STATURE AND WEIGHT OF MEN FROM ENGLAND AND WALES IN 1941

BY

E. M. B. CLEMENTS AND KATHLEEN G. PICKETT

Department of Anatomy, University of Birmingham

Variation in stature and weight from one region of Britain to another is generally taken for granted: the short Welshman, the burly Scot, and the tall Southerner are accepted national types. But until recent years, there has been little scientific evidence to confirm the reality of such differences in physique, for in the 20th century no extensive anthropometric survey was undertaken to collect the necessary information about the whole population until the second world war. The nearest approach to such a study was the work of the Industrial Health Research Board between 1929 and 1932 (Cathcart, Hughes, and Chalmers, 1935), but this was mainly concerned with the principal industrial areas of England and Scotland.

Between 1939 and 1945, however, a substantial proportion of the population was measured in the course of medical examinations before National Service and of surveys made to assess the adequacy of the diet in the civilian population in war-time conditions. The data so obtained have already formed the basis of a number of reports, including the results of a survey of young adult males measured in 1939 (Martin, 1949), a survey of civilians measured in 1943 (Kemsley, 1950), and a survey of Royal Air Force personnel (Morant, 1949-50).

The present study presents an analysis of the stature and weight of men from England and Wales measured in 1941 by medical boards of the Ministry of Labour and National Service before call up for the services. It shows, in conjunction with the previously published reports relating to Scotsmen measured at the same time (Clements and Pickett,

1952, 1954), the extent of regional variation in recent years. The relationship of these measurements to each other, and to age and socio-economic status, also extends the study of Scotsmen to the whole country.

MATERIAL

Details of the material, methods of sampling, and information abstracted from the records have been given in a previous report (Clements and Pickett, 1952). The same system has been followed in the present survey.

Men on whom the survey is based were examined at ninety medical boards in England and eight in Wales. The towns in which the boards were held have been grouped into twelve regions in England and two in Wales, in accordance with the Registrar-General's geographical classification.

By means of a sampling fraction based on the total number of examinations made in the period between January 1 and March 31, 1941, a sample of approximately 200 was taken from the records available for each medical board. In all 22,315 records were collected, 1,019 of which (4.6 per cent.), mostly men with gross disability, were rejected because information was lacking. The analysis is therefore based on the measurement of 21,296 men from England and Wales.

Men attending the boards wore only trousers while being examined.

Table I shows the distribution of the sample by age.

TABLE I
DISTRIBUTION BY AGE

Age (yrs)	17	18	19	20-24	25-29	30-34	35-39	40-44	45-49
Number	62	583	5,123	4,834	2,481	2,220	5,922	45	26
Percentage	0.29	2.74	24.06	22.70	11.65	10.42	27.81	0.21	0.12

Table II shows the distribution by social class. The social classes correspond to the Registrar-General's classification of occupations (General Register Office, 1951). Students have been placed in Class 2. Classes 1 and 2 have been combined because the number of men in Class 1 is small, and Classes 4 and 5 have been combined because they were found to be very similar.

TABLE II
DISTRIBUTION BY SOCIAL CLASS

Social Class	Data (1941)			Census (1951)	British Association Anthropometric Committee (1883)
	England and Wales		Scotland		
	Number	Percentage	Percentage	Percentage	Percentage
1/2	1,676	7.9	9.2	18.3	43.2
3	10,233	48.0	47.1	52.7	33.6
4/5	9,387	44.1	43.7	29.0	23.2
Total	21,296	100.0	100.0	100.0	100.0

The social class distribution of Scottish National Servicemen measured in 1941 and of the total population of England and Wales in 1951 (General Register Office, 1954) are also given in Table II. The distributions of the two groups of National Servicemen are similar, but in comparison with the 1951 population they show under-representation of Class 1/2 and over-representation of Class 4/5. An examination of the distribution of volunteers and conscripts among Scottish National Servicemen showed a significantly greater proportion of volunteers in Class 1/2 and a significantly smaller proportion in Class 4/5, and it may be that the disproportionate distribution of classes is attributable to the earlier voluntary enlistment of a relatively larger number of Class 1/2 men.

RESULTS

STATURE.—Since Scotsmen are normally distributed by stature (Clements and Pickett, 1952), the usual tests of statistical significance are appropriate. In the following discussion all differences to which attention is drawn satisfy the conventional criteria (5 per cent. level of significance).

(a) *Geographical Variation.*—The Figure (opposite) shows county boundaries and the Registrar-General's geographical regions of England and Wales within which stature has been examined.

It will be seen that northern England is divided into four regions:

North I Northumberland and Durham;

North II North and East Ridings of Yorkshire with Cumberland and Westmorland;
North III West Riding of Yorkshire;
North IV Cheshire and Lancashire.

The Midlands are divided into two regions:

Midland I Western counties;
Midland II Eastern counties.

The East, South-East, and South-West, regions are not sub-divided.

Greater London is considered separately.

Wales I includes the counties of South Wales and Wales II those of North Wales.

Table III gives the mean stature in regions of England, Wales, and Scotland. In England, stature appears to diminish as one moves northwards. The lowest mean stature is found in Wales and in the most northerly counties of England.

TABLE III
MEAN STATURE AND WEIGHT IN EACH GEOGRAPHICAL REGION, IN ORDER OF STATURE

Region		Number	Mean Stature (in.)	Mean Weight (lb.)
England	South-East ..	3,929	67.56 ± 0.04	138.2 ± 0.3
	South-West ..	1,670	67.45 ± 0.06	137.5 ± 0.4
	Midland II ..	1,356	67.29 ± 0.07	135.1 ± 0.5
	Midland I ..	1,963	67.21 ± 0.06	135.9 ± 0.4
	Greater London ..	1,920	67.15 ± 0.06	136.7 ± 0.4
	East ..	1,512	67.09 ± 0.07	137.5 ± 0.5
	North III ..	2,011	67.04 ± 0.06	135.0 ± 0.4
	North II ..	1,289	66.73 ± 0.07	134.6 ± 0.5
	North IV ..	2,760	66.73 ± 0.05	132.9 ± 0.3
	North I ..	1,113	66.51 ± 0.08	134.3 ± 0.5
All		19,523	67.14 ± 0.02	135.9 ± 0.1
Wales	Wales II ..	628	66.60 ± 0.11	134.7 ± 0.7
	Wales I ..	1,145	66.53 ± 0.08	133.2 ± 0.5
	All	1,773	66.55 ± 0.06	133.7 ± 0.4
Scotland	Southern ..	409	66.96 ± 0.13	140.6 ± 0.9
	Northern ..	1,285	66.94 ± 0.07	141.9 ± 0.5
	East Central ..	895	66.78 ± 0.08	135.8 ± 0.6
	West Central ..	1,103	66.65 ± 0.08	134.8 ± 0.5
	All	3,692	66.82 ± 0.04	138.2 ± 0.3
Total England, Wales, and Scotland		24,988	67.05 ± 0.02	136.2 ± 0.1

Since the previous analysis of Scottish data (Clements and Pickett, 1952) indicated that socio-economic status is the main source of variation in adult stature, the data for England and Wales have been divided into three social class groups. An analysis of variance was used to test differences between the statures of men in the same social class who were examined at different boards in the same region. The results enabled "homogeneous regions" to be built up, that is, regions within which no significant variation in stature was found.

There was no significant regional variation in stature in Class 1/2, except in the case of one board

(Barnsley) in region North III, where the average stature was low.

In Class 3 five boards showed deviations from the prevailing stature of the region: men from the Tottenham board (Greater London) were shorter; men from Doncaster and Sheffield (North III) and Swansea and Cardiff (Wales I) were taller. No unusual circumstance was apparent to account for the Cardiff board's deviation, but Tottenham had a raised incidence of men over 30, and the other three boards had a raised incidence of men under 20 years of age.

In Class 4/5, seven boards showed statures greater than the remainder of their regions: Hounslow and

Willesden (Greater London); Taunton, Bath, and Weymouth (South-West); Cambridge (East); and Barrow (North IV). Except in the case of Weymouth, where the sample was disproportionately young, there was no obvious explanation for these differences.

It seems hard to believe that the deviations from the mean stature of other boards in the same region which have just been detailed reflect a genuine geographical variation on what can only be a minute scale. No one factor seems responsible and the explanation remains obscure although there is perhaps a hint that the more urbanized or industrialized centre has an above average stature for the region.

FIGURE.—Registrar-General's geographical regions in England and Wales.
The four areas homogeneous for stature into which the population of Social Class 3 has been grouped are indicated. The county boundaries are very lightly shown within the four areas.

REGIONS

- S.W. South-west (Cornwall, Devon, Dorset, Somerset, Wilts.)
- S.E. South-east (Hants., Sussex, Surrey, Kent, Oxon., Berks., Bucks., Herts, Beds, Essex.)
- L. Greater London
- E. East (Cambs., Lincs., Norfolk, Suffolk)
- M.1. Midlands I (Salop, Staffs., Glouces., Herefs., Worc.)
- M.2. Midlands II (Derbys., Notts., Leics., Warwicks., Northants.)

- N.1. North I (Northumb., Dur.)
- N.2. North II (Cumb., Westmorland, N. Rid., E. Rid.)
- N.3. North III (W. Rid.)
- N.4. North IV (Ches., Lancs.)
- W.1. Wales I (Carmarth., Breck., Glam., Mon.)
- W.2. Wales II (Pemb., Radnor, Cards., Mont., Merioneth., Caernarvon, Anglesey, Flint, Denbighs.)

The data from the unusual samples have been excluded from the computation of the statistics for the various regions. Within each social class group, these statistics have been combined to form areas over which an analysis of variance indicated no significant deviation in stature; Table IV shows the ten groups obtained, three for Classes 1/2 and 4/5, and four for Class 3 (Figure).

Although the combination of regions is not identical for each social class, a similar pattern emerges: decreasing stature from south to north, with Wales always in the group with the shortest mean stature. The two Midland regions are the most stable; for there is little difference between them or their constituent boards, and they are always found in the same group as Greater London and the Eastern region.

A very similar distribution was found by Cathcart, Hughes, and Chalmers (1935) for men measured in England and Scotland between 1929 and 1932, and by Martin (1949), whose figures refer to men in England, Scotland, and Wales between the ages of 20 and 21, measured in 1939. Martin's data are

not generally comparable with those of the present survey, as the age range and the regions into which the men are grouped are very different. Both surveys, however, confirm that the average stature of Englishmen in the south is greater than that of men both in the north of England and in Scotland. It seems to be clear that the factors leading to variation in stature from one part of the country to another affect all sections of the community to a similar extent.

The relative position of men living on the borders of Scotland is perhaps the most surprising. Beddoe (1870), who made the first regional study of the stature and weight of British men, found the inhabitants of the Border country to be the tallest in his sample, which was due, he believed, to a "strong Scandinavian element" among them. Some of his shortest subjects came from the southern counties, but his average for Lancashire was "as low or lower than the rest of England", and similar conclusions were drawn by the British Association Anthropometric Committee of 1883. Table II, however, shows that the social class distribution

TABLE IV

MEAN STATURE (IN.) OF AREAS IN ENGLAND AND WALES SHOWING NO SIGNIFICANT VARIATION IN STATURE

Social Class								
1/2			3			4/5		
Area	Region	Mean Stature and Standard Deviation	Area	Region	Mean Stature and Standard Deviation	Area	Region	Mean Stature and Standard Deviation
1	South-East	68·52 ± 0·11 S.D.: 2·64	4	South-East	67·66 ± 0·05 S.D.: 2·50	8	South-East	67·22 ± 0·07 S.D.: 2·63
	South-West			South-West				
2	Greater London	67·91 ± 0·09 S.D.: 2·57	5	Greater London, without Tottenham	67·44 ± 0·04 S.D.: 2·58	9	South-West, without Bath, Taunton and Weymouth	66·68 ± 0·04 S.D.: 2·68
	East			East			Greater London, without Hounslow and Willesden	
	Midlands I			Midlands I				
	Midlands II		Midlands II					
	North II		North I					
	North III, without Barnsley		North II					
North IV	6	North III, without Doncaster and Sheffield	66·96 ± 0·05 S.D.: 2·64	Midlands I				
	North IV	North III						
3	North I	67·02 ± 0·17 S.D.: 2·64	7	Wales I, without Cardiff and Swansea	66·55 ± 0·11 S.D.: 2·58	10	North I	66·30 ± 0·05 S.D.: 2·68
	Wales I			Wales II			North II	
	Wales II						North IV, without Barrow	
				Wales I				
				Wales II				

N.B. Each group of homogeneous regions has been numbered, and the areas formed are identified in the text by these numbers.

in at least the latter sample was not representative and it seems likely that, in both reports, differences in stature attributed to regional variation are the result of the variation from place to place in the proportion of men of differing socio-economic environment. Stature differences between social class groups appear to have been greater at that time than they are to-day, and their uneven representation may be one reason for the discrepancies.

Migration since the time of the earlier surveys may also have had its effect. The figures given by Martin (1949) show that immigrants into a region, defined as men whose birthplace differs from the town in which they registered for National Service, are almost invariably taller than natives, and that migration to the southern counties has been at a particularly high level. Immigrants may even form over a third of the population in parts of the south-east and south-west of England, while in the north they may reach only 15 per cent. or less of the total. In Scotland the figure for immigrants is 3 per cent. and in Wales 6 per cent. These proportions, as Martin admits, may be over-estimates, but, although some of the men may have moved in childhood, the figures are sufficient to show a very marked trend from north to south.

The mean of 5' 7" for the whole country, obtained when all the social class groups are pooled, agrees with Beddow's estimate made in 1870 of between 5' 6" and 5' 7"; it is however a little shorter than that of 5' 7½" given by the British Association Anthropometric Committee in 1883. Beddow's sample includes a much higher proportion of working men and middle-class men than does the survey of 1883, and his estimate is probably closer to the national mean at that time.

Some small part of regional variation in stature may be of racial origin, but the data suggest that only in Wales and some areas of Scotland has isolation been sufficient for racial characteristics to survive into the 20th century. The Celts, a relatively short-statured race, who moved into Wales, have remained until recent years comparatively undiluted by the taller races who became the main colonizers of Britain. Elsewhere, apart from islanders in the far north, where the descendants of invading Danes of the 8th century are taller than the mainland Scots, racial intermarriage has resulted very largely in a loss of identity. It is probable that other factors, such as migration, encouraged by increasing industrialization, have made an important contribution to the pattern found to-day.

(b) *Socio-Economic Status*.—In not one of the three groups (all England and Wales) for the

composite Class 1/2 does the mean stature of men of Class 1 differ significantly from that of Class 2. However, in a similar examination of the Scottish data a significant difference (1·2") arose between the mean statures in these two classes (Clements and Pickett, 1952), and it is possible that a high degree of variability occurs within Class 1 itself.

Pooled values for the three social class groups (Table V) show a decrease of 0·7" from Class 1/2 to Class 3, and a decrease of 0·6" from Class 3 to Class 4/5. In 1883, the British Association Anthropometric Committee found a difference of almost 2" between "professional and commercial classes" and "artisan classes living in towns".

TABLE V
MEAN STATURE (IN.), BY AGE AND SOCIAL CLASS

Age Group (yrs)	Social Class			
	1/2	3	4/5	All
17-19	68·48 ± 0·14	67·53 ± 0·05	67·07 ± 0·06	67·42 ± 0·04
20-29	68·05 ± 0·11	67·42 ± 0·04	66·89 ± 0·05	67·27 ± 0·03
30-39	67·61 ± 0·10	66·89 ± 0·05	66·41 ± 0·04	66·68 ± 0·03
40-49	68·57 ± 0·76	66·95 ± 0·49	65·94 ± 0·49	66·78 ± 0·32
All	67·97 ± 0·06	67·30 ± 0·03	66·70 ± 0·03	67·09 ± 0·02

It is evident from Table IV that, although there is a decrease from Class 1/2 to 3 and from Class 3 to 4/5 in the stature of men from similarly located areas, a comparison of samples from widely separated areas may show Classes 3 or 4/5 to have a greater mean stature than Class 1/2.

Thus, although the mean stature of Class 1/2 men in the two groups which include all the English regions except North I (Areas 1 and 2 in Table IV), is greater than that of men in any other group, that of Class 1/2 men in the group which includes Wales and North I (Area 3) is less than that of men in Class 3 in most southern and midland regions (Areas 4 and 5) and of men in Class 4/5 in the South-east (Area 8). There is no significant difference between the mean stature of Class 3 men in the Midlands, Eastern region, and Greater London and that of Class 4/5 men in the South-east (Areas 5 and 8). The latter are taller than those of Class 3 in the Welsh regions (Area 7).

(c) *Industry and Occupation*.—The variation of stature was studied in different industries, and in different occupations in the same industry, within each social class group, and within one group where it was known that there was overall homogeneity of stature (Areas in Table IV).

For the purpose of this analysis, to increase the size of the samples and so to provide sub-samples of reasonable size, the discrepant boards have been included and placed with a regional group with which they combine homogeneously. As has been made clear earlier, this should not be taken to imply a geographical association between these areas.

These boards have been included in regional areas as follows:

Class	Board	Regional Area
1/2	Barnsley	3
3	Doncaster and Sheffield	4
	Cardiff and Swansea	5
	Tottenham	7
4/5	Bath, Taunton, Weymouth, Hounslow, Willesden, Cambridge and Barrow	8

Within each social class, the groups containing the greatest numbers were chosen. For each test a covariance analysis was made in which age was the independent variable, to ensure that age differences between the samples were taken into account when making the comparison.

In Class 1/2 an analysis was made of the stature of men from Area 2 (Table IV), and no significant differences among men in the various industries represented were found. Differences at the 5 per cent. level of significance occurred among men in professional occupations.

Men from Area 5 (Table IV) represented Class 3, and here there were marked differences according to industry. This appeared to be due to two groups, one unusually tall and the other unusually short. The first included 463 clerks and typists with an average height of 68.2" (compared with 67.4" for this group as a whole). The second group included men in personal service and in this group it was found on further examination, that the low average was mainly due to a sample of 36 hairdressers (65.6") and twelve chefs (66.4").

An analysis of men in the same class working in the transport and engineering industries indicated no differences related to occupation.

Substantial differences according to industry were again observed among men of Class 4/5 from Area 9 (Table IV). The greatest deviation occurred in a sample of 27 oilers and greasers whose mean stature was 65.9" compared with 66.7" for the group as a whole.

Men in Class 4/5 in the engineering industry showed no occupational variation in stature. There were marked differences in the transport industry, however, where the mean stature of 36 locomotive firemen was 68.4" compared with 67.1" for all men in the industry, but these men may perhaps be wrongly classified as semi-skilled workers. Other groups of men with divergent mean heights include 23 messengers (65.9"), 46 porters (66.3"), and 26 dock labourers (66.2").

Variation of stature within industries and occupations appears in the main to be very slight. A few divergent groups occur, but in most cases these are probably the result of sampling irregularities. The high mean stature of clerks and typists compared with that of others of their economic group, however, has practical significance, for example in the design of office furniture.

(d) *Age*.—Notwithstanding the factors of geographical and socio-economic variation which may affect adult stature, its relationship with age, as demonstrated by regression, does not differ significantly between regional groups or between classes. Table V gives the mean stature for four age groups covered by the sample, and shows that the stature of younger groups is greater than that of older ones. (The trend is less clear because the 40 to 49-year group is a relatively small sample consisting entirely of volunteers). Analysis of the data relating to Scotsmen (Clements and Pickett, 1952) gave the same result and confirms similar findings by Kemsley (1950) and Morant (1950). The regression coefficient of stature on age for the pooled data is -0.048 ± 0.002 /yrs.

Differences between social class means are little affected by standardization for age.

There is a significant difference between regressions on age within the four age groups; and, as the age distribution of the samples for England and Wales and for Scotland differ, this factor probably explains the difference found between the regressions. This difference between age groups may be mainly due to the 17 to 19-year age group, in which stature appears still to be increasing. The data for England and Wales confirm the earlier observation on Scottish data that in all social classes maximum adult stature is reached during the 19th year.

WEIGHT.—Body weight is not normally distributed, but shows an excess around the mean, or kurtosis, and an excess at the upper end of the distribution, or skewness (Clements and Pickett, 1954). Analysis of the Scottish National Service data indicated that log weight, on the other hand, may be considered to be normally distributed for all practical purposes. Individual weights have therefore been converted to their logarithms to the base 10. Log weight has been used throughout the analysis, and conversion to weight on the arithmetic scale for the purposes of Tables III and VII has been made by means of the equation:

$$\text{Observed mean weight (lb.)} = 1.045 \text{ mean log weight (converted to lb.)} - 5.098. \quad (\text{Clements and Pickett, 1954}).$$

(a) *Geographical Variation.*—Table III gives mean weights for regions of England, Wales, and Scotland, pooling all social classes. In the main, the trend for weight in England and Wales follows that for stature, though men in the Eastern region tend to be rather heavy for their stature, whereas men of the Midland II region are rather light.

The heaviest mean weights in Britain are found in the northern and southern regions of Scotland, although stature here is close to the mean of the whole country. Both Beddoe and the British Association Anthropometric Committee at the end of the 19th century found that the Scots were heavier than the English or Welsh, and Martin (1949) also reported that young men in the Highlands, measured in 1939, were heavier than those from all other regions. When the mean weights of all regions are adjusted to constant stature, those of Scotsmen remain greater in every age group than those of the English and Welsh.

The mean log weight of men in each group in which there is no significant variation in stature (Areas in Table IV) is given in Table VI.

TABLE VI

MEAN LOG WEIGHT OF AREAS IN ENGLAND AND WALES SHOWING NO SIGNIFICANT VARIATION IN STATURE

Area (see Table IV)	Social Class		
	1/2	3	4/5
1	2.1509 ± 0.0024		
2	2.1408 ± 0.0020		
3	2.1387 ± 0.0038		
4		2.1358 ± 0.0010	
5		2.1324 ± 0.0009	
6		2.1248 ± 0.0010	
7		2.1236 ± 0.0025	
8			2.1346 ± 0.0013
9			2.1269 ± 0.0009
10			2.1201 ± 0.0009

The regions making up these groups do not show a corresponding homogeneity when weight is considered. Regions within Class 1/2 alone are the same in every respect for both measurements. In Class 3, the weights of men in seven boards differ significantly from those of the remainder of their regions. These boards are Lincoln (East), Canterbury and Brighton (South-east), and Barnsley (North III), with greater weights, and Sunderland (North I), Blackburn and Salford (North IV), with smaller weights. In Class 4/5, eight boards show a similar variation. Men from High Wycombe and Kingston (South-east), Plymouth (South-west), Preston (North IV), and Aberystwyth (Wales II) are heavier, and men from Sunderland (North I), and Bradford and Halifax (North III) are lighter than the others of their regions.

The reason for these deviations is obscure, but weight is generally regarded as being more sensitive to external conditions than stature.

(b) *Socio-Economic Status.*—Observed mean weights of men in the three social class groups have been computed using the total number of records available (21,296) and are given in Table VII. There is a decrease of over 4 lb. from the mean weight of men in Class 1/2 to that of men in Class 3, but of only 1 lb. from Class 3 to Class 4/5. After standardization to constant stature, these differences are much reduced, the mean weight of men in Class 4/5 being only 1 lb. greater than that of men in Class 3, and under 1 lb. less than that of men in Class 1/2.

Weight differences between regional groups, although again decreasing from Class 1/2 to 3 and from Class 3 to 4/5, when similarly located groups are compared, are not always significant. The mean log weights of Class 1/2 men in all regions except the South-east and South-west (Areas 2 and 3 in Table IV) are not significantly different. Those of Class 1/2 men in the Welsh and North I regions (Area 3), Class 3 men in all English regions excepting the Northern (Areas 4 and 5), and Class 4/5 men in the South-east (Area 8) also do not differ. The mean log weights of Class 3 men in the Welsh and Northern regions (Areas 6 and 7) do not differ significantly from those of Class 4/5 men in the English regions, excluding the South-east and North I, II, and IV (Area 9).

There are no significant differences between the mean log weights of men in Class 1 and Class 2 in any part of England and Wales.

(c) *Stature.*—The relationship between log weight and stature may be considered linear for all practical purposes (Kemsley, 1952; Clements and Pickett,

1954). Regression coefficients relating the two measurements in each regional group homogeneous for stature have been calculated separately, and do not differ significantly within the three social class groups. When the regional group means are standardized for stature, they also do not differ except in Class 4/5.

There are significant differences between the regressions within each social class, and between the class means after standardization, non-homogeneity being introduced by Class 1/2. The class regressions cannot therefore be pooled. Regression coefficients for each social class group are:

Social Class 1/2 $0.0107 \pm 0.0005 \log \text{ lb./yrs}$
 Social Class 3 $0.0119 \pm 0.0002 \log \text{ lb./yrs}$
 Social Class 4/5 $0.0119 \pm 0.0002 \log \text{ lb./yrs}$

The correlation coefficient relating weight and stature in men from England and Wales is 0.57, compared with 0.59 in men from Scotland.

(d) *Age*.—Regression coefficients relating log weight to age within each regional group homogeneous for stature are, except in Class 3, consistent only between these groups. This may be in part because there has been no standardization of stature.

Except in Class 1/2, a quadratic relationship between the two is preferable, for there is significant curvilinearity in all other groups. This means that in the age range covered by the data, an equation including the square of age will give a better result than one based on age alone. The best fit is given by the following regression equations:

Social Class	Area	Weight (log lb.) =
1/2	1	$0.000352 \text{ Age (yrs)} + 2.141$
	2	$0.000905 \text{ Age (yrs)} + 2.117$
	3	$0.00116 \text{ Age (yrs)} + 2.106$
3		$0.00857 \text{ Age (yrs)} - 0.000147 \text{ Age}^2 + 2.015$
4/5	8	$0.00760 \text{ Age (yrs)} - 0.000138 \text{ Age}^2 + 2.039$
	9	$0.00206 \text{ Age (yrs)} - 0.0000323 \text{ Age}^2 + 2.097$
	10	$0.00527 \text{ Age (yrs)} - 0.0000848 \text{ Age}^2 + 2.044$

* Areas are those of Table IV modified as explained in section "Industry and Occupation".

The unstandardized mean weights of men in each age and social class group (Table VII) illustrate the differences in the weight-age relationship which arise between the classes. The lightest mean weight is always found in the 17 to 19-year age group, but, while there is a relatively constant increase within Class 1/2, there is little or no difference between the weights of men of 20 to 29 years and of 30 to 39 years within Classes 3 and 4/5 (ignoring the 40 to 49-year age group which is small and unrepresentative).

Standardization to constant stature, however, shows that, in all classes, men in older age groups are heavier in relation to stature than younger men. Table VII (opposite) gives standardized mean weights for pooled classes; and the standardized means for separate classes are very similar. Comparable figures are given by Kemsley (1950) for the civilian population in 1943. Both surveys indicate that increasing weight with age is much less marked than in 1883 (British Association, 1883), or even between 1929 and 1932 (Cathcart, and others 1935). Whether this is a persistent trend or is attributable to war-time dietary conditions, which might be expected to have the least effect on men of favourable socio-economic background, is not clear.

(e) *Stature and Age*.—A multivariate analysis shows that, after standardization for both stature and age, including the square of age, log weight differences between the regional groups homogeneous for stature disappear in Classes 1/2 and 3, and the regressions relating to men in these classes may be pooled. This gives the following relationship for the pooled classes and for the regional groups of Class 4/5:

Social Class	Area	Weight (log lb.) =
1/2		$0.0112 \text{ Stature (in.)} + 0.00363 \text{ Age (yrs)} - 0.0000424 \text{ Age}^2 + 1.317$
3		$0.0122 \text{ Stature (in.)} + 0.00850 \text{ Age (yrs)} - 0.000136 \text{ Age}^2 + 1.192$
4/5	8	$0.0116 \text{ Stature (in.)} + 0.00638 \text{ Age (yrs)} - 0.000106 \text{ Age}^2 + 1.264$
	9	$0.0126 \text{ Stature (in.)} + 0.00298 \text{ Age (yrs)} - 0.0000385 \text{ Age}^2 + 1.236$
	10	$0.0121 \text{ Stature (in.)} + 0.00847 \text{ Age (yrs)} - 0.000134 \text{ Age}^2 + 1.192$

* Areas are those of Table IV modified as explained in Section "Industry and Occupation".

TABLE VII
MEAN WEIGHTS (LB.), BY AGE AND SOCIAL CLASS GROUPS

Age Group (yrs)	Social Class				Standardized Means for All Social Classes
	1/2	3	4/5	All	
17-19	138·1 (382)	133·8 (3,231)	133·0 (2,155)	133·8 (5,768)	132·6
20-29	139·4 (595)	137·1 (4,005)	135·3 (2,715)	136·6 (7,315)	135·9
30-39	142·4 (687)	137·1 (2,969)	135·5 (4,486)	136·7 (8,142)	138·2
40-49	146·9 (12)	148·4 (28)	136·8 (31)	143·1 (71)	144·3
All	140·4 (1,676)	136·1 (10,233)	134·9 (9,387)	135·9 (21,296)	—
Standardized Means for All Age Groups	137·1	135·3	136·4	—	—

The numbers in each sample are shown in brackets.

DISCUSSION

The results reported in earlier sections of the paper provide information on the distribution of physique in the male population. They confirm the existence of national types and show in greater detail the pattern linked to geographical factors which underlies the large normal variation of everyday experience. Stature becomes lower on passing from the South to the North of England or into Wales, whereas weight is greater in Scotland. Socio-economic factors apparently account for most differences in industry and occupation, and on the whole, differences within the same class are small. A number of questions, however, remain unanswered. Thus it is not known whether the pattern of increase in weight with age remains as it was found to exist in war-time conditions, or has now reverted to the increasing trend evident earlier, or perhaps follows some new pattern. We have suggested that the unusual samples which differed from similar samples in the same region may be in some way connected with urbanization, but whether the essential factor is one of migration, genetic origin, or simply one of occupation remains unanswered.

The statistics may serve in addition as standards to which other material may be compared. Taken together, the measurements of stature and weight permit a classification of physique to be made in a quantitative way which will estimate the frequency of occurrence of physical types in the population. Up-to-date estimates have been derived from the material relating to Scotland (Clements, 1955), and the smallness of the difference in the statistics for Scotland, when compared with those for England and Wales makes it clear that for practical purposes

these estimates may be applied to the country as a whole.

The statistics may also be applied to the construction of a sizing system for clothing or in the design of equipment. In this connexion, where a product is to be used by the population as a whole, for practical purposes the wide range normally found in the size of body dimensions makes it unnecessary to allow specifically for local variation, because the difference between one locality or section of the community and another may be taken into account by using a different proportion of each size depending on the characteristics of the particular group they are expected to serve.

SUMMARY

(1) The mean stature and weight of men between the ages of 17 and 50 years measured in 1941 by medical boards of the Ministry of Labour and National Service are given for each of the Registrar-General's geographical regions in England, Scotland, and Wales.

(2) Significant differences are shown to exist between men of different socio-economic status, and of the same socio-economic status in different areas of the country.

(3) The stature of men of the same socio-economic status and geographical location, working in different industries and in different occupations within the same industry, are examined.

(4) It is confirmed that maximum stature is reached during the 19th year. A continuous increase in weight with age occurs only in men in professional and managerial occupations.

(5) The relationships between stature and age, stature and weight, and weight and age are discussed and regression coefficients are given.

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