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THE HEALTH OF THE ELDERLY AT HOME*

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This paper describes the general results of a survey which was carried out in Sheffield in the years 1949-51. Some of the more detailed results have been published in special journals.

The aims of the survey were to investigate and describe the state of health and the diets of elderly people living at home in Sheffield; to examine the relationship between health and such factors as age, sex, marital state, social class, and diet; and to collect information on normal physiological standards in the elderly. In the course of the survey information on social aspects such as income, occupation, and knowledge and use of the social services was collected in addition to the medical and dietary data. There were 476 elderly people in the sample—192 men aged 66 or over and 284 women aged 61 or over. In addition to a full clinical examination carried out in the home, samples of urine and blood were examined and a large proportion of the group also came to hospital for special dental, ophthalmic, and radiological examinations. Similarly, a large proportion agreed to take part in a dietary survey.

With the proportion of elderly people in the population increasing, it is becoming a matter of some importance to know more about the incidence of disease and disability in this group, partly at least in order to try to see what medical and social services are needed at the moment and also to make forecasts for the future. In addition a detailed analysis of morbidity statistics can give important clues to causation and prevention. Most of our knowledge of the illnesses and disabilities of the elderly has come in the past from studies made of old people in hospital. These account at any one time, however, for only a very small proportion of the elderly in the population, and studies based only on hospital cases can give little indication of the state of health of old people in general.

Death rates in the elderly from the various causes can be obtained from the Registrar-General's Annual Review, but to obtain information on morbidity rates the examination of an unselected sample of the ordinary population, including both the sick and the healthy, is necessary.

Apart from the pioneer survey of Sheldon (1948)[†] in Wolverhampton, there are few other systematic mor-

bidity data available relating to the elderly living at home, and the dietary survey of this group of elderly people provides information on a scale not previously available.

The assessment of the health of the group was attempted in two ways; firstly, by attempting to assess what may be called the overall health in terms of function, and, secondly, by discovering the incidence of different disabilities and illnesses.

Many elderly people are found on medical examination to have several pathological conditions. Some of these, such as high blood pressure and arteriosclerosis, may appear to have little effect on their health if this is equated with activity and well-being. Other conditions without danger as regards their prognosis, such as pruritus or plantar warts, may cause much disability. Some conditions with a serious prognosis, such as cancer of the skin or diabetes mellitus, may at first cause no disability at all. For these reasons, measurement of the incidence of conditions alone cannot give a complete picture. Attempts were therefore made to assess general health as well as to enumerate the different pathological conditions found.

Assessment of Health and Disability: 1, Incidence of Specific Causes of Ill-health and Disability

The incidence of the different conditions found varied from, for example, 0.4% who suffered from scurvy to 97.5% who had refractory errors requiring spectacles for their correction.

In the most important group, cardiovascular disease, the commonest conditions found were angina of effort, followed by pulmonary heart failure, "hypertensive heart failure," and cerebrovascular accidents in equal numbers. Then came rheumatic heart disease, degenerative aortic disease, peripheral vascular disease, and syphilitic aortic disease in that order. We found so many people with high blood pressures who appeared to be well that we came to doubt whether hypertension alone ever caused heart failure in the elderly. Possibly myocardial degeneration and failure with hypertension or following hypertension would be a better term than "hypertensive heart failure." Cardiovascular conditions were responsible for more disability than any other condition, 18.2% of the sample being to some extent disabled. There were, however, many subjects with evidence of heart disease who experienced little or no disability. This was particularly evident in cases of

*A shortened version of a monograph describing research relevant to basic problems of ageing which was awarded a £100 prize by the Ciba Foundation.

[†]It is to be noted that Sheldon did not carry out a physical examination of his subjects; his results were based on a medical and social history.

minor degrees of angina of effort (see Droller and Pemberton, 1953a, 1953b; Droller *et al.*, 1952).

Bone and joint conditions which included osteoarthritis and rheumatoid arthritis, and the large number of complaints diagnosed under such headings as rheumatism, lumbago, and sciatica, came second in importance as a cause of disability. Paget's disease was found in 8.6% of the men and in 2.2% of the women. This is a surprisingly high incidence in view of its comparative rarity in hospital practice. In relation to the high incidence of rheumatic disorders, however, the proportion who were to any noticeable extent disabled by them was small.

Bronchitis and emphysema caused*disablement in just over 4%, but were present to a lesser degree in rather more than a third.

Foot disorders and deformities were extremely common, though rarely disabling. It was estimated that three-quarters of the sample would have benefited from chiropody.

With regard to genito-urinary conditions, 15% of the married women and widows complained of symptoms suggesting prolapse, and one-quarter of the men had symptoms commonly caused by enlargement of the prostate.

Hernia was common, especially in the men. It was necessary for 19% of all the men to wear a truss. There was no significant relationship in this sample between heavy manual work and hernia. Sixteen had been operated on for hernia, and in seven of these the condition had recurred.

Failing hearing and eyesight may perhaps be regarded as almost natural results of the ageing process. More men than women had varying degrees of deafness—53% compared with 31%—and this difference was true in each of the age groups studied. With regard to vision, only 3% of the men and 2% of the women were considered not to need spectacles, and the great majority, more than 92%, had spectacles for near or distant vision. Sheldon (1948) had already demonstrated, before the introduction of the National Health Service, the need of many of the elderly for proper sight-testing and spectacles, and this survey showed that within two or three years of the implementation of the Service approximately 50% of the total sample had received spectacles through it. Only a small proportion, less than 2%, had received hearing-aids, but this was partly due to the fact that there was less knowledge about this provision of the Health Service, and also because there was a serious shortage of hearing-aids at that time. There is no doubt that the provision of free spectacles and hearing-aids did a great deal to mitigate these two causes of disability in the elderly in the first three years of the Service.

Cataract in its various stages was not uncommon, being present in approximately one in seven. Two subjects were almost blind with cataract for which they had not bothered to consult their doctor.

Vertigo was a fairly common and disabling condition. 13.1% of the men and 30.3% of the women complained of this symptom. The following case history illustrates the severe disability which can be caused by it.

Case 151.—A retired foreman bricklayer aged 76 complained of nearly continuous vertigo. He said he felt "happy when the room didn't spin round." He also had occasional tinnitus, and marked arteriosclerosis. Blood

pressure 200/100 mm. Hg. He was slow and deliberate, and had to hold on to the furniture because of his vertigo, but managed to do most of the housework, as his wife was crippled with rheumatoid arthritis.

The dental examinations revealed that only a tiny fraction of this group of the elderly had adequate natural dentitions. Approximately a quarter of the sample depended on their gums alone or on a few remaining teeth or stumps, more often than not carious, for mastication. The dentures of many of those who used them required replacement or repair. The dental condition of this group can only be regarded as thoroughly unsatisfactory. They were of a generation that had little or no access to conservative dental treatment and who came to regard complete dental clearance in middle age as a normal event. It is probable, in view of the relatively recent development of the dental profession, that few of these elderly people had had the benefit of treatment in their childhood or early adult life from trained dental surgeons. The fact that the average number of surviving natural teeth was significantly higher in the upper social class group and that there was less caries in them suggests that better dental treatment might considerably reduce the proportion of the elderly who depend on artificial teeth or no teeth at all for mastication (see Hobson and Roseman, 1953).

The radiological survey confirmed that certain conditions, such as calcification and unfolding of the aorta, become increasingly common in the older age groups. It also permitted an examination of the relationship between such factors as enlargement of the heart and high blood pressure, and osteoarthritic lipping of the thoracic vertebrae and "rheumatic" types of pain, largely with negative results.

The diagnoses of mental and emotional disturbances were much more difficult, and the results so far as incidence of the less severe types of psychoneurosis are concerned inevitably depend on criteria which are less objective than those used in physical diagnosis. It was estimated that approximately a quarter of the men and half the women suffered from various degrees of anxiety or depression. Two men and 10 women, 2.5% of the whole sample, were judged to have a severe neurosis. Evidence of early senile dementia was present in 3% and of frank senile dementia in 1%. Minor degrees of insomnia were very common, and 7% of the men and 10% of the women were suffering from severe insomnia.*

Discovery of Previously Undiagnosed Conditions

A good deal of previously undiagnosed illness and disability was discovered. This may be of little significance in regard to minor complaints or in the case of conditions for which there is no effective treatment, such as Paget's disease. Indeed, in some cases the discovery of an abnormality such as symptomless hypertension or atherosclerotic aortic stenosis might affect the health and happiness of an old person adversely if it resulted in the imposition of a strict regimen and the creation of anxiety. Such findings were not communicated to the subjects of the survey. There were discovered, however, a small number of serious conditions which had not previously been suspected and for which treatment was required; these included diabetes in two women, myxoedema in two women, rodent ulcers in three men, and scurvy in two men. Among less serious conditions

*Certain neurological signs and symptoms may occur in the elderly without necessarily indicating significant organic disease. Thus tremor, loss of vibration sense, abnormal plantar responses, and absent tendon-jerks are not uncommon.

which would have benefited from active treatment, including the provision of appliances, were some of the cases of hernia, visual defects including cataract, deafness, dental conditions, and anaemia. Alexander (1954) has shown that many elderly people having hypochromic anaemia can be readily cured by the administration of iron by mouth. Some of these conditions which have been classed as less serious do at times cause considerable disability and distress—for example, cataract.

The following case history describes the remarkable benefit that can result from the removal of a cataract.

Case 103.—Since his recovery from cataract operation this patient has worked again full time. He had become very morose and apathetic before operation, when he had to be led about everywhere, and the operation brought a remarkable change; he is once again full of energy and zest.

A few cases were found in which there were abnormally high levels of serum alkaline phosphatase and serum cholesterol without any demonstrable cause. A recent follow-up of a case which had a high serum alkaline phosphatase with no obvious cause showed extensive Paget's disease radiologically. This is a striking example of how the existence of a disease may be discovered before showing any signs or symptoms.

Association and Causation

The analysis of the incidence of specific conditions in the sample provided an opportunity to see if there were any significant associations between certain conditions which are sometimes thought to be causally related. In old age, when degenerative and chronic diseases are bound to be common, there is a special risk of assuming that two or more conditions are causally related because they often occur together. Perhaps the best example of this is to be found in various symptoms and pathological conditions that have been linked to hypertension. It is clear that those people with hypertension who also have symptoms, such as headaches and vertigo, will be the ones who are referred to hospital, and those with hypertension who have no symptoms may not be discovered at all.

The examination of an unselected sample of people, including the healthy as well as the unhealthy, makes it possible to find out how often two conditions occur together and how often they occur separately. A simple statistical test will then reveal whether they occur together more often than might be expected on the grounds of chance alone. We were able to examine in this way the incidence of hypertension in those with bronchitis, vertigo, tinnitus, angina of effort, clinically detectable arteriosclerosis, enlargement of the heart assessed radiologically, and albuminuria. In no case was hypertension significantly more or less common in these groups than in the remainder of the sample. There was the same absence of correlation between the height of the blood pressure and the physician's general assessment of health and the subject's sense of well-being. While it is not suggested that hypertension in the elderly is of no clinical significance or that it does not determine on occasion the onset of serious illness such as cardiac failure or cerebrovascular haemorrhage, our findings do suggest that it may have been sometimes wrongly blamed for certain symptoms and signs and that many elderly people remain active and well in spite of high blood-pressure readings. Indeed, it may well be that hypertension in the elderly is often a natural and beneficial adaptation for the purpose of maintaining an adequate blood supply to organs, the circulation in which is being impeded by vascular degeneration.

Paget (1877) described deafness as a characteristic feature of the disease that bears his name. In the small number of cases of this disease in our sample, deafness was no commoner than in the whole sample, and it seems possible that it is the frequency of deafness in this age group that is responsible for the supposed association with Paget's disease.

Some conditions were associated more often than could reasonably be expected to have occurred by chance. Among these were impaired hearing and tinnitus, impaired hearing and vertigo, and vertigo and generalized arteriosclerosis.

2. General Assessments of Health

An attempt to assess what may be termed the effective health of this group of elderly people as distinct from the enumeration of the pathological conditions which they were found to have was made in five different ways: by estimating the mobility of the subject; by the subject's own assessment of his or her health; by the physician's general assessment; by the frequency of medical attention received by the subject; and by the use of a disability scoring system.

The classification by mobility showed that in 71% of the men and 55% of the women their activity was regarded by the subjects as unrestricted. In 26% of the men and 31% of the women there was some limitation of outside activity, while in only 3% of the men and 14% of the women was the subject confined to the house. In this latter group five women and one man were bedridden.

The self-assessment of fitness revealed that rather more men (61.4%) than women (48.7%) considered themselves fit, while the physician rated them much lower and found little difference in the proportions in the two sexes. He rated as "fit" 26.2% men and 23.0% women. Similarly, there was only a small difference between the sexes as regards the frequency with which they received medical attention. Among the men, 44.8% were receiving medical attention every three months or more often, compared with 47.9% of the women. It will be realized, of course, that all of these assessments were to a greater or lesser extent subjective or dependent on the subject's memory, and for these reasons an attempt was made, rather by way of an experiment, to devise a more objective disability scoring system in order to try to express degrees of disability in numerical terms and to permit comparisons between different age, sex, and social groups within the sample. Each common type of disability was given a score, so that for each individual a total score could be calculated, based on the medical examination. In the case of rarer causes of disability *ad hoc* scores were given. No attempt was made to include mental conditions in the assessment.* The scoring system (Table I)

TABLE I.—*Contribution of Different Causes to Total Amount of Ill-health as Measured by Disability Score*

Group	% Disability Score		Group	% Disability Score	
	Men	Women		Men	Women
Cardiac ..	36.8	37.5	Prolapse ..	—	1.5
Joints, etc. ..	10.2	11.2	Sight ..	1.2	1.9
Respiratory ..	10.8	10.2	Anaemia ..	1.4	1.4
Feet ..	8.1	8.7	Varicose veins, etc.	0.8	0.8
Urinary ..	7.5	6.9	Nutritional ..	0.5	0.4
Hearing ..	6.6	5.1	Trauma ..	0.8	0.4
Nervous system ..	2.6	2.8	Diabetes ..	0.0	0.3
Vertigo ..	1.8	3.1	Additional ..	1.3	1.1
Hernia ..	4.7	2.2			
Digestive ..	2.2	2.7	Total ..	99.8	100.1
Piles ..	2.5	1.9			

selected cardiovascular disease as the chief cause of disability, followed by joint conditions and chronic bronchitis in that order.

General Factors Influencing the Health of the Elderly

The incidence of different pathological conditions in groups within the sample and the use of the general assessments, particularly the disability scoring system, made it possible to analyse the findings with the object of trying to discover to what extent general factors such as age, sex, social class, and marital state influence the health of the elderly.

*Details of the method are given by Hobson and Pemberton (1955).

On several occasions differences were found between groups which, owing to the smallness of numbers or the variability of the observations, or to a combination of both, were not statistically significant. It is clear in retrospect that, without much larger numbers, final answers on the importance of such factors as the above cannot be reached, and the conclusions in this section should be regarded as tentative. A further point which should be emphasized is that when significant relationships were found—for example, between the incidence of bronchitis and the district of residence—a causal relationship is not necessarily implied. It is, of course, possible that two related phenomena are both the result of a third condition or set of conditions.

Age.—The general assessments of health showed, as might be expected, a steady increase of disability with age. Mobility became more restricted, a feeling of fitness became less common, the physician assessed fewer people as generally fit, medical attention was more frequently sought, and the mean disability score gradually increased. Specific pathological conditions which were found more often in the older age groups included cardiovascular disease, rheumatoid arthritis, deafness, vertigo, loss of vibration sense, senile dementia, radiological enlargement of the heart, unfolding and calcification of the aorta, radiological "lipping" in the thoracic spine, and thoracic kyphosis. The amount of food consumed, as measured by the calorie intake, was lower in the older age groups. The mean systolic blood pressure was higher in the later age groups, but the differences were not statistically significant, possibly owing to insufficient numbers. The mean diastolic pressure showed no increase with age.

A possibility that has to be considered when there is a lack of expected relationship between increasing age and the frequency of such conditions as hypertension is that there may be a selective removal by death of the subjects with the condition, concealing, for example, a tendency of the blood pressure to rise with age. The same consideration may apply to obesity. It was found, for example, in women that the mean weight and the mean thickness of skin folds were much less in the older age groups.

Sex.—There were some striking sex differences in the morbidity experience of this group. The total amount of disability as judged by the scoring system and the other methods for assessing disability was greater, age for age, amongst the women. This is in conformity with morbidity studies by other workers and for earlier ages (Downes, 1950), and is in marked contrast to the fact that the expectation of life is longer in women. For example, of the population who survive to the age of 85 and over, two-thirds are women. The specific conditions which were much more common in women included vertigo, systolic and diastolic hypertension, neurosis, regular incontinence of urine and faeces, rheumatoid arthritis, spontaneous subcutaneous bruising, pediculosis capitis, and a history of fracture. On the other hand, angina pectoris, deafness, Paget's disease, hernia, and severe clinical arteriosclerosis were much commoner in the men. These differences suggest that endocrine or occupational factors may play a causal part.

Social Class.—Each subject was placed in one of the Registrar-General's five social classes according to the chief occupation the subject, or in the case of married women the husband, had followed. Using the scoring system, we found that in both men and women there was a tendency towards increasing disability in the poorer occupational groups. This trend did not, however, reach the conventional level of statistical significance. The incidence of dental caries and defective hearing increased as the social scale was descended. The incidence of bronchitis in men, but not in women, showed a similar trend. Obesity was commonest in men of the upper social group and in women of the lower social group. It is interesting to note that the same trends are shown by the mortality figures for diabetes and gall-stones, both of which are associated with obesity. There was in general a deterioration in both the quantity and the quality of the diets as the social scale was descended.

Income.—The quality of the diets and the amounts consumed of the more expensive foodstuffs were directly related to income—closely in the case of the men, and less closely in the case of women. This fact alone might be expected to have some bearing on health. The incomes of 369 of the sample were known from information collected in a preceding social survey. It was found in the case of the men, both those living alone and those with wives, that the mean disability scores were definitely lower in those with the higher incomes (see Table II). The same sort of difference applied to the married women, but not to women living alone. Among the latter, the mean disability score was practically the same in the higher and the lower income

TABLE II.—Mean Disablement Scores by Income

	Income			
	35s. a Week or Less		More than 35s. a Week	
	No.	Mean Score	No.	Mean Score
Men living alone	21	20.76	14	12.78
Women " " " " ..	54	19.55	34	19.68
	59s. a Week or Less		More than 59s. a Week	
	No.	Mean Score	No.	Mean Score
Men in married couples ..	53	17.42	68	15.37
Women " " " " ..	62	19.42	63	16.63

TABLE III.—Mean Disablement Score by District of Residence

District of Residence	Men		Women	
	No.	Mean Score	No.	Mean Score
A. Better residential ..	27	13.7	35	14.2
B. Older and less fashionable suburbs ..	37	16.5	57	16.9
C. Densely populated central area ..	40	16.0	69	18.5
D. Municipal housing estates ..	31	17.3	31	19.3
E. Industrial area and two mining villages ..	51	18.2	78	20.3

TABLE IV.—Receipt of Medical Attention by Area and Sex

	Area			Total
	A	B	C, D, E	
Men at risk	31	40	121	192
No. receiving treatment every three months or more often ..	11	18	57	86
Percentage	35.4	45.0	47.1	44.8
Women at risk	40	61	183	284
No. receiving treatment every three months or more often ..	18	26	92	136
Percentage	45.0	42.6	50.2	47.9

A = Better residential. B = Intermediate. C, D, and E = Old industrial and municipal housing.

groups. None of these differences shown in the table, however, reached the conventional level of statistical significance.

District of Residence.—A further method of examining the relationship between health and the constellation of factors included under the term social class was available—namely, the relation of health to district of residence. The mean disability score increased steadily from those who lived in the western and south-western residential suburbs, through the older and less fashionable suburbs, a densely populated central area, the municipal housing estates, to those who lived in the eastern and north-eastern industrial area (see Table III). The difference between the mean scores in the western and south-western residential suburbs and all the other areas grouped together was statistically significant. It was also found that the proportion of subjects receiving medical attention every three months or more often was highest in the poorest areas of the city (Table IV). One specific disease which appeared to have some relation to the part of Sheffield in which the subject lived was bronchitis. This condition was most common in the industrial districts and least common in the better residential area (see Table V).

TABLE V.—Incidence of Bronchitis in Different Areas of Sheffield among 64 Men and 87 Women with Bronchitis

	Men		Women	
	No. at Risk	No. Affected	No. at Risk	No. Affected
Area A. W. and S.W. suburbs, better residential	31	10 (32.3%)	40	12 (30.0%)
Area C. Central, densely populated	39	18 (46.2%)	70	24 (34.3%)
Area D. Municipal housing estates	30	11 (36.7%)	32	12 (37.5%)
Area E. Eastern steel industry area	50	25 (50.0%)	79	39 (49.4%)

TABLE VI.—Average Daily Intake per Head of Calories and Nutrients of those who were Medically Graded as Fit, Analysed by Age and Sex

Calories and Nutrient	Unit	Average Daily Intake per Head							
		Men (Age in Years)				Women (Age in Years)			
		65–	70–	75+	Total	60–	70–	75+	Total
Calories	Cal.	2261	2254	2015	2205	1902	1483	1740	1826
Vegetable protein	g.	36	34	31	34	27	20	24	26
Animal protein	g.	38	43	32	39	35	25	36	34
Fat	g.	91	92	88	91	83	65	73	79
Carbohydrate	g.	287	279	244	274	230	181	213	221
Calcium	g.	0.9	0.9	0.7	0.86	0.8	0.6	0.7	0.76
Iron	mg.	16	15	13	15	11	8	10	10
Vitamin A	I.U.	2356	2647	2094	2450	2430	1872	1776	2280
Thiamine	mg.	1.3	1.1	1.0	1.1	0.9	0.7	0.8	0.86
Riboflavin	mg.	1.2	1.2	0.9	1.1	1.1	0.8	0.9	1.0
Nicotinic acid	mg.	11	10	9	10	7	6	6	7
Vitamin C	mg.	32	23	19	25	23	16	17	21
No. of individuals in group		9	17	7	33	33	6	5	45

TABLE VII.—Average Daily Intake per Head of Calories and Nutrients by Eight Elderly Men and Eight Elderly Women in Residential Homes, and Number of Old People in Survey Consuming Less

Calories and Nutrients	Unit	Average Daily Intake by those in Residential Homes		No. in Main Survey Consuming Less than Residential Home Mean	
		Men	Women	Men	Women
Calories	Cal.	2,536	2,138	102 81.6%	150 84.3%
Veg. protein	g.	36	27	83 66.4%	113 63.5%
Animal protein	g.	34	33	44 35.2%	103 57.9%
Fat	g.	108	103	107 85.6%	165 92.7%
Carbohydrate	g.	311	244	96 76.8%	126 70.8%
Calcium	g.	0.9	0.7	71 56.8%	79 44.4%
Iron	mg.	12	10	46 36.8%	107 60.1%
Thiamine	mg.	1.1	0.9	66 52.8%	107 60.1%
Vitamin C	mg.	26	38	90 72.0%	163 91.6%

Marital State.—Using the disability score, we found that those living alone had slightly higher mean scores than those living in married couples. These differences were not statistically significant. The analyses of the diets showed, rather surprisingly, that while women living alone consumed less than those with their husbands (possibly because they were older), men living alone fared as well from the dietary point of view as men in married couples.

Diet.—At younger age groups, especially in childhood, the quality of the diet exerts a powerful influence on health. It is not possible to estimate from our data to what extent the illness and disabilities found in this group of elderly people were due to a poor diet. The average consumption of the various nutrients in those graded fit by the physician, however (Table VI), was in almost every case higher than the average for the whole sample. This could be interpreted as meaning that those who consumed the better diets were in general more healthy because of that, or that those who were healthy had better appetites and in consequence consumed more food. It is suggested that the mean intakes of calories and the various nutrients of those classed as fit provide average standards of adequacy for the elderly (Table VI). The larger quantities that were being consumed

by old people living in two hostels (Table VII) might be regarded as optimal standards (see Bransby and Osborne, 1953). About one-fifth of the subjects were classed as having poor nutrition. Two men had signs of scurvy, and a further group of three women and one man were possible examples of that condition. Nine men (5%) and 16 women (11%) had anaemia, much of which was believed to be nutritional in origin (see Hobson and Blackburn, 1953). There was a strong correlation between fat intake and the serum cholesterol level (see Hobson, Jordan, and Roseman, 1953).

Obesity.—While an adequate and well-balanced diet promotes health, overeating and obesity are known to be associated with a diminished life expectation. For this reason the mean disability scores of those who were overweight (12 stones (72.2 kg.) or more) were compared with the remainder. There was no difference in the mean scores in the case of the men. In the women, those who weighed 12 stones (76.2 kg.) or more had a higher mean score than those under that weight, but the difference did not reach the conventional level of significance. Most of those subjects who had evidence of diabetes mellitus or symptoms of gall-bladder disease were overweight. There was a strong correlation between obesity, as measured by thickness of skin folds, and the serum cholesterol level.

Employment.—There has been much discussion recently on whether it is desirable for people to go on working after the age at which statutory retirement pensions become payable. Apart from the war years, the tendency over the last quarter of a century has been for men to retire from work at an earlier age. The economic needs of the nation, together with the realization that the proportion of the elderly and the aged in the population is increasing quite rapidly, have led many responsible bodies—for example, the Ministry of Labour (1953)—to advocate the provision of more jobs for those over 65. Of the men who had retired in our sample, only one-third said they had retired on grounds of ill-health. There was little difference in the health of those who had retired and those who were still working, when similar age groups were compared. The survey does not enable us to say that those who continued in work benefited in physical health from doing so, although we received the impression that they were on the whole happier and more alert than those who had retired. It did show, however, that many retired men were fit enough to undertake whole-time employment. A more direct result of occupation on health was shown by the cases of pneumoconiosis revealed by the radiological examinations. A number of occupations in Sheffield still carry a risk of silicosis and many more did so when this group of elderly men were working. It was not surprising, therefore, to find that between 3.5% and 5% of the men (according to the radiologist making the assessment) had evidence of pneumoconiosis of a slight to moderate degree.

Mental State.—The general mental state plays an important part in determining the health of the elderly. Apathy, which might almost be defined as the occupational disease of old age, was quite often encountered and had sometimes led to neglect of the diet, of the feet, or of general cleanliness. An example of apathy was a widower with scurvy who ate no greens or potatoes because their preparation was "too much bother."

Conclusions With Regard to General Factors Influencing the Health of the Elderly

It is not easy to state any conclusions on this aspect without running the risk of repeating truisms or of making assertions on insufficient evidence.

It is obvious that advancing age increases the risk of ill-health, although this does not mean that every old person eventually suffers from some chronic illness or disability. There are interesting sex differences in the incidence of several conditions which suggest that endocrine or occupational factors may be of aetiological importance. The social class complex of conditions which includes previous occupation, present income, and place of residence appears

to be of some importance in determining health in the elderly. The evidence with regard to the influence on health of marital state and of obesity was inconclusive. It suggested that those living alone were on the whole less fit than those living in married couples, and that, in the case of women at least, obesity was to some extent related to ill-health. There can be little doubt that an adequate well-balanced diet is an important factor in preserving the health of the elderly. Mental factors characteristic of the elderly, such as apathy or forgetfulness, may, as already stated, adversely influence health by leading, for example, to neglect of cleanliness and care of the feet and to a monotonous and inadequate diet. The latter in turn may result in wasting and malnutrition or in severe cases to deficiency disease. We found no evidence that working on after the statutory retiring age or retirement had any effect on physical health, though many of those who were still working seemed particularly cheerful and alert.

Normal Biochemical Values

One of the aims of the survey was to help to indicate some standards for normal biochemical values in the elderly, since there is little such information available in the literature.

The following measurements were made: blood haemoglobin, serum calcium, serum cholesterol, serum alkaline phosphatase, and blood urea. The procedure adopted was first to plot the values as a frequency distribution for each sex. A number of the distributions fitted a "normal" curve, but others were positively skewed and of the lognormal type. Wootton *et al.* (1951) have shown that the frequency distribution of a number of biological measurements are of this type. The results showing the type of distribution, and mean, range of normality, and number of subjects for each sex, are shown in Table VIII, and the norms given by

TABLE VIII.—"Normal" Range of Variability in the Elderly

	Sex	Mean	Range of Normality	Norms, Sunderman and Boerner	No. of Subjects	Type of Distribution
Haemoglobin, g./100 ml.	{ M F	14.4 13.8	10.8-17.9 10.9-16.7	12-17 11-15	177 247	{ "Normal" curve
Serum calcium, mg./100 ml.	{ M F	10.1 10.2	9.0-11.2 9.1-11.3	9-11	35 57	{ "Normal" curve
Serum cholesterol, mg./100 ml.	{ M F	268 310	176-409 200-481	160-210	98 141	{ "Log-normal" curve
Serum alkaline phosphatase, K.-A. units	{ M F	8.3 9.6	2.7-25.5 2.6-25.7	3.7-13.1	64 90	{ "Log-normal" curve
Blood urea, mg./100 ml.	{ M F	39.1 36.7	26.4-57.8 26.3-51.2	18.9-32.3	50 65	{ "Log-normal" curve

Sunderman and Boerner (1949) are included for comparison. Only in the case of haemoglobin is any mention made of changing values with age. The results show that biochemical norms in the elderly may differ greatly from those found in younger age groups. There is a normal range of variability for these measurements in the elderly which should be taken into account when interpreting the results of diagnostic procedures. The serum cholesterol, serum alkaline phosphatase, and blood urea levels are all higher than in younger age groups.

Prevention of Disease and Disability in the Elderly

If we accept three-score years and ten as the natural span of human life, although there seems no good reason why it should not be longer, there is much premature death amongst the elderly. The causes are not far to seek: cardiovascular disease, followed by cancer, claims the majority.

The prevention or delay in the development of arteriosclerotic heart and cerebral disease would make the greatest

single contribution to the health of the elderly. So far, however, we have only one or two uncertain clues to how this might be achieved. Morris *et al.* (1953) have produced suggestive evidence that lack of physical activity predisposes to the development of coronary artery occlusion, while the work of Ancel Keys (1952, 1953) indicates that a diet rich in fat encourages the development of arterial degeneration, and this survey has suggested that high dietary fat and obesity raise the serum cholesterol level. There is certainly evidence that obesity reduces the expectation of life and that it is also associated with diabetes mellitus and with gall-stones.

Adequate physical activity, the avoidance of an excessive consumption of fatty foods, and the control of body weight are practical measures which might be expected to reduce illness in the elderly. It is probable, however, that such advice, if it is to be effective, must be taken before the onset of old age.

Residence in a crowded industrial area where the air is heavily polluted is a factor adversely affecting health in the elderly, particularly with regard to chronic respiratory disease. This was shown most dramatically by the great increase in deaths from respiratory disease amongst the elderly during and after the prolonged fog in London in 1952 (Logan, 1953).

The increased incidence of deafness in men in the poorer occupational groups suggests that some of this may be of industrial origin. Many of these men had worked for many years under noisy conditions in heavy industry. Further investigation is needed with a view to preventive action.

The work of Doll and Bradford Hill (1952) indicates that some at least of the recent increase in cancer of the lung is due to heavy cigarette smoking and is therefore to that extent preventable. It has been suggested that heavy smokers should undergo routine chest radiography from the age of 45 years onwards with the object of discovering cases at an early and operable stage.

The poor lighting and dilapidated conditions in many of the old houses in which some elderly people live contribute to the frequent falls and fractures which they experience in their homes. Well-lit and more convenient dwellings for the elderly offer the means of reducing the number of accidents in this age group.

Nutritional deficiency disease is now rarely seen in children in this country, and serious malnutrition in the young is much rarer than it was only one or two decades ago. The same cannot be said of the elderly. In the big cities, the admission to hospital of old people with severe malnutrition, including nutritional anaemia, is fairly common and the old man who has scurvy is no great rarity. The reasons for this are poverty, ignorance, and apathy. Those existing on a meagre retirement pension calculated to cover only the necessities of life are the first to suffer when the cost of living rises. Lack of knowledge of what food to buy and how to prepare it is most likely to affect the elderly man who has recently lost his wife. He tends to live on a diet involving little preparation, such as tinned meat, biscuits, jam, and tea with condensed milk. It is understandable if in some cases the husband or wife left to live alone ceases to care about his or her diet, appearance, or surroundings, and becomes in consequence ill and decrepit. The increasing use now being made of health visitors for advising and encouraging old people in this sort of situation is a valuable preventive measure.

Little attention appears to have been given to the special dietary needs of the elderly, and there seems to be a special risk that the requirements of vitamin C, calcium, and the anti-anaemic factors may not be met in this group. Also with advancing years the amount of food consumed as measured by its calorific value becomes less. This may be due to a natural tendency on the part of the elderly to reduce the bulk of the food they eat. Unfortunately, if all types of food are reduced in proportion, the amounts of essential

food factors consumed may fall to dangerously low levels. The development of "meals on wheels" services provides an opportunity of supplying a meal which is not bulky and unappetizing to the elderly and is rich in the nutrients mentioned above. It must also be easy to masticate. The design of such meals constitutes a special problem in dietetics.

Elderly people are often loath to consult the doctor for conditions which are not painful and do not disable them. Quite often they believe that these are the inevitable concomitants of old age. Even among doctors there is sometimes found an unnecessarily fatalistic attitude.

In this survey the frequency of symptoms of untreated prolapse in the women suggested that some of these patients might have benefited, perhaps many years before, from attendance at post-natal clinics and from active gynaecological treatment. Similarly, with the men, there were a fair number with hernia whose condition would have been improved by an operation or a properly fitting truss.

Much of the disability of old age due to failure of eyesight and hearing can be ameliorated by the provision of suitable spectacles, by ophthalmic operations for such conditions as cataract, and by hearing-aids.

It has been noted that foot troubles were a common cause of disability. Many old people would benefit from the services of a chiropodist and advice on the care of the feet.

Routine Medical Examinations

The discovery, in the course of the survey, of several cases of unsuspected serious and treatable disease has already been mentioned. This suggests that certain specified routine examinations of the elderly aimed at early diagnosis are worth considering. A simple set of tests consisting of an examination of the urine for sugar, a haemoglobin estimation, inspection for evidence of myxoedema and carcinoma of the skin, and weighing, would detect most cases of diabetes, anaemia, myxoedema, carcinoma of the skin, obesity, and loss of weight. A test of visual acuity and hearing might also be included. Such a routine examination should be feasible in the general practitioner's surgery or even in the patient's home, and would lead to the earlier diagnosis of some important and common conditions in the elderly. It might, on the other hand, be appropriate for the local health authority to organize such a service as a preventive measure.

Summary

This paper describes the general results of a survey which was carried out in Sheffield in the years 1949-51. The aims of the survey were to investigate and describe the state of health and the diets of elderly people living at home in Sheffield; to examine the relationship between health and such factors as age, sex, marital state, social class, and diet, and to collect information on normal physiological standards in the elderly.

A good deal of previously undiagnosed illness and disability was discovered for which treatment was required.

Specific suggestions are made for the prevention of disease and disability in the elderly.

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CEREBRAL HYPOXIA: AETIOLOGY AND TREATMENT

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The therapeutic value of dehydration therapy following an acute hypoxic episode has been demonstrated in cases of cardiac arrest by Sadove *et al.* (1953). They suggest that once the heart has been restarted and an adequate oxygen supply to the brain ensured, an active regimen should be instituted to combat the cerebral oedema which occurs, and which is a direct result of hypoxic damage to the cerebral capillaries. Seldon *et al.* (1949), Lucas (1950), and Cole (1951) have also considered this hypothesis and instituted dehydration therapy.

We would stress, however, that this syndrome of cerebral oedema also occurs in instances other than that of cardiac arrest and that any case showing signs of cerebral damage after a period of cerebral hypoxia may be adequately and gratifyingly treated by means of dehydration therapy. The supply of oxygen to the brain is of paramount importance, and it may not be realized that gradual deprivation of the oxygen supply by any means may lead to the onset of cerebral oedema. Examples of some of the clinical conditions which may produce hypoxia to a degree sufficient to cause cerebral oedema are shown in the diagrammatic Table.

The immediate effect of hypoxia is to produce a vascular dilatation (Courville, 1947). The vessels may be so damaged that small haemorrhages occur from rupture of their walls; in areas less severely damaged there is interference in their normal permeability, and cerebral oedema is produced. Should this oedema not be treated, progressive damage to the brain may continue for a long