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SOCIAL MEDICINE STUDIES BASED ON CIVILIAN MEDICAL BOARD RECORDS

II. PHYSICAL AND OCCUPATIONAL CHARACTERISTICS OF MEN WITH VARICOSE CONDITIONS

BY

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There were several reasons why it seemed appropriate to include in a study of the wartime records of Civilian Medical Boards a detailed analysis of varicose veins, varicocoeles, and haemorrhoids. These three types of abnormally distended veins are known to be common, but exactly how common they are and who is most likely to be affected are questions which have never been satisfactorily answered. Mild cases need no treatment, severe cases are notoriously resistant to treatment, and the death rate is negligible. It is, therefore, hopeless to expect either hospital records or national statistics of mortality to yield accurate estimates of prevalence. Short of a planned survey, what is required is a medical census of the population with systematic recording of all clinical signs of venous incompetence. It is, therefore, particularly fortunate that, at a time when Civilian Medical Boards were examining a relatively broad cross-section of the community, the printed headings in the schedules included "Varicose Veins", "External Genitalia", and "Piles".

MATERIAL

These schedules and the method of coding the information they contained have already been described (Stewart, Webb, and Hewitt, 1955).

Briefly, they came from three regions (Essex, Leicestershire, and Northamptonshire) and represent men under 45 years of age who were called up for National Service during the period 1941–44. In the coded version of the records, which were transcribed on to Powers Samas punch cards, there were six age groups (17–19 years, and the four following 5-year groups), nine height groups (intervals of 2 in.), and ten weight groups (intervals of 10 lb.). All entries under medical history and clinical findings were given their International Code numbers (World Health Organization, 1948), and all occupations were identified in the 1951 Census (General Register Office, 1951) and given their appropriate Social Classes (I–V), Main Orders (I–XXVIII), and Sub-Orders (1–999). In approximately 6 per cent. of cases an occupation common to several trades (*e.g.*, cutters, fitters, finishers, inspectors, etc.) could not be exactly identified. In this and subsequent papers, these men will be found in one occupational group ("trade not identified"). The men who were weighed and measured were also placed in one of ninety body-build groups. These were not included in the original code, but it was assumed that all men at a given intersection of the nine height and ten weight categories were of similar build. For each of these ninety groups an average estimate of the index $Height \div \sqrt[3]{Weight}$ was obtained from the appropriate midpoints of the height and weight intervals. In the following account the ninety groups have been reduced to six by pooling.†

AIMS AND METHODS

For reasons already discussed in the first paper of the present series (Stewart and others, 1955), Civilian Medical Board records do not provide a reliable basis for estimating total prevalence rates. It was decided, therefore, to limit the present investigation to a study of *relative rates* in groups defined by weight, height, body-build, occupation, and social class. With this end in view the following tabulations were prepared for all cards (48,908) and for cards with mention of varicose veins (3,582), varicocoele (1,773), and haemorrhoids (1,376):

(1) Joint frequency distribution by height and by weight,
(2) Distribution by main order occupations,
(3) Distribution by social class.

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† The effect of this was to reduce the importance of errors caused by the original approximations.

By repeating each sorting eighteen times the three regions and the six age groups were distinguished in each set of tabulations.

The calculations based on these cross-correlations were designed to test five "null hypotheses": that all three varieties of venous incompetence occurred independently of the five characteristics named above (weight, height, body-build, occupation, and social class). The possibility that the number of times each condition was recorded might vary with age of the man examined and, to some extent, with the rigour of the examination, was allowed for by making separate calculations for each of the eighteen sub-groups.

The numbers of men "expected", on the basis of the null hypothesis, to fall into each intersection of height by weight, and into each of the main order occupations and social classes, were obtained by scaling each of the distributions down to the corresponding numbers of men with each type of abnormality. These "expected" numbers were then summed over the age groups for comparison with the actual numbers obtained. To test the null hypothesis concerning height, a further summation over weight was necessary; conversely, a summation over height was necessary to test the hypothesis concerning weight. Finally, when the results had been examined for each region separately, the three regions were aggregated to obtain a final comparison of actual with expected cases.

The findings were compared in two ways. First the technical significance of the departures from expectation were assessed by means of the χ^2 test. Secondly the magnitude and pattern of the departures from expectation were assessed by calculating a Standardized Prevalence Ratio:

$$(\text{S.P.R.} = \frac{\text{Actual Number}}{\text{Expected Number}} \times 100).$$

The ratios based on the final aggregations are shown for main order occupation and social class in Tables II and III, and for heights, weights, and body build in Figs 1 to 3. For the sake of uniformity in the figures, the three scales of measurement have been divided into the same number of sub-ranges.* The abscissae on the graphs represent either mid-points of a single coded group (heights and weights), or the weighted average of mid-points from a number of groups (body build), the weighting being determined by the "expected" number in each group.

Because of the varying numbers of cases on which they are based, the S.P.R.s are of unequal reliability. Following the practice of the Registrar-General, an arbitrary number of twenty cases was set as the limit below which no ratio would be calculated.

Though not essential to the main purposes of the present investigation, the regional prevalence rates for the three types of venous incompetence are shown in Table I. It will be seen that there was considerably less variation in the rates for varicose veins than in the rates for varicocoele and haemorrhoids, but this does not necessarily mean that varicose veins were more accurately recorded than the other conditions. Earlier tests have shown that the standard of recording was appreciably lower in Northamptonshire than in the other two regions.

TABLE I

RECORDED PREVALENCE OF VARICOSE CONDITIONS AMONG MEN EXAMINED AT THREE CIVILIAN MEDICAL BOARD CENTRES (1941–44)

Centre	Varicose Veins		Varicocoele		Haemorrhoids	
	Number	Per cent.	Number	Per cent.	Number	Per cent.
Essex	903	7·7	534	4·5	426	3·6
Leicester ..	1,636	7·2	840	3·7	632	2·8
Northampton	1,043	7·3	399	2·8	318	2·2
Total ..	3,582	7·3	1,773	3·6	1,376	2·8

There is also evidence, both in Table II of the previous paper and in Table II of this paper, that for men who work in boot and shoe factories, varicose veins are a genuine occupational risk. Since shoemaking is the staple trade of Northamptonshire (it accounted for 30 per cent. of the men examined in this region) it is reasonable to

TABLE II

COMPARATIVE PREVALENCE OF VARICOSE CONDITIONS IN TWELVE OCCUPATIONAL GROUPS

Significant departures from standard prevalence of 100 are indicated as follows:—* = $P<0{\cdot}05$; ** = $P<0{\cdot}01$; *** = $P<0{\cdot}001$.

Occupational Groups	Registrar-General Main Orders	Standardized Prevalence Ratios† (S.P.R.s)		
		Varicose Veins	Varicocoele	Haemorrhoids
Professional and Administrative	XVI, XIX	81**	107	103
Commercial ..	XVIII	97	89	128***
Clerical	XXIII	69***	99	94
Boot and Shoe ..	VIII	116***	117**	96
Textile	VII	105	95	81*
Metal	VI	88	102	98
Trade not Defined‡	—	111	91	96
Warehouse ..	XXIV	103	110	108
Transport ..	XVII	95	92	99
Building, Agriculture	III, XIV	97	79**	96
Unskilled ..	XXVI	101	99	96
Other Occupations	Residue	101	109	105

* It was found that six was the largest number of divisions which always left a convenient number in the extreme groups.

† *i.e.*, standardized for age and region and expressed as a ratio of the standard rate of 100.

‡ See text.

expect an appreciable excess of varicose veins in the Northamptonshire sample. For similar reasons the relatively divergent rates for varicocoele and haemorrhoids should not be interpreted as geniune regional differences. Even if, as we suspect, slight cases in Northamptonshire were under-recorded, it will not have affected the S.P.R.s for these are based on *relative rates* within each region.

The age gradients of the three diseases provide a convenient illustration of the reliability of relative rates of morbidity for certain purposes. In all three regions these showed the same features. Thus the proportion of men with varicose veins and haemorrhoids steadily increased and eventually became over ten times greater after the age of 40 than before the age of 20. The prevalence of varicocoele, on the other hand, reached its maximum by 20 years and thereafter remained fairly level.

VARICOSITIES AND HEIGHT.—The first of the five null hypotheses—that varicose conditions occur independently of height—was decisively discredited by the statistical test both in the case of varicose veins and in the case of varicocoele. An increase of 10 in. in height (*i.e.*, from a point about two standard deviations below the mean to a point about two standard deviations above the mean) was accompanied by a three-fold increase in the prevalence of both conditions. This was true in each region taken separately (all six of the test results concerned gave value of $P < 0{\cdot}001$), and in every calculation the S.P.R.s increased with height in a more or less regular fashion.

Results from the aggregated material (Fig. 1) suggest that this dependence upon height may be adequately described by linear equations. By means of least squares it can be found that the linear equation of best fit to the ratios for varicose veins was:

$$R_{(VV)} = 9{\cdot}93\,H - 565{\cdot}9$$

in which $R_{(VV)}$ represents the risk of recording a case of varicose veins, expressed as a percentage of the risk for all examinees of a given age, and H represents the standing height in inches. This equation is not offered as a description of any natural law governing the prevalence of varicose veins. It is only meant to provide a basis for comparing the empirical relationship ascertained in this material with whatever may be found to apply elsewhere. The internal consistency of the present material does, however, imply that a similar equation might be derived for any large group of young men, as the coefficients of H in the corresponding equations for the three regions taken separately were:

Essex	+11·7	per cent. per inch.
Leicester ..	+ 9·4	
Northampton ..	+ 9·8	

Fig. 1 shows that the dependence of varicocoele upon height was similar to and (despite the smaller number of cases) more nearly linear than that of varicose veins.

The equation of best fit proved to be:

$$R_{(VAR)} = 9{\cdot}62\,H - 546{\cdot}9.$$

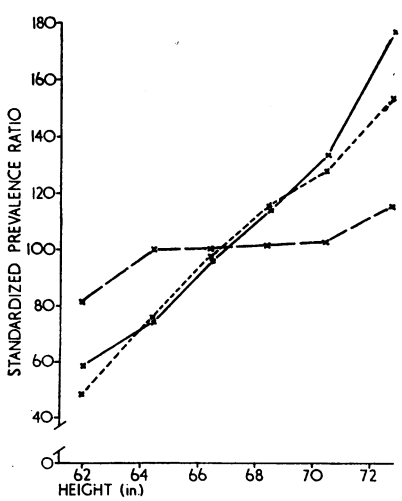

FIG. 1.—Standardized prevalence ratios related to height.

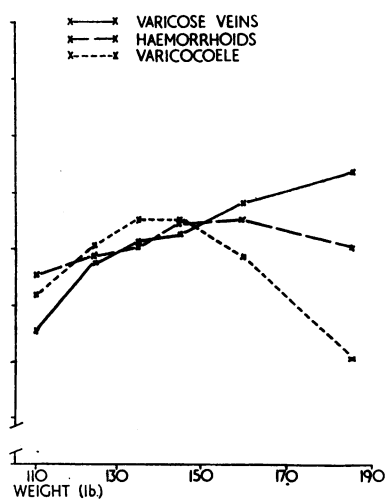

FIG. 2.—Standardized prevalence ratios related to weight.

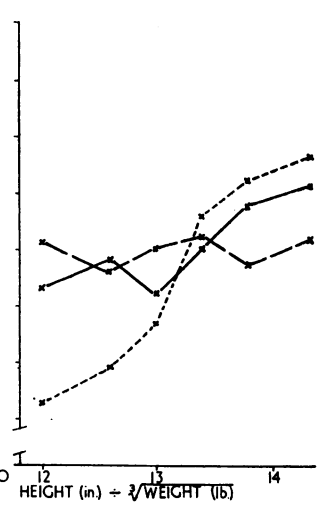

FIG. 3.—Standardized prevalence ratios related to body-build.

The coefficients of H calculated from the separate regions were:

Essex	+ 8·5	per cent. per inch.
Leicester	+ 9·8	
Northampton	+10·5	

Although the tendency for the prevalence of varicocoele to increase with height applied with much the same force in all three regions, it did not apply equally to men of all ages. This was shown by calculating for each age group the prevalence among taller men (5ft. 6in. or more) and shorter men, and expressing the results as follows:

Age	*Ratio*
17–19	1·75
20–24	1·61
25–29	1·56
30–34	1·39
35–39	1·40
40–44	1·20

The apparent reduction with age in the slope of the line relating prevalence of varicocoele to height was confirmed in the results obtained independently from each region. Using the same ratio as above but compacting the age groups to maintain adequate numbers, the following result was obtained:

Age	*Essex*	*Leicester*	*Northampton*
17–29	1·60	1·67	1·79
30–44	1·23	1·43	1·44

Haemorrhoids did not show the same dependence on height, and although each point on the graph in Fig. 1 lies a little higher than the preceding point, by the χ^2 criterion, there is no significant departure from expectation.

VARICOSITIES AND WEIGHT.—Having found that varicose veins had such a well-defined relationship to height, we were virtually certain that some association with body weight would also be demonstrable (for the correlation coefficient between weight and height in the present sample was + 0·7). Fig. 2 shows that the prevalence of varicose veins was lowest among the men who weighed less than 120 lb., and increased continuously with increasing weight. However the gradient was not so steep as that of height, for although the extreme points on Fig. 2 are over five standard deviations apart, the increase in prevalence is less than two-fold (as against a three-fold increase with height over four standard deviations).

By contrast, the relationship between varicocoele and weight could not have been predicted from the earlier findings. Men with the lowest weights certainly had a statistically significant deficiency of cases, but the lowest prevalence was found among men who weighed over 180 lb. and a clear maximum occurred just above the average weight for all men examined. The location of this unexpected maximum showed some regional variation, but in all three samples the prevalence at both extremes of the weight scale was lower than at the centre.

The weight distributions of men with haemorrhoids did not differ significantly from the distributions of "expected" cases.

VARICOSITIES AND BODY-BUILD.—Fig. 3 shows how the prevalence of the three diseases varied along the body-build scale.

With varicose veins the highest prevalence was found in men who were exceptionally tall for their weight, the observed numbers differing from the expected number at the highest tabulated level of statistical significance. The average variation was, however, less extreme and less regular than it had been along either the height scale or the weight scale.

When the prevalence of varicocoele was plotted against the body-build index, the six points were found to lie on a fairly regular sigmoid curve, and the variation was almost as great as in the height graph. However, the lowest S.P.R. (46) in Fig. 3 corresponds to a more extreme body-build group than the lowest S.P.R. (48) in Fig. 1, for only the lowest 3 per cent. of the body-build distribution is covered, compared with 9 per cent. of the height distribution.

The departures from expectation in the case of haemorrhoids were irregular and, as before, too small to be regarded as significant.

VARICOSITIES AND OCCUPATION.—Each of the three diseases varied significantly with occupation, but not to the same degree. χ^2 tests with eleven degrees of freedom gave $P < 0{\cdot}001$ for varicose veins, $P < 0{\cdot}02$ for varicocoele, and $P < 0{\cdot}05$ for haemorrhoids.

The role of environment in the aetiology of varicose conditions is still uncertain but the general consensus of opinion is that the best preventives are regular exercise and no garters! Kramer (1948) has suggested that persons whose employment causes them to stand for long periods are especially liable to varicose veins, while Illingworth and Dick (1949) say that the condition is apt to occur in hyposthenic subjects of sedentary occupation. It is not clear whether by sedentary work these authors mean a "light job" or literally work done in the sitting position, but the one completely (and literally) sedentary group of workers in the present sample (clerks and typists) had, in all three regions, the *lowest* prevalence. The bulk of the professional

and administrative group were also office workers, and they too had low prevalence ratios. Boot and shoe factory operatives, on the other hand, who are compelled to stand in roughly the same position all day, and have little or no occasion to use their leg muscles,* had a significantly high ratio in both the regions where this occupation was represented (Leicester and Northampton). It must, however, be admitted that two occupations gave inconsistent results: unskilled labourers had S.P.R.s below 100 in Southend and Northampton but showed a 20 per cent. excess in Leicester. This may, of course, be due to regional differences in the jobs available to unskilled men. Transport workers also had a deficiency of cases in two regions and an excess in one, but the amount of sitting or standing to be done varies widely (a theme which has been developed by Morris and others (1953) in connection with another disease of the circulatory system).

One unexpected finding was that in each region the comparative freedom from varicose veins of the clerical workers appeared to diminish with age. For men under and over the age of 35 the S.P.R.s were as follows:

Clerical Workers	*Essex*	*Leicester*	*Northampton*
17–34 ..	37	61	35
35–44 ..	87	98	90

In the aggregated material the ratios were 33 for men under 25 years, 55 for men between 25 and 35 years, and 92 for men over 35. This raises the question whether it is only young persons, or persons who take active exercise in their spare time who benefit by a "sitting down" job.

The occupational distribution of varicocoele also revealed an exceptional risk for boot and shoe workers. The low prevalence of varicocoele in the group which included both builders and agricultural workers was found, on a more detailed analysis, to result from an exceptionally low prevalence among the agriculturalists. (This group was very small in the Leicester sample, but the S.P.R. was 54 for agricultural workers in Essex and Northampton. This result is probably related to the fact that active exercise prevents venous stasis).

A relation between occupation and haemorrhoids has often been suspected but never confirmed. According to Gabriel (1948) they are a special risk of porters, coal-heavers, and labourers because they strain themselves at work, of sedentary workers (because they strain themselves on holiday), of drivers of trams and shop-walkers (because they stand for long periods at work), and of those who do much riding on horseback or sit cross-legged at work! However this may be, there were only two occupational groups in the present series with S.P.R.s which lay outside the narrow range of 94 and 108; the only outstanding finding was a ratio of 128 for men employed in commerce (mainly shop assistants). According to the χ^2 test this one group (which had exceptionally high rates in all three regions) contributed no less than 11·94 to the total of 19·38 for eleven degrees of freedom. Since this result can hardly be attributed to chance it certainly warrants more detailed investigation.

VARICOSITIES AND SOCIAL CLASS.—Table III shows S.P.R.s for the three conditions by social classes.

TABLE III

COMPARATIVE PREVALENCE OF VARICOSE CONDITIONS IN THE REGISTRAR-GENERAL'S SOCIAL CLASSES

Social Class	Varicose Veins	Varicocoele	Haemorrhoids
I and II	84	96	112
III	101	104	100
IV	108	94	97
V	102	88	90

Only varicose veins showed a distribution of cases which has to be regarded as significantly different from expectation. This is evidently due to the low ratio (84) for Social Classes I and II combined. Since this figure is identical with the S.P.R. for professional and administrative workers, and since these men constitute the bulk of Social Class I and II, it is clear that the classification by social class has added nothing to the classification by main order occupations.

Although the Social Class S.P.R.s for haemorrhoids do not differ significantly from 100 it will be noted that there is a steady trend from the wealthiest to the poorest group. Alone of the three varicose conditions, haemorrhoids produced more than twenty cases in Social Class I, and the combined group in Table III may be divided as follows: Social Class I, 138; Social Class II, 109. The consistent ranking is therefore maintained through the full range of social classes.

DISCUSSION

Varicose veins and varicocoele have both shown such strong and regular associations with height that it is hard to resist the idea of a causal relationship. In both cases, but more particularly for varicocoele, there was some suggestion of weight and body-build influences which slightly complicated

* There are sitting jobs in shoe factories but these tend to be monopolized by the women.

the issue. It was, however, height which yielded the greatest departure from the "expected" distribution, and it was height which showed the simplest graphical relations. There is, therefore, good reason to suppose that this factor (which certainly influences venous pressure) is the most important correlate of the three. If so, the associations with weight and body-build would be regarded merely as corollaries of the following proposition: that in young men the risk of contracting either varicose veins or varicocoele is directly proportional to the length of the veins in the lower half of the body.

Haemorrhoids did not show such close dependence on any of the three dimensional variables. Nevertheless the result which most nearly approached statistical significance was that for height, and once again the tallest men showed the greatest prevalence. The results for haemorrhoids should, however, be read with special caution, for unlike varicose veins and varicocoele it was recorded more frequently at the upper than at the lower end of the social scale (*i.e.*, in the section of the community which is by and large the tallest and the heaviest).

Studies in constitutional medicine usually take as their starting point certain pre-conceived "body types"* (Sheldon and others, 1940; Kretschmer, 1944). It is, however, possible that for estimating certain disease risks *absolute* dimensions are more important than relative dimensions. Certainly, the stock index of body-build ($H \div \sqrt[3]{W}$) is a very crude measure of physique. This fact, together with the imperfect way in which the index had to be applied, may have led to our underestimating the importance of body-build in relation to varicosities. On the other hand, this same index, used in precisely the same way, has for certain risks (*e.g.*, foot defects, hernia, and spinal curvature) given better discriminations than height or weight taken alone (Hewitt and others, 1953; Webb and others, 1955).

By comparison with the earlier findings the effects of occupation and social class appear slight. There are, however, several points of interest. The absence of any excess of varicose veins and varicocoele in the upper (taller) social classes means that there has, for once, been no confusion between constitutional and environmental effects. *Per contra*, what appears to be a slight "haemorrhoidal diathesis" may be nothing more than a coincidence between habits of behaviour and physical type.

* It is not difficult to infer how the present findings would have appeared if the investigation had been based on somatotypes. In view of the known relations between the recognized somatotype groups and the body-build index we have used, it is certain that a significant excess of both varicose veins and varicocoele would have been found among ectomorphs and corresponding deficiency among endomorphs.

The valves in the femoral vein are relatively ineffectual structures and the regular contraction and relaxation of the deep leg muscles is largely responsible for the upward blood flow. Even at rest these rhythmic movements persist and provided one is sitting or lying the veins work perfectly well. Prolonged standing, on the other hand, is not a natural habit in man, and it certainly hampers the blood flow in the lower half of the body. It is not surprising therefore that varicose veins and varicosities should be common in members of an occupational group who for all intents and purposes neither sit down nor walk about. There must, of course, be small sub-groups of such men in other industries, but in a broad classification of occupations they are likely to be outnumbered by those whose work involves a wider range of movement.

The difference between the younger and older clerks raises the question whether the effects of occupation on health are necessarily most clearly seen in workers who have been exposed to the relevant conditions for a long time. In the case of a slow cumulative poison such as quartz dust, this must be so, but where the effects depend on the absence of some factor which is common to the population at large it need not be so. In the present instance it is possible that a particularly favourable blend of rest at work and exercise during spare time is characteristic of young male clerks but not of their older colleagues.

Summary

Several thousand cases of varicose veins, varicocoele, and haemorrhoids reported by Civilian Medical Boards were studied in relation to the height, weight, body-build, occupation, and social class of the men examined.

It was found that the tendency to varicose veins increased steadily with increasing height but showed little association with weight or body-build. Varicocoele and height were also associated, but tall men became less liable to variocoele with advancing age, and men who, though not exceptionally tall, were tall for their weight were more liable.

Boot and shoe factory operatives were found to have more than their fair share of varicose veins and varicocoele, and both these conditions were comparatively infrequent among young clerical workers. For these two diseases there was no regular social gradient. Haemorrhoids seemed to be more common among Social Classes I and II, but the only statistically significant finding for this disease was an exceptionally large number of cases among shop assistants and other men in commercial occupations.

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