planning and formulating the possibilities of research, and observing the material from which their hypothesis can be constructed, before any of the ambitious programmes of which they may be capable can even be begun. In this respect time and money are almost interchangeable terms. Even the preparation of this lecture, and the selection and review of the points by which I might hope to bring home the challenge and the possibilities throughout the whole field, has necessarily employed time for which many other activities have been competing. Unless one has research teams suitably recruited from able physicians and laboratory technicians, and amply supported by the necessary funds, the ideas which are needed to follow up possibilities will not be thrown up, the hypotheses will not be formulated, and the work will never be done. In this respect it is interesting to compare the way in which the design of our bodies makes allowance for the service of our brains with the way in which research into the activities of the brain is provided for in modern society.

The human brain is an organ weighing between forty and fifty ounces, roughly one-fortieth of the total body weight. Yet it receives no less than 25% of the total blood supply circulating through the body, and it receives it first: immediately after its oxygenation and refreshment in the lungs, and before its distribution elsewhere. If we compare this distribution with the distribution of money by the community for the care and study of mental illness as a fraction of the total sum spent upon the care of all illness, the comparison is striking. The average expenditure on medical care of patients in the mental hospitals of this country is in the region of five shillings per week per patient (Robinson, 1958). Comparable figures for the overall cost of medical care for patients in general hospitals (and the teaching hospitals are specifically excluded from this comparison owing to their disproportionately but necessarily high cost of operation), are twenty-five to sixty shillings a week.

Therefore, while the organization of the human body allocates to the maintenance of the brain roughly twelve times the proportion by weight of all its most vital resources in comparison to those given to the rest of the body, the distribution of money in the community in which we live almost exactly reverses these proportions. Expenditure upon the care of bodily ailments, other than those affecting the brain, exceeds by twelve to twenty times that provided for medical care, treatment, and research into mental illness. And this is all the more incongruous, even from the purely economical aspect, when one realizes that at the present time 40% of all the beds in the National Health Service are occupied by patients suffering from mental illness.

One of the objects of this address has been to outline some of the tools and methods of modern research in psychiatry, which in the last twenty-five years have increased immeasurably the possibilities for progress. If we add to these tools and methods the natural skills and interest of those already active in the field, and recognize that almost the only significant limiting factors upon our progress are those of time and money, then we reach the point at which the implications become inescapable.

Money must be made available to those with the initiative, interest, resource, and responsibility to use it; and made available even in advance of specifically endorsed projects with a predictably favourable outcome. If enough able and imaginative people are to be sustained in their willingness to commit themselves to the uncertainties of research, somebody must be prepared to gamble something on them: otherwise the projects of which they are potentially capable may never be conceived, or may remain crippled in their execution by lack of funds—at least in this country.

This, then, is the challenge which faces us. But if we retain the wit to see that the exploration of man's mind and its psychophysiological foundation in his brain is at least as significant an activity as the exploration of that extension of its environment which we call outer space, and so devote to clinical research in psychiatry even a fraction of the expenditure already laid down for cosmic rocketry, we need not fail.

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FOLLOW-UP STUDY OF ARTERIAL PRESSURE IN THE POPULATION OF A WELSH MINING VALLEY

BY

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During three months of the winter of 1953–4 arterial blood-pressure measurements were made in a random sample of the general population of the Rhondda Fach, one of the Welsh coal-mining valleys (Miall and Oldham, 1955). Subsequently a similar survey was carried out in the agricultural population of the Vale of Glamorgan (Miall and Oldham, 1958). Both surveys were designed to give measurements which would form the basis for longitudinal studies.

Four years after the first survey in the Rhondda Fach, during the same three months of the winter of 1957–8, measurements were repeated under exactly comparable conditions for the survivors of the original population. The findings confirmed the influence of parity and occupation on arterial pressure found previously, and a fuller analysis of the results will be published when the first follow-up survey of the agricultural population has been carried out. In this paper other findings from this first follow-up study are presented and discussed in relation to changes in cardiovascular mortality reported in the most recent publications of the Registrar-General.

Methods

Population Sample.—The original objective was a study of genetic factors in arterial pressure, and for this 250 families were studied, the propositi being selected by a random method from the general population. All members of the families studied then formed the population for the follow-up ; the material available is shown in Table I. Repeat measurements were obtained for 1,114 (99.6%) of the 1,119 subjects still alive and resident within 25 miles of the valley.

Technique.—Casual blood-pressure measurements were made by the same observer using the identical technique previously described. Medical, obstetrical, and occupational histories were taken, and measurements were made of height, weight, arm girth, and arm skinfold. All new measurements were made without reference to the previous records. Dahl and Love (1954, 1957) have claimed that hypertension is commoner in those who customarily take additional salt with their food than in those who do not ; questions about salt intake were therefore asked in this survey also.

Analysis.—In surveys of this kind, where casual arterial pressure measurements are recorded, it would be surprising if the results found did not reflect the well-known variability of pressure recorded in this way. Fluctuation in pressure or observational error will result in those with "falsely" high initial pressures tending to have lower subsequent readings, and those with "falsely" low initial pressures having higher subsequent readings. Changes in pressure and initial pressure are also not statistically independent pieces of information, so that in comparing the observed change in pressure of two groups selected because they have high and low average initial pressures it is unsafe to assume that the number of falsely high or low readings is the same in each group and wrong to expect that the pressure change should be the same in both groups if no disturbing factor is operating. In the following analyses, however, it has been assumed that the "falsely" high or low readings are randomly distributed, and that the correlation between the mean *inter-survey pressure* (taken as the mean of the two survey readings) and the change of pressure is small. The tables show pressure change related to this mean pressure for the various groups studied. A more rigorous analysis will be published when further follow-up material is available.

Relationship Between Pressure and Age at the Two Surveys

As these data were collected in exactly comparable ways during each survey no systematic difference between the mean values in five-year age-groups in 1954 and 1958 was expected. For females this was so (Fig. 1), but for males there is a consistent suggestion of a secular change—a change occurring in subjects of the same age as time passes. For each age group between 15 and 55 both systolic and diastolic mean pressures were higher in 1958 than they were in 1954. Though the mean differences are small and may have little meaning medically, they are highly significant statistically, and it is difficult to imagine how an artifact would be likely to produce a difference of this kind in males but not in females. Furthermore, when the data are subdivided into those for random samples and those

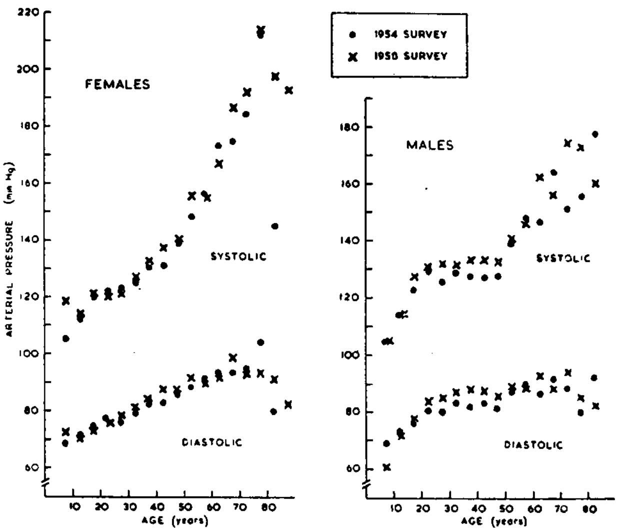

FIG. 1.—Mean systolic and diastolic pressures by age in the two surveys.

for relatives, identical results are found—there is no suggestion of a secular trend in either group of females, but similar changes in both groups of males.

The difference between the findings at two surveys is not due to differences in the populations ; though 11% of the original male population had died or left the area, removing them from the 1954 results does not materially influence the difference found between the two surveys.

Those age groups in males which appear to show this secular trend are examined in greater detail later. The trend cannot be explained by changes in arm girth ; the mean values differed between the surveys by less than ¼-in. (6 mm.) for each 5-year age-group. As arm girth is highly correlated with weight ($r=0.9$) it seems improbable that weight changes could explain the findings either ; but, unfortunately, weight was not recorded for all subjects in the original survey.

Influence of Occupation on Arterial Pressure

It was found in the analysis of the data collected in our first surveys in the Rhondda Fach and the Vale of Glamorgan that arterial pressure is significantly higher in men previously employed mainly in light occupations.

TABLE I.—*Follow-up of Male and Female Populations, Rhondda Fach,* 1954–8

	Males				Females				Total			
	Random Sample		1st Degree Relatives		Random Sample		1st Degree Relatives		Random Sample		1st Degree Relatives	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Followed up	120	88	404	89	103	90	487	93	223	89·2	891	91·3
Left area	9	7	28	6	6	5	23	4	15	6·0	51	5·2
Died	5	4	22	5	5	4	9	2	10	4·0	31	3·2
Refused follow-up	2	1	1	—	0	—	2	—	2	0·8	3	0·3
Original population	136	100	455	100	114	100	521	100	250	100	976	100

The differences in the mean systolic and diastolic pressures as at age 45 between men in light occupations and those in heavy occupations were 10 mm. and 8 mm. Hg respectively. Men in heavy jobs have larger arms, so that applying a correction for arm girth enhances the difference between the groups.

Though these findings were in apparent conflict with those of Brown *et al.* (1957), and Humerfelt and Wedervang (1957), who both found lower pressures in professional groups, they were strongly supported by the recent *Occupational Mortality Supplement* of the Registrar-General (1958). Standardized mortality ratios for hypertension, vascular lesions of the central nervous system, and coronary disease were greatly increased in the light occupation groups (Table II). A more detailed analysis of the effect of occupation on rate of change of pressure will be possible after the follow-up of the rural population. The Rhondda Fach population is less satisfactory for this type of study as there is a deficiency of men in light occupations, particularly in the older age groups.

The findings from this first follow-up are interesting but difficult to interpret. Men whose predominant past occupation was classified as light or moderately light had higher mean inter-survey pressures than those in heavy jobs (Table III) except between the ages of 35 and 45, where the effect of family size (see later) predominates and causes little difference between the occupational groups.

Between the two surveys, however, the increase in both systolic and diastolic pressure is greatest in those previously employed in heavy occupations. Changes in pressure analysed by inter-survey occupation rather than predominant past occupation also showed a greater increase in the four-year interval for those engaged in heavy work.

TABLE II.—*Standardized Mortality Ratios for Males Aged 20–64 by Socio-economic Groups, 1949–53*

	Hypertension (440–447)	Coronary Disease (420–422)	Vascular Lesions of C.N.S. (330–334)
1. Farmers	70	62	76
2. Agricultural workers	60	55	73
3. Higher administrative, etc.	123	147	124
4. Other administrative, etc.	109	116	104
5. Shopkeepers	118	123	117
6. Clerical workers	117	132	118
7. Shop assistants	93	96	86
8. Personal services	114	105	108
9. Foremen	90	99	88
10. Skilled workers	102	102	101
11. Semi-skilled „	87	84	89
12. Unskilled „	102	89	102

TABLE III.—*Mean Inter-survey Systolic and Diastolic Pressures, and Mean Change of Pressure* 1954–8 *for Males Aged* 15–65 *at the Time of the First Survey, Whose Predominant Past Occupation was Light or Heavy Before the* 1954 *Survey*

Age in 1954	Occupation	No.	Mean Inter-survey Systolic Pressure	Mean Inter-survey Diastolic Pressure	Mean Systolic Change 1954–58	Mean Diastolic Change 1954–58
15–	Light	35	130·6	81·7	+ 2·7	+2·5
	Heavy	49	126·7	79·8	+ 6·1	+6·1
25–	Light	19	135·0	87·5	+ 3·4	+3·6
	Heavy	73	128·9	84·3	+ 5·0	+5·9
35–	Light	12	126·7	83·0	0	+1·7
	Heavy	74	130·2	85·2	+ 6·4	+4·0
45–	Light	17	142·7	88·9	+ 3·9	+2·2
	Heavy	64	136·1	84·8	+ 8·9	+2·7
55–	Light	9	160·6	94·2	+ 9·5	+2·2
	Heavy	44	152·5	88·4	+14·4	+3·4

It is difficult to reconcile these findings with the fact that those in heavy occupations previously had lower pressures except in terms of a secular trend which is now influencing the heavy occupation group. It is possible that the considerable social changes which are occurring in the Welsh mining valleys are influencing those in heavy manual work more than those in light jobs, but it would seem unlikely that any recent change in the nature of the work itself has occurred which could have any direct effect of this kind.

Association Between Family Size and Arterial Pressure

We have previously shown that the pressures of married men and women show an inverse correlation with the size of their families—the larger the family the lower the pressure. Similar but less marked trends were reported for women by Humerfelt and Wedervang (1957) in their analysis of the Bergen survey.

In our data this trend was really clear-cut only in the "child-bearing" age-groups, which were taken as 15–45 for females and 15–50 for males (Miall and Oldham, 1958), though, as can be seen in Table IV, in the Rhondda Fach childless men and women have fairly consistently higher pressures than have those up to age 75 with children, where differences in survival probably become important.

TABLE IV.—*Systolic and Diastolic Mean Pressures by Age for Rhondda Fach Females and Males With and Without Children (Based on Data from* 1954 *and* 1958 *Surveys)*

Age	Children	Females			Males		
		No.	Systolic	Diastolic	No.	Systolic	Diastolic
15–	Without	169	121·4	75·7	164	127·8	79·4
	With	32	116·9	72·4	17	124·0	76·9
25–	Without	42	129·2	81·8	69	132·4	85·6
	With	167	123·4	78·1	120	127·7	82·9
35–	Without	23	134·5	82·3	40	135·4	88·9
	With	205	132·5	84·6	155	129·2	84·3
45–	Without	12	142·1	87·9	19	138·8	86·5
	With	150	145·1	87·9	147	134·5	85·7
55–	Without	13	169·8	96·4	14	155·0	91·1
	With	127	161·3	91·0	109	149·7	89·1
65–	Without	10	188·5	97·5	14	163·6	93·2
	With	63	182·8	94·5	60	161·8	90·2
75+	Without	4	180·0	83·8	1	147·5	52·5
	With	20	206·0	97·5	27	164·0	83·6

The data available from these two surveys enable us to see to what extent this results from selection or from having a child. The mean pressures at the time of the first survey were somewhat lower for those women who subsequently had children than for those who did not (Table V). The difference between the two groups for mean inter-survey pressure was more marked. In several of the age-groups the mean pressure on the second occasion had actually fallen in the women who had had children, whereas this did not occur in any age-group for those who had not.

The first survey pressures were also slightly lower in the men who subsequently increased their family size than in those not doing so, and though there was not the same tendency as in women for pressures to fall, they rose less in that group than in those who had no children in the interval (Table VI).

The lower initial pressures of those subsequently having children did not appear to be explained by differences in "parity," but in our previous analysis we found unmarried men and women had higher pressures than those married without children, and this fact must contribute to the initial differences between the groups.

TABLE V.—*Mean Systolic and Diastolic Pressures in* 1954, *Mean Inter-survey Systolic and Diastolic Pressures, and Mean Change of Pressure* 1954–8 *for Females Aged* 10–45 *at Time of First Survey Who Have and Have Not Increased Their Families Between the Surveys*

Age in 1954	Increase in Family Size, 1954–8	No.	Mean Systolic Pressure, 1954	Mean Diastolic Pressure, 1954	Mean Inter-survey Systolic Pressure	Mean Inter-survey Diastolic Pressure	Mean Systolic Change, 1954–8	Mean Diastolic Change, 1954–8
10–	No	55	112·6	72·2	117·0	73·7	+ 8·7	+2·9
	Yes	2	110·0	65·0	111·3	65·0	+ 2·5	0
15–	No	35	120·2	73·9	120·2	74·2	0	+0·6
	Yes	10	118·0	75·0	117·3	73·8	− 1·5	−2·5
20–	No	28	121·8	78·2	122·6	78·2	+ 1·6	0
	Yes	22	121·6	74·1	119·7	75·4	− 3·9	+2·5
25–	No	25	123·5	76·9	125·3	78·3	+ 3·6	+2·8
	Yes	18	121·1	74·4	123·3	78·5	+ 4·4	+8·1
30–	No	51	125·6	79·8	128·5	82·0	+ 5·8	+4·3
	Yes	12	125·0	78·3	126·7	80·4	+ 3·3	+4·2
35–	No	52	128·5	81·5	132·0	83·7	+ 7·0	+4·4
	Yes	4	152·5	103·8	149·4	99·4	− 6·3	−8·8
40–	No	48	131·1	83·1	135·1	85·4	+ 7·9	+4·6
	Yes	2	125·0	77·5	118·8	73·8	−12·5	−7·5

TABLE VI.—*Mean Systolic and Diastolic Pressures in* 1954, *Mean Inter-survey Systolic and Diastolic Pressures, and Mean Change of Pressure* 1954–8 *for Males Aged* 15–50 *at Time of First Survey Who Have and Have Not Increased Their Families Between the Surveys*

Age in 1954	Increase in Family Size, 1954–8	No.	Mean Systolic Pressure, 1954	Mean Diastolic Pressure, 1954	Mean Inter-survey Systolic Pressure	Mean Inter-survey Diastolic Pressure	Mean Systolic Change, 1954–8	Mean Diastolic Change, 1954–8
15–	No	40	122·5	76·4	126·8	79·6	+ 8·5	+6·3
	Yes	5	122·5	73·5	121·0	74·0	− 3·0	+1·0
20–	No	26	132·5	84·4	135·9	86·3	+ 6·7	+3·8
	Yes	13	124·8	75·2	126·2	75·6	+ 2·7	+0·8
25–	No	21	128·0	83·0	131·6	86·4	+ 7·1	+6·7
	Yes	18	123·3	77·2	126·1	80·4	+ 5·6	+6·4
30–	No	38	127·9	82·4	129·9	84·9	+ 4·0	+5·0
	Yes	15	132·2	86·2	133·6	88·2	+ 2·7	+4·0
35–	No	40	127·3	83·8	130·5	85·8	+ 6·3	+3·9
	Yes	7	124·6	78·9	127·5	82·5	+ 5·8	+7·1
40–	No	37	127·1	83·2	129·8	84·6	+ 5·3	+2·8
	Yes	2	127·5	80·0	127·5	81·3	0	+2·5
45–	No	42	128·0	81·1	132·6	84·3	+ 9·2	+6·2
	Yes	2	125·0	82·5	131·3	83·8	+12·5	+2·5

Weight changes are again unlikely to explain the blood-pressure association with family size, for in our data and in the Board of Trade (1957) survey of women's measurements and sizes women with children are somewhat heavier than those without.

Though selection may play some part in causing the difference in pressure between those who did and did not subsequently have children, it appears to be less important than some change which occurs as a result of having a child, which in women can cause an actual fall in pressure. The difference in pressure increments between those who had children and those not doing so are small in a four-year interval, but the cumulative effects on pressure of an active or inactive reproductive life, whether they are direct physiological effects or an indirect effect associated with standards of living or energy expenditure, would be considerable, as judged from Tables V and VI.

It is not unreasonable to expect that the process, whatever its mechanism, would account entirely for the 20 mm. and 9 mm. Hg differences which were found previously in systolic and diastolic pressures between childless women and women with six children at age 45–50. For males the greater rise in pressure for those not having children is also large enough to explain the considerable differences between men with no children and those with large families found previously, without introducing hypotheses involving medical selection to account for the findings.

Influence of Salt on Arterial Pressure

That there are abnormalities of electrolyte metabolism and excretion in hypertension is now well established. High blood-pressure can be reduced by salt starvation (Kempner, 1948) and induced by a very large salt-intake in man (Perera and Blood, 1947) and in animals (Meneely *et al.*, 1953). Retention of sodium is a well-known finding in Cushing's disease, where hypertension is characteristic. Addison's disease manifests the opposite findings. Some workers—for example, Holley *et al.* (1951)—have found high serum sodium values in hypertensive subjects ; others—for example, Cottier *et al.* (1958)—found no difference in sodium levels between normotensive and moderately and severely hypertensive subjects, though mildly hypertensive subjects in their study showed consistently a slightly high value. Though the evidence suggests that hypertensive humans and animals have higher sodium values in the body, hypertensives reject sodium after a saltload to a greater extent than do normal subjects (Farnsworth and Barker, 1943 ; Farnsworth, 1946 ; Cottier *et al.*, 1958).

The relationship between blood-pressure levels and normal salt intake is less well established. Dahl and Love, 1954, 1957) presented evidence that those who take additional salt with their food at table have higher pressures than those who do not. They questioned both men and women about their salt habits but confined their analysis to men, in whom they found that the prevalence of hypertension (140/90 and over) was increased in those taking salt in this way, and much increased in those who were both overweight and added extra salt.

Similar questions to those used by Dahl and Love were asked in this follow-up study, and on the response to these questions each subject was classified into one of three groups: (1) "high salt intake"—for those habitually adding extra salt to a cooked meal, without previously tasing it ; (2) "medium salt intake"—for those adding extra salt to such a meal only occasionally, and after previously tasting it ; and (3) "low salt intake"—for those normally not taking additional salt with such a meal.

It cannot be assumed that the questions asked necessarily detect subjects with different salt-intakes, especially in women. It is possible that those women who regularly add salt at the table are those who salt the food insufficiently in its preparation. The three questions asked do, however, produce a clear-cut response and classify the population into well-defined groups, and there is an interesting sex-difference in the response to the questions (Table VII). A smaller

TABLE VII.—*Response to Standard Questions on Salt Intake Habits. Males and Females.* 1958

	Salt Intake Group—All Ages							
	High		Medium		Low		Total	
	No.	%	No.	%	No.	%	No.	%
Males	228	48·9	133	28·5	105	22·5	446	100
Females	183	36·1	145	28·6	179	35·3	507	100

percentage of women than men are in the high salt-intake group (36.1% against 48.9%), and a larger proportion are in the low salt-intake group (35.3% against 22.5%). Dahl and Love also found a similar significant difference in the sex distribution. These sex differences in salt habits at table may be occupational and due to loss of salt from sweating in men, or may merely indicate that women, rightly or wrongly, believe that they have added sufficient salt in the kitchen.

The mean pressures of the high intake and low intake groups are shown in Fig. 2. There is no suggestion of any systematic difference between the two groups of males. Among the females there is a consistent difference between the two groups, but, surprisingly, it is in the opposite direction from that expected from the findings of Dahl and Love for males—women who habitually add salt show lower systolic and diastolic pressures than those who do not. All subjects advised to omit salt on medical grounds have been excluded from this comparison. Not only had those women who habitually take extra salt lower pressures in 1958 than those not taking salt, but their pressures had increased less in the previous four years, and, except in old age, they were lighter in weight (Table VIII). Furthermore, their pulse pressures were less in most age-groups over age 35, and had increased less rapidly in the preceding four years (Table IX). These findings appear to merit further investigation.

Separate analyses showed no correlation between parity and salt intake in women, nor between the energy expenditure of occupation and salt intake in men.

These results only suggest that the findings of Dahl and Love for American men do not necessarily apply in other populations where salt habits may be different. Phear (1958) also found in a small series of hospital patients a greater proportion of high salt-takers in his normotensive than in his hypertensive subjects. The questions presumably correlate with salt appetite, but we need an indication of how this is related to the sodium content of the body, and this is not a practicable investigation to tackle by using epidemiological techniques. If salt retention is accompanied by a smaller appetite for salt, these findings accord with the general body of evidence relating sodium metabolism and pressure.

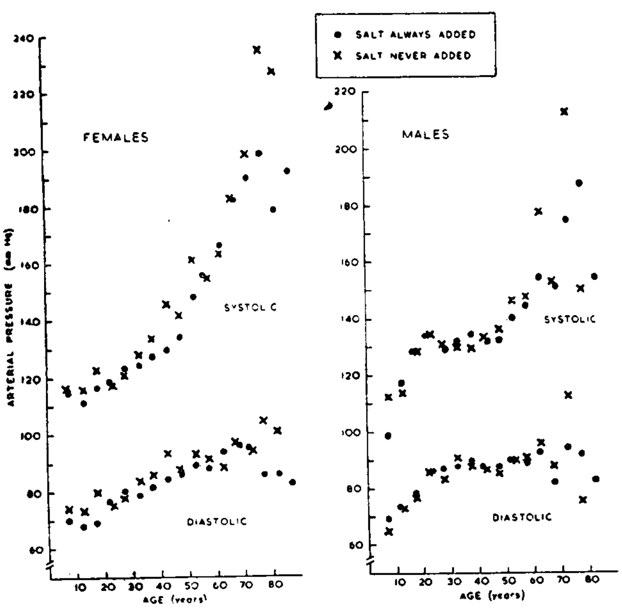

FIG. 2.—Mean systolic and diastolic pressures by age and salt habits in the 1958 survey.

TABLE VIII.—*Mean Systolic and Diastolic Pressures* (1958), *Changes in Pressure* (1954–8) *and Weights* (1958). *Females Aged* 15–90, *by Salt Intake*

Age in 1958	Salt Intake Group	No.	Mean Systolic Pressure, 1958	Mean Diastolic Pressure, 1958	Change in Systolic Pressure, 1954–8	Change in Diastolic Pressure, 1954–8	Weight 1958	
							lb.	kg.
15–	Low	23	119·9	77·3	+ 3·0	+1·5	125·6	57·0
	High	37	117·5	72·9	− 2·0	−0·1	121·3	55·0
25–	Low	37	124·9	81·0	+ 0·2	+3·8	132·0	59·9
	High	38	123·8	79·4	+ 5·4	+4·4	130·6	59·2
35–	Low	44	140·1	89·4	+ 9·5	+6·0	143·7	65·2
	High	37	128·7	83·0	+ 3·1	+4·0	138·2	62·7
45–	Low	29	149·4	90·3	+13·3	+5·2	150·2	68·1
	High	28	138·6	87·2	+ 7·2	+4·0	143·0	64·9
55–	Low	25	158·7	90·1	+11·6	+2·2	160·1	72·6
	High	27	162·2	91·4	+ 7·0	+0·7	151·0	68·5
65–	Low	16	187·8	94·2	+21·3	+3·8	146·2	66·3
	High	9	185·8	95·8	+11·7	+6·1	168·1	76·3
75+	Low	5	230·5	102·5	+ 2·0	−7·0	120·5	54·7
	High	7	189·7	85·3	+ 7·1	−2·9	144·6	65·6

TABLE IX.—*Mean Pulse-pressures* (1958) *and Changes in Pulse-pressure* (1954–8). *Females Aged* 15–90, *by Salt Intake*

Age in 1958	Salt Intake Group	No.	Pulse-pressure, 1958	Change in Pulse-pressure 1954–8
15–	Low	23	47·0	+ 1·5
	High	37	44·6	− 1·9
25–	Low	37	43·8	− 3·9
	High	38	44·5	+ 0·6
35–	Low	44	50·7	+ 3·5
	High	37	45·6	− 0·8
45–	Low	29	59·1	+ 8·1
	High	28	51·4	+ 3·2
55–	Low	25	68·6	+ 9·4
	High	27	70·7	+ 6·3
65–	Low	16	93·7	+17·5
	High	9	90·0	+ 5·6
75+	Low	5	128·0	+ 9·0
	High	7	104·3	+10·0

TABLE X.—*Mean Values for* 24-*hour Urinary Excretion of Sodium by Systolic Pressure and Salt Intake in Post-menopausal Women*

Salt Intake Group	Systolic Pressure Over 200 mm. Hg			Systolic Pressure Under 150 mm. Hg		
	No. of Specimens	Na Output in 24 Hours in Milli-equivalents		No. of Specimens	Na Output in 24 Hours in Milli-equivalents	
		Mean	S.D.		Mean	S.D.
Low ..	26	123·1	42·60	61	130·7	48·72
High ..	23	122·1	36·49	43	146·3	48·31

We have determined the sodium output in 24-hour specimens of urine for four groups of post-menopausal women in the sample; all women over age 50 in the high intake and low intake groups with systolic pressures over 200 mm. or under 150 mm. Hg were asked to provide 24-hour urine specimens daily for a week. The completeness of the specimens was checked by measurement of urinary creatinine. The results, based in each case on the highest creatinine values (provided they varied by less than 25%, which we have found to be normal variability on known 24-hour specimens), are shown in Table X.

The hypertensive women in this sample excreted less sodium than those with low pressure, whether in the high or the low salt-intake group, but the differences are not significant at the 5% level. There was no difference in sodium output between hypertensive women who did and did not add extra salt to their food, but a rather suggestive difference (0.20>P>0.10) between the two groups of normotensive women.

Relationship Between the Survey Findings and Mortality Rates

Though it would be rash to attach much significance to the secular change in arterial pressure which seems to be occurring amongst middle-aged males in this survey unless it is confirmed in subsequent studies, it is nevertheless possible that the higher pressures found in the second survey are a manifestation of the process which is causing the secular trend in male mortality from cardiovascular disease.

The total number of deaths attributed to cardiovascular diseases is increasing in both sexes in Britain. Some of the apparent increase is due to changes in the age structure of the population; changes in the habits of those responsible for certifying and classifying deaths may also have resulted in changes in the reported rates for specific causes of death. Deaths of hypertensives are apt to be classified under four main headings: (1) hypertensive diseases (*International Classification*, 440–447); (2) arteriosclerotic and degenerative heart disease (420–422); (3) vascular lesions affecting the central nervous system (330–334); and (4) nephritis and nephrosis (590–594).

The last group is small and can be ignored. By pooling the other three we can overcome changes in certification and classification and get an indication of any secular change which is occurring in those diseases most directly affected by arterial pressure.

Between 1950 and 1956 the overall mortality rates for males from these three groups have shown a very definite increase, which is confined to the middle-aged; there is a clear upward trend in each five-year age-group from 25 to 60 (Table XI). In females there is no such increase; indeed, the death rates for the combined group are tending to fall in age-groups over 45 (Table XII).

Examination of the separate groups shows that the increase in the male mortality rates is entirely due to the arteriosclerotic and degenerative heart disease group. The rates for cerebrovascular lesions show no change and there is a slight fall in those attributed to hypertension in males between ages 45 and 65. It is not clear what kind of patients would be certified as dying of hypertension, but certainly the majority of hypertensives who die would not be so classified, but would occur in one of these other groups.

The secular trend in mortality in middle-aged males is therefore largely due to coronary artery disease, the attack rate of which is significantly higher in hypertensives (Dawber *et al.*, 1957; Chapman *et al.*, 1957).

The changes in male mortality from coronary artery disease are certainly occurring in the same age-groups as we have found to show a secular change in pressure. In our survey it is the heavy-occupation groups which are contributing most to this rise, and it is perhaps significant that the *Occupational Mortality Supplement* of the Registrar-General (1958) shows a flattening of the downward mortality gradient from social class I to social class V between 1930–2 and 1949–53 (Table XIII). Furthermore, there is other evidence suggestive of a marked secular trend for coronary disease. The mortality ratios for 10-year age-groups for 1949–53 show, in males aged 25–34, a clear reversal of the normal downward gradient by social class seen in older age-groups (Table XIII). The heavy-occupation groups are apparently starting to show higher mortality than those engaged in lighter work; our survey findings may be reflecting this trend.

TABLE XI.—*Death Rates (Per Million of Living Population) from Arteriosclerotic and Degenerative Heart Disease* (420–422), *Hypertensive Diseases* (440–447) *and Vascular Lesions Affecting the Central Nervous System* (330–334). *Males. England and Wales*, 1950, 1952, 1954, *and* 1956

Age	1950	1952	1954	1956
15–	18	20	20	18
20–	40	45	45	42
25–	51	66	74	73
30–	120	126	159	147
35–	275	316	330	373
40–	658	696	748	783
45–	1,570	1,576	1,646	1,727
50–	3.205	3,349	3,468	3.456
55–	5.909	6,127	6,284	6.512
60–	11,307	11,106	11,237	11,274
65–	19,273	19,508	19,584	19 466
70–	33,168	32,986	32,721	33,013
75–	54,823	56,217	55,215	56,039
80–	89,994	95,105	89,589	89,720
85+	139,721	155,714	136,932	138,262

TABLE XII.—*Death Rates (Per Million of Living Population) from Arteriosclerotic and Degenerative Heart Disease* (420–422), *Hypertensive Diseases* (440–447), *and Vascular Lesions Affecting the Central Nervous System* (330–334). *Females. England and Wales.* 1950, 1952, 1954, *and* 1956

Age	1950	1952	1954	1956
15–	10	14	14	12
20–	28	28	25	25
25–	35	51	44	36
30–	84	74	92	83
35–	163	155	179	143
40–	290	315	317	297
45–	762	760	681	669
50–	1,586	1,646	1,466	1,347
55–	3,058	3,030	2,847	2,708
60–	6.376	5,979	5,796	5,631
65–	12.528	11,993	11,625	11,290
70–	24,533	22,791	20,368	21,999
75–	45,468	42,508	41,327	41.163
80–	77,827	75,774	71,802	72,482
85+	128,062	138,754	124,770	128,486

TABLE XIII.—*Standardized Mortality Ratios* (20–64) *for Coronary Disease by Social Class*, 1930–32 *and* 1949–53, *and Mortality Ratios for Coronary Disease by Social Class* (1949–53). *Males* (*Registrar-General*, 1958)

Social Class	S.M.R.s (20–64)		Mortality Ratios			
	1930–32	1949–53	25–34	35–44	45–54	55–64
I ..	237	147	81	108	144	154
II ..	147	110	86	104	110	111
III ..	96	105	97	100	102	108
IV ..	67	79	100	84	80	78
V ..	67	89	128	108	93	86

Further confirmation of the relationship between hypertension, physical activity, and ischaemic heart disease has been provided by Morris and Crawford (1958). In their analysis of a national necropsy survey they found that hypertension, based on clinical and pathological findings, was less common and occurred 10 to 15 years later in men previously employed in heavy occupations than in others; they also found that within each occupational group, graded according to physical activity, myocardial scarring was commoner in those with evidence of hypertension. When the social classes were broken down into groups categorized by physical activity and graded as light, active, and heavy, these occupational groups showed no social class trend in ischaemic heart disease, but the relationship between myocardial fibrosis and physical activity was then evident within single social class groups.

Mortality by marital status is not given in any detail in the Registrar-General's reports. An analysis of deaths in the United States for the years 1949–51 (U.S.

Public Health Service, 1956) shows much higher rates for cardiovascular deaths at all ages for the single, widowed, and divorced males than for the married. The differences are even more pronounced for the non-white population. Among females the widowed and divorced show a similar excess mortality from these causes; single coloured women also show a very marked excess. Single white women, both in the United States and in Britain, show no excess cardiovascular mortality.

This favourable mortality experience of the married is not confined to the cardiovascular group of diseases, however; similar results are found for such diverse conditions as pneumonia, peptic ulcer, and cirrhosis of the liver. There are many mechanisms which may account for such findings, and it is impossible to determine to what extent they are due to a beneficial influence on health of married life; to the deprivations and worries of the single, widowed, and divorced; or to the health selection which occurs at marriage.

We have, fortunately, too few deaths in this follow-up study to be able to relate our blood-pressure readings to mortality rates or expectation of life, and too few widowed and divorced to warrant their separate analysis until further material is available.

Conclusions and Summary

The results of the first follow-up survey of arterial pressure in the population of one of the Welsh mining valleys are reported. The original measurements were made in 1954 on a random sample of this population and all first-degree relatives living within 25 miles. Repeat readings were made four years later, at the same time of year, in 1958. The recordings were all taken by one observer, under identical circumstances, without reference to previous readings.

The results suggest the possibility that arterial pressure, when full allowance is made for age, may be increasing in middle-aged males. This trend is occurring to a greater extent in men previously engaged in heavy jobs, though they still have lower pressures than those previously in light occupations. These findings are discussed in terms of the secular trend in mortality from cardiovascular diseases reported by the Registrar-General.

Blood-pressure was again found to correlate with family size, and increases in pressure were less in those subjects who had children during the four-year interval. The differences in the rate of increase of pressure with age between those having children and those not having them appeared sufficient to explain the marked difference found previously between childless men and women and those with large families.

In women, those adding salt at table to cooked meals, who presumably have a larger salt appetite, were found to have lower blood-pressures and smaller pulse-pressures in 1958, to have gained less in blood-pressure and pulse-pressure during the previous four years, and to be lighter than women who do not take additional salt in this way. No comparable differences were found in the men.

I should like to record my thanks to the people of the Rhondda Fach, who have again so willingly co-operated in this survey; to my colleagues at the Pneumoconiosis Research Unit, in particular Dr. J. C. Gilson, the Director, and Dr. A. L. Cochrane and Mr. P. D. Oldham for valuable discussion and advice; to Dr. T. G. Morris for the analyses of sodium output; to Miss G. Jones and all members of the field survey team who helped with the collection and analysis of the material, and especially Miss L. Roberts, who provided secretarial help, and Mr. F. Moore, who assisted with all the field work.

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METHOTREXATE IN TREATMENT OF METASTASIZING CHORIONCARCINOMA

A CASE REPORT

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The known predilection of chorioncarcinoma to penetrate blood vessels and metastasize early makes it obvious that treatment must be immediate if it is to be successful. Once metastases have appeared they may be treated as they are found, but the long-term results in proved cases of chorioncarcinoma are disappointing.

Reports on the treatment of these advanced cases with folic acid antagonists and 6-mercaptopurine have come from America, but so far there has been no comparable group of cases reported from this country. The case detailed below, though ultimately fatal, is reported in the hope that interest may be aroused in this form of therapy, which may be of value in certain of these advanced cases.

Dosage of Methotrexate in Chorioncarcinoma.—Hertz *et al.* (1958) recommended a dosage of 1–4.5 mg. per kg. body weight for the first course of treatment, to be followed by subsequent courses in which a dose of 2.5 mg. per kg. body weight was employed. The calculated amount of methotrexate was given, either orally or by the intravenous route, in divided doses daily over each five-day course. This dosage is in excess of

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