A STUDY OF RHEUMATIC FEVER IN THE WEST RIDING OF YORKSHIRE

BY

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A STUDY OF RHEUMATIC FEVER IN THE WEST RIDING OF YORKSHIRE.

With the gradual increase in our knowledge of the microbic origin of certain common diseases there has been a corresponding keenness to explore the strongholds which still defy our penetration. Among these is rheumatism, whether in its acute form or in its less obvious but no less important manifestations. And if as yet we are unable to isolate and define with precision the exciting cause of the disease we have realized that, while heart-disease is often the result of rheumatic fever, it is also the sequel, perhaps just as often, of an attack of rhematism in early life, faint, evanescent, unrecognised and untreated.

Rheumatism has a significance in social economy which cannot be ignored. By affecting the heart in early life it may cause a crippled career or premature death. Events such as these may have a profound effect on the social well-being of the individual and the family. A youthful cardiac case may become a chronic invalid with diminished wage-earning capacity; on the other hand, when the first stress of the disease is overcome, a damaged heart may cause death in middle-age at a time when the familial resources are perhaps most dependent on the bread-winner. There is also the serious question of impaired life-assurance. All these points are important, because it is agreed that rheumatic fever is more common in the working-classes than among the well-to-do.

Rheumatism being so protean in its forms, one is not surprised that discussions of its origin are still speculative in nature and vague in conclusion. I refer to that form of rheumatism which is more or less acute, affecting joints temporarily and showing a predilection for serous or endothelial membranes. In dealing with statistics, the changes of nomenclature in returns of the disease and the inclusion of various manifestations make the estimation of the incidence of rheumatic fever very uncertain; in fact, the main supply of figures up till recently has come, not from the Registrar-General, but through hospital, military, and other institutional reports. This, of course, is due to the fact that rheumatic fever is not notifiable in this country, and the Registrar-General deals therefore only with the death-rate.

As the fatality-rate of rheumatic fever is low—certainly under one per cent.—the death-rate has a correspondingly reduced value as an index of the prevalence of the disease. However I was forced to use the death-rate because no other indicator was available for the inquiry which I made, and the results of which are given in the following pages. This inquiry concerns the prevalence of rheumatic fever in the West Riding during three recent years, a comparison of the districts as regards moisture and soil, and the relation, if any, betwen rheumatic fever and cerain manifestations, such as enlarged tonsils and chorea, found in school-children. For these two conditions I have used figures derived from records of the medical inspectios of the 204,257 children annually attending our schools in the West Riding. The deaths are given as the rate per million living.

For the purposes of school medical inspection the Administrative County of the West Riding * was during the years under consideration (1911–12–13) divided into 10 areas, the division being accommodated largely to the railway facilities. Thus while some of the areas are almost purely manufacturing, mining, or agricultural, others are a mixture of two of these elements. In regard therefore to occupation I can only only offer general remarks. The figures are compiled from returns of the above-mentioned years because it was only during these years that the information which I required has been given.

Rheumatism in School Children.

Clinicians, such as Thomson of Edinburgh and Still of London, who have had exceptional experience in diseases of children, are agreed that rheumatism is commoner in young children than was at first supposed though it is very infrequent before the age of three. I have examined over 20,000 school-children between the ages of 5 and 14, and have experienced the difficulty of judging whether a murmur was congenital or acquired. A history obtained from the parents is often helpful in these cases. Functional murmurs and Still's physiological bruit are fairly easy to recognise. The main points are that in children the fever is often the least conspicuous manifestation of the attack of rheumatism and the pain seldom approaches in severity the adult type of the disease. From this it is clear that many attacks of rheumatism in children pass unnoticed, or at any rate unrecognised, though the resulting cardiac lesion may be severe and quite out of proportion to the original rheumatism. After consideration of all the evidence we are justified in regarding "growing pains" as a sign of rheumatism and forerunner of chronic endocardial or pericardial disease. In the West Riding, during twelve months, we examined all school-children aged 5, 7, 10, and 13 years, and for the four groups the percentages of heart disease were in an ascending series, viz:—1·96, 2·26, 2·92, and 3·24. This means that with the increasing years of childhood there is an increasing liability to cardiac disease. In the West Riding, the death-rate from rheumatic fever among children of school age (5-14) is about one-fifth of the total.

* The County Boroughs and autonomous school areas are not included in the figures.

Rheumatic Fever at all ages.

The elaborate and extensive researches of Dr. Newsholme appear to show that rheumatic fever is not dependent on climatic conditions. The disease occurs in all latitudes, though commonest in temperate and sub-tropical zones. For example, the Army returns record a higher rate among the troops in Egypt than among those in Scotland. A fact such as this is antagonistic to any theory of dampness of climate being a cause of the disease. Further, it has been stated that while chronic rheumatism is found in valleys, rheumatic fever cases are more common in high and dry districts where daily extremes of temperature occur. It has also been pointed out—and the Registrar-General recently lays stress on the fact—that rheumatic fever is more an urban than a rural disease. In view of these statements I have examined the statistics for the different school areas in the West Riding, and a short description of these areas is appropriate here.

School Areas.

The SKIPTON area, the most northerly, is placed on the Pennines; the population is mainly agricultural, except in the southern part, where cloth mills and other industries are established. The area is almost bisected by the ridge of the Pennines with the result that the climatic conditions vary here more than in any of the other areas. The western slopes, receiving the moist winds from the Irish Sea, are warmer in autumn and winter than the other side, where however the summers are hotter. Geologically this district also varies more than than the others. It is mainly mountain limestone and red conglomerates, the highest peaks are of millstone grit and in the valleys are found the upper and lower Silurian strata, namely green slates and porphyries, Coniston limestone, flags, and grits, and Bannisdale slates. The lower coal measures also appear. A great fault runs across from west to east. In the southern part of the district the stratum is millstone grit. The rainfall in some parts of the area is very heavy but that at Settle—39·69 inches may be taken as the average.

The rheumatic death-rate per million during the three years was 49·4, and was the second lowest of all the areas.

The HARROGATE area is less elevated and slopes to the eastern plain in rolling uplands separated by the dales of the Aire, Wharfe, Nidd, and partly by the Ure. From west to east the geological strata are (1) millstone grit, (2) a band of Permian limestone and marl extending from the north down through Ripon, Knaresborough, Tadcaster and Wetherby, (3) an area of Triassic with alluvial deposit extending to York. The mean annual rainfall may be taken as 23·71, which is very much less than that of the Skipton area; the mean humidity is, however, not so divergent, that at York being 86 and at Ripon 84, whilst the average of the readings at Settle and Sedburgh is not more than 90. The rheumatic fever death-rate for this area was 59·4. Is there any relation between the disproportion of rainfall and humidity and the death-rate? It is not possible to make a definite answer, but it is worth noting that in the other districts of the West Riding where high humidity is found, namely, in the valleys of the millstone grit above Penistone, there has been a high death-rate from rheumatic fever in the three years under observation.

The SOWERBY BRIDGE area is one of numerous valleys running from west to east separated by spurs of the Pennines; the population is manufacturing, living in long villages at the bottom of the valleys. The stratum is millstone grit, the rainfall averages about 35 inches and the humidity is that of York, 86. The rheumatic fever death-rate was 91.

The HUDDERSFIELD area resembles the last in having a manufacturing population residing mainly in valleys. There is also a proportion of mining and agricultural industries. The stratum is millstone grit in the west, and lower coal measures in the east. The rainfall is 32·60 (J. R. Parsons). The death-rate was 52.

The SHIPLEY area from west to east lies upon lower coal measures, upper coal measures, and partly on the Permian. In the western half it is manufacturing and hilly, in the eastern it is agricultural and flat. It is therefore intermediate between the west and east. The mean annual rainfall is difficult to estimate, but at Leeds near the centre of the area it is 24·00. The rheumatic fever death-rate was 51, and the incidence was higher in the western half than the eastern.

The WAKEFIELD and BARNSLEY areas are so similar that they can be considered together. By occupation they are both mainly coal-mining, and lie on the upper coal measures. They are on the margin of the great plain which stretches from the foot of the Pennines to the Humber and Trent. The mean annual rainfall at Barnsley is 32·28 inches and at Wakefield 23·40. The rheumatic fever death-rate was respectively 77 and 107.

The CASTLEFORD area from west to east is on (1) the upper coal measures, (2) the Permian band running from north to south, (3) the Triassic and alluvial. The land is flat, the population is partly mining and partly agricultural. The rainfall averages 21 inches and the death-rate was 58.

The SWINTON area from west to east lies on the upper coal and Permian strata. It is flat, and the population is almost entirely mining. The rainfall for the district is 25·80 inches and the death-rate from rheumatic fever for the three years was 70.

The DONCASTER area is quite flat and in certain places only slightly above sea level. It lies partly on the Permian where the population is a mining one and largely on the Triassic and alluvial where agriculture is the chief industry. The mean annual rainfall is 25·00 inches. The death-rate was 42, the lowest of the series.

Certain of the above facts may be tabulated thus:—

Area.	Rheumatic fever death-rate.	Rainfall.
Wakefield	107	23·40
Sowerby Bridge	91	35·00
Barnsley	77	32·28
Swinton	70	25·80
Harrogate	59·4	23·71
Castleford	58	21·00
Huddersfield	52	32·60
Shipley	51	24·00
Skipton	49·4	37·69
Doncaster	42	25·00

The figures of the rainfall have been taken indiscriminately over several years and are not intended to apply as a nexus between yearly rainfall and rheumatic fever but as an indication of a wet or dry district. It will be seen that there is no relation between the death-rate from rheumatic fever and the wetness or dryness of a district measured by several years of rainfall. The last two on the list agree in one point, only to diverge on the other; they agree in having low death-rates but while Skipton has the highest average rainfall, Doncaster has one of the lowest.

Humidity of the Air.

I have previously mentioned that the most humid parts of the West Riding are to be found on the western slopes of the Pennines which are not far from the Irish Sea and are drained by the Lune and Ribble, and probably also in deep glens in certain parts of the millstone grit. The peculiarity is that though these western slopes have a rainfall double that of the other parts of the West Riding the humidity of the atmosphere is only one-fifth greater, and this has been attributed by Dr. Arnold Lees to the drier nature of mountain limestone as compared with the millstone grit. My figures show that the rheumatic fever death rate is higher in the humid parts of the millstone grit than in those of the mountain limestone.

Rheumatic Fever and Enlarged Tonsils.

There is a general willingness to believe that a definite morbid correspondence exists between rheumatism and the tonsils. The theory in its latest terms is that the rheumatic poison is a streptococcus which gains entrance to the body through the tonsillar crypts. There is some justification for this view, because tonsillitis is not infrequently an initial feature of an attack of rheumatic fever. And when one considers the number and variety of cocci which may grow in cultures from a throat swab, the analogy of implication of the throat in other infectious diseases, and the recent isolation of micrococci or streptococci by independent workers seeking a microbic origin for rheumatism, it is quite probable that the tonsils may be the mode of entrance for the rheumatic contagion. Be that as it may, we are now able by the systematic medical inspection of school children to estimate the incidence of enlarged tonsils. The following table shows the rheumatic fever death-rate among children of school age (5 to 14 inclusive) and the percentage of enlarged tonsils in the school children examined.

Area.	Death-rate.	Percentage enlarged Tonsils.
Barnsley	158	3·15
Castleford	145	4·34
Shipley	137	5·10
Sowerby Bridge	129	9·41
Swinton	106	5·06
Wakefield	82	7·57
Harrogate	71	8·72
Huddersfield	68	12·11
Skipton	19	4·11
Doncaster	13	5·46

There is no indication in these figures of any correlation between the death-rate from rheumatic fever and the frequency of enlarged tonsils.

Rheumatic Fever and Chorea.

Chorea is generally recognised as a manifestation of rheumatism. It has been stated by Dr. Fletcher of St. Bartholomew's Hospital, that 26 per cent. of choreic cases have suffered previously from rheumatic fever. Batten, as the result of inquiry lasting over six years, found that 20 per cent. of cases of chorea developed afterwards first attacks of rheumatism. The numbers which have been compiled from our medical inspection of school-children do not reveal any correlation between the rheumatic fever deaths in children of school age and chorea found in children attending school. It must be remembered, however, that only a small number of chorea cases is likely to be encountered in children actually in attendance, and fewer are being seen each year owing to the stringent exclusion of such cases by the school medical inspectors.

Area.	Rheumatic Fever Death-Rate.	Per cent. of Chorea.
Barnsley	158	·31
Castleford	145	·04
Shipley	137	·12
Sowerby Bridge	129	·00
Swinton	106	·03
Wakefield	82	·06
Harrogate	71	·08
Huddersfield	68	·09
Skipton	19	·03
Doncaster	13	·01

Enlarged Tonsils and Chorea.

Is any correspondence to be found between these? On arranging the areas in order of decreasing numbers as regards enlarged tonsils I find that this is the only one of my tables in which there is any approach to correlation.

Area.	Per cent. Enlarged Tonsils	Per cent. Chorea	
Huddersfield	12·11	·09	2
Sowerby Bridge	9·41	.00	10
Harrogate	8·72	·08	3
Wakefield	7·57	·06	4
Doncaster	5·46	·01	8-9
Shipley	5·10	·12	1
Swinton	5·06	·03	5-7
Castleford	4·34	·04	5
Skipton	4·11	·03	6-7
Barnsley	3.15	·01	8-9

The names put together show the correlation which is noticeable though not uniform. The lists are in order of decreasing percentages:—

Enlarged Tousils.	Chorea.
Huddersfield	Shipley
Sowerby Bridge	Huddersfield
Harrogate	Harrogate

Enlarged Tonsils.	Chorea.
Wakefield	Wakefield
Doncaster	Castleford
Shipley	Skipton
Swinton	Swinton
Castleford	Doncaster
Skipton	Barnsley
Barnsley	Sowerby Bridge

Rheumatic Fever and Geological Features.

Some work has already been done in seeking a relation between the porosity of the soil and prevalence of the disease, but the results, according to Dr. Newsholme, have been most confusing. The character of soil depends on the rock from which it is formed. In the West Riding the configuration of the land is from the altitudes of the Pennines down to a broad plain. The northern part of the Riding is to some degree sheltered from the east wind by the elevations of the East Riding. The southern part merges into the open lands of Lincolnshire and Nottinghamshire. The two portions most widely separated, viz.: the Skipton area in the north-west and the Doncaster area in the south-east have the smallest rheumatic fever death rates of all the areas. The Doncaster area borders on Lincolnshire which, among the counties of England, has a low incidence of rheumatic fever; the soil of the area is alluvial on Triassic strata, and on breaking through the crust one finds water at a depth of a few feet. In the Skipton area there is nothing similar; the high lands are mountain limestone, the valleys are of Silurian slates, etc., and the soil is drier than in the south-eastern area, yet the area has a low rate and is contiguous to Lancashire which has a high percentage of rheumatic fever. As for the central parts of the West Riding, from west to east they are on the millstone grit and the lower and upper coal measures. The soil is clayey and damp, and it is in these areas that we find the highest death-rate:—

Coal Measures.		*Millstone Grit.*	
Wakefield	107	Sowerby Bridge	91
Barnsley	77	Harrogate (partly)	59·4
Swinton	70	Huddersfield (partly)	52
Shipley	51		
Mountain Limestone, etc.		*Triassic and Alluvial.*	
Skipton	49.4	Doncaster	42

Lastly there is the band of Permian limestone and marl, stretching through the country from Ripon in the north, to Roche Abbey in the south. This formation is a hard fissured rock which does not retain water, the soil therefore tends to to resemble that of the dry mountain limestone. The band, however, is only a few miles in width, and an examination of the death-rate of this portion does not show that it is notably free from rheumatic fever, cases occuring/all parts of it.

We have now seen that the rheumatic fever death-rate is highest in those parts of the West Riding which lie on the millstone grit and the coal measures. Generally speaking the population in the millstone grit dwells in valleys and is engaged in manufacturing; that on the coal measures is engaged in mining and lives on the low levels where the valleys broaden out to the plain. The points which they have in common are (1) they are urban populations, (2) they live on damp soils. We know already that rheumatic fever is more urban than rural in distribution. As to the second point, is the West Riding soil more damp than that of Lincolnshire? It is not; and further, though Lincolnshire has in many parts a marshy and damp soil, yet rheumatic fever has not taken the place of malaria where malaria was formerly prevalent. Dampness of soil is therefore not a potent factor in the prevalence of rheumatic fever, and it can quite well be argued that the populations in the West Riding which are on the damp soils of the millstone grit and coal measures are urban and that this "urbanity" explains the higher prevalence of the disease. Indeed if we accept rheumatic fever as an infectious disease like diphtheria there is no reason to look for more than a common element in all latitudes and climates, namely, the element of contact, and consequently the more frequent exposure to contact in urban dwellers.

From statistics taken during three years the following conclusions are made regarding the West Riding:—

1. There is no relation between the wetness or dryness of a district (measured by its rainfall over several years) and the rheumatic fever death-rate,
2. The rheumatic fever death-rate is higher in urban than in rural populations.
3. The urban populations live mainly on the millstone grit and coal measures, but there no reason to believe that these formations have any effect on the prevalence of the disease.
4. There is no relation found between the rheumatic fever death-rate in children of school age and the incidence of enlarged tonsils in school children.
5. There is no relation found between the rheumatic fever death-rate in children of school age and the number of cases of chorea seen in the course of school inspection.
6. There is a distinct, though not uniform, correspondence found between the number of cases of enlarged tonsils and the number of cases of chorea seen in the course of school inspection.

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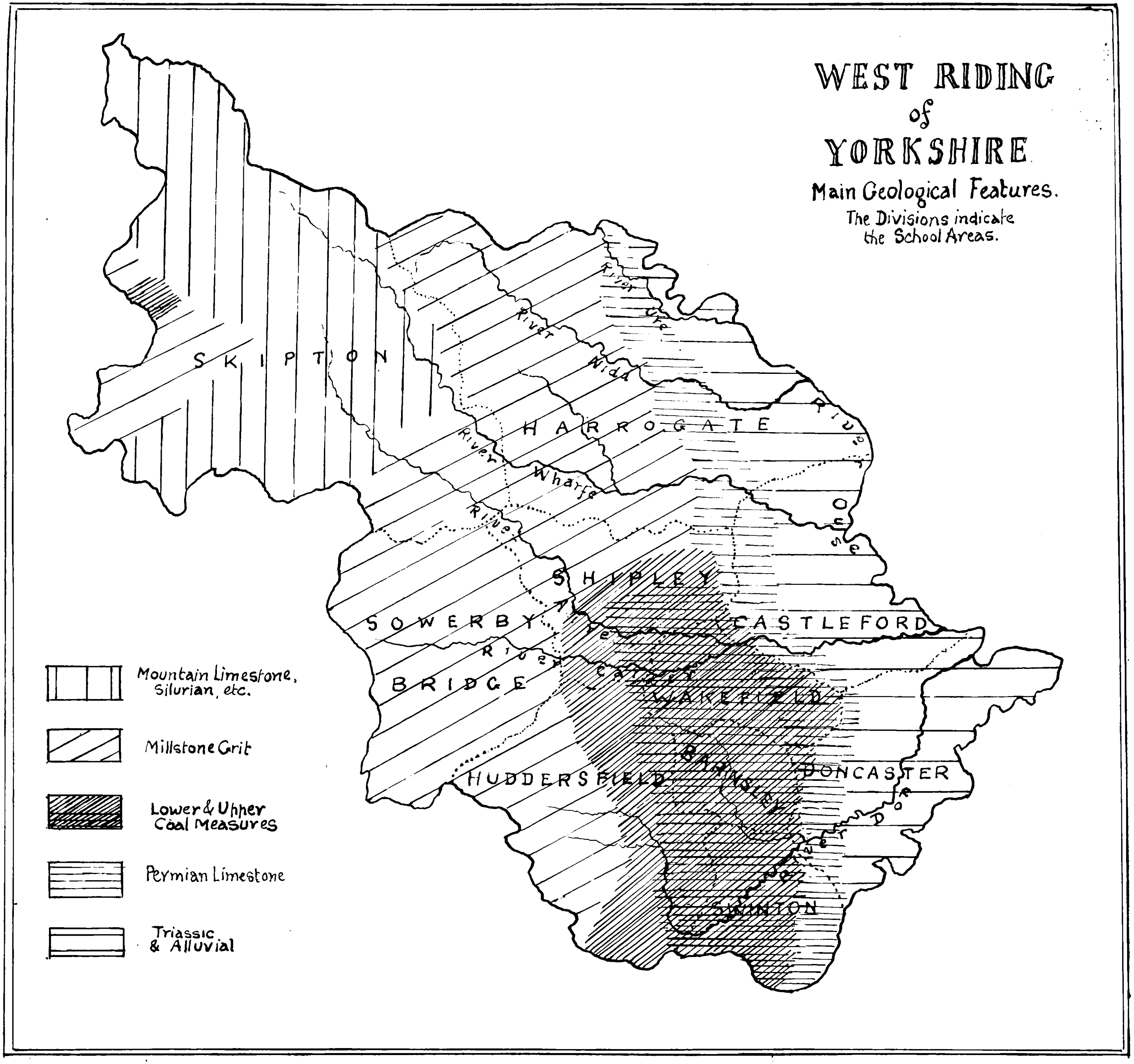
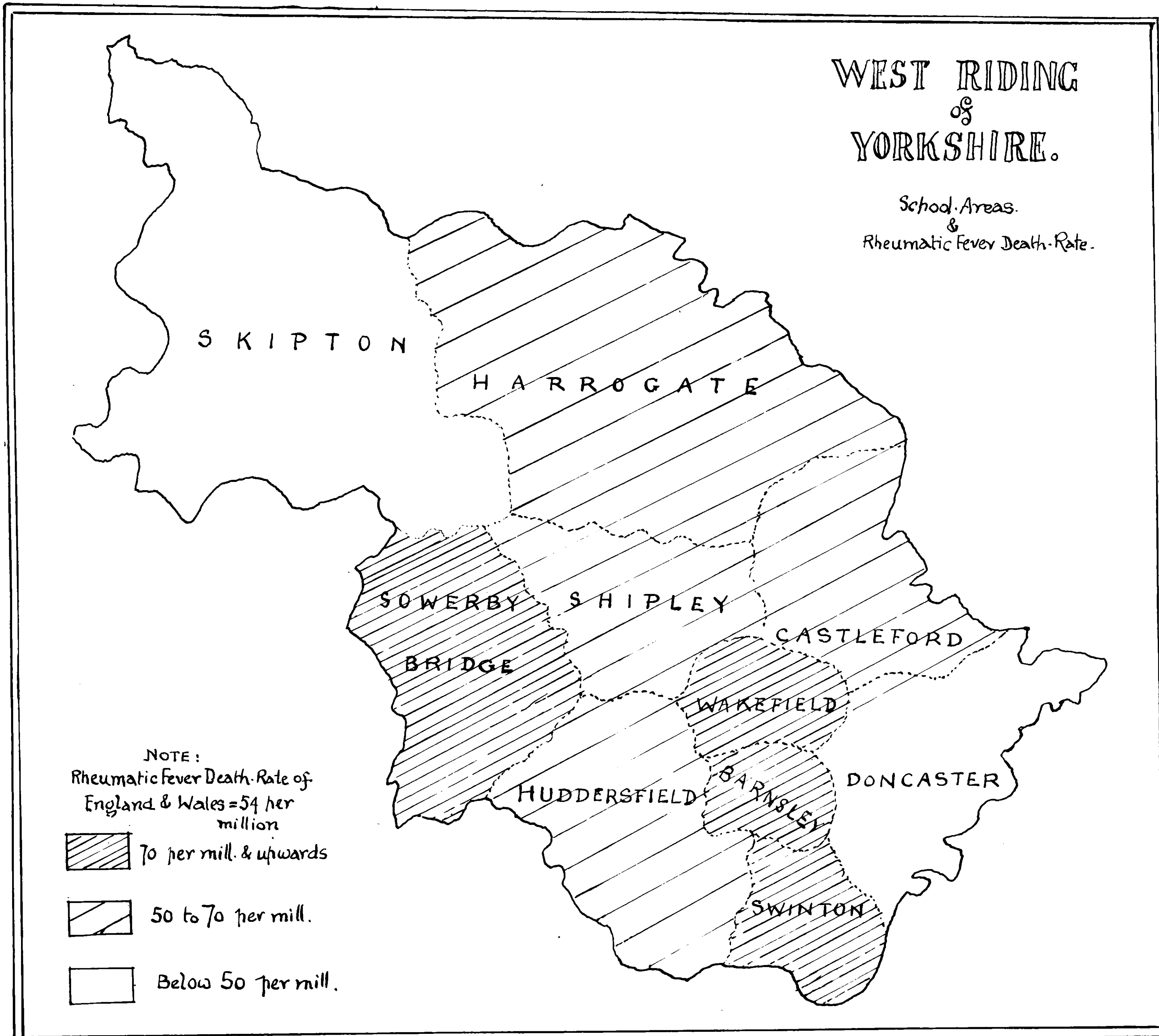

WEST RIDING
of
YORKSHIRE
Main Geological Features.
The Divisions indicate the School Areas.
SKIPTON
HARROGATE
SHIPLEY
SOWERBY BRIDGE
CASTLEFORD
WAKEFIELD
HUDDERSFIELD
BARNSLEY
DONCASTER
SWINTON
River Ure
River Nidd
River Wharfe
River Aire
River Calder
River Ouse
River Don
Mountain Limestone, Silurian, etc.
Millstone Grit
Lower & Upper Coal Measures
Permian Limestone
Triassic & Alluvial


WEST RIDING
of
YORKSHIRE.
School. Areas.
&
Rheumatic Fever Death. Rate.
SKIPTON
HARROGATE
SOWERBY
BRIDGE
SHIPLEY
CASTLEFORD
WAKEFIELD
HUDDERSFIELD
BARNSLEY
DONCASTER
SWINTON
NOTE:
Rheumatic Fever Death. Rate of England & Wales = 54 per million
70 per mill. & upwards
50 to 70 per mill.
Below 50 per mill.

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Other Papers with

Thesis for D.Sc. (Public Health)

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A N T H R O P O M E T R I C A L   F O R M U L A E

F O R   N U T R I T I O N.

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ANTHROPOMETRICAL FORMULAE FOR NUTRITION.

Those engaged in school medical inspection have felt the difficulty of forming, in regard to the nutrition of the children, an estimate which will be suitable for a general comparison of results. Most commonly the "notation" of nutrition is accomplished by the use of such words as good, moderate, poor, or by equivalent figures as one, two, three. The personal equation of the observer operates here and no doubt in some measure tends to impair the value of statistics compiled in this way. Several methods have been devised in order to reduce the diversity to one basis, and at present no method has taken a place in general use as being the most accurate and convenient. I have therefore tested the anthropometrical results of my school examinations by various methods.

PIGNET'S FORMULA.:- This is one introduced by a French military surgeon. The equation is:- $F = H - (C+W)$.

in which H = height in centimetres.

C = minimum in extreme expiration in centimetres.

W = Weight in kilograms.

F = factor of physical fitness.

The larger the excess of height over the sum of the chest measurement and the weight expressed in the terms first stated the poorer is the physique of the subject.

If F is under 10, Pignet classes as very strong.

: F	: 10 to 15,	:	:	: strong.
: F	: less than 20,	:	:	: good.
: F	: 25 and upward,	:	:	: weak.
: F	: 30 to 35,	:	:	: very weak.
: F	: over 35,	:	:	: unfit for
: F	:			military service.

Col. Firth. R.A.M.C., has applied this formula and found that Gurkhas give 44% under 20, and that Hindus and Musalmans give 70% of 25 and more. The short sturdy type of man gives the lowest range while the tall lean men give the highest factors. I have used the formula for older school children, age group 12, and found that the factor for children of this age lay between 35 and 40 but the fluctuations were too great to be of value.

OPPENHEIM'S FORMULA. This ignores the height and weight and takes account of two girths, the chest in expiration and the arm. Oppenheim claims that it is reliable for all ages and conditions. The formula is:-

$$\frac{\text{Relaxed arm x 100}}{\text{Chest in expiration}} = \text{Factor for nutrition.}$$

In malnutrition it is evident that there will be loss of subcutaneous fat and the difference will be greater in the arm; therefore, though both arm and chest are reduced the figure for the arm-the numerator- will be relatively more decreased consequently F will be reduced. The normal value of F is 29, anything above is excellent nutrition and values below are indices of poor nutrition in increasing degree as the values diminish. Here is a comparison of Pignets and Oppenheim's figures taken at random. The measurements are in Kilograms and Centimetres. The children are aged I2.

No.	Weight.	Height.	Chest.	Arm.	Pignet.	Oppenheim.
(I)	3I·5	I4I·5	6I·5	I9	49	30·8
(2)	29·3	I4I	63·5	I8	49·7	28·3
(3)	25·7	I29·5	6I	I8·5	42·8	30·3
(4)	32·5	I43·5	6I	I9	50·4	3I
(5)	3I·4	I32·5	64·5	20	36·6	3I
(6)	3I·9	I39	63	I9	44·1	30·1
(7)	32·1	138·5	61	17	44·4	27·8
(8)	31·8	135·3	64	19·5	39·5	30·4
(9)	33·4	143·5	62	20	48·1	32·2
(I0)	31·6	143·2	65	19	46·6	29·2
(II)	43·9	144	71	24	29·1	33·9
(I2)	28·3	138	58	17	52	29·3

The relation between Pignet's and Oppenheim's figures is that as the former goes up the latter should go down. A glance at the figures above shows that the relation between them is not constantly of this nature. Oppenheim's formula is an excellent one for children of a certain age but just as Pignet's is only suitable for those who are older and almost fully grown so Oppenheim's is only suitable for older school children. It is almost impossible to measure correctly the chest in expiration in young children.

GRAM WEIGHT PER CENTIMETRE. This is obtained, as the term suggests, by dividing the weight in grams by the height in centimetres. This is an easily worked formula. The London average for boys of I2 was 230 and for girls 232. The anthropometrical committee's average was respectively 236 and 230. The formula depends on the definite relation between nutrition and weight for a given stature.

CONTINENTAL FORMULA. This is of the nature of the last with a difference in numerical structure:

$$\text{Index} = \frac{100\sqrt[3]{\text{Weight in Kilograms.}}}{\text{Height in Centimetres.}}$$

The average value of this index is said, at all ordinary school ages (8-14), to be between 2·3 and 2·4 and to be independent of racial influences. Dr. Kerr of London has enumerated nutritional values by this factor and has found it to be fairly accurate. I think, however, that the complexity of this formula will prevent its general use. Many observers in estimating nutrition by the ocular method have taken into consideration the mental alertness of the child and have included such points as the condition of the muscles ,hair ,skin ,etc; they have also relegated fat and flabby children to a "moderate" or "poor" class of nutrition. It is quite apparent that these conditions cannot be estimated by a system based on anthropometrical statistics. Still ,I find it is useful to be able to calculate readily on some basis of measurements and thus to put the children quickly into a recognisable class of nutrition. The system I have used is analogous to the gram-weight per centimetre but the English enumeration is used, namely, the weight in pounds is divided by the height in inches. The measurements of normal school children, as given in anthropometrical tables, are taken as the standards and a factor is obtained for each age. The following tables show the measurements and the resulting factor.

BOYS.

AGE LAST BIRTHDAY.	HEIGHT IN INCHES.	WEIGHT IN LBS.	FACTOR OF NORMAL.
3	35	35	$\frac{w}{h}$ = 1·0
4	37	37	$\frac{w}{h}$ = 1·0
5	40	40	$\frac{w}{h}$ = 1·0
6	43	44½	$\frac{w}{h}$ = 1·0
7	46	49¾	$\frac{w}{h}$ = 1·0
8	47	55	$\frac{w}{h}$ = 1·1
9	49¾	60½	$\frac{w}{h}$ = 1·2
10	51¾	67½	$\frac{w}{h}$ = 1·3
11	53½	72	$\frac{w}{h}$ = 1·3
12	55	76¾	$\frac{w}{h}$ = 1·4
13	57	82½	$\frac{w}{h}$ = 1·4

GIRLS.

3	34	31½	$\frac{w}{h}$ = 0·9
4	36	36	$\frac{w}{h}$ = 1·0
5	39	39	$\frac{w}{h}$ = 1·0
6	42	41¾	$\frac{w}{h}$ = 0·99
7	44	47½	$\frac{w}{h}$ = 1·0
8	46½	52	$\frac{w}{h}$ = 1·1
9	48¾	55½	$\frac{w}{h}$ = 1·1
10	51	62	$\frac{w}{h}$ = 1·2
11	53	68	$\frac{w}{h}$ = 1·3
12	55½	76½	$\frac{w}{h}$ = 1·3
13	57¾	87	$\frac{w}{h}$ = 1·5

I suggest therefore the use of these figures as a convenient nutrition index. It will be seen that the factor up to the age of 7 is 1 for the boys and is practically 1 also for the girls, except 0·9 at age 3 and 0·99 at age 6. The figure for girls at age 6 can be taken as 1, and the only exception then left is 0·9 for age 3. Now as children of this early age do not form the bulk of the "entrants" the medical inspector will find that for most purposes up to the age of 7 he can use the integer 1. When he is dealing with girls of 3 he can easily remember the change to 0·9. The other age group which the inspector sees regularly, the "leavers", is composed of boys and girls aged 12 and 13. There is no difficulty in remembering the boys' figure, it is 1·4 for both ages, and owing to the absence of such an index for the girls this very fact will enable him to remember the lower and higher indices of 1·3 and 1·5. With regard to figures to the intervening ages, these ages will occur in age groups at intervals prescribed by the Board of Education. For example, the Board has directed that age group 8 shall be examined during 1915. The inspector can easily add the index 1·1 to his memory of handy data.

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Dr. Kerr points out that in using the gram weight per centimetre formula one should adopt a slightly higher index during the winter months. A similar qualification should also be applied to the formula under question but in practice I have never done so, though I think it could be easily accomplished by raising the value say ·1 in each factor. The use of the factor which I suggest is open to most of the objections that may be urged against all numerical ways of estimating nutrition. A comparison of ocular and numerical estimates shows that the ocular method is reliable and that its results correspond closely with those obtained by factors. But the height-weight factor is got easily, and is especially useful in estimating young children- "entrants"- whose chest measurement in expiration for Oppenheim's formula is unreliable. The estimation of nutrition in the school records of the West Riding County is taken over all ages and both sexes. I am therefore not able to compare fully the results of the School Medical Inspectors and my own as regards sex and age. The percentage of poorly-nourished children in the schools is 0·5 for 1912. This is the average of ten school areas; the highest figure of the ten being 2·5, others were as low as 0·02. The estimation of nutrition in all the cases was by ocular judgment. I have compared as far as possible certain sets of figures with the above percentages and found that I had to reduce my standard of classification in working with the factor. For instance in regard to "entrants", that is children up to the age of 7:— The normal figure for boys from 3 to 7 is 1, but though that is the normal, many fine children fall just below that factor, so I took 0·95 and over as being "good", from 0·95 to 0·80 as "moderate", and below 0·80 as "poor". And similarly with the figures of 1·4 for boys of 12 and 1·3 for girls of 12. In the first case I took anything above 1·35 as good: in the girls, figures above 1·25. At the other end of the scale for age 12, figures below 1·1 were considered poor for boys, and below 1 poor for girls. I took the figures for 973 boys and girls and struck an average of 1·35 (the numbers of boys and girls being almost equal). The factor for nutrition came to 1·06 which is between the "poor" limit for boys and that for girls. Yet 25% were 1·35 or over, that is, distinctly "good". On taking the proportion below 1 (which is the "poor" limit for girls but was used for the mixed numbers in this case) the percentage was 1·6, on taking the proportion below 1·1 the percentage was 7. The way in which I should read these figures is:- "poorly nourished" 7%; "very poorly nourished" 1·6 % of total. It will be noticed that this figure 1·6 % comes close to the School Medical Inspectors figures (0·02 to 2·5) from which the average of 0·5 was obtained. At the younger end of the schools I have found that the children aged 3 are more nearly approximated to the normal than the older children. It seems as if malnutrition becomes more common as the age rises. I do not mean a marked degree of malnutrition, but a general diminution of physique.

CONGENITAL WORD BLINDNESS.

WITH A RECORD OF TEN CASES IN ONE FAMILY.

CONGENITAL WORD-BLINDNESS.

Cases of pure congenital word-blindness are being recorded at home and abroad, and since my attention was directed some years ago to the subject by the publications of Dr. Hinshelwood of Glasgow I have been on the outlook for the defect in school work. I have frequently thought that I was on the track of a case but nearly as frequently have found after a brief investigation that the case was one of general defect, that is to say the child's inability to read was the result of a mental defect blighting more or less distinctly all the intellectual faculties. For example, a boy aged 7 was brought to me by his teacher who said that the child could not learn to read or write. The pecularity of his case was that the lad made one symbol for everything. The symbol was the figure 6, and he covered pages with this in attempting to copy letters or figures. It was quite evident that the child was mentally defective, but the case was nevertheless interesting as a type of those defectives who constantly make the same symbol in writing, a kind of graphic alalia comparable to those more deeply defective who only produce one sound or word, vocal-alalia, that is, the less defective child is wanting in the faculty of visual and graphic speech, the secondary or higher couple as Dr. Wyllie calls it; while the more defective is wanting also in the faculty of the auditory and vocal speech- the primary or lower couple. And of course this is what one would expect. The primary couple is an attribute of primitive man, it is present to some degree in the lower animals, and is acquired by infants as part of their normal development. I have, however, been able to isolate for investigation several cases which are examples of pure congenital word blindness, though some of them are really not so marked as to call for more than passing notice. I mean that in every school there may be one or two otherwise bright children who are slow in learning to read but yet finally acquire the faculty before leaving school. At the same time I believe there is a type of word blindness to be seen in children who are very backward or moderately defective. The boy mentioned above, for instance, is one of this kind; he is quiet and obedient, and I do not consider him worse mentally than other defective children who are able to read and write simple words and still remain in attendance at elementary schools, but he is so grossly defective in this one particular that he may be considered as suffering from word blindness, yet as there is obvious defect in all other directions it is wrong to take account of him in a discussion on word blindness. He is not a "pure" case, and his inclusion in the category would complicate the suggested methods of training "pure" cases. In fact he is, as already said, mentally deficient by reason of a general cerebral defect which involves the highest faculties of intelligence and will in the first place, and secondly, the centres for visual, auditory, and vocal speech. I have been impressed by the frequency with which the defect of being slow to learn to read is found in several members of a family. When the cases of general mental feebleness or dullness have been eliminated there still remain instances in which two or more members of one family signalise their presence, or rather the recurring presence of the family growing up through the school, by being one after another a burden to the teachers; these are no doubt genuine cases of word blindness, more or less in degree, but it is not often that one has a chance of seeing two or three members of such a family in school. Usually the cases do not impress themselves on the teaching staff until the older children of the family are beyond school age, and it is then an embarrassing mission to follow them up at their homes to quiz them on their inability to learn when they were at school. From what I have seen and heard however, I am convinced that congenital word blindness is often a family affection and therefore hereditary. This point will be determined in the course of a few years, as the duration of compulsory education renders the population less and less immune to educational influences. It is useless at present to look for the play of heredity in children whose parents have never been taught and therefore never been suspected of inability to learn. I have an opportunity of putting on record several cases of pure word blindness, two of these cases are in one family and ten in another.

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Of the first two cases the younger of these was seen by me at school. The boy, aged 13, is well nourished and healthy-looking. The head teacher brought him forward as one for whom he had given up hope. He had taught the lad specially two or three times a week for several months but without inducing any progress. I found that the boy was quite bright and intelligent and there was absolutely no mental defect. When told to read he stood looking at the print evidently searching for something to recognise. He then read out several little and common words such as "the". "on" etc; when asked to spell larger words he did so, but even then there was a hesitancy at each letter which reminded one of the efforts of an infant. Next a lesson that he knew was shown to him and immediately he began to pick out longer words than before: it was apparent that he had learned each of these words as a visual picture because he could recognise certain long words but could not pick out shorter and easier ones. That his auditory speech centre was intact was proved by a few tests. For instance, I asked him what I held in my hand; he said at once "a pen". The pen was given to him and he was asked to write the word; after a long pause he put down the letter "p" but could not go on until the other letters were repeated to him. His writing by the way, was very good. His memory was excellent for other things; he repeated some verses about the nightingale, but when, after an interval of other questions, I shewed him the poem without telling him what it was he did not recognise it. In a little while, however, he noticed the title and picked out the word "nightingale" though he did not appear to be able to recognise it where it occurred in the verse. A similar result was got with a poem on Lucknow. He recognised the title and repeated several lines, but when he faltered he could not, even with the book before him, take up his cue until the opening words of the verse were spoken to him. When asked to point out the word "pipes" he passed over the word twice until he found it in a prominent place in the last line of a verse. On turning to figures a marked difference was seen. He could do sums fairly well and was sufficiently advanced to calculate weights and measures. The head teacher here interposed and said that the boy could not do sums on the board, he could copy the figures but had to be told by a class-mate the meaning of the words written in the problem. This was shewn by a test. I wrote down " twenty thousand four hundred and six ", he could not read this but when the words were spoken to him he immediately wrote the figures. There is one interesting point further. The head teacher informed me that the boy had three brothers who had passed through the school; two of them were fair scholars, but one was like the present case, and learned to read only with the very greatest difficulty. There are, therefore, two cases of the defect in one family. I said before that from the teachers in the schools one may hear of several members of a family who have passed through school without evincing much progress in reading, and on enquiry it frequently turns out that the defect is not confined to this faculty alone but is part of a general intellectual weakness; that is to say, there is actually mental feebleness. I am able, however, to give an account of a family whose members all acquired in the local school the notoriety of being very slow in learning to read, and I bring them forward as cases of congenital word blindness, because apart from this defect they are all mentally quite up to the average. I cannot absolutely vouch for every one of these cases because I have not seen them all, but I am convinced that, judging from the condition of those whom I have had the opportunity of examining and from statements regarding those whom I did not see, they are all cases of congenital word blindness. The mother (who had the defect herself) stated possitively that all her children were alike in having difficulty in learning to read; thus from the teachers and the mother there was testimony, and as to the mental condition the teachers had no hesitation in saying that the children were normal in intelligence. The father of the family can read and write, he owns a fish and chip shop, and his wife helps him in the business. Of the nine children only the youngest is now at school.

1. Mrs. B. Mother (52) when she left school at the age of 13 could neither read nor write; is a smart, intelligent woman, quite frank about the family defect, and has encouraged her children to learn after leaving school. She has learned to read a little herself, but her knowledge is confined mainly to spelling out large print such as the play-bills hung up in her shop. She depends

entirely on memory for the conduct of her business, and her memory appears to be very good, no doubt having been cultivated by necessity to supply the other deficiency.

2. E.B. Daughter (28) was very slow at reading when at school but tried to improve afterwards.

3. H.B. Son (25) could not read or write when he left school. He took up physical culture, and his eagerness to read the instructions and other matters relating to his hobby impelled him to learn his letters sufficiently to read what he wanted to know.

4. E.B. Daughter (24) was very slow in reading and writing; though so backward in these subjects when she left school at I3, ahe shewed herself very capable as a shop girl and astute in money matters.

5. H.B. Daughter (22) was very slow at reading but had not so much difficulty as the others; her mother thinks she was the "best of the lot".

6. E.B. Daughter (20) was like the others, very slow in learning to read but tried to improve herself after leaving school.

7. L.B. Son (I6) left school without learning to read; he could reckon a little. He felt keenly the difficulty of learning, and when asked to continue at the night school said he would "sooner throw himself into the canal".

8. D.B. Daughter (I5) was very backward in reading and arithmetic. She is of average intelligence, assists her parents in the house and shop, and is trying to improve her reading.

9. T.B. Son (I4) left school without learning to read. He is now apprenticed to a butcher whose impatience with his inability to write down orders has stimulated him to tackle reading and writing and he is improving slightly. He is otherwise a very smart boy.

IO. B.B. Daughter (I2) is a neat, clean girl, of average intelligence. She is poor at both letters and figures. She cannot read anything beyond the smallest common words and her writing is merely a copy of what she sees written elsewhere. She is quite incapable of writing composition or to dictation. She is not much better at sums, but her memory is fairly good.

I think this is the largest number of cases on record in one family. Dr. Hinshelwood has published an account of four in one family, and I do not consider that I am casting too wide a net when I include all the family memtioned above in the category of word-blindness. I believe also that this is the first time a definite trace of heredity has been recorded.* I have already spoken of the difficulty in adducing proof of heredity, but the proof is clear here.

The education in school of such cases is a duty which must be faced by education authorities. These children are not suitable for special schools, it would be unfair to stigmatise them by segregation with mental defectives, and a modified curriculum in the public elementary schools is the proper method of overcoming the difficulty. I have had no experience in this matter, but Dr. Hinshelwood has originated and used a system of block-letters which has given, under his directions, a satisfactory result, and I propose to suggest this system in future to the teacher

* In this country.

and parent when a case of word-blindness comes to my notice. No doubt there are enormous difficulties in the path of the subject of congenital word-blindness; here, in very truth, there is no royal road to learning but a steep and stony path. Yet determination and the impulsive power of awakened desire will work wonders. The case of H.B., son (25) is an example; he learned to read sufficiently to read about his hobby; this is reminiscent of Dr. Hinshelwood's case who was keen on football and learned to read or recognise the words in his football papers. In the family described above it will be observed that the incidence of the defect is more marked on the boys than the girls.

A C H O N D R O P L A S I A.

A C H O N D R O P L A S I A.

This defect in development is not common in the mining population of South Yorkshire. The miners are, as a class, of good physique, not bulky and ruddy, but sturdy and muscular. Housing conditions are often not hygienic, but wages are good and food is plentiful. I have noted more cases of achondroplasia in the large towns than in the small villages, and perhaps the defect is due to environment and related therefore to rickets. Indeed the frequent references of German writers to "Sogenannte fötale Rachitis" shew that opinion first tended, though with scepticism, in that way. On the other hand Virchow spoke of it as a fetal type of cretinism. The earliest published case dates back to I79I when Sömmerling gave an account of the post-mortem appearances in a case of fetal abnormality which he was unable to classify, but the description leaves no doubt (according to Guthrie Rankin) as to its nature. It was not until I860 that the condition was recognised as a definite pathological entity.

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The subject of achondroplasia is a dwarf with a large head, pug nose, prominent abdomen with lordosis, and very short arms and legs. The limbs are deformed as well as shortened, being thick and bent or bowed. An interesting fact is that, whereas in the normal infant the umbilicus marks the central point between the crown of the head and the soles of the feet, in the achondroplasic child the central point of the body is above the umbilicus and this relationship remains through life. The resemblance between achondroplasia and rickets is strong enough to cause confusion in mild cases of the former defect, and differentiation is sometimes not easy owing to the two conditions being present, the rickets having been superimposed on the achondroplasia. I have been deceived in some such cases, but by attention to certain points one need not be puzzled for long.

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The main characteristics of achondroplasia now recognised are:-

1. Congenital origin.
2. Abnormally large vault of cranium.
3. Arrested development of arms and legs.
4. Normal development of trunk.
5. Decentralisation of middle point of body above umbilicus.
6. Main-en-trident.
7. Prominent abdomen with lordosis.

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The accompanying photographs shew a fairly typical case of achondroplasia. The boy is aged 9, his height is 36½in, and his weight 37lbs. The various defects can be easily seen; the large head, the depressed nose, prognathism, the prominent abdomen with lordosis, and the decentralisation of the body. Something of a "main-en-trident" can be seen in his hand. The humerus measures 4½ inches, and the

Carry on to page second of the photographs

The mother says that the boy was like the others when born but his teeth came late, he did not walk till the age of 3, and he was then treated for "rickets and water in the head". When he was 4 he had acquired a habit of scratching his head with his foot. He can even now put his toes in his mouth without bending his knee. At first I took this case to be one of rickets, but could not decide whether infantilism or achondroplasia was the other partner. I saw a photograph of the child at the age of 2 and he then had the appearance which he shews at the present time, so I am inclined to discount his mother's statement as to his normality at birth.

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The etiology of achondroplasia is still obscure. It has been definitely separated from rickets and cretinism, and certain pathological changes have been described in post-mortem examinations. These changes seem to be located mainly in the base of the skull and in the long bones. In the base of the skull

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clavicle 4 inches in length. The skull is 2I inches in circumference- more than half his height- and is markedly protuberant in the frontal and parietal regions. The palate is very narrow, the superior alveolus thick, the teeth irregular and decayed, and mouth breathing is present. The skin is smooth, supple, and well cushioned with fat. There is slight strabismus, and a small inguinal hernia was present at one time. The centre of the body is above the umbilicus at a point nearly one-third of the distance to the xiphoid. The principal joints are enlarged but there is only a faint rachitic rosary. The face is pale and the expression vacuous, still the boy is physically active though below the average in intelligence. Sexual development is unimpaired. He is the second of five children, his parents are cousins and are not very intelligent.

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the union between the presphenoid takes place about the time of birth, but the union between the presphenoid and the basilar portion of the occipital bone is normally delayed until adolescence. In achondroplasia the union between the postsphenoid and the occipital is perverted and is synosted before birth and at the same time as the one between the presphenoid and the postsphenoid. The vault of the skull grows normally and is not of the rachitic type. The changes in the long bones are related to inhibition of the proliferating cartilage in the preparatory stages of ossification.

Cases of achondroplasia can be classed during school life as physical defectives, but it is not necessary to assume that they are so defective as to be unfit to benefit from instruction in a public school. No doubt they are subject to the social disability which pursues those unfortunate sufferers from obvious and grotesque abnormality, but their intelligence is usually of the average and they are able to make a living after school age. The defect is not incompatible with length of life. In China I saw a marked case of achondroplasia in a native who was past middle age.

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