THE SUBJECTIVE ASSESSMENT OF NORMAL SLEEP PATTERNS

By

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and

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INTRODUCTION

"WHEN we consider the immense human significance of sleep, the absolute necessity for us to spend a considerable part of our lives in abject mental annihilation, it is remarkable how little we know about it. . . ." In these words, Sir John Eccles introduced the recently published Ciba Foundation Symposium on "The Nature of Sleep" (3), in which are described many of the advances which have been made in recent years in our attempts to understand the phenomena which are involved in the state of sleep. In one of the papers included in this Symposium, Bremer (2) reviews the work which has been reported since 1954 on the neurophysiological mechanisms involved in sleep. The relationship of dreaming to the depth of sleep has been investigated by such workers as Kleitman (5), Dement (4) and Wolpert (11). These studies have been made possible by the application of modern techniques of measuring mental activity. The use of electroencephalographic methods has allowed an approximate classification of the different levels of sleep which enables different workers to adopt a standard frame of reference. Measurements of rapid eye movements and of changes in muscle potential during sleep have provided more objective methods of assessing dream activity. Other recent studies have attempted to make an objective assessment of the physical and mental effects of sleep deprivation (Morris *et al.*, 7, Bliss *et al.*, 1, Murray *et al.*, 8, Wilkinson, 9, Williams *et al.*, 10).

Many of the findings arising from this recent interest in the state of sleep are of interest to psychiatrists who have long recognized the correspondence between disturbance of the normal sleep pattern and mental illness. Sleep disturbance has been noted in such varied psychiatric conditions as depression, anxiety states, delirium and catatonia. In depressive illness the disturbance of the sleep pattern may be regarded as one of the most important and characteristic of the clinical features. The prevalence of early morning wakening in depressive psychosis has caused this aspect of sleep disturbance to be regarded as a symptom of particular importance in establishing the diagnosis and in assessing the patient's response to treatment.

In view of the number of studies which have been made on different aspects of sleep in recent years, it is perhaps somewhat surprising to find that very little appears to be known about the normal pattern of sleep and the way in which this varies with such factors as age, sex and social class. Although several studies have been made of the variations in the sleep rhythm in infancy, little attention has been paid to the sleep cycle of the adult population. It tends to be assumed that the average healthy adult sleeps around 8 hours a night and a few reported studies of small groups who were at liberty to sleep as long as they

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wished (e.g., Lewis, 6), substantiate our impression that this period represents the normal human requirement. Although we may recognize that the length of the sleep period decreases with age, there have been no critical studies of the variation of sleep with age. The present study attempts to study the sleep patterns of a group of normal subjects and to assess the variations in the sleep rhythm with age.

Method

In spite of the obvious deficiencies of subjective evaluation, the questionnaire method seemed the only feasible method of surveying a population large enough to allow a statistical comparison of the various age groups. In order to limit this subjective influence as much as possible, our questionnaire was constructed so that all possible responses were already noted after each question, the subjects being required to underline the response appropriate to them. The first section of the questionnaire included items relating directly to the quantitative aspects of the sleep pattern. It thus contained questions on the habitual time of retiring to bed, the time at which the subject normally falls asleep, normal wakening time, rising time, etc. The second part of the questionnaire enquired into the more qualitative aspects of sleep—e.g. did the subject describe himself as a light, moderate, or deep sleeper? was his sleep frequently broken by night wakening? did he tend to feel tired in the morning or during the day? The last section contained items related only indirectly to sleep. The subjects were asked if they were in the habit of taking hypnotics, if they would describe themselves as being of a nervous disposition, and finally they were asked a number of questions on the state of their physical health. The subjects were not asked to note their names on the questionnaire, but they were asked to give details of their age, sex and occupation, the latter being used to obtain a rough grading of the subject's social class according to the Registrar General's Classification of Occupations.

Selection of Subjects

The subjects who took part in the enquiry were made available through the kind co-operation of a variety of agencies in the Dundee and Glasgow areas including Further Education authorities, community centres, Territorial Army units and old people's clubs. Each of the bodies involved supported the enquiry by distributing the questionnaires among its members and collecting the completed forms for subsequent dispatch to us. It will be readily seen that our method of selection was unlikely to provide us with a random sample of the general population, most of our subjects belonging as they did to some educational or social organization. The enquiry was designed to include subjects from both the Dundee and Glasgow areas, to allow not only an extension in the number of subjects taking part, but also a comparison between the two communities. It proved impossible to obtain a wholly accurate assessment of the number of subjects who refused to co-operate in this enquiry, but it appeared that approximately 80 per cent. of the subjects who were approached completed a questionnaire. In this manner a total of 2,446 completed questionnaires were made available for subsequent analysis.

The age distribution of the survey population is shown in Table I. Fourteen per cent. of the subjects in the total sample omitted to note their age on the questionnaire and consequently could not be considered in the analysis. For purposes of comparison the comparative figures for the Scottish population based on the 1961 census figures are also noted. We have shown all subjects

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over the age of 65 years as constituting a single age group to allow ready comparison with the census figures. In analysing our data, however, we examined these subjects in two separate age groups of 65–74 years and over 75 years in order to observe any further noticeable changes occurring some time after the male retiral age. It may be seen that the survey sample deviates most markedly from the national sample at the age groups 15–24, 45–54 and 55–64 years. Our population over-represents the younger group and under-represents the middle-aged sector of the community. This is particularly marked in the case of the male subjects, the deviation being much less in the case of the females. It may also be seen that our male sample under-represents the 65 year and above group (7 per cent. as compared with 12 per cent. in the national population). In the case of the female subjects of 65 years and over, the reverse is true (18 per cent. as compared with 14 per cent. in the national population). The sample as a whole carries an over-weighted sex ratio (160·2 F : 100 M) as compared with the sex ratio in the total population of Scotland in 1961 (108·5 F : 100 M).

TABLE I

Age Distribution

	15–24	25–34	35–44	45–54	55–64	65+	Not Known
Survey Sample ..	23%	15%	17%	12%	7%	12%	14%
National Population	19%	19%	19%	17%	13%	13%	0%
Survey Sample (Male)	31%	23%	18%	11%	5%	7%	5%
National Population (Male)	19%	19%	20%	18%	12%	12%	0%
Survey Sample (Female)	21%	13%	19%	14%	10%	18%	5%
National Population (Female)	19%	18%	19%	17%	13%	14%	0%

On the basis of the Registrar General's Classification of Occupations, each subject was placed in a social class category. The percentage distribution of the social class categories is shown in Table II for our male subjects, together with the comparative figures of the male social class distribution for Scotland as a whole. It was not possible to make a similar comparison for our female subjects, as the national figures are calculated separately for single women and working wives. It can be seen that the social class distribution of the males in our survey sample is almost identical to that of the national population.

TABLE II

Social Class Distribution (Male)

	I	II	III	IV	V
Survey Sample	3%	14%	50%	19%	14%
National Population ..	3%	13%	51%	18%	15%

METHOD OF ANALYSIS

The information on the completed questionnaire was coded, transferred to punch-cards and subsequently collated by a Powers-Samas machine. The resultant data were analysed by applying the χ^2 technique or, where multiple comparisons were involved, Ryan's Significance Test of Proportions. The main variables considered in the analysis were age, sex, area and social class and the

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relation between each of these factors and the various items of information given by the questionnaire responses was examined. Age groups were considered in decades beginning at 15–24 years and ending with the group 75 years and over. Although we were mainly concerned with the effect of age on the normal sleep pattern, we also considered any variations related to sex and social class differences. The preponderance of females in our sample was particularly evident in the upper age levels. In order to ensure that apparent age differences were not due to the unequal sex ratio, we have analysed the male and female responses separately for each item which showed a significant sex difference. Throughout the analysis of the data we have accepted as significant only these items which are beyond the 1 per cent. level. (In most cases the differences involved were in fact beyond the 0·1 per cent. level.)

Our treatment of the data has been selective in that we were mainly interested in finding the answers to a number of specific questions which appeared to be of relevance to the clinical field. We have been less interested in the average patterns of response than in the responses which deviate appreciably from the average. In analysing the data we have accordingly chosen an arbitrary cut-off point in the distribution of the responses given to each item of the questionnaire, and in presenting our results, it is the responses beyond this point which will be considered. The analysis of the main variable, that of age, is most easily represented in the form of histograms.

Results

Before considering the responses which deviate from the average we might first consider the distribution of the number of hours slept as reported by the survey population as a whole (Fig. 1). It may be seen that this approaches closely to a normal distribution curve, 62 per cent. of the subjects reporting an average sleep of between 7 and 8 hours per night.

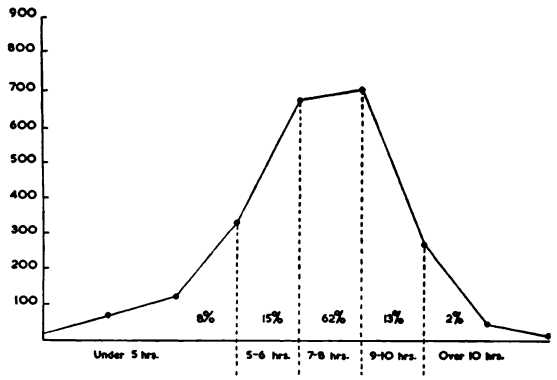


FIG. 1

We next examine the variation with age, sex, and social class of the responses given to each item of the questionnaire. Any differences between the two urban areas covered by the survey are also indicated, but there were very few cases where such differences reached a significant level.

1. *Average Hours Sleep* (5 hours—)

We have restricted our analysis of this item to those subjects who reported that they habitually slept for a maximum of 5 hours per night. A comparison

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of the two areas showed no significant difference for this item and no appreciable sex difference was indicated. There was, however, a significant relationship ($\chi^2=24{\cdot}69$; $p<0{\cdot}01$) with social class, more subjects in social classes IV and V reporting that their usual night's sleep was no longer than 5 hours. The distribution of this item with age for the survey group as a whole is presented in Figure 2. It can be seen that an increasing proportion of people sleep 5 hours or less as age advances. This change in the length of sleep reaches a peak at the age of 65–74 years, where 22 per cent. of the sample reported an average sleep duration of 5 hours or less.

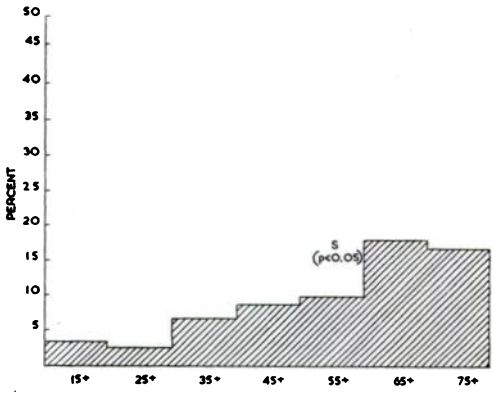


FIG. 2

2. *Pre-Sleep Period* ($+1\frac{1}{2}$ hours)

This item deals with the duration of time subjects reported that they lie in bed awake before getting off to sleep. We have taken a pre-sleep period of over $1\frac{1}{2}$ hours as indicating some difficulty in getting to sleep and considered only those subjects who fall under this category. There was again no significant difference between the two areas but a clear-cut sex difference was apparent. A long pre-sleep period was reported more frequently by females than by males ($\chi^2=32{\cdot}58$; $p<0{\cdot}01$). There was also a distinct relationship with social class, subjects in social classes IV and V more frequently reporting a difficulty in getting to sleep ($\chi^2=15{\cdot}18$; $p<0{\cdot}01$). In view of the significant sex difference the variation with age was considered separately for the two sexes (Figure 3). A

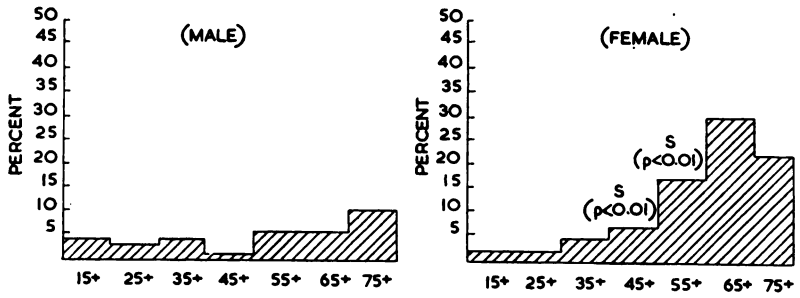


FIG. 3

comparison of the two histograms indicates that the variation with age was mainly evident in the case of the female subjects, there being comparatively

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little variation with age in males. Pre-sleep difficulty is particularly evident in women after the age of 55 years, reaching a peak between the ages of 65 to 74 years when 30 per cent. of the women gave a positive response. It would appear that the increased difficulty in getting off to sleep with advancing age is more or less specific to women.

3. *Time of Wakening* (before 5 a.m.)

In dealing with this item we have concentrated on subjects who reported that they usually waken before 5 a.m. In this case no significant relationship was found between early morning wakening and the three variables, social class, sex and area. Indeed, early morning wakening, as here defined, constituted the only variable in the sleep pattern which did not show a clear sex difference. The variation in early morning wakening with age is indicated in Figure 4. Although

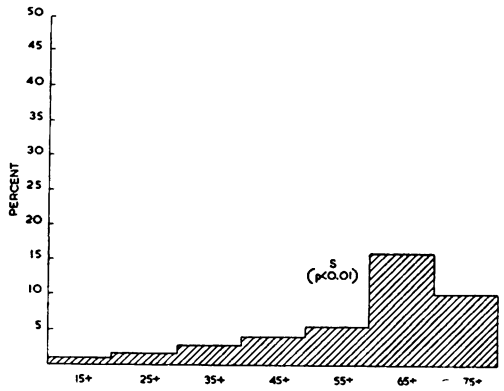


FIG. 4

the frequency of early morning wakening increases slightly with age, the increases are insignificant until the age group 65–74 years. Of the subjects in this age group, 18 per cent. report early morning wakening although this figure falls to 12 per cent. after the age of 75 years. Although early morning wakening as represented in this study appears to have a very low incidence in the normal population, the significant increase (from 5 per cent. to 18 per cent.) at the age of 65 years suggests that, in assessing early morning wakening as a clinical symptom, the age of the patient should be taken into consideration.

4. *Depth of Sleep* (Light)

Subjects were asked to describe their usual sleep level as being deep, moderate or light. In our analysis we have considered only those subjects who describe themselves as being light sleepers. Once again there was no significant difference between the two areas. With social class the differences were significant, the tendency towards light sleep increasing as the social class grading moves downwards from Class I to Class V ($\chi^2=15{\cdot}85$; $p<0{\cdot}01$). A comparison of the male and female responses to this item showed a highly significant sex difference ($\chi^2=32{\cdot}29$; $p<0{\cdot}01$), light sleeping being more frequently described by women. In view of the marked sex difference the variation in age for this

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item is presented in Figure 5 for the next two sexes separately. In the case of the men, it can be seen that light sleeping occurs most frequently in the age range 35–44 years (22 per cent.) and after the age of 65 (25 per cent.). There is an interesting drop off in the incidence of light sleeping in men between the ages of 55–64 years at which time the reported incidence is at its lowest. In women the increase in light sleep with age is much more marked. By the age of 35 years, 25 per cent. of the women described themselves as being light sleepers and the incidence accelerates significantly after the age of 45 years to reach a peak of 40 per cent. Apart from a small but insignificant decrease between the ages of 55–64 years, the level remains constant at 40 per cent. thereafter. It would appear that light sleeping is more pronounced in women, particularly from middle age onwards.

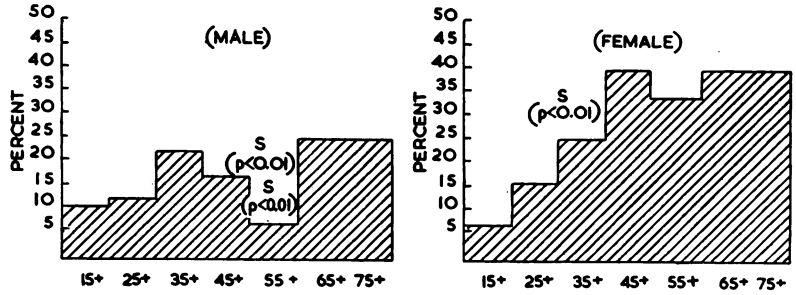


FIG. 5

5. *Disturbed Sleep* (Frequent Night Wakening)

In this item we asked subjects to describe to what extent their sleep was usually disturbed by night wakening and we have examined only those subjects who reported that this occurred with great frequency. Although there was no appreciable social class or area difference, there was again on this item a marked sex difference ($\chi^2=41\cdot07$; $p<0\cdot01$), women more frequently reporting frequent night wakening. The comparison of the two sexes in the incidence of disturbed sleep with age is shown in Figure 6. The incidence of disturbed sleep

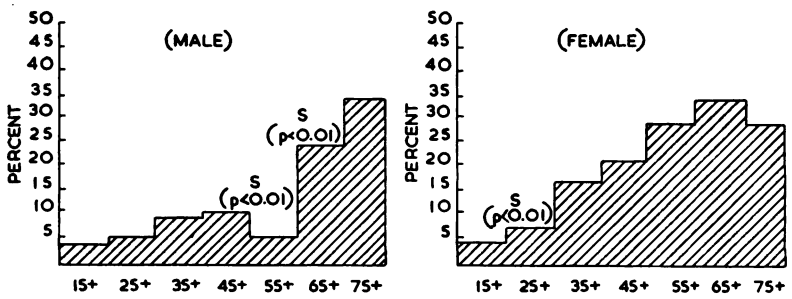


FIG. 6

in men is low (maximum 10 per cent.) until the age range 65–74 years when a significant increase was reported (25 per cent.). After the age of 75 years there is another significant increase in the incidence of disturbed sleep, 35 per cent. of males of this age reported frequent night wakening. The acceleration in the incidence of disturbed sleep with age is much more marked in the case of

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women. At the age of 45 years, 21 per cent. of the women reported disturbed sleep, 30 per cent. at the age of 55 years and, between the ages of 65–74 years, 43 per cent. of the women described themselves as wakening frequently during the night. Here again we might conclude that this change in the sleep pattern is not evident in men until after the age of 65 years, whereas in women, disturbed sleep may be apparent from middle age onwards.

6. *Morning Tiredness* (Frequent)

The subjects were asked if they usually felt tired in the morning and here we have considered only those subjects who described frequent morning tiredness. Examination of the data showed a relationship between morning tiredness and social class ($\chi^2=11\cdot65$; $p<0\cdot01$) but this takes the opposite form from that shown by other items. Here it is the subjects in Social Classes IV and V who are less likely to report morning tiredness. There is also a significant difference between the two areas ($\chi^2=30\cdot47$; $p<0\cdot01$), morning tiredness having a higher incidence in the Glasgow area. There is, however, no sex difference and the variation of morning tiredness with age for the group as a whole, is indicated in Figure 7. In place of the usual increase with age we found

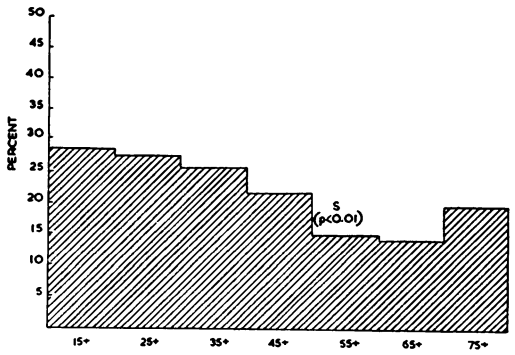


FIG. 7

that, with morning tiredness, the incidence falls as age advances although there is a slight but significant increase after the age of 75 years. It is of some interest that, in spite of the fact that as age advances the sleep pattern changes in the direction of shorter, lighter and more broken sleep, morning tiredness is less frequently reported. One might interpret this finding as indicating that we require less sleep as we grow older. Although it might seem likely that elderly people would be more inclined to sleep during the day, only 42 of our subjects (1·72 per cent. of the total sample) admitted to this in their responses to the questionnaire. The decreasing incidence in reports of morning tiredness is also evident long before old age is reached.

7. *Day Tiredness* (Frequent)

A related item in the questionnaire concerned the frequency of day tiredness and again we have considered only those subjects who described themselves as being frequently tired as the day progresses. No significant differences for either social class or area were found but once again there was a pronounced sex difference ($\chi^2=16\cdot11$; $p<0\cdot01$), day tiredness being more frequently reported by women. Changes in the incidence of this item with age are indicated for the

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two sexes separately in Figure 8. Both sexes show very little variation in the frequency of day tiredness until the age of 75 years where there is a significant increase in the incidence reported by both sexes, reaching a maximum incidence of 20 per cent. for men and 29 per cent. for women.

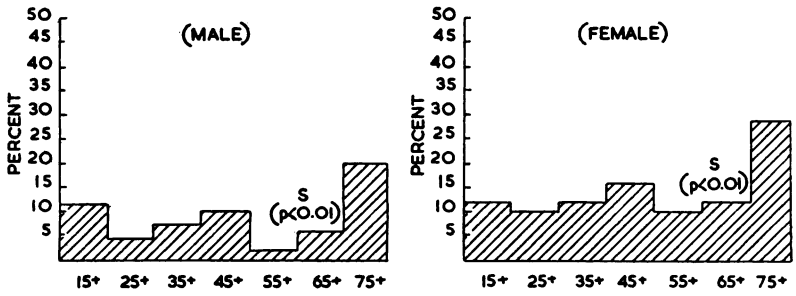


FIG. 8

8. *Hypnotics*

Subjects were asked if they were in the habit of taking a hypnotic and a subsequent question attempted to establish the source of the sedative which was being taken. In analysing this item we have taken into consideration only those subjects who describe themselves as taking a regular hypnotic issued either directly by a doctor or through a chemist. No variation between social class or area was apparent, but again the sex difference was significant ($\chi^2=41\cdot40$; $p<0\cdot01$), women more frequently reporting that they took a regular hypnotic. The variation in the incidence of the use of hypnotics with age is illustrated for the male and female subjects in Figure 9 above. The male subjects showed a

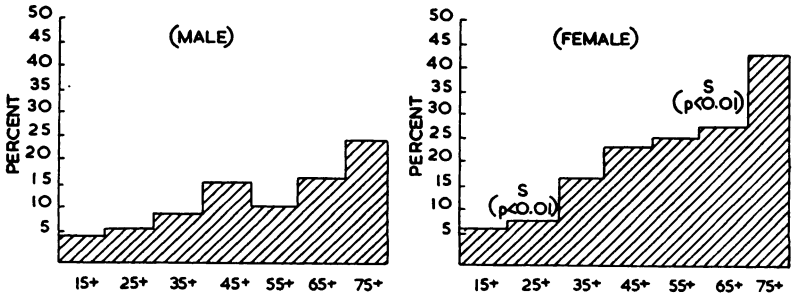


FIG. 9

regular increase in the use of hypnotics as age advanced apart from a small and statistically insignificant decrease in the age range 55–64 years. The peak age level for hypnotics in the male subjects occurred after the age of 75 years (25 per cent. of the male subjects). In the case of women, there was also a steady increase with age, but the incidence at each age was higher than that of the men. There was a significant rise in the proportion of women taking hypnotics in the age range 35–44 years and again after the age of 75 years when a peak incidence of 45 per cent. is reached. It would thus seem that the habit of taking a hypnotic increases for both sexes with advancing years, but that both the incidence and its acceleration with age are more pronounced in the case of women.

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9. *Nervous Disposition*

The subjects were asked if they would describe themselves as being by nature a nervous person. The incidence of positive responses to this question was approximately the same in each social class group, but there was a significant difference between the two areas ($\chi^2=37\cdot13$; $p<0\cdot01$), the Glasgow subjects showing a higher incidence of subjectively evaluated "nervousness". The sex difference was also very evident ($\chi^2=114\cdot98$; $p<0\cdot01$), this item being answered in the affirmative much more frequently by women. As indicated in Figure 10, the incidence of reported nervousness varied very little with age in the

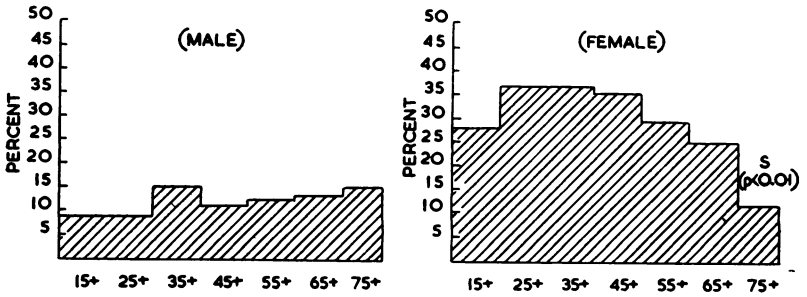


FIG. 10

case of the male subjects. The highest incidence was only 15 per cent., this occurring between the ages of 35–44 years and again after the age of 75 years. The female subjects presented a distinctly different pattern of response, the peak incidence being reached between the ages of 25 and 44 years when 36 per cent. of the women described themselves in this manner. Thereafter the incidence fell rapidly with increasing age until, at the age of 75 years, 13 per cent. of the women described themselves as being nervous. We might conclude from this that women are more likely to describe themselves as being nervous particularly between the ages of 25 and 44 years. The sex difference in this response may of course merely mean that men are less willing than women to describe themselves in such terms. In a subsequent item the subjects were asked to indicate whether they had at any time been treated for a nervous illness. A total of 183 subjects (7·5 per cent. of the sample) admitted to a previous nervous breakdown and the distribution of nervous breakdown with age reached a peak between the ages of 35 and 44 years. We found no significant social class differences in the distribution of either the subjective evaluation of nervousness or reported nervous breakdown. We did find, however, a significant sex difference ($\chi^2=8\cdot68$; $p<0\cdot01$) with a higher proportion of women reporting a previous breakdown. The small numbers who reported a previous nervous breakdown and the ill-defined nature of the term itself, must however cause us to regard this information with some caution.

As we were interested in assessing any relationship between the sleep pattern and the mental health of the individual, we next examined the reported sleep rhythms of those subjects who described themselves as being of a nervous disposition. This enquiry showed a significant positive relationship between subjectively described nervousness and a number of the items in the sleep pattern. Those subjects who described themselves as nervous were more inclined to report that they have difficulty in getting off to sleep ($\chi^2=19\cdot00$; $p<0\cdot01$) and that their sleep is light and easily disturbed ($\chi^2=69\cdot05$; $p<0\cdot01$). They

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tend to waken frequently during the night ($\chi^2=45\cdot73$; $p<0\cdot01$) and to report a higher frequency of dreams ($\chi^2=20\cdot47$; $p<0\cdot01$) and nightmares ($\chi^2=16\cdot11$; $p<0\cdot01$). These subjects also complained more frequently of both morning and day tiredness ($\chi^2=81\cdot29$ and $87\cdot30$; $p<0\cdot01$) and they are more likely to be taking a regular hypnotic ($\chi^2=52\cdot18$; $p<0\cdot01$). In reference to their physical state of health they more frequently describe this as poor ($\chi^2=24\cdot86$; $p<0\cdot01$). The following specific complaints relating to physical health were found more frequently in those subjects who are of a nervous disposition : (1) heart trouble ($\chi^2=21\cdot61$; $p<0\cdot01$); (2) high blood pressure ($\chi^2=30\cdot17$; $p<0\cdot01$); (3) regular and severe headaches ($\chi^2=60\cdot50$; $p<0\cdot01$). The same items were found to be significantly related in the sleep pattern of the 183 subjects who admitted to a previous nervous breakdown, with the exception of the specific physical complaints where the numbers were too small to allow reliable calculations to be performed. The relatively small numbers involved in this group of 183 subjects as a whole and the ambiguity of the term "nervous breakdown" greatly detract from any findings related to this group but they do provide some tentative suggestions which might be explored further in a subsequent study of the sleep pattern in abnormal states.

Summary and Conclusions

Before drawing any conclusions from our data we must first recognize the limitations of this type of enquiry. The 2,446 subjects who co-operated in the enquiry did not by any means constitute a randomly selected sample of the community and their responses cannot be taken as representative of the normal population as a whole. In formulating the questionnaire we attempted to minimize the subjective nature of the responses but our findings are still open to the usual criticisms applicable to all surveys involving an impersonal questionnaire approach. Although one might object that the individual may misrepresent his actual sleep habits in his own introspective report, the same objection might be levelled at much of the information obtained in clinical interviews. In any clinical investigation we find ourselves partly dependent on the patient's subjective assessment of his own symptoms. One might argue that the phenomenon of sleep is particularly vulnerable to subjective error and indeed, some investigations, using objective methods of measurement such as the EEG, have demonstrated the discrepancy between subjective and objective assessment of sleep disturbance. If it were further established that the tendency to overestimate sleep disturbance increases sharply with age and is more prevalent in women than men, the reliability of our data would obviously be affected. As yet, however, there is no objective evidence to support such an argument. One might also note that investigation of the sleep pattern by external observation and objective methods of measurement themselves introduce an artificial variable which may disturb the normal sleep pattern. Nevertheless, we must be cautious in interpreting our subjects' reports regarding their sleep in too literal a manner. The information in this survey allows us to report with some confidence on the way in which individuals view their own sleep habits, and the information might also be thought to have a higher objective reliability than the pure assumptions which are normally made on this subject.

The study has certainly suggested that any evaluation of the normal sleep pattern must necessarily take into account the variations due to such factors as age, sex and social class. Our findings support the generally held opinion that as people grow older their sleep pattern changes. This change appears to include

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a reduction in the number of hours slept, an increase in the time taken in getting off to sleep and a greater tendency for sleep to be light and easily disturbed by frequent night wakening. At the same time we have noted that as age advances people tend to complain less of morning tiredness. It is possible that, as age advances, people do not subjectively experience any great harm from the change in their sleep pattern, and that, as we grow older, we require less sleep. The variation of the sleep pattern with age is much more marked in the case of the female subjects of our sample. Although the two sexes do not differ significantly in the average number of hours slept, there are a number of significant variations in the form which their sleep takes. In general the sleep pattern of the female tends to change earlier than that of the male, usually during middle age. The change in the male sleep pattern with age is not only less marked but tends to be fully established later—some time after the retiral age of 65 years. We have also seen that the incidence in the use of hypnotics appears to increase rapidly with age but our findings suggest that this increase is almost entirely specific to women, 45 per cent. of whom admitted to taking a regular hypnotic in their 70's. The incidence of reported nervousness is again much higher in the case of women and reaches its peak between the ages of 25 and 44 years. These findings might be, of course, interpreted as merely indicating that men are less inclined to admit to taking a regular hypnotic or to being of a nervous disposition. A positive relationship has been demonstrated between the subjective estimation of nervousness and specific changes in the pattern of sleep as evaluated by the subjects. Those people who describe themselves as being nervous tend to report more difficulty in getting off to sleep and a more disturbed night's sleep. They are also more likely to complain of physical symptoms such as heart conditions, high blood pressure and severe headaches. It would thus seem that our general physical and mental state is reflected in the form and quality of our sleep.

Investigations of this type seem worthwhile in providing some sort of standard upon which an individual's sleep pattern may be more objectively evaluated. It is our intention to follow this investigation with a similar study applied to the patterns of sleep typical of patients receiving psychiatric treatment.

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