

**Phthisis in relation to life assurance : read before the Hunterian Society,  
Wednesday, 26 October 1892 / by Thos. Glover Lyon.**

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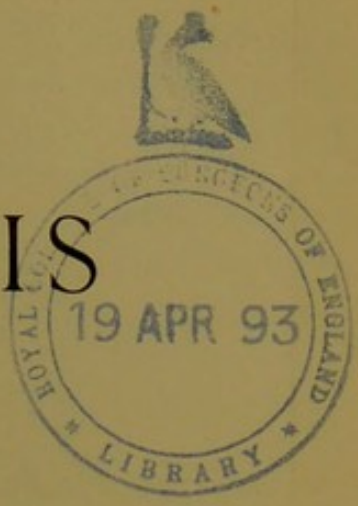
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# PHTHISIS



IN RELATION TO

# LIFE ASSURANCE.

*Read before the*

HUNTERIAN SOCIETY,

*Wednesday, 26 October 1892.*

BY

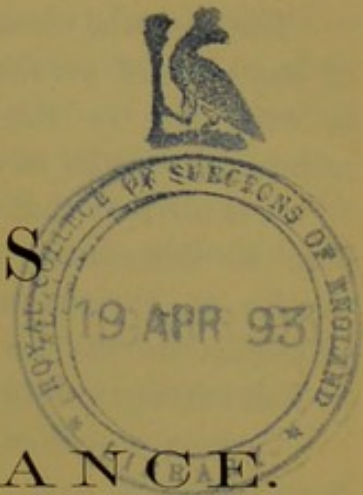
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MEDICAL OFFICER TO THE MUTUAL LIFE OFFICE;  
FORMERLY MATHEMATICAL SCHOLAR EMMANUEL COLLEGE, CAMBRIDGE.

LONDON :  
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THE following remarks are the outcome of an enquiry into the mortality experience of the Mutual Life Office, amongst such of its members who at entry gave a family history of consumption and of those whose mothers had died in childbirth. In placing the results of this enquiry before the Institute of Actuaries, in February last, Mr. Manly, the actuary of the Mutual, was careful to point out that the paucity of his figures prevented any definite conclusions being arrived at from them, and several speakers expressed a hope that more material might be collected from other offices, so that the points in question might be finally settled. The Institute of Actuaries was not, of course, the place to discuss the medical side of the enquiry, but some criticisms and suggestions in relation to the paper were made by the medical officers present. It seemed, therefore, advisable to bring the matter before a medical society, so that the method of enquiry adopted might be fully discussed from its medical aspect, and so receive the sanction of medical experts and, perhaps, undergo some modification in accordance with the opinion of the meeting. It was hoped also that a paper upon the subject under consideration might so far interest those present as to induce them to join in the completion of the investigation.

The essential elements in an investigation into the mortality of any class of persons are :—*First*. The number of lives at risk at each age in the class under consideration. *Second*. The number of deaths at each age amongst them.

It is obvious that medical experience is quite unable to afford data to determine correctly these two quantities. Although deaths at various ages come under the observation of the physician he has no means of ascertaining the number of lives at risk corresponding to those deaths.

Various so-called statistics, however, have from time to time been collected from hospitals, relating to deaths from phthisis. But such groups of figures are wanting in the very essential elements of statistics, and any attempts to arrive at conclusions from them must end in confusion and error.

The same applies to all opinions founded upon the experience of physicians in private practice.

Even supposing it were possible from medical records to obtain complete data for the estimation of the extra risk attending a family history of consumption, it would be of little value in the present enquiry, for like figures apply only to like classes, and as we shall see immediately the mortality from consumption amongst insured lives differs materially from that of the population generally.

No. The data essential to the estimation of the extra risk amongst insurable lives incident upon a family history of consumption is to be found only in the records of insurance offices, and the investigation can be brought to a satisfactory conclusion only by the combined efforts of the actuary and medical officer.

Such an enquiry so conducted may be expected not only to be of great value from an insurance point of view, but may possibly throw light upon many unsettled questions in connection with the medical side of this disease.

It will be convenient here to consider the points, as regards the applicant himself, generally considered to be important in the selection of lives, who may be suspected of being specially liable to consumption. They are—

1. Physique.
2. Conditions of Life.
3. Age.

Without assuming the existence of a recognizable consumptive type, there is no doubt that delicate persons, more especially those who are weak in the chest, are specially liable to phthisis.

The importance, therefore, of rejecting applicants of such constitutions will be evident. The reports of some offices appear to show that the weight of the applicant is an indication of his power of resisting the disease, those above the average weight being less liable than those below it. I believe that reliance upon the general impression of the medical examiner is preferable to trusting to any rules of this kind.

The necessity of rejecting applicants engaged in pursuits whose conditions favour in them the production of phthisis need not be insisted upon.

*Table showing the Mortality from Phthisis in England and Wales between 1871 and 1880, according to the Registrar-General; also the Mortality from Consumption in Three Life Offices—the Policies at Risk extending over 392,668 Years of Life.*

Age at Death	DEATHS PER MILLE PER ANNUM		
	Registrar-General		Three Offices
	Males	Females	
0- 1	1·48	1·33	...
1- 2	1·19	1·55	...
2- 3	·52	·57	...
3- 4	·34	·34	...
4- 5	·30	·30	...
5- 9	·34	·38	...
10-14	·48	·85	...
15-19	1·68	2·40	...
20-24	3·09	3·14	2·0
25-34	3·70	3·54	2·29
35-44	4·12	3·34	2·28
45-54	3·86	2·46	1·93
55-64	3·19	1·78	1·79
65-74	1·92	1·09	...
75-	·60	·41	...
20-64	3·45	2·91	2·06
All Ages	2·21	2·03	...

The apparently high mortality in children under two, compared with the neighbouring ages, is probably due to errors of diagnosis.

Consumption, so far as our present subject is concerned, must be taken to be synonymous with phthisis pulmonalis. As all other forms of consumption are included in the above, during the period of childhood it is probable that the mortality from

pulmonary phthisis is even lighter than it would here appear, but amongst adults these figures may be taken to apply approximately to pulmonary phthisis.

From these tables it will be seen that the highest mortality from consumption in males, according to the registrar-general, is between 35 and 45, decreasing only slightly as age advances, so that the percentage of death of those living between 55 and 64 is higher than that between 20 and 24. This variation in mortality according to age, is in great divergence from the impression in general acceptance.

It will be observed that there is no rise in the mortality amongst females corresponding to the climacteric.

It would appear also that the mortality amongst insured lives varies much in the same way, according to age, as in the population generally.

It has often been contended that the danger from consumption is much diminished after 40 years of age, but in the face of these figures this must be taken with great reserve. The fact being that the danger from consumption diminishes only slightly with age absolutely, but relatively to the danger from other diseases, it diminishes quickly after about 45. This is important from an insurance point of view, as showing that consumption, speaking generally, becomes of less consequence as age advances.

Our chief concern is, however, with the extra risk alleged to attend a family history of consumption. Now, the mere fact that a man has survived to the age of 40, and is still in robust health, is evidence in itself that he was not born with a special liability to the disease. Indeed, I do not believe that, as a rule, much harm would be done by taking all applicants who had arrived at 40 years of age, and who still remained of robust constitution, at ordinary rates. Deaths occurring from phthisis after 45 should be regarded as accidental and not due to any special susceptibility to the disease. But whether this view be the correct one or not can be determined only by actuarial investigation.

The variation which takes place in the mortality from phthisis at the various ages, suggests at least two causes acting against each other; one tending to increase the mortality as age advances, and the other to diminish it; the first being in excess of the second up to the age of about 40, causing a gradual increase with age, but after 40 the second cause becoming in excess of the first and so producing a gradual decline in the mortality as age went on.

I believe such causes exist.

It is well made out that the lungs in any particular subject are less liable to phthisis the greater are their vital and mechanical activity. It is, therefore, not unreasonable to suppose that the great pulmonary activity of childhood might give almost perfect immunity from phthisis, the same thing continuing in a gradually modified degree through youth and early manhood.

On the other hand, in any group of persons those most liable to phthisis would be likely to die the earliest, and hence, those who are advanced in age would be on the average less liable to phthisis than the younger persons in the group; hence, in groups of persons generally, advance in age would denote decrease in liability to the disease.

These two causes acting antagonistically would be capable of producing the particular variations of mortality from phthisis according to age recorded by the registrar-general.

A reference to the tables given above shows that during insurable ages the mortality from phthisis amongst women, according to the registrar-general, is much less than amongst men—3·91 against 3·45—so that, generally speaking, so far as risk from the disease is concerned, women must be looked upon as better lives than men. Whether the extra risk due to family history is less in women than in men is, of course, another question, and on the whole it would, I believe, be best to make no difference between the sexes in the matter of selection.

Let us now pass on to the consideration of the effect of family history in relation to the subject of discussion.

It is now proved beyond reasonable doubt that phthisis is caused by the entrance into the lungs and growth there of a specific micro-organism—in other words, that phthisis is a zymotic disease.

As in the case of other diseases of this class—

1. The susceptibility to contract phthisis varies in different persons and in the same person according to his age and the conditions of his life.
2. The degree of susceptibility to the disease is largely hereditary.

The germs of infection are pretty generally scattered in civilized communities, although in some instances a concentration of infection occurs.

In order to protect insurance offices from loss by the acceptance of applicants specially liable to phthisis, it has been the custom



in most offices to form classes according to the varieties of family histories, and to charge various extra premiums upon applicants falling into those classes. These extras have up to now been fixed by the medical advisers of the office, according to their opinions as to the extra risk involved. These opinions have been based upon no definite calculations; indeed, the data for such calculations were not in existence.

Such a condition of things is obviously unsatisfactory, more especially as ample material is known to be collected in the London insurance offices to afford data with which, by actuarial methods, to ascertain the real extra risk involved in phthisical family history.

There are certain points which it would be well to discuss before passing on to consider the results obtained from the examination of the experience of the Mutual Life Office.

First of all, it must be remembered that such results apply to insurable lives only. We have seen that the process of selection through which applicants have to pass before they are accepted by an insurance office, eliminates from the general body of applicants many of those specially liable to phthisis, so that, even supposing a large proportion of persons in the general population who have family histories of consumption are specially liable to the disease, yet a considerable number of them may be weeded out by selection, and those which are accepted may, as a class, be but slightly inferior to the general mass of the insured.

The records of insurance offices do not give reliable information with respect to the cause of death of any relation outside the immediate family circle, so that we are forced to limit our enquiry accordingly.

The fact that advance in age denotes small liability to phthisis applies equally to the relations of any applicant as to himself, so that cases of phthisis occurring in relations advanced in life are of less value in family history than those occurring in early life.

From a medical point of view it would be valuable to distinguish between the various forms of phthisis in the parent. The occurrence, without evident cause, of phthisis in the prime of life would have a very different value in point of family history from a case arising in a man debilitated, or broken down from one cause or another. The one would indicate a special susceptibility to the disease, the other nothing of the kind.

Unfortunately, it is impossible to separate cases recorded by assurance offices into these two classes.

There are two theories pretty generally accepted, which call for notice.

It is said that applicants whose parents have died of phthisis, who have passed the age at which their parents died of consumption, are less risky lives than those who have not done so. This is based upon the fact that the children of phthisical parents, if they succumb to the disease, on the average do so at an earlier age than their parents.

But it is evident that those who have lived long enough to be parents will, on the average, be older than the general population, whether they die of consumption or not.

Again, it is said that brothers and sisters who die of consumption usually die about the same age, and it is argued that, in the case of a brother or sister having died of consumption, applicants who have out-lived the age at which they died are better lives than those who have not done so. I doubt very much whether this is supported by facts. It is, of course, a common experience that in a family highly susceptible to phthisis several of the family will succumb to the disease early in life, say about 20 years of age. We are struck by this coincidence, and are apt to neglect the cases which do not conform to the rule and forget altogether the large number of persons, one of whose brothers or sisters die of consumption, and who never contract the disease at all.

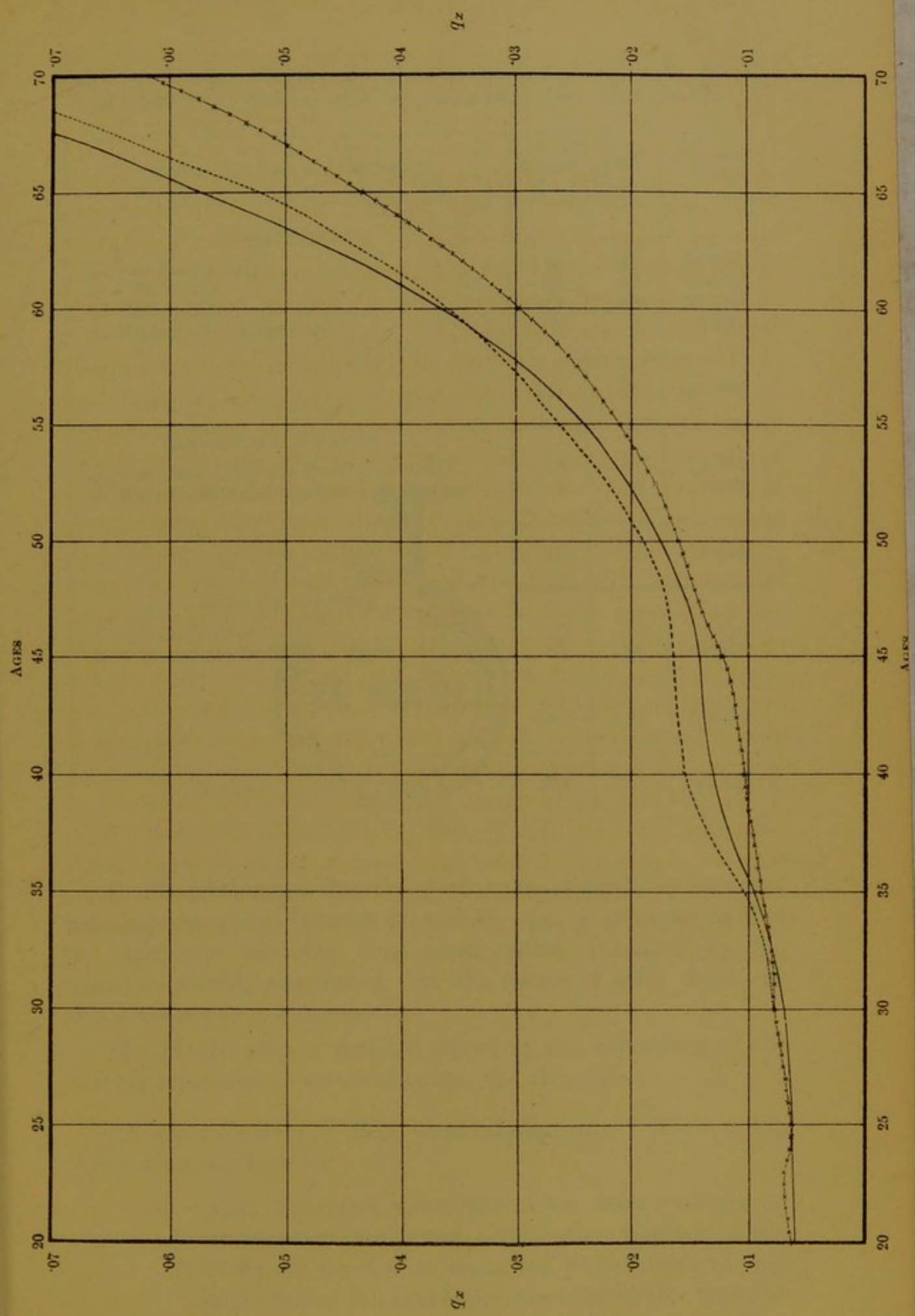
I am inclined to think that when we have said advance of age denotes small susceptibility to the disease, whether it be in the applicant himself or his relations, we have said the last word of importance in the matter, and that the respective ages of relations are of no value at all.

It is said by some that death from phthisis in the mother is of more importance than in the father. The proposition is supposed to be supported by the alleged fact that more phthisical patients give a family history of death from the disease in the mother than in the father. Even if this were true, and authorities differ upon the point, it would prove nothing, for we have no record for comparison showing the proportion of fathers and mothers dying of consumption amongst the general population. Many causes would tend to make more mothers in general die of consumption than fathers, the most obvious one being that women marry earlier than men.

The following is the result of the investigation of the mortality experience of the Mutual Life Office, between 1847 and 1890, amongst those of its members who had given on entry a family history of consumption. A large number of these in the earlier part of the period were taken at ordinary rates, and it is only recently that it was thought necessary to charge an extra on account of family history. These lives must therefore be looked upon as being, so far as personal examinations is concerned, of robust, physical condition. Family history was not recorded before this period at this office.

The work of thus selecting all the policies containing a family history of phthisis was performed by myself, but in any future investigation it would not be necessary for the medical officer to go through this somewhat laborious though interesting work; it would be sufficient if a clerk was set to pick out all policies where the following causes of death appeared: consumption, phthisis, decline, debility, hæmoptysis, chronic pneumonia, tuberculosis. The medical officer might then look over the papers and mark those causes of death which might be safely considered phthisis. By this means a certain small part of the experience of the offices would be wasted, but the medical work of the investigation would be reduced to a minimum. The rest of the work, after it has been decided into what classes the cases should be arranged, is entirely actuarial.

Mr. Manly, in bringing his paper before the Institute of Actuaries, explained that he had put the results into such a form that the experience of other offices might be easily super-posed, and then a really reliable solution of the problem be arrived at. The following is a summary of the report, the words between inverted commas being Mr. Manly's:



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*Table containing Number of Deaths amongst Lives with Family Histories of Consumption compared with Expected Deaths.*

Relations who Died of Consumption	Entered	Died	Expected Deaths
LINEALS ONLY.			
1. One Parent only . . . . .	152	42	33·661
2. Father only . . . . .	69	20	16·091
3. Mother only . . . . .	83	22	17·570
4. Mother and Father only . . . . .	9	3	3·821
	161	45	37·482
LINEALS AND COLLATERALS.			
5. One Parent and one Brother or Sister .	58	11	12·399
6. Both Parents and one Sister or Brother .	2	0	·242
	60	11	12·641
COLLATERALS ONLY.			
7. One Brother or Sister . . . . .	282	73	71·510
8. Two or more Brothers or Sisters . . . . .	81	22	22·699
	363	95	94·209
TOTALS . . . . .	584	151	144·332

It will be observed that the chief excess of mortality amongst consumptives occurs between 35 and 45—*i.e.*, at the same ages as the maximum mortality from consumption recorded by the registrar-general, suggesting that the excess of early deaths in this class is due to consumption.

Mr. Manly gives a detailed report of the experience of the Mutual experience in actuarial terms, and then says :

“A general survey of these observations leads, I think, to the following conclusions:

“1st.—That the cases where there has been evidence of  
 “ consumption in a parent and another member of the  
 “ family are too few to make the observations of any  
 “ value, but as the experience has been lighter than the  
 “ expected, we are bound to come to the conclusion that

“ they were selected with extreme care, and that great  
 “ credit is due to the medical advisers.

“ 2nd.—That, so far as these observations have any weight,  
 “ cases of consumption in the family, other than in a  
 “ parent, may be disregarded where the applicant is  
 “ perfectly sound. As the total observations under the  
 “ head of ‘Collaterals’ embrace 6,714 years of life and  
 “ 128 deaths, I think it will be considered that some  
 “ weight does attach to them.

“ There are only left for consideration the classes where one  
 “ parent alone has died of consumption, and where the mother has  
 “ died of childbirth. As regards the total mortality, it appears  
 “ that the effect is exactly the same whether the father or the  
 “ mother died of consumption; but the greatest excess has  
 “ occurred at different ages, owing probably to the paucity of the  
 “ numbers. By combining the two, the mortality will run more  
 “ smoothly, and we shall obtain a very fair estimate of the  
 “ mortality prevailing where *one parent* died of consumption,  
 “ deduced from 2,193 years of life and 42 deaths, the observations  
 “ extending over an average period of  $14\frac{1}{2}$  years.

“ With respect to those cases where the mother died in  
 “ childbirth, the mortality has been slightly heavier than where  
 “ one parent died of consumption; but the greatest excess has  
 “ occurred in a different place.

“ These tables (given in full in Mr. Manly’s report) show  
 “ that in the case of first-class lives, where one parent has died  
 “ of consumption, an addition of 3 to 4 years of age will cover  
 “ the extra risk; but where the mother has died in childbirth an  
 “ addition of 5 years under age 40 should be required; from 40  
 “ to 45, 4 years; and after 45, 3 years.

“ No great value, however, must be attached to these tables  
 “ where the lives are under 30 years of age, on account of the  
 “ paucity of the observations.

“ It is a practice, I believe, with some offices to take these  
 “ lives at ordinary rates for endowment assurances, and I have  
 “ therefore calculated the premiums for such assurances and  
 “ placed them side by side with the  $H^M$  rates. Roughly, it may  
 “ be said that the extra risk would be covered by adding, for  
 “ every hundred pounds insured, 2s. to the premium for an  
 “ assurance at 45 or death; 3s. at 50 or death; 3s. 6d. at 55  
 “ or death; 4s. at 60 or death; and 5s. at 65 or death.

“ I believe it is a rule amongst some of the American offices  
 “ to absolutely decline all cases where there is evidence of two  
 “ cases of consumption in the family. The cases in my statistics  
 “ embrace 140 lives and 33 deaths, and the facts certainly do not  
 “ justify the theory, for the mortality in these tables is as good  
 “ as any under observation. It appears to me that the rule  
 “ is too drastic, and all that is required is increased caution  
 “ on the part of the medical officer.

“ Then, again, there is a theory that the risk is greater  
 “ where the age of the applicant is less than the age at death  
 “ of the relative who died of consumption. The cases are not  
 “ numerous enough to justify any conclusion being drawn from  
 “ them, but I cannot find that that had any weight with the  
 “ medical examiners in selecting these lives, nor have I any reason  
 “ to suppose that the mortality would be different from the rest of  
 “ the class.

“ There is still another theory, that the time of the greatest  
 “ risk of the hereditary taint being developed is in early manhood;  
 “ and that when that time is past and the applicant is of sound  
 “ constitution, and in every respect, but for the family history, a  
 “ first-class life, then the risk, as is actually shown by these  
 “ figures, is small.

“ Personally, I have a great respect for the last theory; and  
 “ I am inclined to think that all persons under 25 years of age  
 “ who had a parent die of consumption or childbirth should be  
 “ charged the premium for age 30, but that after the age of 25 an  
 “ addition of from 5 to 3 years is quite sufficient to cover the  
 “ risk.”

The question as to whether the excess of mortality amongst lives with a family history of phthisis, as shown by the Mutual figures, is due to excess of deaths from phthisis is difficult to determine.

The deaths from phthisis amongst lives with phthisical family history are, as a matter of fact, in excess compared with those from other causes, being 14·12 against 8·5 amongst the general body of assurers in the Mutual between 1837 and 1890. This, however, proves nothing. The mortality from consumption, in all cases compared with that from other diseases, varies greatly according to the ages of those at risk. The ages of those at risk will be influenced by many causes. The older the office the smaller will be the average age of its members. Again, offices which do large



loan businesses, and whose members do not continue their policies unto old age, will, other things equal, contain a large proportion of young lives. We thus find a very great difference between the percentage of deaths due to phthisis in different offices. In the Scottish Widows, 1815-1873, the percentage of deaths from this disease is only 7.58, whereas in the British Empire Mutual, between 1847 and 1878, it is 17.75.

The same will happen in the different classes of policies in the same office, so that any comparison of the mortality in different classes from consumption is impossible, except it be done upon strict actuarial principles. Several offices have lately issued reports giving the relative mortality from different diseases, but the fact that they do not give the number at risk at the different ages makes them as they stand—of no value. A very elaborate report of this kind has been issued by an American office, in which appear the percentages of death from consumption in different districts. One is tempted to seek in such a report information as to the value of these districts as health resorts for consumption. But conclusion based upon such figures would only be misleading, for the nature of the business transacted and the age of the business in the several districts would, no doubt, vary considerably, and so the percentage of deaths caused by phthisis would vary, independently of the characters of the climates. The same consideration makes it evident that the ordinary nosological tables giving the percentage of deaths from the various diseases are of little value on account of the fact that they do not give the number at risk at the different ages.

The question of the relative value of family history in lineals and collaterals is very interesting and somewhat difficult. The great difference in mortality according to the Mutual figures between the class in which one brother or sister only had died of consumption, and that in which one parent only had succumbed to the disease, does not really show that collaterals may be neglected in relation to the question under consideration. It suggests that collaterals are of little consequence where lineals are free from the taint, but in the cases where lineals were found to have died of consumption the occurrence of the disease or not in collaterals would probably be very valuable, as showing whether or not the taint has been handed down to the second generation.

It should be remembered here that the history of the parents is more complete than the history of collaterals, so that many

applicants who on entry give a history of one parent alone having died of consumption, if they survived and were examined later on, would often have to add a death of a brother or sister from the disease at an early age, and would then fall into the class having a history of phthisis in both lineals and collaterals.

On the other hand, if a parent died of phthisis after the entry of an applicant it would be, as a rule, after 45, and would thus fall into the category of accidental cases.

The favourable experience of the Mutual with regard to lives belonging to families apparently deeply tainted with consumption leads us to hope that, whatever the family history of applicants may be, careful examination is able to eliminate the greater part of those who are specially liable to the disease.

It should be mentioned here that about eight-ninths of the applicants which form the class of one brother or sister dying of consumption had passed the age at which the consumptive relations might be fairly considered to have contracted the disease, so that whether this was the result of special selection or not, Mr. Manly's result must for the present be considered to apply only to such a selected class, in the face of the general medical impression that such selections would be valuable in the case.

In concluding his remarks before the Institute, Mr. Manly expressed the opinion that if a greater number of figures were collected together, bearing upon the point, it was not impossible that the extra risk amongst carefully selected lives having a family history of consumption might prove to be so small that it might be neglected altogether.

It has long been the opinion of insurance medical officers that applicants whose mothers had died in childbirth are inferior lives: this opinion is supported by the experience of the Mutual as far as it goes. Whether this is due to the fact that when the cause of death is given as childbirth it is often consumption, cannot be determined from the data before us.

In conclusion let me summarize as follows:

Medical records contain no adequate data for determining the question of consumption in relation to life insurance.

Several theories exist of an obstructive nature, relating to the selection of lives having a family history of consumption. Examination of these theories show them to be founded upon insufficient data.

As the records of insurance offices contain the material for settling equitably the various questions belonging to this subject, it is advisable that an enquiry should be made, based upon these records, and conducted jointly by actuary and medical officer.

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#### ADDENDUM.

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After the extra risk accompanying the different varieties of consumptive family history has been ascertained, it will remain for the medical officer, guided by these results, to use his discretion in dealing with individual cases according to their special features.