

THE GEOGRAPHICAL DISTRIBUTION OF GOITRE IN SCHOOL CHILDREN (ENGLAND AND WALES).

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(With 3 Maps and 1 Diagram.)

IN most European countries the geographical distribution of simple goitre is known from the number of men who are rejected on this account for military service^(1,2). There are no similar figures for Britain but what is known about its probable incidence has been discussed by Hirsch⁽²⁾ and by Berry⁽³⁾ and in a more recent paper, where it was also shown that there was a geographical distribution of the deaths from "exophthalmic goitre" as recorded in the Registrar General's reports⁽⁵⁾. There were still many gaps in our knowledge, especially as regards simple goitre, but there appeared to be some tendency for deaths from "exophthalmic goitre" to be more frequent in areas where goitre was endemic, though this was contrary to the evidence of most parts of the world where goitre was seriously endemic.

The routine school inspections which take place all over the country seemed the opportunity to learn the incidence of simple goitre, at any rate in children. Through the interest of Sir George Newman, Chief Medical Officer to the Board of Education, the various School Medical Officers were requested to make such a survey. Results for the year 1924-25 were obtained for nearly all the areas and gave several points of interest.

Since similar investigations have shown that the incidence of goitre increased as the children grew older it seemed best to examine those aged 13-14. The great difficulty, where the enquiry had to be made by so many observers, was to decide what standard of thyroid enlargement should be adopted. We hoped that some simple method which would not entail too much extra work would be most likely to succeed, and asked that the children in their last year at school (boys and girls separately) should be classified as:

A. Those in whom the thyroid was sufficiently enlarged for the increase in the size of the neck to be noticed on casual inspection (without measurement or palpation); and

B. Those in whom it was not so enlarged.

While recognising the drawbacks of this division, nothing better was suggested and the prospect of obtaining results which would be useful, even if not strictly accurate, seemed hopeful.

The first inspection of the returns was rather disappointing because it was evident that different medical officers had classified the children very differently. Neighbouring towns or areas where the conditions were apparently

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similar showed such enormous variations, and in some of the county areas where the work was done by several doctors there were big individual differences which did not seem to be due to the localities in which they had worked. This certainly means that any conclusions are not really reliable about a particular small area; but where the total number of observers is so large (about 350) the individual's point of view can be made less important by combining these small areas into larger ones. How far this method is justifiable depends on the range of variation, the number of observers, and whether their results appear to be haphazard or to show some general concordance. I think a study of the full figures will convince anyone that certain general conclusions can be drawn independent of any possible errors, while there is doubt about the details. Some illustrations of this will be given later.

The figures were given for the different areas of the educational authorities—boroughs, urban districts and county areas. The last are more likely to give the geographical information required and will be considered in detail after a few more general points.

GENERAL DISTRIBUTION.

The two results which are immediately obvious are that goitre is more common in the country than in the towns, and more common in the West of England than in the East. This is shown in Table I which also gives the relative incidence in boys and girls.

Table I. *Incidence of Goitre in School Children in Country and Town, in East and West, and in Boys and Girls.*

Area	Children inspected (thousands)	Children with goitre	%
West of England, } (counties)	86.4	7,402	8.5
Midlands and Wales } (towns)	123.5	5,865	4.8
East of England (in- } (counties)	60.6	2,654	4.4
cluding Yorkshire) } (towns)	92.2	1,809	1.9
West of England (total)	209.9	13,267	6.4
East of England (total)	152.8	4,463	2.9
All England (counties)	147.0	10,056	6.8
All England (towns)	215.7	7,674	3.5
All England, girls (approx.)	179.8	12,980	7.2
All England, boys (approx.)	182.9	4,750	2.6
England and Wales (total)	362.7	17,730	4.9

Shortly goitre is twice as common in the country as in the towns, more than twice as common in the West of England as in the East, and nearly three times as common in girls as in boys. It is rather surprising that the difference between boys and girls is not even more than this.

DISTRIBUTION OF GOITRE IN THE COUNTRY.

Here (and throughout this paper) the boys and girls have been taken together and the figure given is the percentage incidence for all children in their last year at school. As regards the rural districts of each county (*i.e.* omit-

ting the boroughs and urban districts) there are no figures available for Suffolk, Stafford, Westmorland or Cumberland. The figures for Hertford are uncertain as the incidence is given for all ages combined; the probable figure for children in their last year at school has been obtained by interpolating from other areas where the incidence at each different age is given. With these exceptions the figures are complete. Where the number of children inspected was less than a thousand, the county has been combined with a neighbouring one which seemed to give a similar result, *e.g.* Cambridge and Huntingdon, Oxford and Buckingham, Northampton and Rutland, and nine Welsh counties which have been combined in four groups.

Allowing for these omissions and combinations and for the three Ridings of Yorkshire, for which there are separate figures, there are 41 areas in each of which from one to seven thousand children were inspected. The full details for all of these are given in Table VI (columns 1-4) at the end. They fall fairly naturally into seven groups which will be taken in the order of decreasing incidence of goitre.

I. In the south-west of England the incidence is higher than anywhere else. This area includes Cornwall, Devon and Somerset, where the incidence is highest, and Gloucester, Dorset, Wiltshire and Hampshire. In Dorset the percentage incidence is so low as to make the figures doubtful; in Gloucester it is rather low; in all the other five it is high, and four of them are among the six counties with the highest incidence for all England and Wales—the other two being Hereford and the combined area of Oxford and Buckingham.

II. The next highest incidence is in a large area containing Lancashire, Cheshire, Worcester and Hereford and all Wales except Glamorgan. The percentage of children with goitre is very uniform, in each case between 8 and 11, except in Hereford where it is much higher and in Cardigan and Pembroke where it is much lower.

III. The incidence is almost as high in the Midlands of England, an area comprising Oxford and Buckingham, Northampton and Rutland, Leicester, Derby, Nottingham, Warwick, Shropshire and probably Stafford, for which there are only figures for the urban areas. The percentage of children with goitre is again rather uniform, being between 8 and 12 in each county, except in Oxford where it is much higher, and in Warwick and Shropshire where it is much lower.

IV. The next area is the north-east and includes Northumberland, Durham and Yorkshire. Generally the incidence is a little lower than in the second and third groups and in the North and West Ridings of Yorkshire it is considerably lower.

V. In the south-east (Kent, Sussex, Surrey and Berkshire) the incidence is still lower, the percentage varying from just under 3 to just over 6. It is rather striking that there are only four areas in the first three groups, Dorset, Warwick, Shropshire and Cardigan and Pembroke, where the incidence is as low as the average of this group.

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Just as in the first group the incidence is much higher than in any of the others, so in the last two the incidence is much lower.

VI. This is a large Eastern group containing Middlesex, Hertford, Essex, Cambridge, Huntingdon, Bedford, Norfolk, (Suffolk) and Lincoln. The incidence is uniformly low. In Bedford on the west of this group and approaching the Midlands it is 4.6; elsewhere it never reaches 4, and except in Norfolk is always below 3 per cent. In Essex it is lower than in any other county in England or Wales.

VII. The last group, in which the incidence is even lower, consists of two coastal counties, Monmouth and Glamorgan. Possibly Pembroke and Cardigan should be added, but the population of these two is too small to give reliable results, so they are included with the rest of Wales. This question of small numbers does not apply to Monmouth and Glamorgan, and another reason for thinking that the results are accurate is that when the distribution of exophthalmic goitre was considered, Monmouth and Glamorgan were again areas of low incidence contrasted with the rest of Wales in which it was high.

These data are given in Table II.

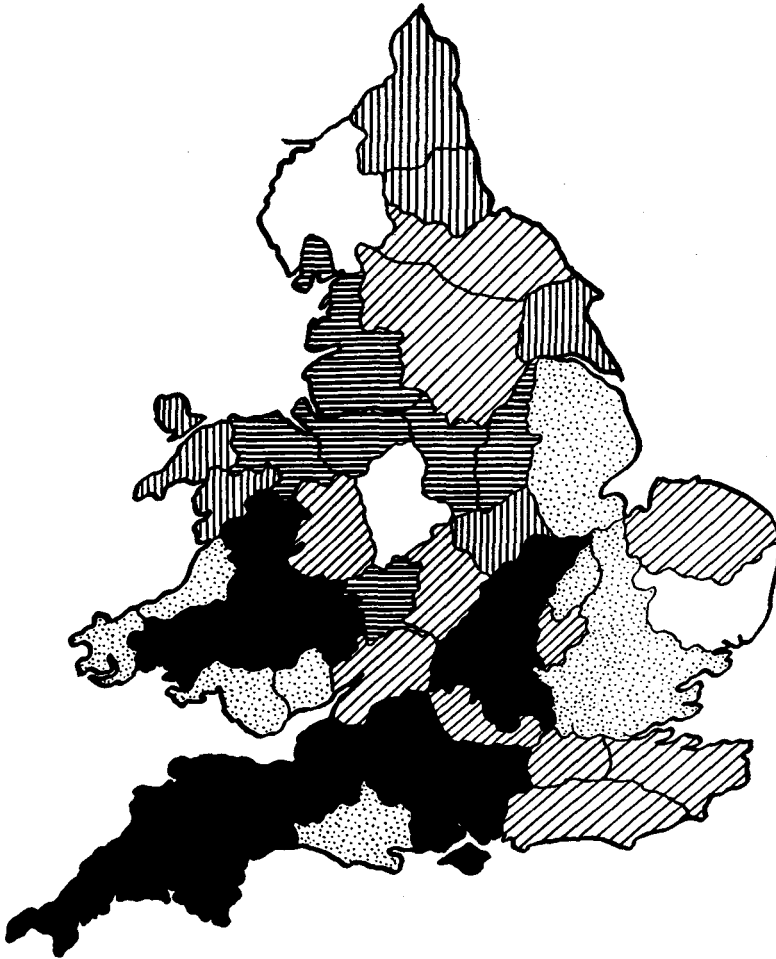
Table II. *Incidence of Goitre in School Children in Different County areas of England and Wales.*

Group	Counties	Children inspected (thousands)	Children with goitre	%
I	South-west; <i>i.e.</i> S.W. of and including Hampshire, Wiltshire and Gloucester	22.2	2766	12.5
II	West and North-west; <i>i.e.</i> Lancashire, Cheshire, Hereford, Worcester and Wales, excluding Glamorgan	26.1	2388	9.1
III	Midlands	26.1	2090	8.0
IV	North-east; Northumberland, Durham and Yorkshire	21.1	1306	6.2
V	South-east; Kent, Sussex, Surrey and Berkshire	17.5	865	4.9
VI	East; E. of and including Middlesex, Hertford, Bedford and Lincoln	22.0	483	2.2
VII	Glamorgan and Monmouth	11.9	158	1.3
	West and Central England and Wales	86.4	7402	8.5
	East of England	60.6	2654	4.4

Perhaps an even better idea of the state of affairs is given by Map I, which shows the incidence of goitre in school children in each county (the figures for the boroughs and urban districts being omitted). The map shows the 41 areas already referred to (p. 3), the detailed figures for which are given in the first four columns of Table VI at the end.

The generally high incidence in the West and Midlands and the low incidence in the East are clearly shown. Where a small area, *e.g.* Dorset or Cardigan and Pembroke, differs strikingly from the surrounding areas, it is impossible to say if these figures are accurate or if it depends on the adoption of a different standard by the inspecting medical officers. The natural grouping

of areas of high and low incidence which is generally shown could not have been produced by mere coincidence, and must represent with some degree of accuracy the true state of affairs.



Map I. Incidence of goitre in school children in counties. (Rural figures only.) This map shows the incidence in 41 separate areas, generally a county (see p. 3).

- More than 10.5
- From 8.6 to 10.5
- From 6.6 to 8.5
- From 2.6 to 6.5
- Up to 2.5

No information is left blank.

The main criticism of the grouping of Table II is that the map suggests a chain of relatively low incidence stretching northward from Glamorgan and Monmouth through Gloucester, Warwick, (Stafford) and Shropshire, between

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the two areas of Wales and the Midlands where the incidence is higher. The result would be to raise the average figure for Groups I and III to 14 and 10 by removing the area of lowest incidence in each group (Gloucester from Group I and Shropshire and Warwick from Group III), and at the same time to raise the figure for Group VII which would now be Glamorgan and Monmouth and an area between England and Wales, west of the Welsh border, to 2.4. The changes are not very great, and the data are not sufficient to decide which of these groupings gives the more accurate picture. Similarly Berkshire may be thought to belong to the Midland or South-western more naturally than to the South-eastern Group, with which it has been placed because of its similar low incidence; but the population is not large enough for this to make much difference statistically.

DISTRIBUTION OF GOITRE IN THE TOWNS.

Separate figures have been obtained for all the county boroughs and urban districts where there was an independent education authority. The figures for London have been excluded as the method of classification adopted was not strictly comparable, and there were a few other towns without any available figures. Broadly speaking these results confirm those for the country areas (compare Tables II and III), but they are more variable, possibly because the greater uniformity of a town water supply may minimise or exaggerate the effect of the average water supply of the villages and smaller towns of any area. Though there are differences in the order of the individual groups, in each of the three western groups the incidence is twice as great as the average in the three eastern groups.

Table III. *Incidence of Goitre in School Children in the Towns.*

Group	Area	Children inspected (thousands)	Children with goitre	%
I	South-west	18.9	761	4.0*
II and VII	West and North-west and Wales	68.8	3633	5.3
III	Midlands	35.8	1471	4.1
Wales and West and Central England. }				
Groups I, II, III and VII . }		123.5	5865	4.8
IV	North-east (including Yorkshire)	44.9	721	1.6
V	South-east	16.4	455	2.8*
VI	East	30.9	633	2.1
East of England (including Yorkshire, }				
Groups IV, V and VI }		92.2	1809	1.9

* The figures 4.0 and 2.8 would be changed to 5.3 and 2.4 by transferring Southampton and Portsmouth in which the incidence is very low from the South-western to the South-eastern group.

The individual results, some of which are given in Table VII at the end, are interesting. Though the figures for London are very low, the incidence in most of the other large towns is greater than in the smaller towns, e.g. Manchester 9.7, Bristol 7, and Birmingham 6.3, but Liverpool is low—1.7 (or excluding Bootle, still lower).

The most striking disagreement between the towns and surrounding district is in Glamorgan. In these towns over twelve thousand children were inspected and the percentage incidence of goitre was 6·8, a figure as high as that for any large urban area except parts of Lancashire and Cheshire. It is curious that these towns should agree with Wales as a whole rather than with their immediate surroundings, and there is no obvious explanation unless their water supply comes from further away in Wales. The figures for several separate towns show that almost certainly it is not due to the individual opinions of one or two doctors, *e.g.* Aberdare 15·5, Ebbw Vale 14·2, Pontypridd 8, Rhondda 5·4, Merthyr 4·1, Cardiff 3·6, Abertillery 2·6 and Port Talbot 1·6. It must be recalled that town figures are relatively low and that all these but the last two are above the general average.

With a few exceptions all towns with a high incidence of goitre fall into five groups as follows:

- (1) Bristol and several towns of Devonshire, where the high incidence agrees with that of the surrounding country.
- (2) Glamorgan, as already described.
- (3) The Midlands, especially round Birmingham.
- (4) Cheshire.
- (5) Parts of Lancashire.

The towns immediately round Birmingham fall into two groups: Wolverhampton, Wednesbury, Bilston, Dudley, Coventry and Leamington, in which the incidence is very low, generally less than 1 per cent.; and Birmingham, Rowley Regis, Walsall, Smethwick, Coseley, Oldbury and Sutton Coldfield, in which the average incidence is over 6 per cent. Leicester with an incidence of 4·5 and Derby, Ilkeston, Chesterfield and Glossop with an average incidence of 6·3 and Nuneaton and Kidderminster with an incidence of over 10 may be taken as belonging to the latter group. Again the reason for the difference between these two groups immediately round Birmingham is not at all obvious, but it does appear to be a real difference.

Lancashire and Cheshire will be considered later.

Figures found in these five areas of high incidence are not merely the range which might be expected in any industrial or urban area. The thickly-populated areas of the North-east Coast and of Essex, Middlesex and Kent show quite a different result.

In Essex there are six towns including East and West Ham, where over 7000 children were inspected, with an incidence of less than 0·5 per cent.; Barking, Leigh and Leyton with an incidence of 1 to 3 per cent.; and only Ilford with an incidence of 10 per cent. In Middlesex there are eight urban districts where the average incidence is 1 per cent. and only Hendon and Edmonton which have an incidence of over 5 per cent.

It is the same in Kent, where Maidstone and Tunbridge Wells have an incidence of about 10 per cent. of goitre, while in thirteen other towns the average incidence is about 1 per cent. I do not know whether the apparently

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high incidence in Ilford, Hendon, Edmonton, Maidstone and Tunbridge Wells is real or due to a different standard being used by the examiner—I am inclined to think it may be real in the two latter but fortuitous in the three former. In any case the state of affairs in the towns of these three counties is quite different from that in Lancashire, Cheshire and Derbyshire, and the figures for the separate towns point in the same direction as the figures for the rural areas.

There is the same general picture as in the South, in Northumberland, Durham and Yorkshire, where the average incidence of all the towns is between 1 and 2 per cent.—the figures for the larger towns being Newcastle 0·8, Tynemouth 0·2, South Shields 0·9, Sunderland 4·3, Hartlepool 0·5, Stockton 1·5 and Darlington 5·1; and in Yorkshire, Middlesbrough 0·1, Hull 0·3, York 1·5, Bradford 1·6, Halifax 0·5, Huddersfield 0·8, Leeds 1·2, Wakefield 0·3 and Sheffield 2·9.

While in the south-east the figures for the towns are lower than the country figures by the usual proportion, in this North-eastern group they are very considerably lower. The relatively high figures for the county probably depend on the inclusion of some small areas, where the endemicity of goitre is quite high, with the great bulk of the area where it is much lower(4).

In the thickly populated areas round London and on the North-east Coast the usual incidence of goitre is about 1 per cent. and there are only a few towns where it is recorded as much higher than this; in the equally thickly populated areas of Lancashire about half the towns show this high incidence of from 10 to 15 per cent. Perhaps the contrast in the figures for Lancashire and Yorkshire is the most striking because the industrial and social conditions are so closely parallel.

It is clear that in many particulars the towns bear out the distribution of goitre which was found for the county areas. The complete figures for all the areas for which there are statistics are given in Table IV which includes county areas and urban districts and county boroughs which have separate education authorities.

Table IV. *Incidence of Goitre in School Children in Different Areas of England and Wales (Town and Country).*

Group	Area	Children inspected (thousands)	Children with goitre	%
I	South-west	41·1	3,527	8·6
II	West and North-west and Wales (excluding Glamorgan and Monmouth)	80·8	5,147	6·4
III	Midlands	61·9	3,561	5·8
IV	North-east (including Yorkshire)	66·0	2,027	3·1
V	South-east	33·9	1,320	3·9
VI	East	52·9	1,116	2·1
VII	Glamorgan and Monmouth	26·0	1,032	3·9
Western and Central England and Wales. } Groups I, II, III and VII		209·8	13,267	6·4
East of England (including Yorkshire). Groups IV-VI		152·8	4,463	2·9

DETAILED DISTRIBUTION IN LANCASHIRE AND CHESHIRE.

This area is specially interesting because separate figures are given for a large number of towns and because the report for the Lancashire rural areas gives a complete geographical summary of the findings⁽⁶⁾ so that the survey here is unusually detailed.

In Cheshire the results are with two exceptions uniformly high—Wallasey 18, Stalybridge 16, Chester 15, Crewe 12, Hyde 11, Congleton 10 and Ashton 7 per cent. Only Birkenhead and Stockport are very low, less than 1 per cent.

In Lancashire the following areas showed an incidence of more than 10 per cent., viz. Blackpool, Preston (urban), Preston (rural), Clitheroe and the lower Ribble valley in the north; Colne, Great Harwood, Church, Clayton-Moor, Rishton, Oswaldtwistle, Blackburn (rural), Chorley (rural), Ramsbottom, Turton and Torrington in and near the Colne valley; and Lever, Hindley, Ashton in Makerfield, Newton in Makerfield, Prestwich and Ormskirk farther south. In Manchester itself the incidence was 9.7 per cent. and Swinton, Chadderton, Rochdale, Heywood and Darwen only just failed to reach 10 per cent.

In Lancashire as a whole over 50,000 children were inspected by a large number of medical officers and the average incidence of goitre was 5.4 per cent. This is apparently only just above the average for all England, but it is considerably above, when the large urban and relatively small rural population have been taken into account. Looking at the figures in more detail it appears that most of the areas of high incidence are in the hills and foothills to the east, and that in the plains of the west of Lancashire and the Wirral peninsula of Cheshire the incidence is almost invariably low.

It is possible to draw a line passing from north to south with two or three bends which divides Lancashire and Cheshire into two halves in each of which about 30,000 children were inspected. To the east of this line the average incidence of goitre is 9 per cent. and it generally varies from 4 to 15 per cent.; to the west of it the average is 2 and there are very few towns with an incidence above 4 per cent.

This line starts north of Chester and passes east to the foothills, so that Birkenhead in the Wirral peninsula and Stockport in the east are both included with the plains. It passes northwards along the foothills, with a western projection to include Manchester and some urban districts to the north-west, and then makes a smaller reverse bend to the east to include Bolton and Bury with the plains. The dividing line would be straighter if these two were included with the foothills to which they naturally seem to belong, but in both of them the incidence is recorded as low.

It then follows the foothills for the rest of its course, except that at the debouchment of the Colne and Ribble valleys, in both of which the incidence is high, it bends to the west to include these river valleys right up to the sea

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coast. This brings Preston and Blackpool, with an incidence of 17 and 12, into the group of the foothills.

This line may seem an artificial one but it would hardly be possible to divide such a large area into two parts by any line at all, unless there was some real physical difference producing the different effects in the two halves. Of all the towns already mentioned with a high incidence Ormskirk is the only one which falls to the west of this dividing line. There may be some areas which are shown in wrong groups because of the adoption of varying standards, but of the general truth of this irregular division into eastern and western halves there can be no doubt.

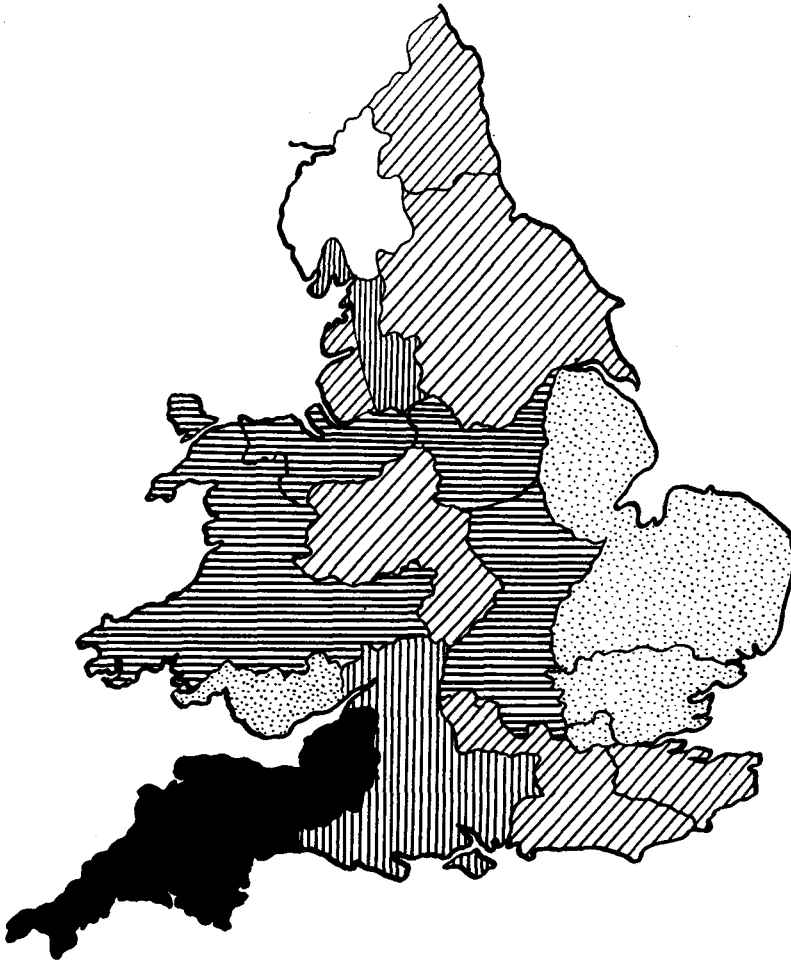
COMPARISON OF THE DISTRIBUTION OF SIMPLE GOITRE AND EXOPHTHALMIC GOITRE.

One point of special interest is to see the resemblance between the distribution of simple goitre as shown by these school inspections, and "exophthalmic goitre" as shown by the deaths in the reports of the Registrar General. In some parts there is a striking agreement, but in others obvious if less striking divergence. Both are more common in the country than in the towns and in the West than in the East, but exophthalmic goitre is more common on the East Coast than in the Midlands while the reverse was true of simple goitre. The statistics for exophthalmic goitre were obtained separately for county boroughs and urban and rural districts, and those for simple goitre, for all areas in which there was a separate education authority, with the result that an absolute comparison is not possible.

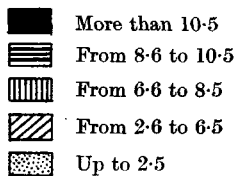
A comparison can most easily be made from the maps showing the distribution of the two conditions. Map I (p. 5) which shows the incidence of simple goitre may be compared with the second map in the paper already quoted which gives similar information for exophthalmic goitre (2, p. 199). The latter is for rural and urban districts (excluding the county boroughs), while the former is for rural areas only, but if the urban districts and smaller county boroughs (in which less than 1800 children were examined) are added to the county areas the changes would not generally be great, except in Northampton, and West Lancashire which would have a lower incidence owing to the inclusion of large towns with low incidence of goitre such as Liverpool. The other changes would be decreases in Cornwall, Worcester, Northumberland, Durham, Yorkshire (E. R.) and Berkshire and slight increases in Dorset, Hertford and Glamorgan.

To avoid this difficulty Maps II and III (pp. 11, 12) have been prepared to show the distribution of simple goitre and exophthalmic goitre. As for the statistics of exophthalmic goitre, rural and urban areas were taken together without the county boroughs, here for simple goitre the figures from the county education authorities have been combined with those for all the towns, except the larger ones mentioned below.

England and Wales have been divided into seventeen areas (of very different size, in each of which from 10,000 to 20,000 children were inspected),



Map II. Incidence of goitre in school children in seventeen larger areas. (Rural and urban figures.) This map shows the incidence in seventeen larger areas obtained by grouping neighbouring counties with those of most similar incidence. Rural and urban figures are made use of except that some of the largest towns are excluded (see p. 12).

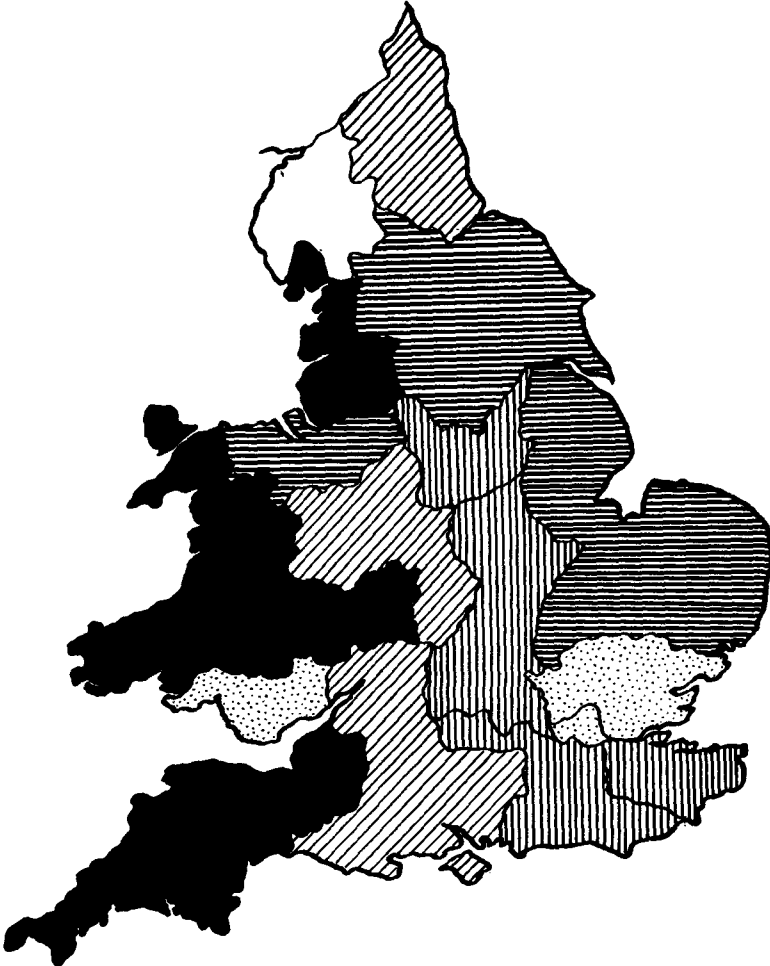


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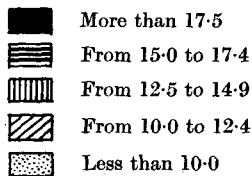
so that comparison may be easier and statistical errors may be minimised. The figures for exophthalmic goitre have been taken from the paper already

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quoted; those for the seventeen areas for simple goitre are given in full in Table VI, columns 5-7, and the groups are shown as I A-B, II A-D, etc.



Map III. Incidence of exophthalmic goitre. This map shows the death-rate from exophthalmic goitre as recorded in the Registrar General's reports for the same seventeen areas (figures for rural and urban districts excluding county boroughs). Incidence of exophthalmic goitre as deaths annually per million of population.



Thirty-one of the larger towns in which more than 1800 children were inspected (see in Table VII) have not been included because the lower urban incidence

would make the comparison less fair between areas which are mainly rural and others which are mainly industrial.

A comparison of these maps shows striking agreement in two points and one obvious discrepancy. The South-west of England and most of Wales agree in having a high incidence of both. Glamorgan and Monmouth and Essex, Hertford and Middlesex agree in having a low incidence of both. But an area on the East Coast north of this, up to and including Yorkshire, has much exophthalmic and little simple goitre.

To consider this in rather more detail, four areas agree in showing a high incidence of both: Cornwall, Devon and Somerset; Hereford and most of Wales; Lancashire and Cheshire; and Oxford. The North and East Ridings of Yorkshire, Cardigan and Pembroke, and to a lesser extent Lincoln and Sussex, show a lot of exophthalmic but little simple goitre. The resemblances here are more striking than the differences.

The most important groups with a low incidence of exophthalmic goitre are four, viz.: Essex, Middlesex and Hertford; Monmouth and Glamorgan; Dorset; and Durham. Except for Durham all of these have a low incidence of simple goitre, but a large group comprising most of the Eastern counties must be taken with Essex, Middlesex and Hertford. It is here in the East that the differences are greatest. Except for Essex, Middlesex and Hertford, there was more exophthalmic goitre on the East Coast than in the Midlands. With simple goitre the reverse is the case and the divergence is specially great in Derby, Leicester, Northampton and Worcester, which have little exophthalmic and a good deal of simple goitre. Wiltshire, Hampshire and Nottinghamshire also show a lot of simple but less exophthalmic goitre.

It is desirable to obtain more objective measurement of the correlation of these two sets of figures. This has been done by the "scatter" diagram (p. 14) where the percentage incidence of goitre in the various counties has been plotted against the mortality (per million living) from exophthalmic goitre. There is no very close agreement but with the exception of Hampshire and Wiltshire with more, and Lincoln and Cardigan and Pembroke with less goitre than would be expected, all the other counties lie within a broad band about a mean line, showing that within this considerable range of variation simple and exophthalmic goitre tend to increase together. In this diagram all the towns except those in which more than 1800 children were inspected during the year have been included with the county areas for the reasons already given.

The statistics for all the separate towns have not been recorded here because where small areas are concerned so much depends on the exact standard of classification adopted by one medical officer. Table V, in which a few towns have been omitted because figures are not available for both, shows the eight towns where the recorded death-rate from exophthalmic goitre was highest and the eight where it was lowest, with the corresponding incidence of goitre among school children. In six of the eight former the

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incidence of goitre in school children is high, being generally double and often considerably more than double that for the whole country. In the latter the incidence of goitre is very low except in two, being generally less than half of the average for the whole country.

Perhaps the agreement is really closer than appears for of the two apparent exceptions in the first group, Oxford is in the centre of a county where the incidence is exceptionally high and Bolton is situated in a similar part of Lancashire; while in the second group Walsall and Sunderland are in areas where many if not most of the other towns have a very low incidence. It is

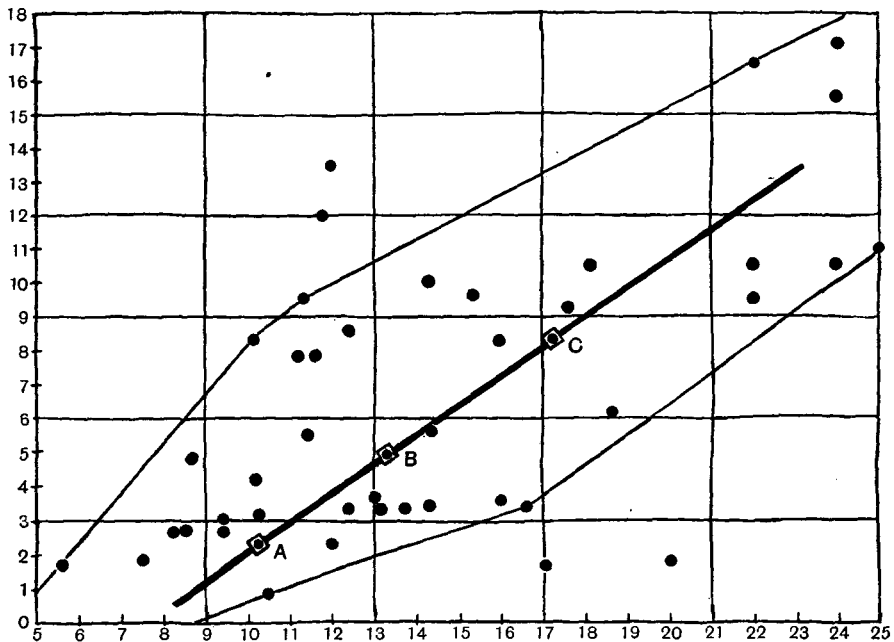


Diagram showing the incidence of simple goitre (as the percentage occurring in school children) compared with the incidence of exophthalmic goitre (as shown by the deaths annually per million living) in the various counties. That there is some positive correlation is shown by nearly all the points falling in the broad area between the two thin lines and by the regular thick line which gives the average result for three large groups (*A* = Groups VI and VII; *B* = Groups III, IV and V, and *C* = Groups I and II).

only fair to add that a similar comparison for towns which are not so near one or other extreme is much less striking, but this might be expected. The agreement shown in Table V could not possibly be reached by chance and at these extremes the changes are sufficiently striking to override any variations of standards in the method of inspection. A "scatter" diagram for the towns similar to that for the counties certainly shows much less agreement, probably because these are often the results of one medical officer, whose personal factor is not eliminated in any way, while in the county areas this has been done to some extent.

Table V. *The Incidence of Goitre in School Children in Towns where the death-rate for Exophthalmic Goitre is high and low.*

Town	Death rate from exophthalmic goitre (per million living)	Incidence of goitre in school children %
A. Much exophthalmic goitre		
Hastings	30.9	12.6
Rochdale	30.7	8.8
Blackpool	30.4	12.4
Wallasey	27.1	18.9
Bolton	24.8	0.5
Plymouth	24.7	7.4
Oxford	23.7	3.2
Burton-on-Trent	21.3	6.1
B. Little exophthalmic goitre		
West Ham	3.0	0.7
Halifax	3.0	0.5
Sunderland	3.7	4.3
East Ham	3.9	0.3
Rotherham	4.4	0.9
Walsall	4.6	6.4
Southampton	4.7	2.0
South Shields	5.0	0.9
Average A	26.8	8.7
Average B	4.2	2.0
Average all England	11.2	3.6

CONCLUSIONS.

1. Statistics have been obtained for the incidence of goitre in children during their last year at school. It has been difficult to obtain a standard for observations by so many school medical officers, and some of the figures are obviously invalidated by this difficulty. By combining groups of results and by treating the figures statistically this can be minimised.

2. In girls goitre is about three times as common as in boys; in the West more than twice as common as in the East; and in the country nearly twice as common as in the towns. In addition to this there is a definite geographical distribution.

3. Goitre is most common in: (1) the south-west of England, with which perhaps Wiltshire and Hampshire should be included; (2) Hereford and most of Wales; (3) much of Lancashire, Cheshire, Derby and Nottingham; (4) a midland group comprising Oxford and perhaps Buckingham and Northampton.

4. Goitre is least common in: (1) Glamorgan and Monmouth; (2) Essex, Hertford and Middlesex; (3) an eastern group north of this up to and including Lincoln.

5. There is no evidence that proximity to the sea coast is itself a factor of predominant importance. Most of the areas where the incidence is specially low and many where it is specially high are on the sea coast.

6. Here and in most other countries where the incidence of goitre is known, hills seem to play a much more important part, as is shown by a comparison of the first map here produced with a physical map of England and Wales.

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7. There is some correlation between the incidence of simple goitre in school children and the deaths from "exophthalmic goitre" as recorded in the Registrar General's report. The question whether these deaths are true exophthalmic goitre or hyperthyroidism following adenoma is difficult to settle. In either case it is an additional reason for systematic treatment in areas where the incidence is high. This agrees with experience round the Great Lakes of North America, but is contrary to what is found in most parts of the world where goitre is seriously endemic.

I wish to thank Sir George Newman, Chief Medical Officer to the Board of Education, for permission to publish these figures, and Dr R. H. Crowley for his assistance and helpful discussion.

Table VI. *Incidence of Goitre in School Children in each County of England and Wales.*

1	County areas alone			County areas with all but the larger towns (see Table VII)		
	2	3	4	5	6	7
	Children inspected	Children with goitre	% with goitre	Children inspected	Children with goitre	% with goitre
Cornwall	2,357	258	10.9	2,477	258	10.4
Devon	4,532	614	13.6	7,225	763	10.6
Somerset	2,496	610	24.5	4,047	667	16.5
I A	9,385	1482	15.8	13,749	1688	12.3
Dorset	2,064	12	0.6	2,851	87	3.0
Hampshire	5,595	841	15.0	6,303	870	13.8
Gloucester	3,772	190	5.0	5,990	219	3.7
Wiltshire	1,354	241	17.8	2,585	310	12.0
I B	12,785	1284	10.0	17,729	1486	8.4
Group I	22,170	2766	12.5	31,478	3174	10.1
Oxford and Buckingham	2,015	380	18.8	2,981	414	14.0
Northampton and Rutland	3,122	349	11.2	4,680	371	7.9
Leicester	3,411	281	8.2	3,577	282	7.9
III A	8,548	1010	11.8	11,238	1067	9.5
Warwick	3,865	99	2.6	6,058	189	3.1
Stafford	—	—	—	9,036	303	3.4
Shropshire	3,633	115	3.1	4,050	138	3.4
III B	7,498	214	2.8	19,144	630	3.3
Derby	7,165	609	8.6	8,587	729	8.5
Nottingham	2,891	257	8.6	3,661	366	10.0
III C	10,056	866	8.6	12,248	1095	8.9
Group III	26,102	2090	8.0	42,630	2792	6.5
II A. Lancashire (N.W.) }	6,543	607	9.2	15,883	1285	8.1
II B. Lancashire (S.E.) }				10,793	313	2.9
Cheshire	6,377	571	9.0	8,852	862	9.7
Denbigh and Flint	2,040	187	9.2	2,040	187	9.2
II C	8,417	758	9.0	10,892	1049	9.6
Hereford	1,232	197	16.0	1,520	257	16.9
Worcester	3,952	362	9.1	5,013	422	8.3
Carnarvon and Merioneth	1,477	121	8.2	1,477	121	8.2
Montgomery, Radnor and Brecknock	1,416	154	10.9	1,416	154	10.9
Carmarthen	1,442	155	10.7	1,442	155	10.7
Cardigan and Pembroke	1,686	34	2.1	1,849	34	1.8
II D	11,205	1023	9.1	12,717	1143	9.0
Group II	26,165	2388	9.1	50,285	3790	7.5

Table VI—Continued.

1	County areas alone			County areas with all but the larger towns (see Table VII)		
	2	3	4	5	6	7
	Children inspected	Children with goitre	% with goitre	Children inspected	Children with goitre	% with goitre
Glamorgan	7,942	83	1.0	10,491	289	2.7
Monmouth	3,950	75	1.9	5,570	98	1.8
Group VII	11,892	158	1.3	16,061	387	2.5
Northumberland	4,373	316	7.2	5,750	324	5.6
Durham	6,654	516	7.7	13,900	677	4.9
IV A	11,027	832	7.5	19,650	1001	5.1
Yorkshire (E. R.)	2,930	248	8.4	4,111	251	6.1
Yorkshire (N. R.)	4,054	105	2.6	5,429	188	3.5
Yorkshire (W. R.)	3,079	121	3.9	11,440	309	2.7
IV B	10,063	474	4.7	20,980	748	3.6
Group IV	21,090	1306	6.2	40,630	1749	4.3
Berkshire	1,844	42	2.8	4,050	95	2.3
Surrey	6,368	411	6.5	8,810	485	5.5
Sussex	3,460	134	3.9	5,790	220	3.8
V A	11,672	587	5.0	18,650	800	4.3
V B. Kent	5,859	278	4.7	15,250	520	3.4
Group V	17,531	865	4.9	33,900	1320	3.9
Hertford	1,400?	35?	2.5	1,620	49	3.0
Essex	4,828	20	0.4	9,473	180	1.9
VI A	6,228	55	0.9	11,093	229	2.1
VI B. Middlesex	3,921	99	2.5	12,724	299	2.3
Cambridge and Huntingdon	2,404	23	0.9	3,674	29	0.8
Bedford	1,340	62	4.6	2,200	93	4.2
Norfolk and (Suffolk)	3,532	137	3.9	7,460	264	3.5
Lincoln	4,609	107	2.3	6,670	121	1.8
VI C	11,885	329	2.8	20,004	507	2.5
Group VI	22,034	483	2.2	43,821	1035	2.4

Table VII. Incidence of Goitre in School Children in the larger Towns, where more than 1800 children were inspected (not included in Table VI).

Group	Town	Children inspected	Children with goitre	% with goitre
I	Bristol	4302	301	7.0
	Southampton	2230	45	2.0
	Portsmouth	3057	7	0.2
III	Birmingham	3415	216	6.3
	Stoke	4955	163	3.3
	Dudley	3484	18	0.5
	Walsall	1995	127	6.4
	Leicester	3457	156	4.5
	Derby	1931	89	4.6
II	Birkenhead and Wallasey	3292	144	4.4
	Stockport	2900?	21	0.7
	Preston	1881	325	17.2
	Bolton	2922	16	0.5
	Middleton	1918	56	3.0
	Manchester	6523	631	9.7
	Salford	2850	93	3.3
	Liverpool, etc.	8305	71	0.9
VII	Cardiff	2872	105	3.6
	Merthyr	1878	76	4.1
	Rhondda	3178	172	5.4
	Ebbw Vale	2051	292	14.2

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Table VII—*Continued.*

Group	Town	Children inspected	Children with goitre	% with goitre
IV	Newcastle	6085	49	0·8
	Middlesborough	2294	3	0·1
	Kingston-on-Hull	4103	14	0·3
	Bradford	1896	31	1·6
	Leeds	4258	51	1·2
	Wakefield	2404	7	0·3
	Sheffield	4314	123	2·9
VI	West Ham	4851	34	0·7
	East Ham	2412	9	0·3
	Leyton	1895	38	2·0

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