

PHTHISIS AND PHYSICAL MEASUREMENTS IN WALES

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THE high incidence of phthisis in Wales has been the subject of much attention, and many explanations have been advanced to account for a part or the whole of the excess. A brief summary of the aspects from which the subject has been approached is as follows.

DIAGNOSIS

That the difference in phthisis mortality between Wales and England is not due to diagnostic differentiation alone has been shown by various workers. If there had been a greater tendency in Wales than in England to ascribe bronchitis and other forms of respiratory deaths to the pulmonary tuberculosis group, then a deficiency would appear in the Welsh mortality from bronchitis, etc. No such deficit exists, but, on the contrary, there is in Wales an excess of mortality from other respiratory diseases over that of England.

Standardized rates of mortality per 1000 at ages 5 +

	England		Wales and Monmouth	
	Urban	Rural	Urban	Rural
	1911-14			
Phthisis	0.952	0.815	1.017	1.166
Bronchitis	0.715	0.500	0.857	0.601
Pneumonia	0.512	0.378	0.578	0.522
Other respiratory diseases	0.169	0.144	0.212	0.193
	1929-31			
Phthisis	0.643	0.536	0.852	0.824
Bronchitis	0.330	0.264	0.451	0.374
Pneumonia	0.386	0.316	0.344	0.326
Other respiratory diseases	0.093	0.085	0.134	0.110

CLIMATE

The relation of climate to phthisis has been a source of considerable speculation. Attempts, particularly by Brownlee,¹ have been made to treat this aspect quantitatively, especially with regard to wind and rain. Some interesting correlations have been found for a few districts but the relationship does not hold when applied to neighbouring districts with similar climatic

¹ Brownlee, J. *An Investigation into the Epidemiology of Phthisis in Great Britain and Ireland, 1918 and 1920.* London: H.M. Stationery Office.

conditions. On the whole the results obtained are inconclusive, and it seems that climatic conditions within the country do not affect the mortality from phthisis.

GEOLOGICAL FORMATION

The effect of subsoil on phthisis has been studied and varying results have been found. It seems that no definite relationship can be established between the mortality from phthisis and different geological formations. It was found in Wales that a considerable difference existed in the death-rate between two valleys although both were similarly situated on impervious subsoil and surrounded by marshy and mountainous land.

MIGRATION

Migration as a contributory factor in the health of a community has been extensively studied. The importance of this factor is seen in Wales where the population of most of the counties has shown a continuous decline, although there has been an excess of births over deaths. The statement has often been made that a large proportion of the tuberculosis in the country is of town origin. The young people migrate to towns, work and live in unhealthy conditions, contract phthisis and return home to die. The opinion of some medical officers, who have made local studies in Wales, is that the returned immigrant often became infected in the home prior to migration. It has also been argued that the emigrants are more healthy than those who remain and that the latter live in more impoverished circumstances and are more likely to be attacked. A comparison of various districts in Wales shows that when the population was increased by immigration the death-rate for phthisis was lower than in the districts which had a loss through emigration. Among the investigations made into this aspect, with adequate statistical data, is one relating to 2477 persons who were notified, in Glasgow in 1911, as suffering from phthisis.¹ Dr Chalmers, the medical officer of health, analysed these cases according to whether the patient was born in the city or not and whether one or both of the parents were city born or came from outside. This analysis showed that the immigrant can stand the conditions of city life better than the natives when judged from this standpoint. One-ninth of the patients born outside the city had contracted phthisis before their arrival. This is in opposition to the usual theory. Dr Chalmers's figures are:

Number of notifications from phthisis. Glasgow 1911

Patients born outside the city who came to the city after contracting phthisis ...	107
Patients born outside the city whose parents were born outside	870
Patients born inside the city whose parents were born elsewhere	648
Patients born inside the city with one parent born elsewhere	420
Patients born inside the city with both parents city born	432
Rate per 1000 of notifications among persons born outside the city	3.5
Rate per 1000 of notifications among persons born inside the city	7.0

¹ *Annual Report of the Medical Officer of Health for Glasgow, 1911.*

Hill¹ in a recent investigation into phthisis in young adult ages in England and Wales arrived at the conclusion that the level of mortality from phthisis amongst young adults has been undoubtedly influenced by the movement of the population. He showed that the highly urbanized areas which have continued to attract young adults have, on the average, shown a declining death-rate, while those areas which have lost population tended to show a rising death-rate from young adult phthisis.

OCCUPATION

The influence of occupation on the incidence of phthisis in Wales has been regarded as an important factor. Some investigators have suggested that the high death-rate is mainly due to this cause. That the tuberculosis risk is high among stone and slate quarriers and some metal workers has been well known for some years. In a recent study of the phthisis mortality in Wales, Russell and Salmon² found "no conclusive evidence that occupation was the sole determining consideration, because in the counties with an excessive phthisis mortality there was still an excess when the possible influence of occupation had been taken into account". This opinion is confirmed by the trend of the mortality among slate workers which shows that the highest phthisis mortality occurs later in life, ages 65 and over, and one would expect an excessive mortality earlier if the incidence was due entirely to occupation.

HYGIENIC CONDITIONS

The mortality from all causes less phthisis, in age groups and for all ages, is no greater in the counties with an excessive phthisis rate than in Wales generally. Overcrowding as measured by the Registrar-General (the proportion living more than two in a room) is no greater in Wales than in England. So that these measures of general hygienic conditions cannot be factors in the high phthisis death-rate.

INTERMARRIAGE

Local investigations have led various workers to the belief that intermarriage has a marked effect on maintaining a high phthisis death-rate. That considerable intermarriage takes place in the Welsh villages has been established in most of the reports. Chalke found that he had to abandon a scheme for investigating family histories of consumptives owing to extensive and complicated ramifications in the family tree: "It is said that in one village of six or seven hundred inhabitants, every one is a member of one of three families. This would not appear to be an exaggeration."

¹ Hill, A. B. (1936). The recent trend in England and Wales of mortality from phthisis at young adult ages. *J. Roy. Stat. Soc.* **99**, 247.

² Russell, W. T. & Salmon, G. (1934). Pulmonary tuberculosis in Wales between 1911 and 1931. *J. Hygiene*, **34**, 380.

SOCIAL AND ENVIRONMENTAL CONDITIONS

Intensive enquiries have been held into local social and environmental conditions of the areas with an excessive phthisis mortality by the King Edward VII Welsh National Memorial Association¹ and by other workers. These reports revealed many factors which were capable of great improvement and which, in the opinion of the medical officers, adversely affect the phthisis mortality. Improperly ventilated houses, built on an impervious subsoil without a damp course and with very defective sanitary arrangements, were a main factor. The influence on the mortality of these conditions of housing, supplemented by the malnutrition of the occupants have been stressed in several reports. The latter factor, malnutrition, has been attributed to bad tradition and not to poverty alone. Tinned foods, bacon and tea are consumed, in place of milk, meat and fresh vegetables. In many villages fresh meat was obtainable only once during the week. These unsatisfactory conditions arose mainly owing to the influx of workers to a rural area as a consequence of the opening of a quarry or mine and the overtaxing of the inadequate rural housing and sanitation. This sudden growth of a village has been advanced in part explanation of the excessive mortality from phthisis. It has been argued that the formation of quarrying villages in isolated rural districts, during the middle of the last century, and the consequent attraction to them of the people who previously lived on isolated farms and who had never been exposed to infection, caused the disease to flare up, since the population had previously acquired no immunity.

The assessment of the influence of the foregoing factors upon the phthisis rate is extremely difficult and to describe the relative importance of each variable is impossible, since in many reports some of the variables are dealt with in only a descriptive manner and economic and social conditions vary from district to district.

RACIAL TYPE

It has been suggested by many writers that there exists a racial type in Wales that is more prone to phthisis than other types. This has been offered as an explanation of the excess phthisis mortality in certain areas. Others do not ascribe the variation in the mortality rate directly to race but suggest that the short, dark, long-headed type who migrated from the moors to mining centres became inured to poor feeding and bad social conditions more readily than the other types. Fleure, Bowen and others have studied the relation of race type to phthisis. Most of these reports are purely descriptive and allow of no numerical treatment. In contrasting the short, dark, long-headed type with the Nordic, Bowen² formed the opinion that the former had greater resistance to phthisis than the latter under industrial conditions of life. He

¹ *Reports of the King Edward VII Welsh National Memorial Association*. Cardiff.

² Bowen, E. G. (1928). The incidence of phthisis in relation to race type and social environment in South and West Wales. *J. Roy. Anthropol. Inst.* **58**, 363.

emphasized that the social conditions should be considered with the racial one when making comparisons. He arrived at the following conclusion: "Thus, physical anthropological and their associated cultural characters seem to be determinants of the general constitution of individuals, and these differences of constitution seem to connect themselves not only with adaptability to certain environments, but also with resistance to various diseases." Some hospital data, dealing with this aspect, have been published but generally the numbers are too few for any conclusions to be drawn. Lloyd examined the eye and hair colour of hospital patients over a period of six years in Cardiganshire and found "tuberculosis is fairly generally disseminated throughout Cardiganshire population irrespective of pigmentation". He also examined the history of 110 female patients and found some evidence to support Bowen's suggestion that death among fair folk takes place at more advanced ages than among the dark people.

Anthropometrical records of adult men in the rural areas of Wales have been published serially in the *Bulletin of the Board of Celtic Studies* since 1928. The records now published include those counties with high and low phthisis mortality. These data provide a means of testing roughly whether physical measurements are related to the phthisis death-rate.

The death-rates from phthisis for the five divisions are given in Table I, the physical measurements in Table II and the percentage distribution of eye and hair colour in Table III.

Table I. *Death-rates from phthisis per 1000. Males. Rural areas*

	Ages				Standardized death-rate ages 15 and over
	15-	25-	45-	65-	
Cardiganshire:					
1911-13	2.054	3.642	2.687	2.226	2.877
1920-22	2.382	2.350	2.067	1.620	2.224
Merionethshire:					
1911-13	1.839	2.448	3.438	—	2.381
1920-22	1.538	1.670	2.621	2.471	1.960
Carmarthenshire:					
1911-13	1.369	1.632	1.385	1.867	1.517
1920-22	1.144	1.783	1.590	0.948	1.507
Montgomeryshire:					
1911-13	0.776	2.065	1.572	0.465	1.487
1920-22	0.914	1.203	1.965	0.454	1.283
North-eastern counties:					
1911-13	0.870	1.418	1.132	1.390	1.201
1920-22	0.700	0.966	1.185	1.042	0.966

Table II shows some considerable differences between the means of the physical measurements for the various areas but when they are brought into relation with the phthisis death-rate there does not appear to be any consistent trend. The statement that the short, dark long-headed type is more prone to phthisis than other types can only partly be supported from these data. Cardigan, with the highest death-rate, has the largest average head length and the smallest average stature (not statistically less in every case),

Table II. *Physical measurements. Adult males. Rural areas*

All measurements except cephalic index in millimetres	Cardiganshire			Merionethshire			Carmarthenshire			Montgomeryshire			North-eastern counties		
	No. of obs.	Mean \pm s.e.	s.d.	No. of obs.	Mean \pm s.e.	s.d.	No. of obs.	Mean \pm s.e.	s.d.	No. of obs.	Mean \pm s.e.	s.d.	No. of obs.	Mean \pm s.e.	s.d.
Head length	654	196 \pm 0.255	6.53	367	194 \pm 0.319	6.27	428	196 \pm 0.304	6.29	239	195 \pm 0.435	6.73	248	195 \pm 0.408	6.43
Head breadth	654	154 \pm 0.206	5.28	388	152 \pm 0.284	5.59	428	154 \pm 0.264	5.45	239	151 \pm 0.437	6.75	254	153 \pm 0.316	5.04
Cephalic index	655	78 \pm 0.110	2.81	389	79 \pm 0.141	2.78	421	79 \pm 0.138	2.84	239	78 \pm 0.216	3.34	255	79 \pm 0.194	3.10
Bizygomatic	652	139 \pm 0.252	6.44	389	136 \pm 0.330	6.51	425	137 \pm 0.354	7.30	237	135 \pm 0.473	7.28	262	135 \pm 0.357	5.78
Bigonal	649	113 \pm 0.270	6.88	388	111 \pm 0.327	6.45	418	112 \pm 0.398	8.13	240	111 \pm 0.476	7.37	256	110 \pm 0.409	6.54
Auriculo-nasal	592	97 \pm 0.276	6.71	381	95 \pm 0.318	6.21	284	98 \pm 0.387	5.92	234	97 \pm 0.485	7.42	220	98 \pm 0.355	5.26
Auriculo-alveolar	604	96 \pm 0.281	6.92	380	94 \pm 0.343	6.68	273	97 \pm 0.357	5.90	229	97 \pm 0.484	7.32	211	96 \pm 0.379	5.50
Auricular height	474	132 \pm 0.326	7.10	218	132 \pm 0.509	7.52	348	127 \pm 0.488	9.11	129	131 \pm 0.693	7.87	167	124 \pm 0.695	8.98
Face length	510	221 \pm 0.565	12.75	211	215 \pm 0.849	13.33	380	217 \pm 0.642	12.52	120	218 \pm 0.868	9.51	169	222 \pm 0.818	10.63
Forehead height	416	98 \pm 0.543	11.08	219	94 \pm 0.858	12.69	394	99 \pm 0.688	13.66	126	108 \pm 1.06	11.87	167	101 \pm 0.976	12.61
Head circumference	536	572 \pm 0.710	16.43	377	566 \pm 0.865	16.80	289	567 \pm 1.00	17.03	233	565 \pm 1.07	16.30	242	570 \pm 1.45	23.53
Stature	680	1688 \pm 2.45	61.51	386	1693 \pm 3.45	67.83	420	1702 \pm 2.89	61.24	238	1691 \pm 4.37	67.43	249	1708 \pm 4.34	68.54
Arm length	624	734 \pm 1.59	39.75	378	745 \pm 2.15	41.83	350	729 \pm 2.38	44.59	217	725 \pm 2.60	38.27	210	730 \pm 2.85	41.29
Leg length	619	871 \pm 1.85	46.05	380	879 \pm 2.69	52.39	286	897 \pm 4.18	70.65	215	880 \pm 4.25	62.38	189	893 \pm 4.84	66.56

Table III. *Percentage distribution of eye and hair colours. Adult males. Rural areas*

	Cardigan-shire	Merioneth-shire	Carmarthen-shire	Montgomery-shire	North-eastern counties
Eye colour:					
Grey	25.83	32.21	21.65	32.34	14.23
Blue	31.02	38.44	29.88	44.26	39.53
Brown	42.52	26.49	34.82	20.85	40.32
Other shades	0.63	2.86	13.65	2.55	5.92
Hair colour:					
Fair	10.86	13.44	13.24	11.81	10.36
Light brown	13.30	11.37	11.11	8.44	10.76
Brown	23.55	21.71	20.80	16.03	15.94
Dark brown	37.61	38.76	37.59	51.48	43.03
Black	9.63	10.85	10.40	5.91	13.15
Red	4.89	3.88	4.96	6.33	6.77
Grey	0.15	—	1.89	—	—

but the percentage of dark-haired men is the lowest in the five areas studied and the percentage of brown-eyed men is only slightly greater than in the north-eastern counties which has the lowest death-rate. There are several fairly large differences between the means found for Cardigan, with a high phthisis death-rate, and those of Carmarthen, Montgomery and the north-eastern counties, with a low phthisis death-rate, but Merioneth, with a high death-rate, does not display the same differences. Head length is greater in Cardigan than in the three areas with a low death-rate but the least head length is in Merioneth. The greatest mean bizygomatic is that of Cardigan but the value for Merioneth is slightly less than that of Carmarthen. Cardigan has an advantage in bigonal while Merioneth has a value only above that of the north-eastern counties. The greatest auricular heights are those of Merioneth and Cardigan but they are not statistically greater than the value for Montgomery. The two counties with highest phthisis death-rates have a smaller mean forehead height than the areas with a lower death-rate. Arm length is greater and leg length is less in Cardigan and Merioneth than in the other counties. There is no apparent relation between eye colour and the phthisis death-rate. The percentages of brown hair in the five areas are in the same order as the death-rates and this is the only variable that exhibits this relation.

From these data no support can be found for the theory that physical measurements are correlated with the phthisis death-rate. There may exist a type that experienced social workers recognize rightly as phthisical but the measurements recorded do not adequately describe it.

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