions, not categorised as cavitated may in fact have been already the seat of Excavation. All cavitation has been included under the one heading and no attempt was made to reduce it further, into the type of cavitation e.g. Thin walled tension type resulting from Endo-bronchial tuberculosis or thick fibrotic walled type of slower evolution.

It would have been a most satisfying procedure to designate the remainder of the lesions according to their predominant characteristic, "Exudative," "Productive;" and "Fibrotic". Apart however, from the fact that quite a considerable number of the films were taken at exposure times of 0.15 sec., with the possibility of subject movement impairing the minute characteristics of a newly detected focus, it seemed that the subdivision into the two former groups was more academic than practical, as the two processes can usually be identified as occurring concomitantly in the one lesion (Twining (1938)). The fibrotic form of the disease is more readily isolated by the identification

of firm fibrotic nodules lacking the usual fluffy border and conform to the criteria laid down by Twining (1938) in his description of indurative tuberculosis in that "(1) the fibrosis in and around the tubercles is evidenced by increased density and definition of the individual lesions, and (2) the fibrosis in the lung stroma around the lymphatics and blood vessels and bronchi causes a coarse striation of the affected region. The strands run in a direction upwards from the hilum to the periphery."

A total of 537 names appeared on the notified register as suffering from respiratory tuberculosis subsequent to the year 1939. All evidence relevant to these patients both in the radiographs and in any case notes was examined and from the information thus obtained the cases were grouped in accordance with the described system of classification.

In 33 cases no evidence was discovered to suggest that they did in fact suffer from active pulmonary tuberculosis during the period under review and consequently this number was deducted from the total. The majority of this number showed calcified foci usually around the hilum but 6 (six) of the 33 were identified as suffering from tuberculosis of other organs, while in 5 (five) additional cases the history and radiological appearances were consistent with bronchiectasis.

The 504 remaining cases were composed of 294 males and 210 females. The respective percentages of males (58%) and females (42%) suggest that the incidence of the

disease is higher among men. That a similar state of affairs exists throughout the country is fully appreciated and the close correlation of the local to the national statistics is evident in a comparison of the percentages disclosed above with those published for Scotland as a whole:-

		MALES	FEMALES
OUTER ISLES (this survey)	1940 - 51	58	42
SCOTLAND	1940 - 47	57.1	42.9

Table 10. Percentage sex distribution of phthisis patients in this present survey compared with sex notifications for Scotland (Scot. Health Services Report. 1951)

There were, however, another 47 cases in which the original radiograph was not available, and as it was upon the appearances in this that the classification was based, this additional number has been excluded.

The following table displays the totals of the various groups and shows also the average age for each group.

Zones involved	Males		Females	
	Number	Av. Age	Number	Av. Age
1	84	22.4	62	21.6
2	68	29.3	50	25.5
3	23	28.2	23	24.8
More than 3	62	30.4	28	27.6
Pleurisies	32	28.3	25	22.5
Original film not available	25	34.4	22	27.8

Table 11. . Extent of initial lesion by number of zones involved. Numbers occurring and average age.

This table, which discloses, as might have been expected, age rising as the disease at diagnosis is found to be more advanced, reveals the very high proportion, as well as large number, of males who have been found to suffer from extensive disease.

Throughout, the male average age is higher than that of the female but the higher figures concerning those whose films are not available result probably from the large numbers diagnosed and treated at the mainland centres and returning to their homes only after discharge from hospital.

LESIONS LIMITED TO A SINGLE ZONE AT THE ORIGINAL DIAGNOSISSITE OF LESION

In all, it was found that 146 patients had lesions which did not extend to more than one zone of the lung field at the date when their names were added to the notified list. Of these 84 were males and 62 females. In these cases the preparation of a table of the frequency of the site of the disease was facilitated by the simplicity of the involvement; with lesions of a more extensive nature this was a matter of considerable difficulty.

	RIGHT LUNG	LEFT LUNG
UPPER zone	43	47
MID zone	20	18
LOWER zone	13	5

Table (12). The frequency of involvement of the various zones in lesions limited to one zone.

It is universally accepted that the commonest site for the appearance of an early adult lesion is in the apex of either lung or lobe of the lung and while the present series includes all the cases, be they primary or post-primary infection, it is noticeable that after deduction of the 21 cases whose lesions are predominantly of a hilar nature (vide infra), the ratio of apical involvement to all other zones is approximately 3 : 1. It seems justifiable to conclude that this is the commonest area of involvement, a judgment which is corroborated by Twining (1938) that in adults the involvement is apical in an early lesion.

Of the 146 cases there are 25 in which cavitation is discernible in addition to the pulmonary lesion. Here, however, the apical frequency is not so predominant.

	RIGHT LUNG	LEFT LUNG
Upper zone	4	8
Mid zone	5	3
Lower zone	3	2

Table (13). Frequency of cavitation noted at original diagnosis in single zone lesion according to zone of lung involved.

From these figures, either in the existence of a lesion or in cavitation of the lesion, there seems to be no predilection for either lung.

HILAR SHADOWS

The main difference between primary and post-primary lesions is that in the former the glands of the related draining area are always involved, a feature which is absent in the latter. That the glandular component of the primary complex is usually larger than the associated parenchymatous lesion is described by PAGEL (1948). This involvement of the hilum has been noted as occurring in 21 cases. These 21 patients in fact show only radiographic shadows around the hilum and it has not been possible to identify the parenchymatous lesion which activated them.

The age average for this group is 13 years which by its lowness confirms the opinion that the lesions are probably of a primary manifestation.

Of the 21 instances of hilar enlargement, 13 occurred on the right side and 8 on the left. Further it was noted that in 6 of those appearing on the right side there was also a triangular shadow radiating outwards with its base to the medias tinum. No such similar shadow was noticeable in any of the left hilar lesions. The pathology of such an appearance is debated by Price (1942) who remarks on the increasing tendency to view these as being due to atelectasis although previously they were accepted as originating in interlobar pleurisies. Since the six cases mentioned here all occur on the same side as the horizontal interlobe - one also has an appearance similar to a minimal shadow of a pleural effusion in the right costophrenic angle - it would appear to suggest that they are in fact attributable to pleural reaction along the horizontal interlobe rather than to atelectasis resultant from bronchial obstruction by the enlarged glands.

LESIONS LIMITED TO ONE ZONE AND OBVIOUSLY CAVITATED AT ORIGINAL DIAGNOSIS.

24 patients fall into this category, of whom one has been lost trace since the initial film was taken in 1949.

There is a male preponderance in the group of 2 : 1. For the prognosis of such a lesion little can be assessed as the majority of the group (17) are of recent notification, having been diagnosed subsequent to 1948, but of the total, the number who have so far shown deterioration of a gross degree is three. In these, two have exhibited

bronchopneumonic type of dissemination of the disease while in the third patient, the extension of the disease process has been of a more gradual nature with an aspirated spread superimposed at a later date. The duration from the appearance of the lesions to the onset of the extension of the process is less than 12 months for the two former, and after a two year period of stability in the latter.

In 16 patients of the whole group radiological examination and repeated sputum examinations suggest that cavity closure has taken place, and such a state has continued up to the present date (Oct. 1952). In these 16 cases therapeutic measures were instituted in all but one instance : collapse therapy was resorted to for 11 patients, and major surgical intervention was necessary for 1. The type of therapy is indicated in the following table :-

Treatment	Years since cavity closure was noted		
	More than 3	2 - 3	1+
Streptomycin & PAS alone	-	2	1
Artificial pneumothorax	3	2	-
Phrenic crush & pneumoperitoneum	-	2	2
Phrenic crush alone	-	1	1
Lobectomy	-	-	1

Table (14) Showing type of therapy applied in single zone cavitated lesions which are now inactive.

Of the cases remaining active and in whom cavity closure has not yet been secured, in addition to the three

mentioned above where deterioration has been marked, there are five others who have had phrenic crush and pneumoperitoneum and in these the cavity still remains patent after more than one year of this treatment. In two cases out of the five, closure seemed to occur immediately after the induction of pneumoperitoneum and in one tomography was used to confirm this, but after a period of three months the cavity was once again visible both in fluoroscopy and in the radiograph. In each of these cases attempts to establish a pneumothorax space were defeated by adhesions. All these patients had streptomycin.

SINGLE ZONE LESIONS OF A PREDOMINANTLY EXUDATIVE CHARACTER WHICH HAVE SUBSEQUENTLY SHOWN CAVITATION.

There are 17 patients in whom the appearances suggest that the lesions, originally solid, have later shown excavation. Of these there are 9 males and 8 females.

The period which has elapsed from the original diagnosis to the appearance of cavitation has varied considerably but in the majority of cases has taken place within one year of notification.

The duration of the time lag is given in the following table:-

DURATION	Less than 6 months	6 months 1 year	1 - 2 years	2 - 6 years	6 years	more than 6 years
NUMBER	7	3	3	3*	1	0

Table (15) Duration from diagnosis to cavitation becoming visible

* not observed in the intervening period but showing bilateral disease more than 3 years after diagnosis. Actual spread of the disease area has taken place in 10 of these cases but in only one of these can any interval between excavation and extension of the process be noted; in this case it occurred within six months, no active therapeutic measures having been undertaken in the meantime.

Where the disease had extended active therapeutic measures have been invoked in all but one case who refused collapse therapy and whose condition has been brought to stability on bed rest alone. In the others there were three artificial pneumothoraces, two of which were successful, mechanically and therapeutically (one after adhesion section); the third could not be continued on account of adhesions. Further therapeutic measures were refused by this patient whose condition, in spite of bed rest, steadily deteriorated till death ultimately supervened.

In six cases phrenic nerve crush and pneumoperitoneum have been carried out and the response has been : 2 are sputum negative and possibly inactive, 3 sputum positive but with radiographs suggesting stability, and 1 in whom the lesions appear uninfluenced.

Where spread of the disease has taken place, in all but one instance it has ultimately given rise to bilateral phthisis and in all the occurrences would appear to have been of a catastrophic character. This includes the three

patients without the intervening films, and here the opinion is based on the clinical history which is that of an acute type substantiated by the gross nature of the lesion. A differentiation of the route of dissemination suggests that 9 have a bronchogenic and one a haematogenous origin.

There has been no particular selection of the new zones involved, four having spread to the upper, one to the mid, and the remainder to all zones of at least one lung.

Cavitation without spread of the disease.

In all cases of this type collapse therapy has been induced and the nature and response to this is as follows:-

A. Four artificial pneumothoraces. All of these showed adhesions, which were successfully divided in two cases and unattempted in the others. Where the division was successful the disease is now quiescent, possibly inactive, having been sputum negative since the collapse was discontinued two years ago. Case No. 3 remains sputum negative but the pneumothorax has been established for only 18 months. In case no. 4 the A.P. was abandoned on account of fluid which subsequently became purulent some five years ago. The cavity remains patent and repeated aspiration, commenced two years ago, is still producing small quantities of straw-coloured fluid, A.F.B. negative. This patient is waiting to have a thoracoplasty.

B Phrenic nerve crush and pneumoperitoneum have been carried out in three cases. One is now considered inactive,

one quiescent and sputum negative although only within the last eighteen months, and one uninfluenced. In this last case an artificial pneumothorax proved ineffectual on account of a previous pleurisy.

LESIONS LIMITED TO ONE ZONE AND NOT SHOWING CAVITATION

62 cases of this nature were discovered and of these the numbers of males and females were equal.

In 3 cases it was not possible to carry out an up-to-date examination and X ray as the patients were employed outwith the Islands. The work in which they were engaged was of a heavy nature: 1 labouring; 1 deep sea sailing; 1 nursing; and they had been so employed for a period of at least three years with no untoward symptoms.

In only 8 cases has deterioration of the focus been noted and in these the duration from the date of diagnosis to the establishment of further disease areas is given in Table (16)

Less than 6 months	6 months to 1 year	1 - 2 years
5*	2	1

Table (16) Period between diagnosis and extension.

*In one of these the extension cleared but reappeared 5 years later.

The type of spread of disease in four of these cases has been bronchogenic disseminations and in the other four extension of the lesion appears to have been of a limited nature involving perhaps a lymphatic spread.

Of the total number (62) there are 12 who show evidence of glandular involvement as well as the local parenchymatous lesion, and this suggests that this number at least are primary complexes, but there may be others not so classified because of the absence of any appreciable

shadow around the hilum. Three of these primaries are included in the eight cases of deterioration noted in this group.

Six patients have, subsequent to notification, shown pleural effusions but this has never occurred later than eighteen months after notification.

The fate of the radiological shadow.

59 of these patients have had recent X rays and in 14 there is now no evidence of the previous pulmonary disease, that is, almost a quarter of those lesions have cleared up completely without leaving even a mark to indicate the site of the original disease. Such a clearing can take place within a short time after the diagnosis viz: about two years. The actual period of observation set against the numbers who now appear free is given in the following table:-

Duration of observation	Under 2 years	2-3 yrs.	3-4yrs.	4-5yrs	5+yrs
Total number	24	5	4	4	22
Number who have no radiological evidence	5	-	1	2	6

Table (17) A comparison of numbers who show complete radiological clearing with total numbers grouped by period of observation.

Treatment Instituted

In discussing the treatment instituted the group has been divided into two: (a) those observed for a period of more than three years and (B) those observed for less than this period.

In group (a)-the longer period- artificial pneumothoraces were induced in 8 cases but were abandoned in three instances within one year. An effusion complicated two other cases though not before the treatment had been established for two years. Of the remainder one showed apical adhesions but the treatment was continued without mishap with the others for a three year period and is now sputum negative and classified as inactive. Of the abandoned pneumothoraces two show fibrotic tuberculosis limited in extent to the original lesion and negative under repeated sputum examination. The remainder are considered inactive and all have returned to work.

Phrenic nerve crush has been carried out in only one instance and that after a lesion had become reactivated. With this treatment the lesion has once again regressed. (This is the patient referred to in the footnote to Table 16).

No collapse measures were carried out in 24 cases. All were put on sanatorium régime either at home or in hospital and this treatment was continued until the lesion was considered to be quiescent. Of this number which includes the 3 referred to as not being recently examined only 4 show lesions which are not yet considered quiescent, although repeated sputum examinations have all been negative throughout the last 18 months.

In group (b) (i.e. those cases diagnosed during 1949 and later), there are 29 patients. Although still being kept under observation there are 6 whose cases are classified as inactive; regarding the remainder, the suggestion is that the

lesions are quiescent, this opinion being based on radiological appearances and bacteriological examination.

In general all these patients have had some form of active treatment as specified below:-

No active treatment	2
Streptomycin & PAS alone	18
" " " + A.P.	2 (both shortly abandoned because of adhesions)
" " " + phrenic crush	1
" " " " + P.P.	5
P.A.S. alone	1

LESIONS INVOLVING ONE ZONE IN WHICH THERE WAS A PREDOMINANCE OF FIBROSIS.

Of the 22 patients, 15 are male and 7 female. In all but one of these the course of the lesion has been benign through the period of observation. The single exception is a patient who, two years after notification, was found to have renal tuberculosis. In no case has a pleural effusion arisen during the period, although there is radiological evidence to suggest that such an involvement had previously taken place..

No notification of this type is recorded since 1949 and all the patients have resumed their usual occupations except one male who remains incapacitated by asthma.

LESIONS EXTENDING TO TWO ZONES AND OBVIOUSLY CAVITATED AT
DIAGNOSIS.

29 patients with such a lesion were discovered in the notified list. Of these 15 were males and 14 females. In 3 cases there is no X ray dated later than 1946 and enquiry has failed to establish the present residence or employability of the patients concerned. These three form with another 15 cases the group who had a pre 1949 notification and it may be appropriate to consider them here.

Pre 1949 Notifications.

The present state of the 15 who have remained under review shows that

- (a) 5 may be regarded as fully inactive.
- (b) 7 quiescent, cavitation not being visible and sputum remaining negative.
- (c) 3 still giving evidence of cavitation.

(a) Disease deterioration.

In only one case in this group has extension of the disease area been noted. This was of a bronchogenic nature and occurred within one year of notification. One other case, having maintained cavitation for five years, showed ballooning after this period, but was brought under control with streptomycin and paramisal sodium.

(b) Treatment instituted.

(a) Of the five cases classified above as "fully inactive" the disease was originally bilateral in four patients but the cavitation was unilateral. In two of these where a unilateral

artificial pneumothorax was carried out, the disease of the contralateral lung was still evident at the induction but seemed to clear up about the time when cavity closure was noted. In the third case the artificial pneumothorax induced had to be abandoned as a broad adhesion had given rise to a contra-selective collapse. The treatment was then replaced by a phrenic crush and pneumoperitoneum which effected closure of the cavity. A similar manoeuvre was successful in a fourth case but ineffectual in the fifth which required a thoracoplasty.

(b) In the intermediate group (i.e. the 7 patients who are at present considered quiescent - present radiographs display the appearance of fibrosis with no obvious cavitation and they have been sputum negative for the last two years -) four commenced as unilateral lesions (one in whom the disease spread is referred to above), and three were bilateral. In only one case was the cavitation bilateral also.

Artificial pneumothoraces were induced in five cases with a successful result in two patients only, in one of whom the disease was bilateral. In the three abandoned pneumothoraces, phrenic nerve crush and pneumoperitoneum were induced with a seemingly satisfactory outcome. In the two remaining cases no active collapse measures were invoked.

(c) Of the three who have maintained their cavitation all were bilateral at the original diagnosis. In only one

case was an attempt at collapse therapy possible, but here after the abandonment of a pneumothorax on account of adhesions, as the phrenic nerve was not identified at operation and the contralateral pleural sac was glued by adhesion, no therapy was successful.

Summing up the pre 1949 cases, the treatment and response may be tabulated as follows:-

Treatment	*Artificial Pneumothorax	Phrenic crush & pneumoperitoneum	Thoracoplasty	Nil
Successful	5	5	1	2
Unsuccessful	6	1	-	2

Table (18) Treatment and response in pre 1949 notified cases.

*Where a bilateral pneumothorax was induced it is counted as two.

1948 AND LATER DIAGNOSED CASES.

In the three years (1949-51) 11 cases of this nature (two zonal lesions with obvious cavitation at diagnosis) were diagnosed, five of these were unilateral and six bilateral (two showing bilateral cavitation).

Up to the present none of these cases has shown deterioration although three of them where collapse measures could not be instituted, still exhibit disease which is obviously active. The others may be regarded as in a quiescent phase, and of these, four had no collapse therapy, while the remainder (4) had phrenic nerve crushes and pneumoperitoneum, one after a peripheral tension type

cavity caused the abandonment of an artificial pneumothorax and one who became reactivated 9 months after the pneumoperitoneum induction and ultimately required a thoracoplasty.

All these patients had a preliminary course of streptomycin and paramisal sodium

LESIONS OF A PREDOMINANTLY EXUDATIVE CHARACTER INVOLVING TWO ZONES, NOT CAVITATED AT ORIGINAL DIAGNOSIS BUT SHOWING THIS LATER.

There are 18 patients in this group, of whom 10 are males and 8 females. The duration from diagnosis to the appearance of cavitation is given in Table 19 below.

Less than 6 months	6 months to 1 year	1 - 2 years	Over 2 years
7	4	4	3

Table (19) Showing period of duration from diagnosis to appearance of cavitation.

Extension of disease area.

As well as displaying cavitation, 10 of these patients have also shown extension of the disease area. In 6 of these, this appeared on the same film as the cavitation, in 2 it occurred about one year before the cavitation but in each of these an artificial pneumothorax had been established before, and in the final two it occurred about six months after cavitation was obvious.

Treatment.

Where spread of the disease area has taken place (10 cases) in only two have no therapeutic measures been possible and in these there has been a further deterioration of the disease. Artificial pneumothoraces were induced in 8 patients but a successful conclusion was reached in one case only. Of those abandoned 6 were discontinued as adhesions were considered indivisible, the seventh

developed a spontaneous pneumothorax shortly after induction in which an empyema supervened which was successfully drained by repeated aspiration. 5 patients had phrenic nerve crushes and pneumoperitoneum - of these two are quiescent now and three stable though remaining sputum positive. One recently has had a thoracoplasty. The eighth case has been successfully treated by thoracoplasty.

Failure of a mechanical nature in attempted phrenic nerve interruption was met with in two cases; in one, the nerve was not identified, and in the other while the crush was carried out satisfactorily there was such marked dyspnoea that it could not be followed by a pneumoperitoneum. In the former case a bilateral artificial pneumothorax was attempted but in neither case was the collapse properly established because of adhesions and this case has been considered as one in which no treatment was possible.

Treatment	Not continued.	Present state	
		Quiescent ? inactive	stable but positive
Artificial Pneumothorax	9	1	-
Phrenic Crush & P.P.	2	2	3
Thoracoplasty	-	2	-

Table (20) Summary of treatment attempted and results observed in mechanically successful instances.

Spread of the disease, form of

Where there has been a deterioration in the radiological appearance these 10 cases show that it has been of a

catastrophic nature. One showed a fine mottling throughout all zones of the lung field but involving the upper zones more than the lower and is thought to be of haematogenous origin. All the others show a type of spread ascribable to a bronchogenic origin. In three a complete lung field has become involved and in the remainder involvement of the lower zones is noted and, by a coincidence, this has invariably been on the left side.

Where cavitation has taken place in the absence of spread of the disease, active treatment has been undertaken in all cases but one. This exception after a period of rest is now considered to be quiescent.

In this group of 8 patients artificial pneumothorax has been performed on five occasions, and although in no case were complicating factors absent, four are now in a quiescent phase. Adhesions were present in all, but in three instances the collapse was continued for two, two and four years respectively. Only one showed no appreciable fluid level during the refill period. In the fourth case a spontaneous pneumothorax developed some two months after induction, and when the fluid was removed gomenol was introduced into the pleural cavity and the collapse so continued. This patient was found to have an empyema three years ago but with repeated aspirations the sac is now dry. The fifth artificial pneumothorax occurring in a diabetic, was abandoned on account of contralateral cavitation. One phrenic nerve crush and pneumoperitoneum was carried out

but has failed to produce sputum conversion. In one case it was necessary to have recourse to pneumonectomy.

Seven cases out of the total number of 18 were originally unilateral, but during the period only 4 have remained so. Streptomycin and P.A.S. have been administered to nine patients in this group but the three months' course had to be terminated prematurely in one who developed oedema. Considerable improvement radiologically and clinically took place in two cases, to a slight degree in five and one remained apparently uninfluenced.

BILONAL LESIONS WHICH WERE PREDOMINANTLY EXUDATIVE AND WHICH WERE NOT APPARENTLY CAVITATED.

48 patients of whom 27 were males and 21 females were identified as falling within this class. Three of these have not been X rayed since their initial examination more than three years ago but all are at present well and working.

During the period of observation 37 cases have shown no deterioration in the lung condition and of the 11 where deterioration is evident the duration from notification to the occurrence is given below:-

Up to 6 months	6 months 1 year	1 - 2 years	Over 2 years
1	3	6	1 ^x

Table (21) Duration from notification to appearance of deterioration.

(^xthis occurred six years after the initial diagnosis)

It is noted that these figures are just the reverse of those observed in the similar group showing disease of one zone.

Of those cases who have shown a spread of the area of disease the average age is 26 years at the time of the occurrence of the deterioration.

TYPE OF SPREAD

In but one instance the deterioration has been of a gradual nature seeming to extend outwards from the initial

focus into the surrounding lung parenchyma and this is the only one of those who have shown extension who has remained unilateral. All the others appear to have been of an acute origin and apart from one case in which the appearances are consistent with disease of haematogenous nature giving rise to a localised area, they are all considered to have been bronchogenic. The site of the new disease in these last 9 has been upperzonal in 5, mid zonal in 1, and in 3 a whole lung field is involved.

The present position of the whole group of 48 patients is given below together with an indication of the length of the observation period.

Duration of observation	Less than 1 year	One year	two years	three years and over
No radiological evidence of any disease	1	-	1	2
No radiological or clinical evidence of active disease	1	3	4	23
Activity probably persisting	2	3	2	6

Table (22) Review of 48 patients considering the present condition of these and the number of years they have been under observation.

Collapse Therapy.

32 patients have not at any time received active collapse therapy of the lung and in those who have, artificial pneumothorax and phrenic crush and pneumoperitonem have been employed.

In those who experienced no extension of the disease recourse was had to artificial pneumothorax in 5 cases. Of these only one was successful mechanically, the others showed indivisible adhesions which caused the treatment of one to be abandoned at the end of six months; the three remaining were continued for a three year period, the final result of these last being lesions no worse than fibrotic and being sputum negative. Fluid occurred as an incidental accompaniment in two cases but seems to have cleared without requiring aspiration.

There were 5 cases in which phrenic nerve crush and pneumoperitoneum were carried out (one as a preliminary stabiliser to the successful A.P. mentioned above). Only one of these cases is not of recent origin and here, after a two year period, the lesion is not yet considered quiescent.

One other patient has, it is learned, been admitted to a mainland hospital and has undergone a thoracoplasty.

Where deterioration of the disease has taken place no collapse therapy has been undertaken in five instances.

In three cases the spread of the lesion occurred subsequent to the induction of the therapy - two A.P.s each having undivided adhesions and one a phrenicectomy which was carried out after the abandonment of the A.P. on account of adhesions; where the spread preceded the treatment there was one unsuccessful A.P. on account of broad adhesions followed by an extra pleural pneumothorax and two phrenic nerve crushes and pneumoperitoneum.

Antibiotics - response to.

(a) In lesions which have spread.

In four of these cases there has been occasion to administer streptomycin and paramisal sodium. Considerable clearing of the disease took place in three of these where the treatment was started as soon as the dissemination was observed, but in the fourth case where the spread had been present for three years only slight alteration was noted and the appearances suggested that the disease was by then in a productive phase.

(b) In simple lesions.

All the lesions treated in this class have been of recent diagnosis and number 11. In one some local extension of the disease process has become evident at a subsequent date ; two of a hilar flare nature have been little influenced as far as radiological appearances are concerned. In the remainder, the majority show considerable clearing and all are probably now quiescent.

BIZONAL LESIONS OF A FIBROTIC NATURE.

13 males and 5 females at original diagnosis show lesions in which a fibrotic element predominates. Two have failed to present themselves for follow-up review but are reported to be well and free from symptoms; 13 have so far run a benign course, of whom 12 have been under observation for periods in excess of five years.

Deterioration.

Three patients in this group have shown deterioration of

the disease. All seem to have cavitated, but in one case the appearances and a repeatedly negative sputum suggest that the lesion is bronchiectatic. The other two have shown extension of the disease area prior to the excavation which, in each case, has occurred during the second year. It is impossible to assess the manner of the spread in either case.

Treatment

Only two patients in this whole group have come under treatment. They are those in whom the disease has deteriorated. A satisfactory result has been obtained with streptomycin and P.A.S. reinforced by a phrenic crush and pneumoperitoneum.

The average of this group is 32 years at diagnosis.

HILAR ENLARGEMENT OF A BILATERAL NATURE as a reason for notification.

Five patients - three males and two females - have been notified, in whose cases the films show only bilateral hilar enlargement. All are pre-1947 notifications and are considered inactive now.

LESIONS SHOWING INVOLVEMENT OF THREE ZONES AND CAVITATED
AT ORIGINAL DIAGNOSIS

This group comprises 20 persons - ten males and ten females - and of this number only one patient could not be examined. It is understood that she remains well and that she is now married and has a family.

Pre - 1949 Notifications

Along with the woman mentioned above there are 10 cases who were notified more than three years ago. The present state of these is:-

Inactive	Quiescent	Still active
1	5	4

Three of these had unilateral disease and in two collapse therapy in the form of a pneumothorax was induced. Both, however, developed considerable fluid levels and the treatment was abandoned after 6 months and 1 year respectively. Cavitation was still obvious in both when the treatment was stopped but closure seemed to occur shortly afterwards. These appearances have been maintained by one patient but the other, some six months later (i.e. 1 year after notification) has experienced a spread of the disease to the whole of the contralateral lung and the appearances suggest a bronchogenic type of metastasis. The single patient who had no therapeutic measures remains unaltered and even now, ten years after diagnosis, shows a persistent cavitated lesion.

Of the bilateral cases five have had artificial

pneumothoraces - in two of these the treatment was bilateral. In none of these five patients was the collapse uncomplicated viz:- One had adhesions which were divisible and the artificial pneumothorax was continued after section; three had adhesions but the collapse was maintained notwithstanding this and the result was ultimately satisfactory; one had fluid complicating adhesions, thus causing abandonment. In two patients atelectasis of a lobar nature took place within a fortnight of the induction; both were continued until the resulting fluid proved uncontrollable six months later, when the treatment was stopped.

Phrenic nerve crush and pneumoperitoneum have been invoked in one case but the lesion remains active and cavitated.

The remaining case in the group has had no collapse therapy and here the lesion would appear to have involved some of the surrounding parenchyma and cavitation is still present.

Post-1949 Notifications

Of those who have been diagnosed in the last three years, three had unilateral and six bilateral disease. The present position of these is :-

Quiescent	I.S.Q. Still cavitated	Deteriorated
4	3	2*

*Enlargement of cavity size.

Collapse Therapy.

Two unilateral artificial pneumothoraces were attempted but neither was wholly successful. One was abandoned on account of a peripheral cavity maintained patent by a slender adhesion band; the other, from two months after induction when adhesion section had been carried out, had fluid which after two years of refills became purulent (A.F.B. negative). This responded to repeated aspiration and the lung re-expanded. It appears that the original cavity is now closed.

Five phrenic nerve crushes and pneumoperitoneums were carried out which apparently have had the effect of sealing the lesions in three cases but the others maintain their original cavitation.

The phrenic nerve was not identified at operation in the case of the patient whose A.P. was abandoned on account of adhesions; in the other A.P. with the empyema some reactivation in the contralateral lesion was noted. This was controlled by a phrenic crush and pneumoperitoneum and is included in the above numbers relating to this treatment.

No actual spread to other zones has taken place in any of these cases. All have had courses of streptomycin and paramisal sodium shortly after diagnosis. The response to this, although veiled by other therapeutic measures induced as the acute stage of the illness passed, has been:-

Complete clearing of the disease	-	nil
Clearing of exudative foci	-	4

Possible cavity closure - 2

No apparent radiological change - 3

LESIONS PREDOMINANTLY EXUDATIVE INVOLVING THREE ZONES
WITHOUT CAVITATION AT THE ORIGINAL NOTIFICATION.

The numbers in this group are 9 males and 10 females. One of these patients has not reported for X ray since 1948 but is reported to be well and working away from home.

The present position of this group considered by the years which have elapsed since notification is:-

Years since notification	1.	2.	3.	4.	5+
No radiological evidence of the lesion	-	-	-	1	1
No obvious activity clinically or radiologically-		2	1	1	3
Still considered active	2	3	-	-	4

Table 23 The present condition of patients in this group with reference to duration of time since notification.

7 patients had unilateral disease and up to the present they have all maintained that condition.

Deterioration, type of

In those patients, numbering nine, who are considered to have deteriorated, simple cavitation of the lesion has taken place in four, reactivation with subsequent excavation in two more, and in three, new areas of disease have been noted, all of which resemble bronchogenic disseminations involving at least two zones of the lung field with cavitation. The time lag between notification and the occurrence of these is:-

	6 months to 1 year	1 - 2 years	Over 2 years
Cavitation alone	2	2	-
Recavitation	1	-	1.....5 yrs
Spread	1	-	2 :::::1 - 2 yrs :::::1 - 5 yrs.

Table 24. The type of deterioration noted in patients of this group and the time interval from notification to occurrence.

Treatment instituted.

Artificial pneumothorax (in one case bilateral) was induced in 7 patients. Four were treated successfully for a three year period although in two cases adhesions were evident. The treatment was terminated prematurely in three instances for the following reasons:- in one case, atelectasis (segmental); in another considerable fluid; and in the last spread of the disease to the contralateral lung. A further artificial pneumothorax started on the side of the new disease was similarly abandoned on account of reactivation of the original lesion.

Of the successful three year pneumothoraces only one remains active.

Phrenic nerve crush and pneumoperitoneum have been employed in two cases but in neither case has the treatment brought the disease to a state of quiescence and, indeed, one experienced excavation during the period of treatment.

Streptomycin and Paramisal Sodium were administered to

11 patients who received a full course of antibiotics. In five of these no collapse measures were employed in addition. The response to these is given below:-

	Streptomycin & P.A.S. alone	Streptomycin & P.A.S. with collapse therapy.
Complete clearing	-	-
Clearing of exudative disease	3	4
Improvement only clinically	2	2

Of those who have exhibited only clinical improvement, three cases are known to have been of at least 2 years establishment.

LESIONS OF A PREDOMINANTLY FIBROTTIC CHARACTER INVOLVING
THREE ZONES

This group comprises 4 males and 3 females. One of the patients was observed for three years and now, seven years after the original diagnosis, is known to be an inmate of a mental institution.

All but two of this group have run a benign course. These two displayed reactivation and cavitation five years after the original diagnosis. Both have since reacted favourably to streptomycin and paramisal sodium but cannot yet be considered quiescent although there is now radiologically no evidence of cavitation. In one case - the only person in this group to receive collapse therapy - the antibiotics were supplemented by a phrenic crush and pneumoperitoneum.

LESIONS INVOLVING FOUR ZONES SHOWING CAVITATION AT DIAGNOSIS

In all there are 25 patients in this group, 19 of whom are male and 6 female. One has not reported in the last three years and he is, it is understood, fit and working.

The present position as far as the clinical and radiological findings relevant to the 15 patients notified before 1949 is:-

Inactive	Quiescent	Active
1	4	10

Deterioration of Disease has occurred in 7 cases. In 5 of these the type is identifiable as one of bronchogenic dissemination; and in the sixth case the route is doubtful but has lacked the catastrophic nature of the others; the last case assumes the form of the excavation and liquefaction of a cavity which has remained filled with inspissated material for five years.

The duration of the period from notification to deterioration is:-

6 months to 1 year	1 - 2 years	2 - 3 years	3 - 4 years	5+ years
1	2	1	-	3

Table (25) The time interval between notification and deterioration in patients of this group.

Treatment instituted.

No active therapeutic measures were induced in 5 patients and in 4 of these the disease remains active and

one has recently died - June 1952.

Artificial pneumothorax has been induced in seven instances only one of which can be considered to have been a successful collapse which was continued for three years. In the remaining six cases the reasons for abandonment were:- adhesions followed by fluid, 3 cases; adhesion complications, 2 cases; atelectasis of a lobe, 1 case.

Improvement in the condition has accrued in only the first mentioned and this case is now considered quiescent.

Phrenic nerve crush and pneumoperitoneum were induced in three instances and have been successful in bringing the disease to quiescence in two cases, one having an upper zone and the other a mid zone cavity.

Post-1948 Notifications.

Of the 10 patients diagnosed since 1949 who fall within this category, two may now be considered quiescent; with the others the situation, so far as the cavitation is concerned, is not radically altered.

Spread of the disease has taken place in only one instance where a further zone has been found to be infected probably by an aspirated spread. This occurred 18 months after the diagnosis of respiratory tuberculosis had been made.

Treatment has been directed primarily against the acute exudative lesion by the use of antibiotics and the response to streptomycin and P.A.S. has shown:-

Considerable improvement	.....	3
Moderate	.....	2
Slight	.....	3
No effect	.....	Nil.

It might be mentioned that one patient who made only slight improvement on Streptomycin and P.A.S. improved considerably when thiosemicarbazone was administered, but out of a total of 16 who have had two months or more of this drug, he is the only patient to show any alteration.

Collapse therapy.

Three pneumothoraces were induced and all showed adhesions, divisible in one case only where the treatment is being continued. The other two were abandoned and the treatment replaced by phrenic crush and pneumoperitoneum which was applied also in another five cases. Cavity closure has been effected so far, in only one case - an upper zone cavity - but the treatment seems to be maintaining stability in the others who are awaiting accommodation in the thoracic surgical unit in Aberdeen.

OTHER LESIONS OF AN EXUDATIVE CHARACTER BUT NOT OBVIOUSLY
CAVITATED AT DIAGNOSIS INVOLVING FOUR ZONES.

There are 7 patients in this group - 4 males and 3 females, one of whom has not been traced since 1946.

Deterioration of the Disease.

Cavitation has taken place in three instances and the duration from diagnosis to this occurrence has been in these cases respectively: less than six months; six months to one year; three years. In one the cavitation has been associated with a catastrophic spread of the disease on two occasions, the first occurring one year after the cavitation.

Four artificial pneumothoraces were induced in these three cases but only one was continued for two years. The other three artificial pneumothoraces showed adhesions, complicated by fluid in two which in one case became purulent. In addition all had phrenic crush and pneumoperitoneum.

The present state of these cases is:-

Inactive	Quiescent	Still Cavitated
1	2	nil

Where cavitation has not occurred, spread of the disease has taken place in only one case, and that one year after notification. The nature of this has been bronchogenic in origin and it has responded to streptomycin and paramisal sodium.

FIBROTIC LESIONS INVOLVING FOUR LONES

Five males and one female have all run a benign course but three cannot yet be considered quiescent, being of too recent diagnosis.

One artificial pneumothorax was attempted in this number but was abandoned on account of adhesions.

LESIONS INVOLVING FIVE ZONES SHOWING CAVITATION AT DIAGNOSIS.

The numbers involved in this group are 7 males and 2 females.

All the patients who were diagnosed under this category have remained under observation up to the present but only four of them were pre-1949 notifications and of these the present position is:-

Inactive	Quiescent	Remaining Active
nil	1	3

Marked deterioration of the disease has not been noted in any of the 9 patients in this group, although one whose radiological picture has shown improvement experienced one year after diagnosis a brisk reactivation in all the zones previously affected.

Treatment.

In pre-1949 notified cases it has been possible to intervene in only two cases. One had a thoracoplasty and is now quiescent; the other had an artificial pneumothorax nine years ago and shortly afterwards developed an atelectasis in the affected lobe immediately followed by an effusion. This was aspirated - the fluid being clear and A.F.B. negative to culture. The fluid, however, persisted and some eight years later was found to be identical in extent and nature. It is now being aspirated at frequent intervals and the volume is showing signs of diminishing.

In post-1949 cases cavitation persists up to the present and the treatment has consisted essentially in the

administration of antibiotics with the following results:-

Considerable improvement		2
Moderate	"	2
Slight	"	1
No	"	nil

Phrenic crush and pneumoperitoneum have been induced in three cases but these have shown very little change from what was brought about by streptomycin and P.A.S.

LESIONS INVOLVING FIVE ZONES NOT CAVITATED AT DIAGNOSIS.

Of these there are 2 males and one female. Two of these patients show excavation about nine months after notification and all are pre-1949 notifications. The present position of these is:-

Inactive	Quiescent	Active
nil	2	1

Apart from cavitation no extension of the disease has been noted.

Treatment.

All have had pneumothoraces but none has been ideal, all being complicated by adhesions. Of the three, two were abandoned since fluid developed within six months; the remaining case was continued for two years without securing cavity closure.

LESIONS INVOLVING ALL ZONES SHOWING CAVITATION AT ORIGINAL DIAGNOSIS.

There are 18 males and 9 females in this group and all have been attending up to 31. 12. 51.

Pre-1949 Notifications

Six names remain on the notified register of patients who had extensive disease of this nature and the present state of these is:-

Inactive	Quiescent	Active
1	2	3

Treatment

Collapse therapy, as detailed below, has been adopted at one stage in all these cases.

Pneumothorax was attempted on five occasions, one bilateral. All these showed adhesions, divisible in only one instance. With one exception, they appear to have remained dry throughout their course (not longer than 15 months) and all seem to have secured cavity closure.

Phrenic nerve crush and pneumoperitoneum were carried out for two years on two occasions during which time the cavities remained patent and the disease underwent reactivation.

Post-1948 Notifications

The 21 cases notified during this period all show cavitation up to the present and are thus still active.

Treatment

The majority of these patients have had a course of antibiotics - streptomycin and P.A.S. with the following results:-

Considerable improvement	.....	5
Moderate	"	..... 8
Slight	"	..... 5
No change		Nil

Collapse Therapy

Three pneumothoraces were performed but soon abandoned, the reasons for discontinuance being adhesions in two cases and a complete atelectasis of the lung in the third.

Nine phrenic nerve crushes followed by pneumoperitoneum have been carried out; in none has the disease been brought to quiescence and at the best they may be considered to be maintaining a stability.

LESIONS INVOLVING ALL ZONES NOT OBVIOUSLY CAVITATED AT
DIAGNOSIS.

There are 9 patients in this group - 4 male, 5 female.
All are pre-1949 notifications.

Subsequent cavitation has been noted in two cases only
and this has been observed one and four years respectively
after the original notification.

Collapse Therapy in the form of a pneumothorax was
carried out in one case but adhesions caused the treatment
to be abandoned; a phrenic crush and pneumoperitoneum
induced later appear to have brought the disease to quiescence.
The other remains active and is considered unsuitable for
therapy.

Of the 7 who have not shown cavitation the present
condition is:-

Inactive	Quiescent	Active
1	6	nil

Treatment

One patient has had a phrenic crush and peritoneum,
and one - a miliary diagnosed late in 1948 - had a course
of streptomycin and P.A.S. in Glasgow, the condition clearing
completely.

FIBROTIC LESIONS INVOLVING ALL ZONES.

Of the 4 patients in this group three are males and one is female.

Only one showed a suspicion of cavitation and a pneumothorax was carried out. The space, however, disclosed a fluid level and the collapse was not maintained. Up to two years later no obvious cavity was noted, but that was in 1945 and the patient does not seem to have been reviewed since. Her present residence is unknown.

The other three have all run benign courses and no therapeutic measures have been necessary.

PLEURISY WITH EFFUSION AS THE REASON FOR NOTIFICATION

There is a considerable diversity of opinion among medical practitioners as to whether or not a pleurisy with effusion, often referred to as an idiopathic effusion, should be notified to the Medical Officer of Health as an incidence of pulmonary tuberculosis.

Where pleurisy with effusion is accompanied by lung lesion accuracy in diagnosis is so adequately assured as to justify immediate notification. In this investigation where an intrapulmonary lesion was visible on the initial radiograph, even were it but the suggestion of a primary complex, the case has been included in the appropriate section according to the area of lung field found to be involved by the parenchymatous changes; no account has been taken, in these cases, of any fluid that might be present in the pleural sacs.

The high incidence of recovery of tubercle bacilli from the effusion is ample evidence of the existence of a close relation between effusion and some active process in the lung, and, in the absence of lung lesion, still provides ample justification for classification as a case of pulmonary tuberculosis.

Where, however, there is neither lung lesion, nor discernible presence of tubercle bacilli it seems possible to adduce sufficient evidence for including this third category (i.e. pleural effusion without detected parenchymatous disease) as notifiable also. Kayne Pagel &

O'Shaughnessy (Pulmonary Tuberculosis) claim 80% as a conservative figure of idiopathic pleurisy being tuberculous. Bearing this in mind, the author has segregated those patients who would appear to have been included in the notified list originally because of pleural effusion only, i.e. there was radiological evidence of fluid in either pleural sac and there was no obvious parenchymatous disease at that time. The total number whose original notification was made on the finding of a pleural effusion and who were alive at 31. 12. 51 was 57. Of these 32 were males and 25 females (percentages respectively 56% male; 44% female). This shows a slight preponderance of male notifications and reflects a similar state in the large series reported by Schiel & Fojen (1928) who, in a total of 927 cases found a preponderance of males amounting to 53%.

One major feature in regard to effusions is the high rate of tuberculous morbidity which occurs as a sequela. Maclean (1948) summarises the percentage tuberculous morbidity in the larger series of reviews of 'Tuberculous Morbidity subsequent to pleural effusion' which have been published since 1882.

Of their occurrence in adults he quotes 17 surveys. These show a considerable fluctuation in the percentage of cases in which tuberculous lesions develop, varying from 82% by Fielden (1882) to 7.7% in the Norwegian Statistics of Jervell & Istre (1946); in his own series of 183 Royal Navy personnel in the five year period subsequent to the

effusion a morbidity rate of approximately 25% is recorded.

One explanation, he suggests, to account for the discrepancies is the considerable variety employed in the conduct of surveys, one major item being the frequency of radiological examination. The conclusion too in the early series, where facilities for excluding the existence of underlying, but clinically silent, pulmonary disease were lacking, he remarks on as a possible accounting factor in raising the percentage.

Morbidity subsequent to Pleural Effusion.

That there have been patients who have had pleural effusions, and remained unⁿnotified, is apparent from the cases subsequently notified as suffering from intrapulmonary disease, whose earlier case history contains records of radiographs showing pleural effusions. Further, several patients may have suffered from an effusion and have had their cases notified. They have subsequently developed a lesion to which they succumbed and consequently there is neither record of their name or history.

For these reasons, and also, as has been pointed out in the introductory paragraphs, since only the 'notified cases' radiographs are held for the Southern Isles for the period up to 1950, it is impossible to furnish exhaustive statistics of the morbidity.

Of the 57 cases notified originally whose X rays at that time showed a pleural effusion with no radiological

appearance of underlying disease 13 have subsequently shown intrapulmonary disease; Enquiry into the progress of the others revealed that 6 in the course following the pleurisy had developed extrapulmonary tuberculosis, viz:- 3 spine; 1 wrist; 1 ankle; 1 renal. The morbidity including all forms of the disease is 38%, and for pulmonary lesions alone is 23%

These figures are based, as had been said before, on the fact that notification was actually made on a diagnosis of pleural effusion and that the patient was alive at the end of 1951.

In the 13 cases who have developed pulmonary lesions there are 9 males and 4 females. Their lesions have become apparent in the subsequent radiographs at the periods from original notification specified in the following table:-

See Table 26 (p.93) Duration from notification as a Pleural Effusion to appearance of disease.

Figures in parenthesis are from a similar analysis by Maclean K.S. (1948)

In the cases of three of those found to have lesions in the third year after notification there were no intermediate radiographs and re-examination was carried out because of respiratory symptoms. All three patients had returned to work on the mainland and it is a reasonable presumption that had routine checks been carried out the lesions would have been discovered earlier.

	Up to 6 months	6 months to 1 year	1 year to 2 years	2 years to 3 years	3 years to Over	Unknown
Total 13 cases	1	3	4	5	-	-
" 42 21 cases	(7)		(6)	(4)	(3)	(1)

Table 26. Duration from notification as a Pleural Effusion to appearance of disease.

The conclusion to be drawn from this is that where parenchymatous disease follows a pleural effusion it is usually evident within the three year period. This coincides with the findings of Maclean (1948) whose figures for 21 pulmonary relapses are given in parenthesis in Table 26.

POST-PLEURISY LESIONS

The Extent of the pulmonary lesion.

In evaluating the extent of the disease process the new appearance at the time of its discovery has been arranged under one of three categories:-

- A. Minimal:- where the disease extent does not exceed one zone of the lung field.
- B. Moderate:- where two zones are involved
- C. Extensive:- where three or more zones show involvement.

The numbers falling into each of these groups are:-

Minimal	Moderate	Considerable
8	2	3

Table (27) - Showing extent of post-pleurisy lesion at its appearance.

Of the minimal lesions three were of a transitory nature, having cleared up by the end of two years and having left no radiological evidence of disease; in another three, although it is possible still to notice

alterations in the X ray, they have so far run a benign course, and two have been so for over 5 years; the remaining two, however, have shown cavitation within one year of the appearance of the lesions and both are still under treatment.

In both the 'moderate' and the 'extensive' lesions cavitation became evident. Two have succumbed this year (1952).

Site of lesion with reference to side involved by effusion

Site of Lesion	Ipsilateral	Contralateral or Bilateral
Number	7	6

Table (28) Frequency of lung involved to side of previous pleurisy.

In two of the bilateral cases it is noted that the preponderance of the disease is markedly on the side of the original effusion.

Site of Lesion with reference to the anatomical position of the disease as shown in the P.A. film.

It is possible to establish the site of the lesion only in those cases where the lesion is not of a considerable extent. The scrutiny was therefore confined to the 8 minimal lesions and revealed that in all cases the lesion occurred in the upper zone in the sub-clavicular area; four were situated in the right lung and four in the left.

The inference from this observation is that this is

the common site for development of the post-primary lesion. This corresponds with the findings of Pagel W. (Kayne & O'Shaughnessy 1948). It is also worth recording that where Maclean found a post-primary lesion, it occurred in this same region.

PERIOD OF OBSERVATION.

While it is unusual to keep pleurisy under observation for periods exceeding five years, it was found that there was a considerable number of persons on the notified list in 1951 who had not been examined for a long period. In an endeavour to revise the list all those whose names appeared were asked to attend at either of the two chest clinics: Stornoway or Daliburgh. All but four presented themselves for examination. Enquiry regarding the absentees revealed that they were employed on the mainland and were well. The duration of observation of the 57 patients who originally showed pleural effusions, including those in whom lesions, either pulmonary or extrapulmonary, were subsequently demonstrated may be tabulated as follows:-

See Table 29 (p.98) Observation period from first to last X ray of those cases notified because of pleural effusion.

It would appear that so far, out of those 57 what might be styled idiopathic pleurisy there have developed 13 pulmonary lesions and 6 extra-pulmonary lesions. The latter, were treated at the orthopaedic unit Inverness:

regarding the former, seven lung lesions have shown cavitation and the 6 others have, by the institution of appropriate measures, been brought under control early after their observation.

It would seem therefore that a very reasonable case could be made out for notifying in the first place all idiopathic effusions even if it were only a precautionary nature calculated to add weight to the gravity and importance of the condition. By keeping them under the regular surveillance of M.O.H. and district nurse any possible source of infection might be investigated and protective measures taken for the house contacts in view of the possibility of bronchogenic disease inciting these incidents. Young (1952).

Duration of observation.	Under 1 year	1 year	2yrs.	3yrs.	4yrs.	5yrs.	6yrs.	7 - 10 yrs.
Number of patients	3	6	9	10	9	5	6	9

Table 29. Observation period from first to last

X ray of those cases notified because of pleural effusion.

EXTENT OF INITIAL DISEASE IN A PROPORTION OF THOSE WHO
ARE KNOWN TO HAVE DIED OF PULMONARY TUBERCULOSIS
(ISLE OF LEWIS ONLY)

Reference has been made previously to the lack of records regarding persons deceased but it was deemed advisable to extract, if possible, some statistics regarding these cases. The method of approach to this problem was a check of each individual record in the Xray register against the list of known deceased persons of whom there was a list of 136 names and addresses. Only 10 of this number could not be traced in the register and from the information contained therein the extent of the initial lesion was assessed. The results are tabulated below:-

Extent of Initial Lesion in Zones	Number of patients
1	14
2	20
3	17
4	20
5	4
6	48
Pl.	3

Table 30 The extent of disease at original diagnosis

in 126 patients who died from pulmonary tuberculosis

From these figures it will be noted that over half (viz. 57%) of the persons who died of respiratory tuberculosis suffered from disease affecting a volume of more than one

lung at the time of first seeking radiological confirmation.

In only six(6) instances of lesions involving one zone or less is cavitation not remarked on.

PRESENTING SYMPTOM.

Dr. Harley Williams in his paper on Tuberculosis in the Outer Hebrides in 1931 refers to the high incidence of toxaemic symptomatology encountered in these parts and this has tempted the author to enquire into the present aspect of this observation. As has been mentioned before, in many cases there is a lack of records but in tabulating the symptoms which precipitated the diagnosis of pulmonary tuberculosis, the writer has examined the records of all those notified as at 31.12.51 for specific mention of these either in the letter from the family practitioner referring the patient or in the hospital record card. In all they have been traced in 243 patients - just less than one half of the survey - and the cardinal symptom has been listed.

The percentage who exhibit an initial symptomatology related to the toxaemic side of their infection is just under 15%. With 12% returning a negative history disclosing a lesion on routine X ray either in the forces or in some walk of civilian life, this leaves approximately 73% whose consultation was precipitated by a lung lesion symptom. From these figures it is noted that the toxaemic manifestation is rather less prominent as an initial symptom than the 17% described by Wingfield (1928)

The various symptoms met with and their frequencies are listed below:-

Symptom	No. of cases	%	Symptom	No. of cases	%
Cough	78	32	Pain (other than in chest)	6	2
Haemoptysis	36	15	Loss of weight	2	1
Pain in chest	52	21	Pyrexia	4	2
Tiredness	13	5	Dyspnoea	3	
Anorexia	4	2	Erythema nodosum	3	4
Routine	30	12	Asthma	3	
Abdomen	4	2			
Hoarseness	5	2			

DISCUSSION

Having examined the statistics referring to the incidence of tuberculosis on these islands in the notification and death rates supplied by the Medical Officer of Health, it was the author's intention to study the form the disease exhibited in this isolated community. He has set out the findings of his series of cases under group headings related to the extent of the disease found at the initial radiological examination. While this method of examination will supply an indication of the severity of the disease met with in so far as the proportion of cases showing involvement of an area equal to one lung and more is high, it involves certain factors which are highly pertinent.

First, the problem of isolation, this question which is so foremost in the Island's economics is a major one, also as far as it affects this investigation. Although relieved to some extent by refunds of travelling expenses and by setting up an X Ray unit in South Uist, many patients setting out for a consultation at the chest clinic have before them the thought of an all night sea trip and a thirty mile bus journey before they reach their destination, others more fortunate have perhaps up to sixty miles of road travel - but even so the state of the road surface makes this an ordeal. The moment therefore, might not be opportune for a practitioner, being presented with a suspicious symptom or sign, to seek radiological confirmation, nor can one expect a full attendance of all the contacts of a recently diagnosed

case at the clinic. Consequently from the outlying areas a firm diagnosis of pulmonary tuberculosis might be expected to be made later than from patients from the environment of the hospital. Secondly, the antipathy in those of the older generations to any suggestion of radiological examination is still present. The reason for this is to be found in the fear of tuberculosis which was inculcated into them in their youth, but the continuance of active propaganda and explanation will see the disappearance of this with the death of these village doyens.

The type of case is thus different from what one would expect to find at a city centre, in so far as the incidence of the symptomless routine diagnosed case is lowered, as also will be that of the group of cases having only minimal symptoms.

For an examination of the type of the disease met with a consideration of the incidence and form of deterioration in diagnosed lesions will suggest the answer.

It is generally agreed that the form of tuberculosis varies in various regions of the world and in the United States of America where two populations - the white, and the negro - live side-by-side, tuberculosis affects the coloured race more acutely than it does the white. Several hypotheses for this occurrence have been postulated, and the one which carries the greatest number of supporters is that which suggests a racial lack of resistance due to the recent introduction of disease into a community which had never

previously experienced the ailment. This, as Underwood (1945) remarks in his "Manual of Tuberculosis", is not the whole story as the negro has now lived under the same conditions as the White population sufficiently long for him to acquire considerable immunity. Whatever be the answer to that problem, it remains that the Negro suffers from a more acute form of the disease. The investigations of Pinner & Kasper (1932) revealed that haematogenous disseminations of the disease occurred twice as frequently in the Negro as in the White, and conversely the White population was more prone to bronchogenic tuberculosis.

In the light of these thoughts the cases who were known to have deteriorated were re-examined as a group.

DETERIORATION OF THE DISEASE.

The theories regarding the progressional route taken by deterioration in a case of pulmonary tuberculosis have shown considerable variation in the last quarter of a century.

Wingfield in "A Textbook of Pulmonary Tuberculosis", first published in 1929, summarises his views on the mode of spread in these words:

"Tuberculosis spreads in the lungs by direct extension, occasionally by the lymphatic stream, under exceptional circumstances by the air passages, and normally by the blood stream!" Fifteen years later Twinning - "A Textbook of X-ray Diagnosis" - says in the section devoted to the respiratory system:- "The spread of Tuberculosis, as studied radiologically, contradicts the old ideas of a steady insidious spread from apex downwards. Rather does it appear to extend by a series of catastrophies". Following up this view, Kayne Pagel and O'Shaughnessy in the most recent edition of "Pulmonary Tuberculosis" discuss only a haematogenous and bronchogenic evolution in the adult form of pulmonary tuberculosis.

It is the author's intention to evaluate the radiological and other evidence of the lesions included in this survey in which deterioration has been remarked and, if possible, arrive at a conclusion as to the normal route taken by the spread in the island population.

Deterioration of a lung lesion, in addition to including spread of the disease, takes in reactivation of

lesions considered quiescent, and also cavitation of a focus which previously had appeared solid. For the purposes of this survey, however, the definition will be limited to include only such lesions as have deteriorated where the spread is revealed by radiological evidence, subsequent to the original film, of an extension of the disease process which involves lung parenchyma not previously suspected of harbouring tuberculosis changes. On this basis 68 patients show extension of the disease and of these 41 are male and 27 female. Represented against the age at the occurrence of the spread, and sex. These figures are analysed in table (31).

Age	-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50+
Females	1	8	8	6	2	2	-	-	-
Males	1	7	6	12	9	2	3	-	1
Total	2	15	14	18	11	4	3	-	1

Table (31) Age and Sex Distribution of tuberculosis disease which has spread.

From the above statistics it would appear that the most favourable period for extension of the disease is the age group 15-35 with a slight loading for a few years on either side of 25 years. They would further suggest that the age at which deterioration becomes evident varies also according to the sex since the majority of the female spreads occur before the age of 25 years whereas the converse is the case with the males. Within the numerically narrow

limits of comparison they are consistent with the peak in the graph of the female mortality at the age of 25-30 and the more level descent of the figures for males after that period as shown in the Scottish respiratory tuberculosis mortality rates - 1931-47.

Duration from Diagnosis to Spread of the Disease.

	Under 6 months	6 months 1 year	1 - 2 years	2 - 3 years	3 - 5 years	5 - 10 years
Females	2	5	6	7	3	4
Males	3	5	14	7	6	6
Total	5	10	20	14	9	10

Table (32) Duration from Diagnosis to occurrence of the spread.

The prognosis of pulmonary tuberculosis at its original diagnosis will be influenced by, among other things, metastasis of the disease. As Maurice Davidson points out in his "Manual of Diseases of the Chest," once a diagnosis of pulmonary tuberculosis has been finally established the patient will fall into one of three rough categories - (1) Those who go progressively downhill in spite of all treatment. (ii) Those who go on to recovery in any circumstances and (iii) an intermediate group - those in whom the balance of life "depends more on those external circumstances the control of which is largely within our knowledge and occasionally within our power. For these we can, within limits, sometimes turn the scale". It would seem important, therefore, to consider at what stage, if any,

a patient might be adjudged to have shed the mantle of possible dissemination of his disease.

From Table (32) giving details of the duration from diagnosis to spread it would appear that the most favourable time for the disease to progress is the period from the end of the first to the end of the third year, but it is also apparent that spread is as liable to occur after the completion of two years as before the expiry of that time. In this survey the longest period in which the disease has been observed to maintain a stability and then to break down by a fresh implant of disease is eight years, this being recorded on three occasions.

So far, spread of the disease has been considered only in its relation to its occurrence. The cases have, however, been assessed and grouped in accordance with the possible mode of the spread. There are many factors, not the least a lack of records, which have raised difficulties in assigning the new lesion to one of the four categories as described by Wingfield (vide supra p.104). It is mainly in the differentiation between haematogenous and bronchogenic lesions that the problems have arisen and the decision has been made by studying the films in the light of criteria detailed in Kayne, Pagel and O'Shaughnessy (pp 333 - 335) viz: That a haematogenous lesion usually presents a symmetry of distribution and a uniformity of size in the individual foci - the apices are more heavily involved than the bases - cavitation where it occurs shows

a thin wall outline- and there is the tendency to the occurrence of calcification in the lesions. The bronchogenic lesion is usually associated with considerable expectoration and the radiological features go on to fibrosis and thick walled cavities.

68 patients have shown extension from the original disease area and it is felt that by far the majority of these - in all, 49-are bronchogenic in origin, the spread having been via the air passages. Three (3) have possibly found their route in the blood vessels and in eight (8) the new foci have appeared in close proximity to the initial disease, thereby being classified as direct continuity spreads. The remaining eight (8) have been found unassessable.

Bronchogenic Lesions.

It was found that the area of new disease encountered in the spread varied very considerably, as so it must, when such indeterminate quantities of infecting dose of organisms, and resistance, inherent and acquired, are concerned, and hence, as a measure of the severity of the deterioration the following classification was adopted: A slight spread did not involve more than a single zone of lung field; a moderate spread included only those where two new zones became implicated and an extensive spread where the new disease area exceeded two zones. On the application of these scales the analysis of the severity of

the extensions was found to be:-

Extensive	15
Moderate	15
Slight	19

Considering first those who were known to have experienced extensive changes. There were five (5) women and ten (10) men and only four (4) of these patients were under 20 years of age at the time of the occurrence. The deterioration did not become apparent at any specific time after the original diagnosis as thirteen (13) cases show it evenly spaced out up to three (3) years, one occurred in the fourth year, and one after an eight year period of stability but sputum positive.

In all but one ~~case~~ case was cavitation in the original lesion visible before or at the time when the degeneration was noted and in the exception, it probably took place, although indistinguishable, in the mass of the disease. The patient referred to was known to be sputum positive at that time.

Eight (8) cases in which the disease has deteriorated by a further spread were noted in this group, occurring usually about two years after the initial spread. In only one case did it occur within the same year. In extent the second wave of disease was found to be smaller than the first in seven (7) cases, and larger in the eighth.

In those who have undergone a moderate extension of the disease twelve (12) are males and three (3) are females. Of

the fifteen (15) cases, the deterioration took place in five (5) before they reached the age of 20 years.

The time lag which has been noted between the original diagnosis and the establishment of the spread shows a considerable variation. In four (4) cases it has taken place more than four years after the patient came under observation.

Cavitation at, or before, the time of the extension is visible in all but three (3) cases and of these two (2) are known to have had positive sputa; the records of the other case are, unfortunately, not available.

Five (5) cases show extension on more than one occasion and the intervals between the deteriorations vary from one to three years. In three (3) instances the second involvements were greater than the first.

Where the extension of the process has been slight the numbers are made up of nine (9) men and ten (10) women. In four (4) cases only has it taken place before the age of 20.

The observed spread of the disease has taken place, with one exception, within three (3) years from notification.

Cavitation is visible in the initial lesion at or before the occurrence of the spread in nine (9) of these cases and in the two others the sputum is known to have been positive. The remaining eight (8) cases, all being spreads to the upper zone, present the problem: Are they, in fact, of bronchogenic origin or do they represent discrete haematogenous lesions? The author appreciates

that there is no known way of differentiating in this highly controversial subject but, as is pointed out by Young in the textbook: "Disease of the Chest", in recumbency the upper zones are dependent areas and in this position might well conform to the requirements of a possible aspiration spread. Seven (7) of the cases are post-pleurisy lesions and in five (5) of them the lesion is apparent within 12 months but there is no indication from the clinical history in the way of symptoms prior to the effusion, to suggest that the effusion may have been secondary to a dissemination which only later exhibited radiological features.

	Less than 6 months	Six months to 1 year	1 - 2 years	2 - 3 years	3 - 4 years	4 - 5 years	5 - 6 years	6+
Extensive	3	3	3	4	1	-	-	1 (8yr)
Moderate	2	2	3	4	-	2	1	1 (6yr)
Slight	2	5	5	6	-	1	-	

Table 33. Duration from diagnosis to extension in bronchogenic spreads.

See Table (33) (p.113) Duration from diagnosis to extension in bronchogenic spreads.

The reason why a case of pulmonary tuberculosis continuing for a considerable time with demonstrable organisms in the sputum should suddenly exhibit a bronchogenic spread of the disease are as yet enshrouded in conjecture. Nayer & Piness (1942) enumerate the known factors such as allergy, immunity, and inherited resistance. They consider that the quantity and the viscosity of the sputum is also important as is also the general condition of the patient e.g. where an enfeebled sufferer is unfit to cough. Having studied these factors they are unable to explain the failure of the disease to spread in the cases with positive sputa observed by them. The seasons of the year, carrying their varied incidence of non-specific respiratory infections does not seem to influence the occurrence of bronchogenic spreads, as a study of the dates at which the catastrophies were first noted in the 62 instances cited above shows an almost equal incidence throughout the year. The relevant figures are given in table 34.

Winter	Spring	Summer	Autumn
16	14	13	19

Table 34 Frequency of 62 bronchogenic spreads by the season of the year in which they were first observed radiologically.

HAEMATOGENOUS SPREADS.

In the three (3) patients all males, in whom the disease extension was considered to be of haematogenous origin, the deterioration was obvious under one year in one case and in the third year in the other two (2). The new lesions were found throughout all zones of the lung fields and were of a minute character. In one of these patients progression took place; subsequent radiographs disclosed cavitation and confluence of the foci. During the year 1952 he succumbed to his infection. In the other two cases it was found possible, however, to control the disease and the final radiograph showed complete clearing of the military areas in one case, while diffuse discrete calcification took place in the other. This last, however, also died recently with symptoms suggestive of a right heart failure.

An interesting point regarding these patients is that they were all over the age of 30 years when they were originally notified and that they all came under observation in the first place because of pleurisies.

DIRECT EXTENSION OF THE DISEASE.

Eight (8) patients have been included in this category by the author as the serial radiographs present a picture, simple in some respects yet complex in others. It is of foci in the lung parenchyma which after varying periods of review show an increasing fluffiness to their borders, associated with an increase in the disease area. The actual increase in the disease extent as measured by the opacity on the radiograph, has never exceeded one zone of a lung and in four cases has amounted only to an increase in the diameter of the focus by 1 - 2.5 c.m. This has later subsided and the lesions so far have been benign. In the other four (4) cases, however, the extension has been in a definite direction as if there had been a gradual unfolding of the disease process and it is this insidious infiltration which can hardly be reconciled with the catastrophic deterioration of a bronchogenic or a haematogenous origin.

Four case histories are cited on the following pages illustrating the three main forms of deterioration mentioned by the author.

CASE NO. 1

E.M.L. (fem.) Age 17 years No 2613

3. 6. 48. Referred because of pain in R. chest.

Signs of R. pleural effusion.

No sputum B.S.R. 45 m.m./hr.

No record of result of pleural fluid examination

X ray (Fig. 1) shows R. pleural effusion with no obvious intrapulmonary lesion. Repeated radiographs to Feb. 1949 show diminution of the shadow of the effusion until only thickened pleura on the right side is visible and no obvious intrapulmonary lesion is noted. The B.S.R. was then 5 m.m./hr.

22. 1. 52 Referred to County Hospital on return from working on the mainland. History productive cough of one month duration.

Sputum positive.

X ray (fig.2) shows a diffuse lesion at the Right apex in which cavitation is visible.

This case demonstrates the emergence of a post pleurisy lesion.

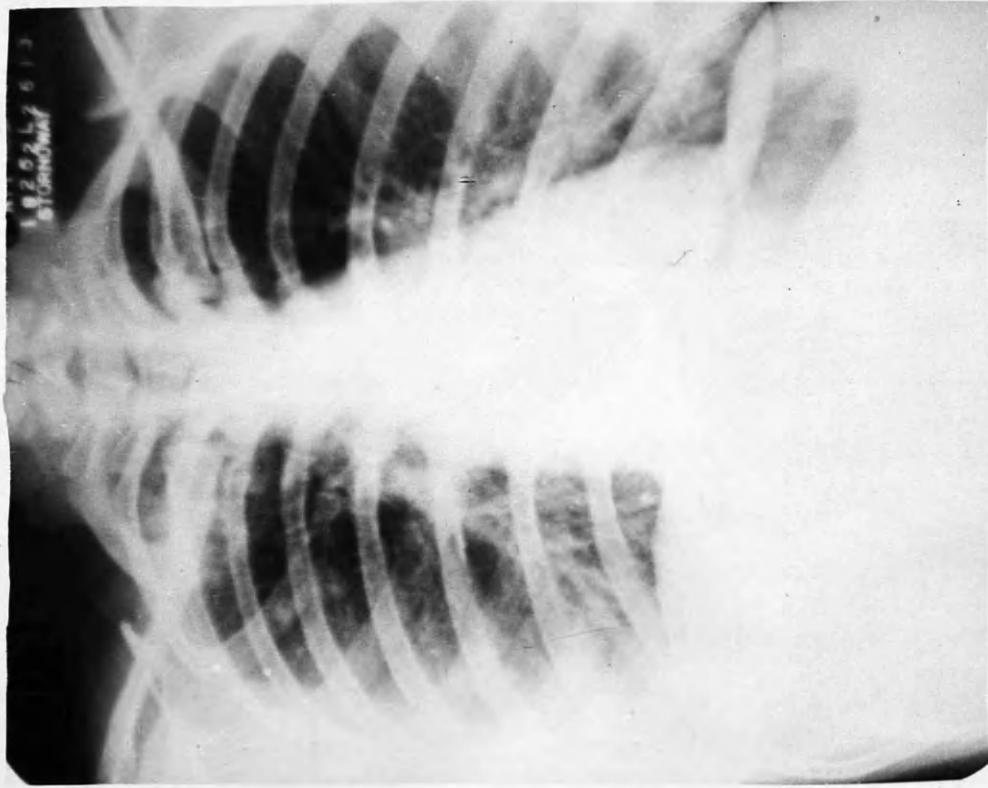


Fig. 2

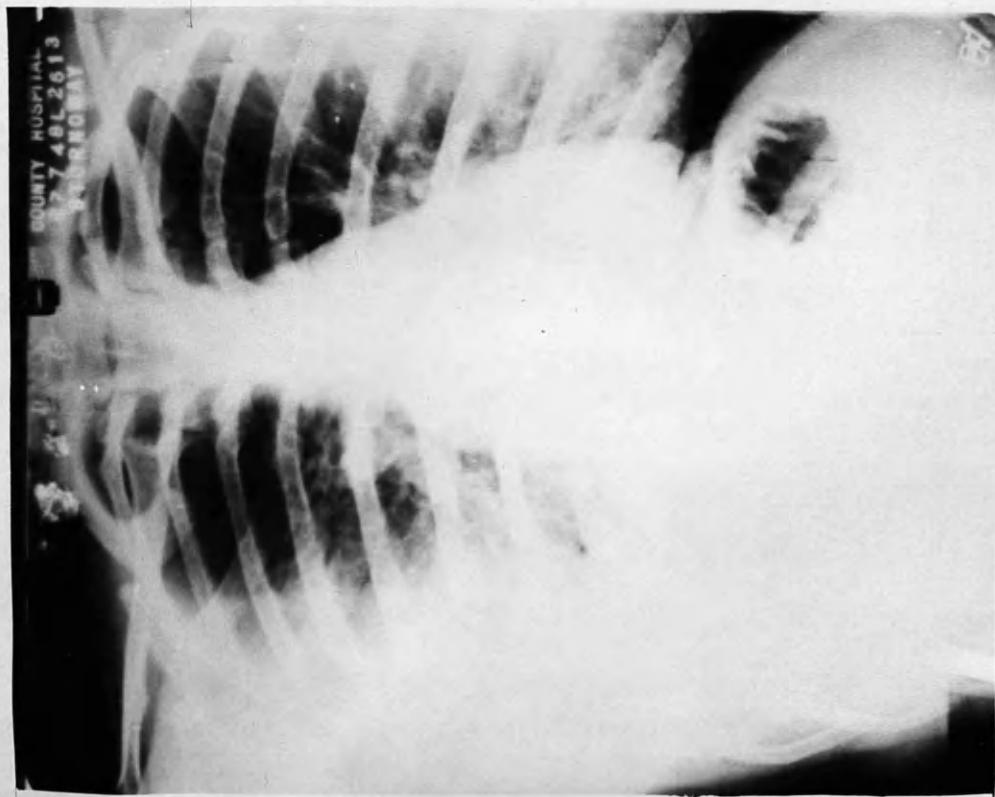


Fig. 1

CASE NO. 2

D. McL. Male. Age 20 years No. 3742

8. 5. 50. First examination routine contact.

Previous illnesses - nil. Family History:
Brother notified P.Tb. (His 2 other siblings
have also been notified subsequently).

Present Condition: Symptomless. Chest no
abnormality noted. Mantoux positive. No
sputum for examination B.S.R. 3 m.m./hr.

X ray (Fig. 3) minimal tuberculous lesion the 3rd Right
interspace near the periphery, no other lesion visible
in the lung fields.

25. 7. 50. No alteration clinically or radiologically.

5. 9. 50. Remains symptomless & B.S.R. 4 m.m.

X ray (fig.4) shows the lesion in the 3rd right
interspace to have increased in size by almost
twice.

The exact nature of the process followed by the
enlargement of the focus in this case may be one of
several, e.g. (a) a local bronchogenic spread around the
original lesion or (b) the excavation and subsequent formation
of a blocked cavity or (c) an extension by direct continuity
where the tissue surrounding has been first devitalised by
toxaemia and subsequently invaded by the disease. On the
slender grounds of failure to recover the tubercle bacillus
from repeated gastric lavage and the absence of any symptoms
of lung destruction in the form of cough or sputum this

case has been considered to show progression by direct extension.

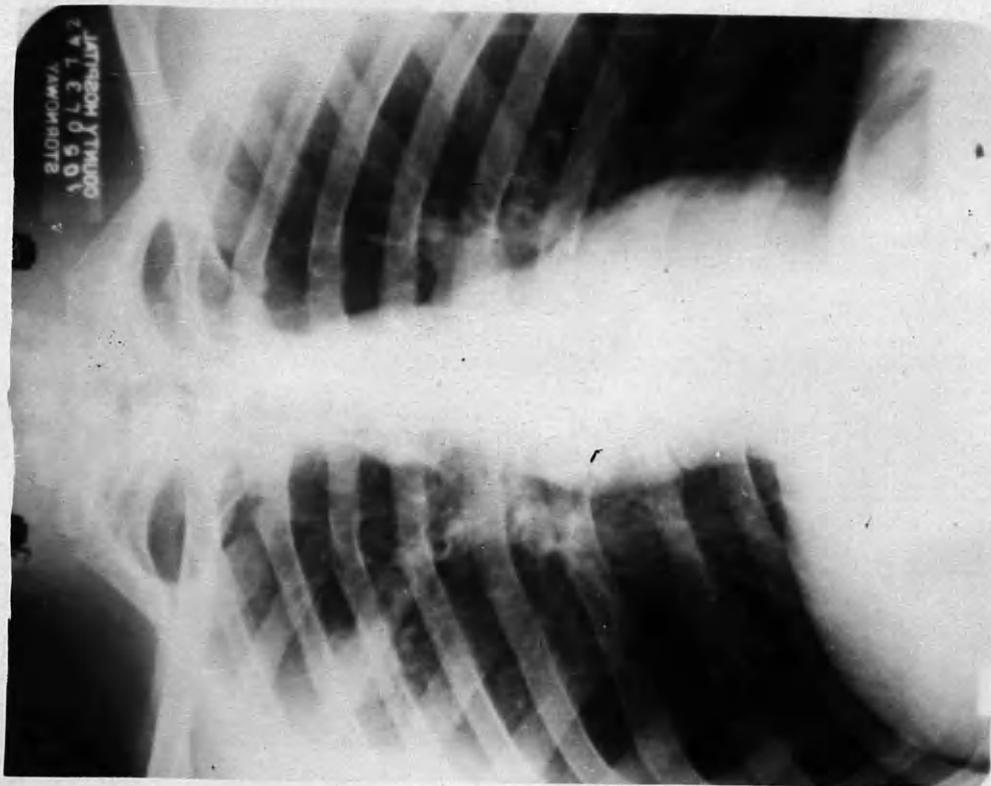


Fig. 4

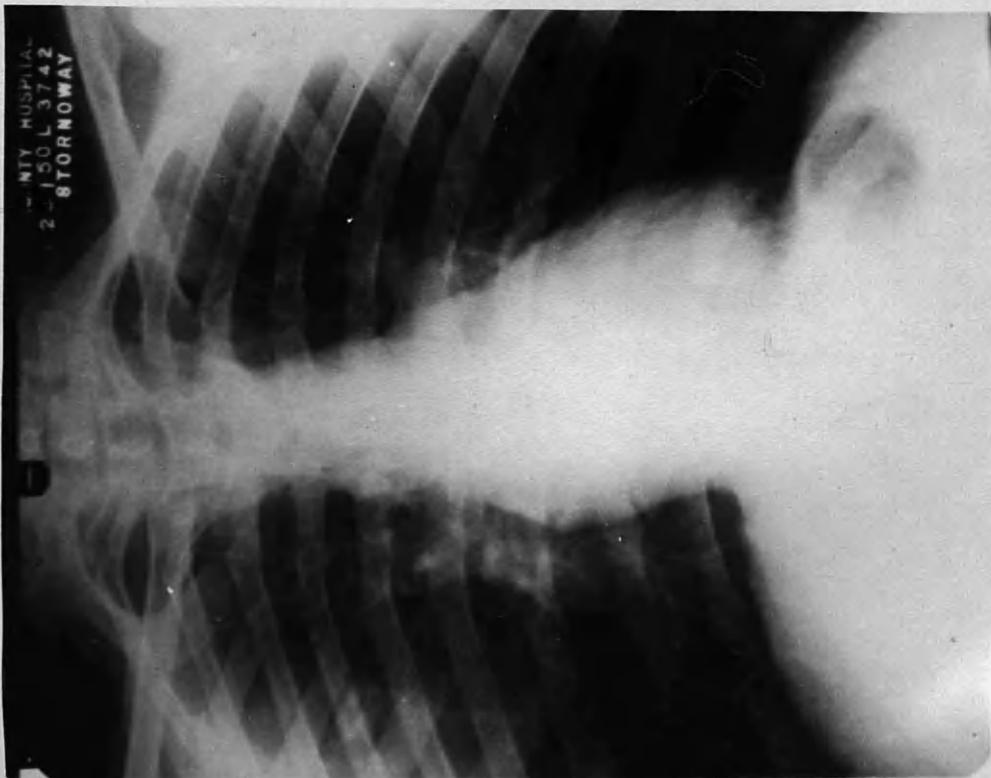


Fig. 3

CASE NO. 3.

L. McD. Male. Age 39 No.2342.

22. 5. 47. Referred to County Hospital complaining of productive cough of several months duration. Previous illness: Pleurisy 1 year previous. Family History: Sister notified P.Tb. Sputum: No record. B.S.R. 20 m.m./hr. X ray (fig.5) Loss of translucency in left upper zone and similar shadow in first right interspace. These appearances are suggestive of tuberculosis (Fig.5). No therapeutic measures and no further examination until 31. 10. 50:referred to chest clinic because of symptoms of toxæmia - pyrexia, loss of weight, and anorexia. He had only an occasional productive cough. Sputum positive. B.S.R. X ray (fig. 6) (Film over penetrated) appearances are those of pulmonary tuberculosis and all zones both lungs are involved in minute foci suggestive of a snow storm appearance. Cavitation is present in both apices. Admitted to hospital (Fig.6)
2. 2. 51. 3 months course of streptomycin Gm. T. & pas. Gm 18 daily completed. X ray (fig.7) shows clearing miliary type disease but residual cavitation in both apices still apparent (Fig.7).

20. 3. 51. R.A.P. induced.
25. 3. 51. L.A.P. induced.
20. 6. 51. Admitted to Woodend Hospital Aberdeen for thoracoscopy which showed indivisible adhesions.
19. 7. 51. Readmitted to County Hospital Stornoway. Bilateral pneumothorax abandoned and patient added to thoracoplasty waiting list.

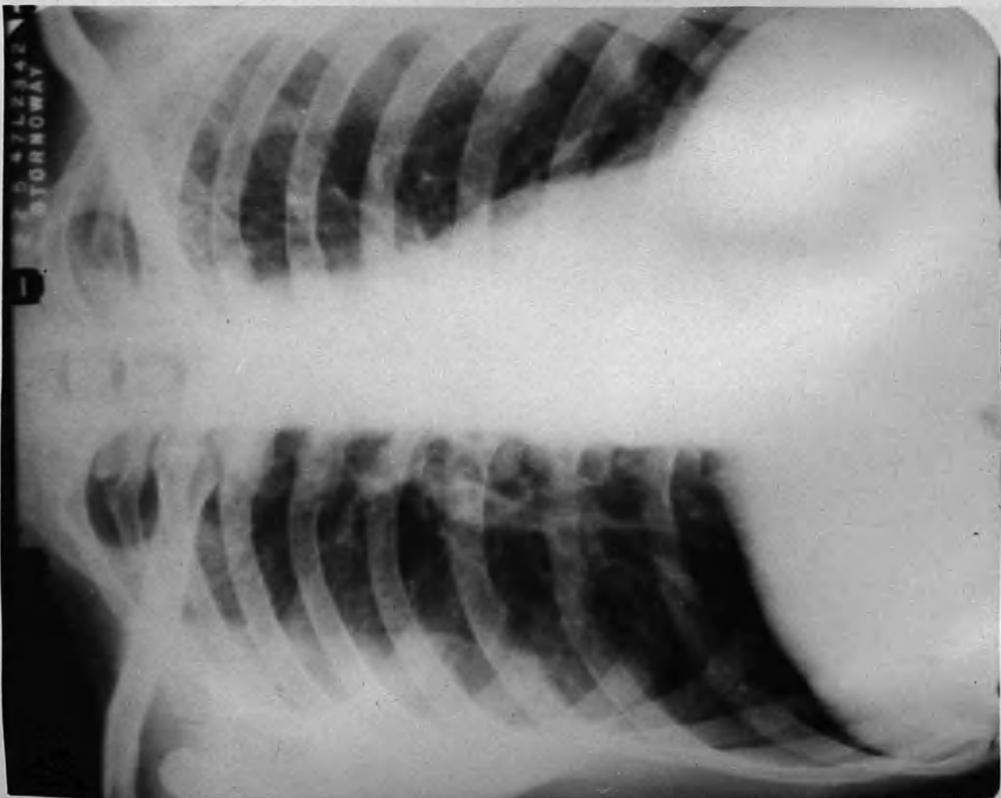


Fig. 5

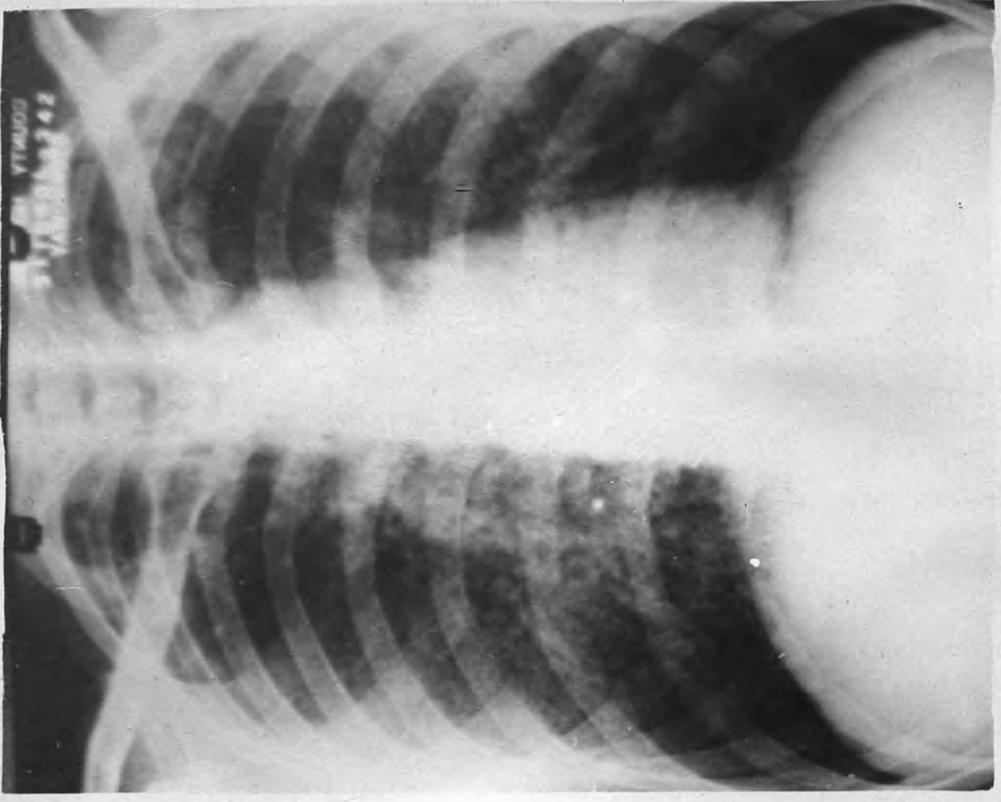


Fig. 6

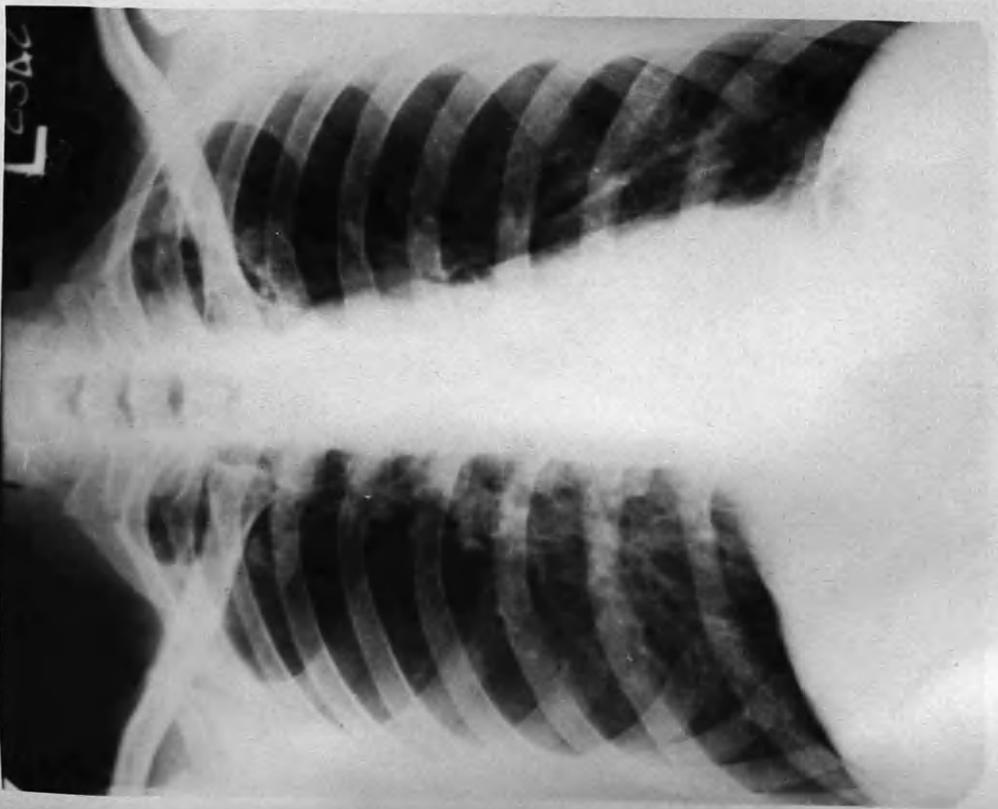


Fig. 7

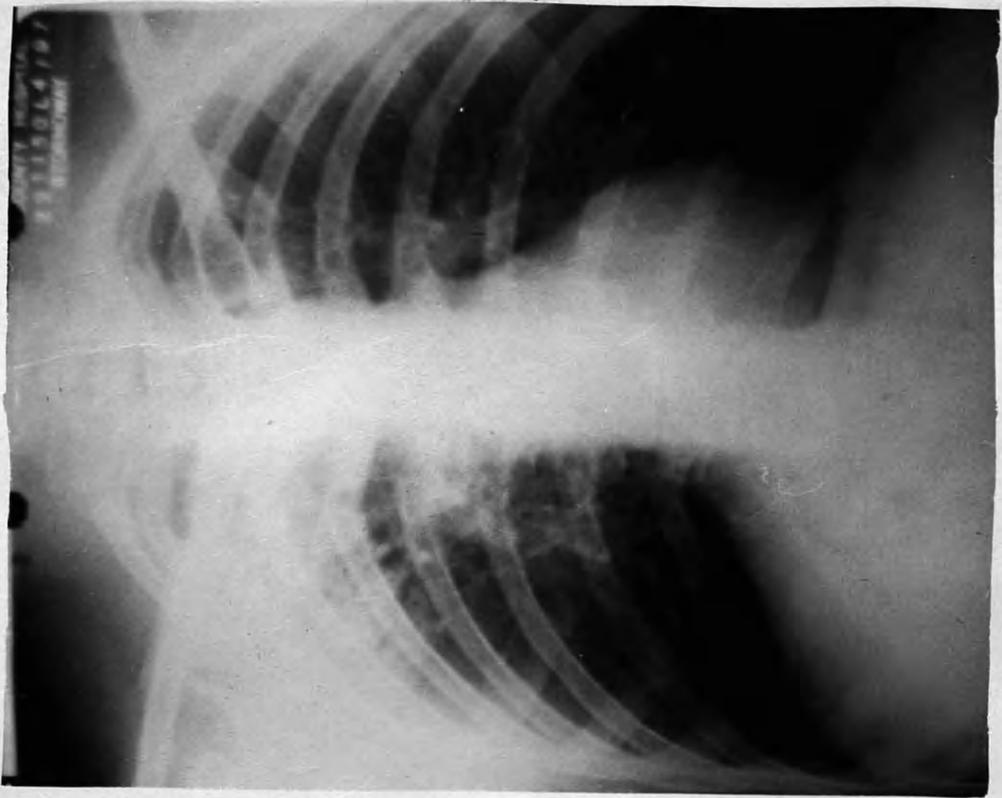


Fig. 8

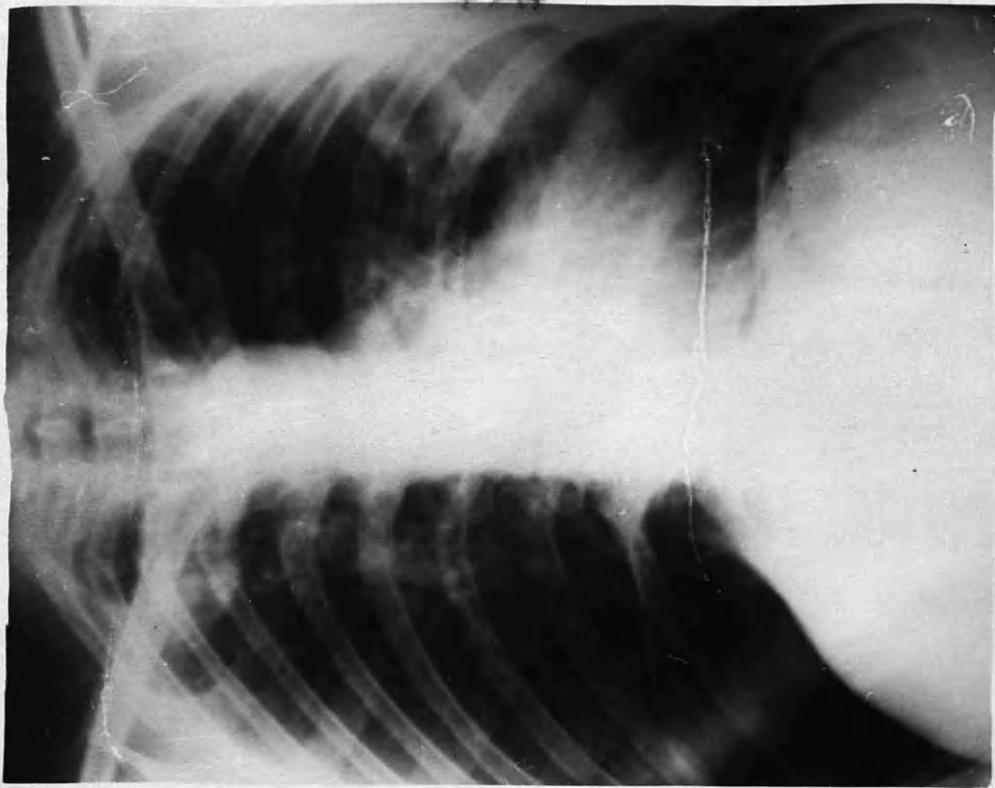


Fig. 10

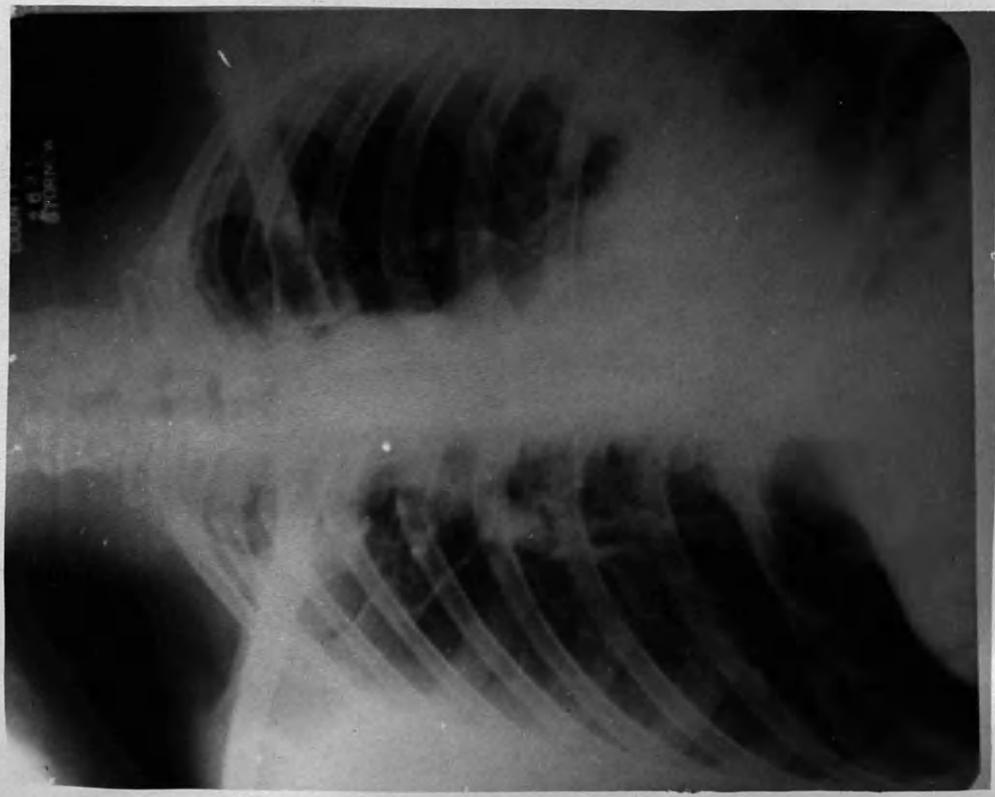


Fig. 9

CASE NO. 4.

J. McL. Male. Age 26 years. No. 4197.

2. 9. 50 Admitted from Bridge of Earn Hospital with a history of a productive cough, night sweats, and loss of weight (2 stones) dating from a 'cold' on 5. 7. 50.

Sputum positive.

X ray (fig.8) Pneumonic type of tuberculosis is present in the upper half of the right lung, no other disease visible.

Streptomycin Gm. 1 and P.A.S. Gm 18 per day commenced for 3 months.

30. 11. 50 R.A.P. induced.

3. 5. 51. R.A.P. abandoned after thoracoscopy.

R. phrenic crush and pneumoperitoneum.

X ray shows cavitated disease still present in R.U.Z. sputum positive.

14. 12. 51. X ray shows bronchogenic type of spread to Left lower zone with involvement of the interlobar surfaces by pleurisy.

The appearances continued unaltered until

21. 10. 52 (fig.10) when the radiograph showed cavitation was evident in the left lower zone lesion.

This excavation responded to antibiotic therapy and is now stable.

This case illustrates a typical bronchogenic

spread of pulmonary tuberculosis and the improvement in the initial focus subsequent to the spread of the disease is interesting.

It would appear that the most common route for deteriorating disease to take, in cases reviewed in this survey, is via the air passages. Consequently it is a type of disease which conforms to that to be expected in a white population and generally speaking the occurrence has been of a catastrophic nature subsequent to a phase of relative quiescence in the battle between the tubercle bacillus and the host. That these intervals in the main extend to about two years would appear to contradict the clinical findings of a century ago - as quoted earlier (vide p.14) - when the disease was recorded to be of an acute progressive nature with few remissions.

It might be argued that reliance of no great degree can be attached to the writings of a hundred years ago as they were by men denied the ancilliary services which have since been added to armamentarium in the fight against tuberculosis and also these articles appeared at least a decade before Koch demonstrated the tubercle bacillus in 1882. The author feels, however, that this historical evidence should be accepted at its face value and assessed against the present findings, drawing therefrom the conclusion that the disease has altered in character over the period and is now appearing in a more chronic form as it is influenced by the build up of an inherited resistance in the patients. Gloyne (1944).

These findings are closely allied to those of similarly located regions in Sweden, the statistics of which will be cited later (vide p.147)

Site of Initial Lesion.

The figures for all the lesions limited to less than one zone under review in this survey are given in the following table - the figures in brackets are those of the Prohit Tuberculosis Survey 1948 (T.31., p.54).

Zone	Right	Left
Upper	47 (74)	51 (51)
Middle	7 (12)	8 (7)
Lower	13 (8)	5 (2)

Table 35. Frequency of single zone lesions including minimal post pleurisy lesions compared with Prohit survey figures.

It will be noted from these figures that whereas in the Prohit statistics lesions involving other than the upper zones account for only 19%, in this survey, after deduction of hilar shadows and the six debatable appearances in the right middle zone mentioned in the section relating to single zone hilar lesions, 27% of the initial radiological appearances are located in either the middle or the lower zones. It has been suggested elsewhere that in the Outer Hebrides a considerable proportion of the tuberculous radiological shadows met with are those of primary lesions arising in adult or late adolescent groups, and possibly herein lies the explanation of the higher percentage of cases of the disease affecting other than the upper zones. The location of the primary focus/

focus is more varied than the post primary lesion, and, as stated by Twining, may be anywhere in the childhood lung although, however, it shows some preference for the lower part of the upper lobe or the upper part of the lower lobe (Pagel), and occurs more often on the right side than on the left. (Blacklock 1932). (Macpherson 1952).

The site of 40 demonstrable lesions of a recent primary character found to occur during the Prophit survey was located as shown in the following frequency:-

Upper zone 23

Middle zone 14

Lower zone 3

and its authors adjoin to these figures a reference to the different physiological character of the child thorax as compared with that of the adult.

A very considerable number of the cases which at diagnosis showed involvement of only one zone have continued up to the present without deterioration, thus presenting a situation which is not in accordance with the published figures for the prognosis of minimal lesions.

The reasons for the divergence of these figures may possibly be found in:-

- (a) The selective nature of the present statistics, one possible factor being the absence of data relative to patients deceased;
- (b) The increasing use of anti-biotics from 1948 onward with the consequent inclusion of two separate groups of cases,;
- (c) The difference in therapeutic treatment prior to the introduction of anti-biotics.

Towards a fuller elucidation of these problems, an analysis was undertaken of the lesions involving at the maximum one zone in the cases notified prior to 1949.

In all there were 82 cases in which cavitation was not visible and the lesion was present in one zone of the lung field only. That number, however, included the 22 cases in whom the appearances were predominantly fibrotic. These shadows, suggesting lesions of some duration, were excluded but the 13 cases of hilar enlargement were retained, thus giving a residuum of 60 cases in which activity was presumable at diagnosis. Out of this number cavitation has become apparent in 14 cases, or 23%.

Reisner (1948) in a series of 344 cases with previous negative radiological findings, found that 190 patients showed minimal lesions and that of these 62 or 33% developed cavitation later. He noted too, that cavitation was a more common feature among the non-white patients in his series.

Collapse therapy was induced in 8 cases where cavitation has not become evident and also in 2 cases where it has developed subsequently.

Disregarding for the moment the 13 cases of hilar enlargement where the intra-pulmonary lesion is not visible, there are in all 12 cases where the character of the initial lesion is suggestive of a primary focus. Of these 12 cases 8 have so far not cavitated and the remaining 4 have degenerated to excavation.

Of the total 60 cases under discussion deterioration of lesion in any manner is discernible in only 18 cases (30%) i.e. less than one third of all the instances.

The prognostication of a higher proportion of deterioration, and perhaps death, is not confirmed by the records of the traceable cases of those who have died. Of 252 patients deceased the records for 126 are still extant. These reveal that at the original diagnosis 14 cases had lesions confined to one zone. Of these, however, 8 were already cavitated at diagnosis, so that only the remaining 6 can really be regarded as genuine minimal cases. Nor is there any reason to assume that in the 126 cases untraced, figures dissimilar in any marked degree, would have been revealed./

revealed. The absence of exhaustive data, therefore, does not seem to vitiate, but rather to support the contention that the disease appears now to be pursuing a less acute course than formerly. Nor are the figures affected in any marked degree by the application of active collapse therapy since recourse to this treatment was made on only 10 occasions.

The relative security of these lesions i.e. the high percentage not showing degeneration has been obtained perhaps by the institution of a regime of rest in bed either at home or in hospital. The much lower progression rate in those receiving sanatorium treatment is commented on by Reisner (1948) who quotes a 28% rate of frank progression in institutionally treated cases against a 67% deterioration in those who were not. Rightly he draws attention to the fact that many factors are involved in the final production of these figures, - not the least being the flouting of the physician's advice by the asymptomatic routine detected case. The horror of "the scourge" which has been built up in the last few decades in these Islands has at least one advantageous feature in that patients here are relatively docile, so that rarely is any difficulty experienced in ensuring that the rest regime is carefully observed.

Amberson (1937) reviewing over 100 cases finds that whereas the untreated cases deteriorate, 90% of the treated cases recover but his 'rest' therapy has been more severe than has been found possible to institute in these Islands.

The 22 cases of fibrotic type with the deduction of one who later was found to be suffering from renal tuberculosis show, out of the pre-1949 single/

single zone notifications which total 89 patients, a rate of 21% in whom the disease could be considered quiescent. Surgeon Capt. Brooks, R.N.V.R. (1944) in publishing his statistics on Tuberculosis among naval personnel reports that out of 2911 sailors found to have minimal lesions, 16% showed evidence of activity, 63% were doubtful, and in 21% the disease was arrested.

The Observed Results of Artificial Pneumothorax Therapy.

The Mechanical aspect.

Laird (1945) in his "Comments on Total Thoracoscopy" says that all artificial pneumothorax spaces should be thorascoped. Such a counsel of perfection is impracticable in an isolated community on account of the lack of thoracic surgical facilities. Patients here have to travel considerable distances to have thoracoscopy carried out, which alone provides a hazard for the 'cooling' lesion. Further, air travel - the most convenient means of transporting the patient to the Centre - can involve the invalid in the alarming condition of dyspnoea caused by alteration in barometric pressures. Consequently, while Laird's dictum is accepted as an ideal investigation for a pneumothorax, it has not been carried out in patients in this survey. The interpretation here of a "Free Space" has been made on the radiographic and fluoroscopic evidence of absence of adhesions, and of the numbers involved, there are probably a few who had adhesions which were never demonstrated.

The following data do not include cases in which pneumothorax was attempted but defeated as the pleural sac could not be identified.

108 pneumothorax spaces are known to have been established and in these only 13 have not shown complicating factors throughout their course. In addition 40 artificial pneumothoraces which showed adhesions were continued for over two years. Of this number there are 8 for whom it was deemed expedient and mechanically possible to carry out adhesion section. Thus it would appear that a free space was being dealt with in only 21 instances (i.e. 19%).

55 cases had to be abandoned at varying periods before two years had elapsed, and by far the commonest complicating factor was adhesions, which occurred on 42 occasions. Atelectasis was the cause in only 6 cases, being mainly (4) of a lobar nature with only one each of a segmental type and of a complete atelectasis of the lung. A spontaneous pneumothorax developed in two cases shortly after the induction and there is no control radiograph prior to the occurrence to indicate the reason for the catastrophe. In 2 instances the development of a tension type cavity of a dangerous nature caused the termination of the treatment. The remaining 3 cases were abandoned because of alteration in the appearances of the contra-lateral lung, viz:- One showed cavitation, one showed a spread of the disease to the contra-lateral side, and one experienced a reactivation of disease considered quiescent.

The occurrence of an effusion into the space has not been noted to occur to any considerable extent in the absence of complicating factors previously mentioned and its accumulation in large amounts is evident in 17 cases. In one of these it occurred post-operatively to adhesion section, and subsequently dried up under repeated aspiration and air replacement. All the other were abandoned and have been included in the figures above according to the presumed precipitating factor, viz:- Adhesions 9; atelectasis, complete 1; lobar 4; spontaneous pneumothorax 2.

The chances of establishing a free pneumothorax space are not considerable and it is only in lesions limited to a single zone that they would appear to approach the figure of one in two. For lesions of a more/

more extensive character it has been possible to establish it in only one in six.

Defining an unsuccessful artificial pneumothorax as being one where no pleural space was identified at induction or where the procedure had to be abandoned within three months, the authors of the Report to the Joint Tuberculosis Council on Artificial Pneumothorax (1937), found failures to occur on 1,329 occasions against 3,021 successes. In a series of 301 Artificial pneumothoraces Perschina found 143 cases in which massive pleural adhesions prevented the control of the disease.

Aycock and Keller (1938) reviewing 530 cases of artificial pneumothoraces found that the complicating factor of adhesions varied considerably with the type of disease under treatment. In their group of "exudative" lesions they found the most satisfactory collapses up to 100% in minimal lesions, and at the lowest 62% in far advanced cases in this group. In the caseous pneumonic cases they recorded only 28% of successful results and in the fibro-cavernous type 26.5%. The frequency of pleural adhesions encountered in the last two groups is commented upon by the authors as to be expected from the nature of the disease. The incidence of pleural exudates is remarked on by these American authors to be practically 100% but in calculating the frequency of this as a complication they have ignored fluid levels which did not reach up to the highest point in the diaphragm. From all their cases they found that the out-pouring of fluid in such quantities occurred in 37.5% of pneumothoraces, although it interfered with the continuance of the therapy in only 8%. Again they remark/

remark on the considerable increase of this complication with the more advanced nature of the disease under treatment.

	% of cases showing pleural exudates.
Minimal	11
Moderately advanced	14
Advanced	47

Table 36. % Incidence of pleural exudates of more than minimal volume in 530 pneumothoraces (from Aycock & Keller 1938).

In the present series of cases of artificial pneumothorax carried out in the Outer Hebrides only fluid in quantity has been specifically remarked upon, i.e. where it appears to exceed a depth of approximately 3 inches, although considerable frequency of minimal effusions in the costo-phrenic angle has been observed at routine fluoroscopic examination of these patients. The numbers who have shown this depth of exudate is small in cases where the original lesion is limited to 1 and 2 zones (being 3 and 2 respectively) but for those with lesions involving 3 zones and over there are 14 recorded cases.

Extent of Lesion in Zones.	Number of Pneumothoraces.	Apparently free Space.	Pneumothoraces showing adhesions.	Adhesion section carried out.	Adhesions ultimately causing abandonment.	Otherwise complicated specific adhesion not known.
1	23	6	17	3	9	-
2	36	3	29	1	16	4
3+	49	4	36	4	17	9

Table 37. The mechanical response to 108 pneumothoraces carried out in Outer Hebrides.

The success clinically of an artificial pneumothorax is not completely dependent on the attainment of a mechanically ideal space and the results of these therapeutic measures must be judged by the clinical outcome of their introduction. Certainly the patient with indivisible adhesions is exposed to considerably wider hazards (e. g. effusion and empyema and spontaneous pneumothorax) when the treatment is continued but, these complications apart, if the ultimate outcome secures cavity closure, which could not be expected by other measures, then the patient derives the same benefit as his more fortunate brother. The supervision of these cases, however, requires from the operator the most careful scrutiny and frequent meticulous attention.

The assessment of the end result has been divided into three categories.

1. The successful case where the disease appearance at the end of treatment is quiescent or inactive and where clinically there are no signs of activity e.g. by the detection of tubercle bacilli in sputum or gastric juice.

2./

2. The unsuccessful case where the disease process at the end of treatment shows persistent evidence of activity.

3. The doubtful case where the radiological and often clinical improvement suggests quiescence but tubercle bacilli have been recovered from the patient after the termination of treatment.

Disease extent in Zones.	Successful	Unsuccessful	Doubtful
1	17	5	1
2	11	21	4
3	6	8	5
4, 5 & 6	8	19	3

Table 38. The clinical results of 108 artificial pneumothoraces.

These figures represent a 39% wholly successful outcome which is not as gratifying as the sputum conversion rates reported by Bendove et alii (1937) of 48% out of 409 cases (another 95 cases were included where no adequate pleural space could be obtained). The disparity of the figures probably arises from the fact that sputum conversion is considered only up to six months after its occurrence during pneumothorax therapy, whereas in the figures for the Outer Hebrides the sputum conversion has remained up to the present.

Pneumothorax giving apparent cavity closure.

In 80 cases there is radiological evidence of an excavated lesion at the inception of the therapy and of these at its termination only 43 still show appearances consistent with cavitation. Once again the prognosis seems to be best in the smaller lesions, the figures being 9 apparent closures to 3 still patent in single zone lesions, 11 against 6 in lesions extending to two zones, and 15 against 24 in lesions of three zones and upwards.

Apparent cavity closure has been secured therefore in 45% of cases. This figure runs reasonably close to the 39% cavity closure reported by Clarke & Erskine (1940). The series reported by these authors in 1940 refer to artificial pneumothoraces which have not been thorascoped.

The Results of Phrenic Nerve Crush and Pneumoperitoneum.

The same criteria in assessing the success of this form of therapy have been used as detailed on page 140.

In all 88 cases have received this combination of treatment and of these 29 are now quiescent. 41 were considered still active radiologically and clinically after the therapy which, in the main, has been continued for 2 year periods, and the remaining 18 have subsequently disclosed evidence that the disease is not quiescent although exhibiting satisfactory radiographic appearances.

Related to the original extent of the disease these figures are sub-divided in the following table:-

Extent of Disease in Zones.	Successful.	Unsuccessful.	Doubtful
1	14	7	4
2	8	8	9
3	3	5	1
4, 5 & 6	4	21	4

Table 39. The observed results of phrenic nerve crush and pneumoperitoneum in 88 patient according to the extent of the disease involvement.

Thus at least 47% did not benefit from the procedure and provides a figure/

figure reasonably constant with 25 out of 50 cases quoted by Edwards & Logan (1945). Divergence does occur, however, in the assessment of the success of the therapy where they claim only 10%, a figure only a third, of the present review successes, accounted for, of course, in the utilisation of anti-microbial therapy.

For the advanced cases of pulmonary tuberculosis the chances of gaining cavity closure by phrenic crush and pneumoperitoneum are only about one in five cases, a similar rate to that found by Netzer (1951) reviewing ten years of pneumoperitoneum therapy.

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The foregoing statistics on therapeutic measures induced and the evaluation of their success are included in this survey as a record only of the attempt that has been made as regards treatment of pulmonary tuberculosis in the Islands. The author realises the full implication of the absence of details in certain cases, and also the discrepancies which must exist in his assessment of the final outcome, where material - have to be sent to Inverness for examination, with the possibility of devitalisation of any organism during transit. He also bears in mind that these therapeutic measures are often inter-related with anti-microbial therapy, and also subsequently with the preparation of the patient for major surgical intervention. This last point is particularly significant, when the results of pneumoperitoneum and phrenic nerve crush are considered, since the broad statement of 41 cases out of 88 still active radiologically and clinically, includes many names where a stability has been brought to the lesion that has justified the inclusion of a name on the waiting rota for surgery that might otherwise have appeared in the obituary list.

The change which occurs in the cyclic trend of tuberculosis has been studied minutely in the League of Nations Health Organisation Survey of Tuberculosis in Denmark, Norway and Sweden (1931). The observations therein contained are very pertinent to the consideration of the disease in this locality - the Outer Hebrides. The isolation of these Islands, geographically and socially from the mainland of the United Kingdom reveals a striking similarity in the position of the northern relative to the southern provinces of Fennoscandia where the domestic economy and inadequate communications maintained an isolation of population down to the middle of last century. As lines of internal communication improved and multiplied, thereby facilitating a more rapid interchange of population, tuberculosis spread northwards. As is emphasised in the treatise, such a migration is important only so long as it is not between two areas carrying similar incidence statistics

Sweden illustrates admirably the sequence of events pursued by the disease as it spread throughout the country at the beginning of the 19th century. Stockholm and the surrounding populated area had the highest mortality rate whereas the figures for the isolated northern provinces from JAMTLAND to NORRBOTTEN were the lowest. The exploitation of the natural resources of these regions - timber and minerals - bringing an influx of industrial workers from the south probably accounts for the engulfing wave of tuberculosis which spread in ever-widening circles

throughout the new development areas. Concomitant with this extension, the mortality figures for the original focal point show a steady decline, so that by 1925 it now returned the lowest mortality rate for the country. The progress of the disease when once it reached the peripheral field became checked and a decline in the mortality figures became apparent, yet even so Norrbotten province had the highest mortality rate for tuberculosis in Sweden in the period 1921 - 25. The declining phase of the disease evidenced in these Swedish observations is important and the time factor is estimated in the following quotation:-

"when the disease was left to itself it apparently spread rapidly and intensively until it reached a maximum; it then became stationary for a period of three or four generations and afterwards again spontaneously declined!"

This gradually diminishing trend is shown in the rates for three areas of Sweden during the period 1911-26.

	1911	1926	Approx. figures for 1801 - 1810
Stockholm (prov.)	18.7	12.1	Over 30
Kopparberg	18.9	13.5	20 - 25
Norrbotten	31.9	27.9	15 - 20

Table 40 Mortality rates per 10,000 pop. of three areas of Sweden (Kopparberg having been selected by the author as an area through which the wave of tuberculosis has passed on its course from Stockholm to Norrbotten.

Ranking high among the factors leading to a regression of the disease is the biological question of resistance and this remains the important consideration up to the beginning of the present century when government sponsored plans for combating tuberculosis were instituted. But the hypothetical case remains whether the country once again will undergo a tuberculosis cycle when the diminished incidence of disease leaves the country with a lowered resistance.

In Norway where the country has been similarly isolated up to last century much the same trend is noted in the tuberculosis mortality figures.

This resume of the trend of tuberculosis in Sweden reveals a marked similarity to the course pursued by the disease in these islands, and from it - therapy apart - a natural decline in the incidence of the disease might be anticipated at the present time.

Mortality figures on a world-wide survey show that there is a very considerable divergence of the acuteness of phthisis from nation to nation. Those of the non-civilised world show a higher mortality figure - the difference being explained by a 'racial' lack of resistance to tuberculosis Pagel (1948). American negro populations return mortality statistics from pulmonary tuberculosis of from three to five times those of their white counterpart e.g. In St. Louis with an 11% negro population from 1922 - 1936, the negro mortality rate was 313 per 100,000 against a mortality in whites of 63 per 100,000.

According to Kettlekamp et Alii (1938) who in reviewing two series of 1,000 consecutive discharges from Robert Koch Hospital (the first from 1922-26 and the second from 1931-37) noted no definite manifestation of tuberculosis peculiar to the negro although the negro presented severer symptoms on admission. Racial characteristics entered into the results of hospital treatment in the first series but the findings of ten years later suggested that sex rather than race was the predominant feature in prognosis of sanatorium treated cases.

Several workers, Cummins et Alii (1935), analysing the problem of tuberculosis in African natives found much the same evidence of acuteness of the disease as did Pinner & Kasper (cit.supra) but one of them, Cummins writing in 1939 found a decrease in the virulence of the infection as it had spread through the community.

Kayne Pagel & O'Shaughnessey mention a view formerly widely held that these manifestations in coloured persons were the outcome of a late primary infection. One of the countering features mentioned by them is high infection rates as found in tuberculin surveys.

It appears, however, that the type of tuberculosis met with in the Outer Hebrides conforms at the present time to the generally accepted trend of the disease for the rest of Europe and that, although the malady is of recent introduction, it has altered to some extent but possibly less than the very considerable degree experienced in its onset

among the natives of Africa. This consideration, however, is not a new one for Europe as similar experiences have been noted in remote areas on the continent. (Cf. Norway & Sweden vide supra)

Brownlee (1917) divided tuberculosis into three epidemiological categories according to the age group which showed the highest peak and from this described (1) the young adult type (2) the middle age type and (3) the old age type. His investigations revealed that the first group - the young adult type of disease - predominated in areas supplied by milk which was clean, i.e. showed a low infection rate. Reviewing the material of this survey, the author would consider the disease to belong to Brownlee's "young adult type" and while remembering that milk sources have been proved to be of a high order he feels that this alone is not the sole factor in establishing the form of pulmonary tuberculosis which has been met.

The bovine organism may be responsible for influencing the later response of a patient to the human type tubercle bacillus, so that the disease per se only emerges in a later age group, possibly from a stage where infection has occurred in a patient with an immunity diminished by time. A similar immunity will result in the child of the city whose environments subject him to a liability to infection and consequently with an immunity acquired during the preadolescent age will move to the older age groups. The child of the croft on the other hand, providing there is no home contact suffering from pulmonary tuberculosis, lives the early part of his life with a much diminished liability to sustaining a primary infection - a fact which is clearly demonstrated in the low Mantoux positive rates of the

rural schools (vide. Table 8).

In the absence of any new influencing factors it is to be expected that the flower of youth will continue to bear the brunt of the onslaught of tuberculosis.

An improvement in the incidence of pulmonary tuberculosis might be expected from the use of B.C.G. vaccination for here is a simple method of influencing the natural trend of the disease. The results from Scandinavia of the influence of this form of preventive control have been summarised by Heaf (1947) and the beneficial results appear most encouraging, e.g. In Oslo the mortality figures for persons up to 50 years of age has been reduced by 82% in the vaccinated against the unprotected community (Hertzberg 1946). From America, however, the results of routine B.C.G. vaccination have been found less advantageous than the removal of the tuberculous patient (Levine & Sackett 1946). These authors summarise the defects in the control system giving a false value to B.C.G. vaccination, especially where they record that only 50% Mantoux conversion was noted with oral administration of the vaccine and 85% with parenteral administration. With the reservation therefore, that the immunity conferred by B.C.G. vaccination is in all probability of shorter duration and not so strong as from natural infection, Wallgreen (1948), it would appear that the vigorous measures being taken by the Medical Officer of Health in the administering of B.C.G. to practically the whole of the Mantoux negative, school population should

result in a change for the better in the incidence of infection in the 15 - 25 year age group. Certainly the figures for a similar population age up to 20 years quoted by Avonson and Palmer (1946) show an incidence of less than a quarter amongst vaccinated Indian children against a similar group of controls.

RECOMMENDATIONS.

The final aim being to eradicate tuberculosis from the community, the first consideration should be of measures directed towards disease prevention. As B.C.G. vaccination is at last being accepted in this Country as an important weapon in the fight against consumption, these islands would appear to offer, by their isolation, an ideal locality to put full scale application into effect.

It has been shown earlier that the type of tuberculosis met with in these parts is the "young adult" form of the disease. An attempt to equate this finding with the results of Mantoux tests carried out in school leavers would suggest that in the past a very high proportion of children from the rural parts leave school, Mantoux negative. It is probable, therefore, that many of the cases met with are of the nature of immediate progression from a primary focus - the activating organism having been acquired once the adolescent is released on to the labour market. This would appear to be one of the first groups requiring attention and if the response on the part of the public is adequate then it should show, at least, an alteration in the age incidence of the disease.

The procedure to adopt would be to carry out Mantoux tests during the last three months of the child's schooling and to administer B.C.G. to all negative reactors with revaccination of those who had been done more than three years previously.

Every effort should be made to repeat testing and vaccination of adolescents leaving the islands. A useful occasion for this would be at pre-recruitment medical examination. This would ensure coverage of a large proportion of the male adolescent group, the others being catered for at periodic local clinics.

Apart from its application to infants under one year old, the above scheme is the one most likely to produce results comparable with the work involved. An extension to include a full protection of all children of school age is relatively easily carried out, and of admitted value, serves further to inculcate in both children and parents the knowledge that the medical authorities are active in this problem and makes useful propaganda for the adolescent period.

Mantoux tests should be carried out on all contacts, both home & work, of patients found to be suffering from pulmonary tuberculosis. The author would like to see this facility extended to the contacts of patients having pleural effusions and this is one of the reasons he would advance for notification of this condition. Any vulnerable contact should be protected by B.C.G. once isolation of the patient has been secured.

A further consideration is the ensuring that protection has been acquired after vaccination. It would not appear practicable to test for Mantoux conversion in all cases although this would be advisable for known contacts - for the others - two or three members of the group receiving

each batch should be tested to ensure the potency of the material.

It is possible to secure a vaccine suitable for administration by the multiple puncture technique and this method would appear preferable to the syringe intradermal route, by minimising the frequency of local reaction. Admittedly in over 2,000 vaccinations with B.C.G. up to April 1952 the Medical Officer of Health experienced no severe reactions and indeed the sole complication was the formation in one case of Keloid scar. The persistence of an ulcer for three months is apt to deter other members of a family from availing themselves of these facilities.

Case detection is the other main assault which can be launched in the tuberculosis battle and here of paramount importance is the use of radiography. General Practitioners should be encouraged to avail themselves of the diagnostic facilities at the chest clinics to the full. Any symptom of a suspicious nature met with should be countered by an X ray examination especially if the patient is in the particularly vulnerable age group of 15 25 years. This facility together with the provision of sessions for examination of contacts and of children leaving school already exists and the only apparent defect is the considerable distances from the outlying villages to the centres at Stornoway and Daliburgh. The Utopia of the provision of facilities to accommodate the patients of Harris (pop. 3,900 at Tarbert, and similarly for the other Isles cannot be

contemplated in the present economic problem of the country.

Radiographic diagnostic facilities on a larger scale are contemplated by the provision of a mobile mass radiographic unit for the region but caution must be exercised in the expectations of the results from this. In the first place there are villages to which a large unit may not be able to penetrate because of the state of the roads, and secondly it is probable that even in spite of intensive propaganda the natural reticence of many to avail themselves of the service will not be overcome and consequently the chronic bronchitics and the asthmatics who have stubbornly refused to submit to radiographic examination in the past will again be absent. For this group repeated bacteriological examination is the method of choice in establishing a diagnosis and it would appear that there is considerable room for general practitioners to avail themselves of this service.

HOSPITAL ACCOMMODATION.

There are 91 beds in use for the treatment of pulmonary tuberculosis for a population of approximately 38,000 in the Outer Hebrides, this represents a rate of 2.4 beds per thousand of the population. The number of staffed beds available per annual death is probably in the region of 2.7. Consequently the hospital facilities compare favourably with those of the rest of Scotland.

	STAFFED 1,000 Population	BEDS AVAILABLE Annual death
ALL SCOTLAND	.93	1.56
OUTER HEBRIDES	2.4	2.7

Table 41 A comparison of staffed beds available for the treatment of respiratory tuberculosis in Scotland as a whole and in the Outer Hebrides.

The provision of another 20 to 25 beds would ensure abolition of the waiting list.

Improved hygiene has come to the island with the replacement of the old black houses by ones of modern design, dry and adequately ventilated, but still the occasion arises of the ~~de~~tection of an open case of pulmonary tuberculosis in one of the old type dwellings. As isolation in the home for these patients is impossible they require immediate admission to hospital if their condition warrants it or they should be provided with hut accommodation. It would probably be advisable to admit such patients in the first place to hospital for a short time to acclimatise them to sanatorium regime thus reducing the risk of the patient forsaking his temporary home for the family circle round the peat fire on a winter's evening.

Destructable sputum containers should be available to all patients on the notified register living at home. These should replace the glass containers which the lack of an internal water system render a potential danger.

In the last five years there has been a considerable intensification of the campaign against tuberculosis especially in Lewis where the considerable work by the Medical Officer of Health in respect of B.C.G. vaccination has brought the subject which previously was mentioned but in whispers out into the open. This and the attitude changed towards the local sanatorium from which the villages are receiving back their sons and daughters cured and where previously they died has resulted in the population becoming tuberculosis conscious. Every effort should be

made to impress on the population the fact that tuberculosis is a preventable disease, and that where it has been contracted it is often possible to cure it. With these lines the old fear of the ailment will die out and full co-operation by the inhabitants will be secured for the preventive scheme outlined above.

There is practically no organisation for rehabilitating persons in this area. It should be possible to arrange suitable employment for a greater number of persons who are being graduated through light work up to standing on their own feet in the labour market. Scope for employment of these people might be found in some of the pre - and post - weaving stages of the tweed industry, but it would be more satisfactory from the working conditions for some encouragement to be given to out-door work either in the form of market gardening or in the development of small poultry farms.

SUMMARY.

The soci-economic evolution of the Outer Hebrides shows that the inhabitants have lead an isolated existence since the Viking invasions. As far as tuberculosis is concerned there is no mention of it appearing in these islands up to about 1850 A.D. and thereafter it assumed a disease of major proportions.

The first cases of tuberculosis arriving here were patients who contracted the disease in the mainland cities and because of an absent inherent resistance and the poor hygenic circumstances of the homes, tuberculosis soon assumed epidemic proportions affecting whole families.

The present finding is still that a high proportion of cases develop in Hebrideans who leave the Islands to work in the cities.

The statistics of Tuberculosis in the Outer Isles is discussed and these show a high notification rate with the age incidence of the two sexes being similar. The death rate from tuberculosis is high but is diminishing.

Percentage infection rates suggest that in the rural parts the majority of children leaving school are Mantoux negative.

A survey of the unrevised notified register in 1951 was carried out and of the 537 patients notified as suffering from pulmonary tuberculosis an evaluation of the extent and type of the disease was made. It was found that males predominate 58% - 42% (females).

A review of the lesions grouped according to initial extent and showing the further course and treatment provides the material on which the form of tuberculosis in this locality is given.

68 patients showing extension of the disease visible radiologically are discussed and the commonest age at which this occurs is between 15 - 35 years with a predominance of females under 25 years and of males above that age.

The spread of the disease is noted to occur as frequently as 2 years and over from the date of notification as before that period.

The predominant form of the extension is a bronchogenic spread and the indications are that the disease conforms to the expected trend for Western Europe.

60 cases of minimal extent and probable activity show that the progression rate of the island-treated case is no higher than that of similar white population reviews.

The results of 108 A.P.s show that only 13 appeared uncomplicated and that just over 50% could not be continued for 2 years.

The success of pneumothorax in relationship to the extent of the initial disease is discussed and the results show it to be unfavourable in disease of more than two zones.

88 patients have received treatment in the form of phrenic nerve crush and pneumoperitoneum of these 47% did not benefit from the therapy and improvement was most marked in lesions limited to two zones and less.

The similarity in the evolution of tuberculosis locally with that observed in isolated districts of Norway and Sweden is examined and the decrease noted after four or five generations in Sweden leads to the expectation that tuberculosis in the Outer Hebrides should now be on the wane.

B.G.G. as a measure to diminish the incidence of tuberculosis in young adults is considered and an extension of its use recommended together with further measures calculated to reduce the disease incidence rates.

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