The influence of age and sex on the prevalence of depressive conditions: report from the National Survey of Psychiatric Morbidity

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ABSTRACT

Background. Women are consistently reported to have a greater prevalence of depressive disorders than men. The reason for this is unclear, and is as likely to be social as biological. There is some evidence that the excess of depression is greater during women's reproductive lives. Data from the National Survey of Psychiatric Morbidity were used to test the hypothesis that the excess disappeared in the post-menopausal years and that obvious social explanations for this were inadequate.

Method. Subjects ($N = 9792$) from a random sample of the British population provided data for the analysis. Psychiatric assessment was carried out by lay interviewers using the CIS-R. Subjects with ICD-10 depressive episode or mixed anxiety/depression were compared with the remainder. Social variables that were likely to contribute to a post-menopausal decline in depressive disorders were controlled in logistic regression analyses.

Results. There was a clear reversal of the sex difference in prevalence of depression in those over age 55. This could not be explained in terms of differential effects of marital status, child care, or employment status.

Conclusions. This large and representative survey adds considerably to the increasingly held view that the sex difference in prevalence of depression is less apparent in later middle age. This may be linked to the menopause, and our attempts to explain it in terms of obvious conditions among social variables were not successful. More specific studies are required to clarify the finding.

INTRODUCTION

One of the major unsolved problems in psychiatric epidemiology is the extremely consistent finding that women suffer from higher rates of depression than men (Weissman & Klerman, 1977; Bebbington, 1988, 1990, 1996). It is not even clear whether the determinants of this sex difference are predominantly biological or social. Women clearly differ from men in both these respects, but it is only possible to construct refutable theories on the basis of variables that not only distinguish between men and women but also between certain categories within the sexes. It is particularly important not to ascribe explanatory value to variables that are merely proxies for sex. However, variables that change with age, even if in only one of the sexes, may be capable of explaining sex differences.

Although attractive, explanations in biological terms face a number of difficulties. If higher rates of depression in women were solely due to a biological vulnerability, the sex ratio ought to be unaffected by the sociodemographic status of

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the studied group. However, groups in which the social differences between men and women are minimized often show a reduced sex difference (e.g. Jenkins, 1985; Wilhelm & Parker, 1989). Marital status also affects the difference. Sex ratios typically differ in the single, the married and the post-marital. Thus, in one community psychiatric survey, single and divorced women had a lower prevalence of minor affective disorder than their male counterparts, while wives had over five times the prevalence of husbands (Bebbington *et al.* 1981). However, this effect of marital status varies according to where the study is carried out. It seems to be much more pronounced in the industrial cities of Northern Europe than in Mediterranean cultures (Mavreas *et al.* 1986; Vázquez-Barquero *et al.* 1987). Similar findings and anomalies have been reported for the involvement of women in child-care, which in some but not all locations is associated with a high prevalence of disorder (e.g. Brown *et al.* 1977; Bebbington *et al.* 1981; Roman-Clarkson *et al.* 1988). This suggests not only that social variables are important in determining the sex ratio for depression, but that the association with relatively simple socio-demographic factors may itself be affected by more subtle sociocultural influences.

It is claimed that clinical depressive disorders are rare in childhood and show no female excess, perhaps even the reverse (Petersen *et al.* 1991; Angold & Rutter, 1992), although not all authors agree (Ruble *et al.* 1993). However, prevalence appear to rise sharply in late adolescence and early adulthood, particularly in females (Lewinsohn *et al.* 1994). Puberty may thus be linked to the emergence of the sex difference (Choquet & Menke, 1987; Cohen *et al.* 1993; Patton *et al.* 1996), but puberty is both a biological and a social transition, and is in any case a prolonged process that is difficult to date (Fombonne, 1995).

Community psychiatric surveys in adults almost invariably study subjects who have already passed through puberty. However, they usually do cover the period of hormonal change at the other end of women's reproductive lives. In the past, this has been seen as a time of vulnerability, to which women for biological or social reasons may respond by developing psychiatric disorder (e.g. Eagles & Whalley, 1985). This is expressed in the old term 'involu-

tional melancholia'. However, although clinicians are ready to adduce the menopause as a significant factor in the development of depression in individual women at the appropriate stage, there is very little epidemiological evidence of increased risk at this time (Der & Bebbington, 1987). Indeed, the recent large scale surveys using standardized instruments suggest the contrary. The ECA surveys (Robins & Regier, 1991) and the sizeable Edmonton DIS survey (Bland *et al.* 1988) both suggest that only in younger subjects is the F:M sex ratio greater than unity. The former showed no excess of women beyond age 55, while in Edmonton the sex ratio was only 1·2 between 45 and 54, and showed an excess of men after age 55. The US National Comorbidity Survey (Kessler *et al.* 1993) unfortunately only sampled subjects less than 55 years old: the excess prevalence of depression in women was maintained until that age.

Purely biological accounts have their own problems (Bebbington, 1996). However, we felt that the possible restriction of the sex difference to women's reproductive lives remains of considerable interest. Thus, to the epidemiological evidence we now add findings from the National Household Survey of Psychiatric Morbidity recently completed in Britain (Meltzer *et al.* 1995; Jenkins *et al.* 1997*a*). This covers the age range from 16 to 64, and therefore allows us to test our primary hypothesis that the sex differences in depressive conditions are no longer apparent after completion of the menopause. There is evidence that the menopause is becoming a progressively later event in women's lives, so we dichotomized age by using 55 as the boundary, on the grounds that by this age virtually all will be post-menopausal. In the light of the earlier research referred to above, we used marital status and the presence of offspring in the home as control variables. The former is important because marital status, in particular marital disruption, is related to age, and women may be less affected by separation and widowing. The presence of children at home may also have a differential impact according to sex and age. Employment status is also related to both age and sex, and has a well established link with affective disorder, particularly the less severe forms (Warr & Parry, 1982). Our secondary hypothesis was, thus, that the decline of the sex ratio with age would remain after controlling for

marital and employment status, and involvement in child care.

METHOD

The survey population was drawn at random from the whole of Britain, with the exception of the Highlands and Islands of Scotland. The sample was of 9792 adults aged 16–64 and living in private households. The sampling procedure and its effectiveness are described by Jenkins and her colleagues (1997*b*).

The prevalence of neurotic disorders and symptoms was based on the revised version of the Clinical Interview Schedule (CIS-R, Lewis *et al.* 1992). This instrument can be administered by clinically untrained interviewers, and results in a relatively short interview of about 30 min. It is made up of 14 sections, each covering a separate area of neurotic symptoms. Symptom areas that have particular relevance for depressive disorders include: concentration and forgetfulness; sleep problems; irritability; worry about physical health; depression; depressive ideas; and worry. There is detailed questioning about symptom characteristics within the last week; the frequency, duration, severity and time since onset. These questions determine the informant's score on each section. Diagnoses are obtained by applying algorithms based on ICD-10 diagnostic criteria to the answers to various sections, including questions which do not necessarily add to the total CIS-R score. We relied on an explicit hierarchy to place subjects in a single diagnostic category, even if they were allocated to more than one category by the algorithm (Table 1).

Table 1. *Rules for establishing a final diagnostic category where criteria for more than one category were met*

Disorder 1	Disorder 2	Priority
Depressive episode		
Any severity	Phobia	Depressive episode
Mild	*OCD	*OCD
Moderate	*OCD	Depressive episode
Severe	*OCD	Depressive episode
Mild	Panic disorder	Panic disorder
Moderate	Panic disorder	Depressive episode
Severe	Panic disorder	Depressive episode
Any severity	**GAD	Depressive episode

   * Obsessive–compulsive disorder.
  ** Generalized anxiety disorder.

In this paper we consider two conditions (see Fig. 1). One is any type of ICD-10 'depressive episode', while the other is a catch-all class of 'mixed anxiety/depression'. The latter requires some explanation. It is a residual category to which subjects are only allocated if they do not meet the criteria for one of the other functional disorders in ICD-10, but are yet above the threshold for the CIS-R (a score of 12 or more). No specific criteria are in fact set out for the ICD-10 category F41.2; mixed anxiety and depressive disorder. While the symptoms of people in this category are often seen as part of depressive and anxiety syndromes, around a third of cases did not have the symptom of depressed mood. The low threshold for recognition represented by this disorder is reflected in the fact that its overall prevalence is around four times greater than that of depressive episode (Jenkins *et al.* 1997*b*). Thus, the category depressive episode represents conditions of at least moderate severity, while the category mixed anxiety/depression is by definition milder.

Interviews were carried out by 200 interviewers who were part of the OPCS general field force. They had a minimum of 3 years prior interviewing experience and had been trained to a high standard to work on Government sponsored surveys. Interviewers were then briefed on the use of the CIS-R in a one day course. Field-work was closely monitored by field supervisors and headquarters staff. The small users post-code address file was chosen as the sampling frame because of its good coverage of households in Great Britain. Two hundred postal sectors were selected and formed the primary sampling unit, with probability proportional to size. This sampling procedure eventually yielded 15765 private households from which 12730 adults were selected for interview. Eighty per cent (10108) of those approached cooperated with the interview. Approximately two-thirds of those who were not interviewed had refused. The final sample was weighted in order to compensate for systematic biases in the sampling procedure, comprising the effects of refusal and household size, and minor divergences from sociodemographic distributions according to census data (Jenkins *et al.* 1997*b*). Routine analyses and the estimate of weighted prevalences were carried out using SPSS for windows, version 6 (Norušis,

ICD-10 disorder   Final diagnostic group

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┌────────────────────────┐
│ F32.00                 │
│ Mild depressive disorder│
│ without somatic symptoms│         ┌──────────────┐
└────────────────────────┘         │ Mild depressive│
                                    │ episode       │
┌────────────────────────┐         └──────────────┘
│ F32.01                 │
│ Mild depressive disorder│
│ with somatic symptoms  │
└────────────────────────┘

┌────────────────────────┐
│ F32.10                 │
│ Moderate depressive    │
│ disorder without       │         ┌──────────────┐
│ somatic symptoms       │         │ Moderate      │
└────────────────────────┘         │ depressive    │
                                    │ episode       │
┌────────────────────────┐         └──────────────┘
│ F32.11                 │
│ Moderate depressive    │
│ disorder with somatic  │
│ symptoms               │
└────────────────────────┘

┌────────────────────────┐
│ F32.2                  │
│ Severe depressive      │
│ episode                │
└────────────────────────┘

┌────────────────────────┐
│ F41.2                  │
│ CIS-R – Positive cases │
│ failing to meet other  │         ┌──────────────────┐
│ ICD-10 criteria        │         │ Mixed anxiety and │
│ without somatic symptoms│        │ depressive disorder│
└────────────────────────┘         └──────────────────┘
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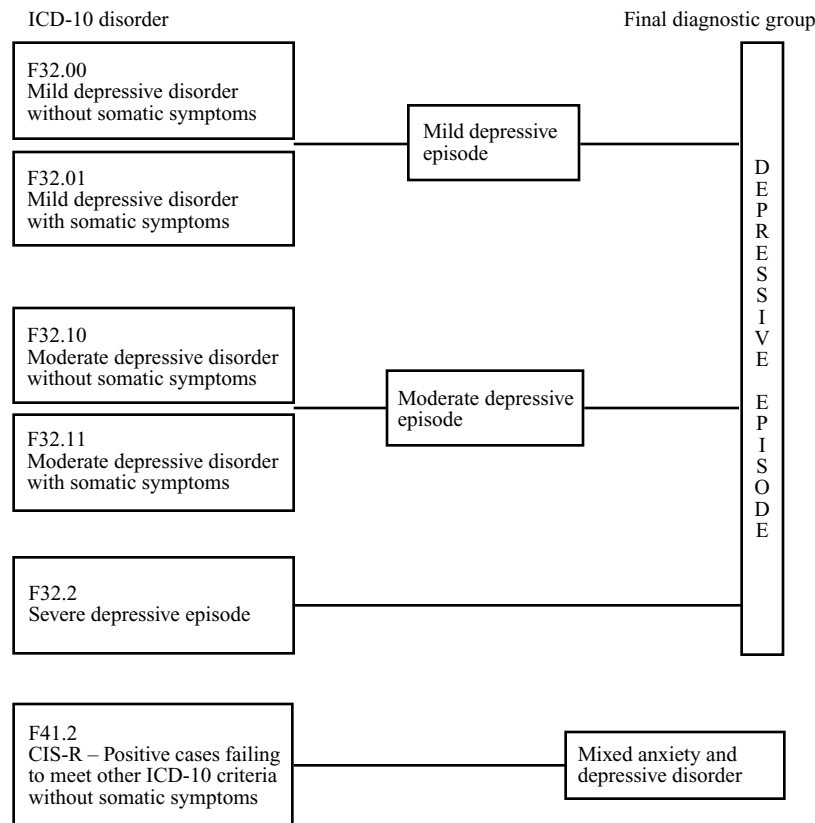
DEPRESSIVE EPISODE

FIG. 1.   Flow chart to show derivation of disorders used in survey analysis.

1993). All significance testing and model fitting to the weighted data were carried out using SUDAAN version 6.3 (Shah *et al.* 1993). The need for the use of appropriate software such as SUDAAN for valid statistical inference from weighted data is described by Lehtonen & Pahkinen (1995).

RESULTS

In the analyses that follow, we present breakdowns by age and sex of the two depressive conditions and of the depressive symptoms described above. Subjects were generally dichotomised into those aged less than 55 and those aged 55 and above. We also evaluated joint effects on depression of age with sex, marital status, employment status and the presence of children under 16 in the home.

Table 2 gives the 1-week prevalence of the two sorts of depressive disorders identified by the

CIS-R in relation to age and sex. The relatively high prevalence of mixed anxiety/depression is apparent, while ICD-10 depressive episode has an overall prevalence of between 1 and 3%, confirming that it covers disorders roughly equivalent to DSM-III-R major depressive disorder. The sex ratio for depressive disorder is 1·5, while that for the milder condition is 1·8. At the bottom of Table 2 we presented two sets of odds-ratios and a chi-square test for the association between disorder and sex within each of the age groups. The top odds-ratio is a measure of the increased risk of depression (depressive disorder and mixed anxiety/depression combined) in women. The bottom one is more complicated as it is a ratio of a ratio. It is the F:M sex ratio of the ratio of depressive episode to mixed anxiety/depression. It is thus a way of indicating within a given age category whether women have a greater proportion of more severe disorders. If it had a value of 1, it

Table 2. *Sex differences in the prevalence of depressive disorders by age**

	Aged 16–54		Aged 55–64	
	Male N (%)	Female N (%)	Male N (%)	Female N (%)
No depression	3811 (93·0)	3588 (86·5)	699 (91·9)	736 (93·6)
Mixed anxiety-depression	219 (5·3)	446 (10·8)	46 (6·0)	41 (5·2)
Depressive episode	68 (1·7)	113 (2·7)	15 (2·0)	9 (1·1)
Total	4098	4147	761	786
χ^2 (2 df)	83·58 ($P < 0·01$)		2·94 ($P = 0·23$)	
Odds ratios				
Any depression in women (males = 1·0)	2·07		0·78	
Ratio of depressive episode to mixed anxiety/depression in women (male ratio = 1·0)	0·82		0·67	

* All counts and other estimates in this and the following tables are weighted to reflect differential sampling fractions.
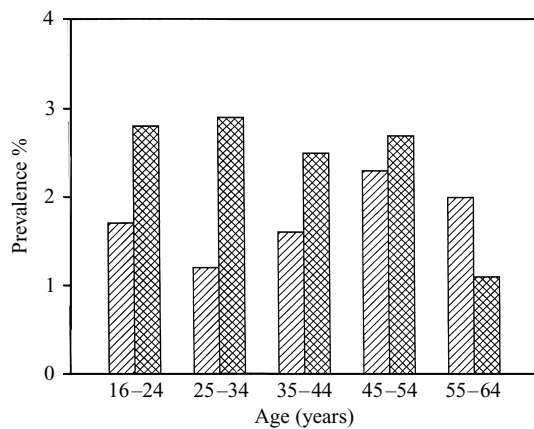

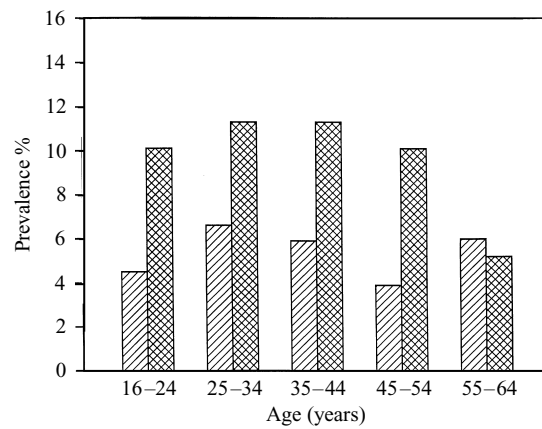Fig. 2. Age and depressive episode (▨, male; ▩, female).

Fig. 3. Age and mixed anxiety/depression (▨, male; ▩, female).

would mean that the proportion of depressive episodes to mixed anxiety/depression was the same in both sexes. If greater than one, the implication is that women suffer disproportionately from the more severe category of disorder. In the event, the top odds-ratio appears to change with age-group (2·07 *v.* 0·78). In other words, under the age of 55 the prevalence of depression in women is about twice as high as in men, as found in most other studies, while in the older group women actually form a minority of subjects suffering from these two conditions. The relationship with age is thus in line with our initial hypothesis.

The relative proportion of depressive episode in the overall depression group does not change with age (0·82 *v.* 0·67). In other words, the age

effect characterizes both type of depressive disorder. The question may be asked, is the sex ratio before age 55 actually uniform, or are there other age groups in which the sex ratio is minimized or reversed? A more detailed breakdown is provided in Fig. 2 and 3. It can be seen that there is actually some variation in the female preponderance before age 55. However, women are always in a majority, and a substantial one, with the exception of depressive episode in the age group 45–54 in which the ratio is reduced because of a particularly high prevalence in men.

In Table 3 we present results in relation to the individual depressive symptoms elicited by the CIS-R. The proportion of females with symptoms of sleep problems, fatigue and worry is

Table 3. *Percentage of adults with score of two or more on each CIS-R symptom by age and sex*

Symptom	Age < 55			Age 55–64		
	Men	Women	(Odds ratio)	Men	Women	(Odds ratio)
Fatigue	20·3	33·5	(1·98)	22·6	29·6	(1·44)
Sleep problems	20·3	27·7	(1·50)	23·9	31·9	(1·49)
Irritability	19·8	27·9	(1·97)	13·1	12·3	(0·93)
Worry	17·5	24·0	(1·49)	13·8	16·9	(1·27)
Depression	8·3	11·3	(1·99)	8·3	7·3	(0·87)
Depressive ideas	6·9	12·3	(1·89)	7·4	5·7	(0·76)
Concentration and forgetfulness	6·2	10·0	(1·68)	7·5	7·2	(0·96)

greater than in men over the whole age range, but except for sleep problems the excess is greater in the younger age category. The symptoms depression, depressive ideas, and concentration and forgetfulness show a female excess until the age of 55. After that the sex ratio is equal or reversed. Thus, the age–sex pattern shown by the depressive disorders is equally apparent for the symptoms most clearly associated with them.

The change in ratio after age 55 arises because of a reduction in the female prevalence of depression, rather than an increase in male prevalence, thus confirming support for the idea that the female preponderance is a phenomenon of the reproductive years. However, before accepting that this may be due to the biological concomitants of reproductivity, it is necessary to consider some of the social implications of ageing, specifically the frequently associated changes in marital status, child-care, and em-

ployment status, which may all differ in impact in men and women. All these variables are strongly associated with age in our data. If they are also associated with variations in the sex ratio, they must be controlled for an analysis.

Table 4 gives a breakdown of disorder by marital situation. Divorced, widowed and separated subjects have been included in a single post-marital category, while cohabiting subjects are amalgamated with their married counterparts. The picture is not consistent. The F:M sex ratio for subjects with any depressive disorder declines progressively as we move from single subjects, through the married to the post-marital. This reduction in the odds ratio could either indicate that the change in sex ratio in later middle-age arises because of the smaller impact of marital breakdown in women, or that post-marital women suffer less depression because they are on average older than their single or married counterparts. However, differences between males and females are significant at the $P < 0.01$ level in all marital categories. The reduced ratio seen in post-marital subjects is the result of a great increase in male sufferers paralleled by a proportionately smaller increase in post-marital women. The second set of odds ratios are based on an analysis only of subjects with depression. In these groups the tendency for women to have a greater proportion of milder disorders increases as we move through the marital classes. As these differences are not significant, the safest conclusion is that although the sex ratio varies, it persists across marital status, and applies equally to severe and mild depression. However, the relationship between sex ratio and marital

Table 4. *Sex differences in the prevalence of depressive disorders by marital status*

	Single		Married		Post-marital	
	Male N (%)	Female N (%)	Male N (%)	Female N (%)	Male N (%)	Female N (%)
No depression	1249 (93·0)	878 (86·5)	2982 (93·3)	2927 (89·0)	280 (87·1)	519 (82·4)
Mixed anxiety/depression	72 (5·4)	103 (10·2)	168 (5·2)	301 (9·2)	25 (7·8)	83 (13·2)
Depressive episode	22 (1·6)	33 (3·3)	45 (1·4)	61 (1·8)	16 (5·1)	28 (4·4)
Total	1343	1014	3194	3289	322	630
χ^2 (2 df)	18·92 ($P < 0.01$)		34·52 ($P < 0.01$)		10·73 ($P < 0.01$)	
Odds ratio						
Any depression in women (males = 1·0)	2·06		1·73		1·46	
Ratio of depressive episode to mixed anxiety/depression in women (male ratio = 1·0)	1·05		0·76		0·53	

Table 5. *Sex differences in the prevalence of depressive disorders by presence of children in the home*

| | Children at home | | No children | |
	Male N (%)	Female N (%)	Male N (%)	Female N (%)
No depression	1674 (92·5)	1786 (85·0)	2836 (93·1)	2538 (89·6)
Mixed anxiety/depression	110 (6·0)	248 (11·8)	155 (5·1)	239 (8·5)
Depressive episode	27 (1·5)	68 (3·2)	57 (1·9)	54 (1·9)
Total	1810	2101	3048	2831
χ^2 (2 df)	47·54 ($P < 0·01$)		24·35 ($P < 0·01$)	
Odds ratios				
Any depression in women (males = 1·0)	2·16		1·62	
Ratio of depressive episode to mixed anxiety/depression in women (male ratio = 1·0)	1·12		0·61	

status would tend to explain some of the reduction in sex ratio with age.

In Table 5, we break down the association of disorder with sex by the presence of children under the age of 16 in the home. The sex difference is significant whether there are children at home or not. However, where there are no children at home, women have a lower prevalence both of depressive episodes and of mixed anxiety/depression. The presence of children has little impact on male subjects. The sex ratio for any form of depressive disorder is higher for subjects with child care responsibilities, and women with children at home are more likely to have the more severe form of depression than women without. The presence of children in the home might therefore account for some increase in the F:M sex ratio in younger subjects, particularly for mixed anxiety/depression.

There are significant differences between males and females in the link between employment status and depression (Table 6). The F:M sex ratio for economically inactive subjects (without paid work and not seeking it) is close to unity for both types of disorder. The unemployed have the highest sex ratio, while those in part-time work have the lowest. Depressive disorder in working women is less likely to take the severe form represented by depressive episode. These data suggests that the impact of unemployment is appreciably greater in women than in men. In some studies this may be masked by incorporating the economically inactive within the category of the unemployed. These results might

also serve to explain the difference in sex ratio by age.

The results presented in Tables 4–6 indicate that marital status, the presence of children in the home, and employment status must be controlled for in analysis.

Weighted logistic regression was used to test the combined effects of sex, age, marital status, employment status and having children living at home on depression. This was carried out in two stages. First, depressive disorder and mixed anxiety and depression were combined to form a single diagnostic group, and factors explaining the variation in the prevalence of the combined disorder examined. What we are hypothesizing here is a significant interaction term between sex and age, whatever the other terms required for the model of best fit. If such an interaction is present, it implies that the age effect on the sex ratio is independent of the social variables that might have accounted for it. The resulting model is summarized in Table 7, from which it is clear that the sex-difference in the prevalence of depression is indeed dependent on the subjects' age (and, incidentally, work status, as indicated by the statistically significant interactions). Our hypothesis thus stands.

The second analysis is designed to test whether the effect of age on the sex ratio applies to both disorders included in the analysis. People without any depression (i.e. neither depressive disorder or mixed anxiety/depression) were dropped from the analysis and a second round of modelling was carried out to look at the relative prevalence of pure depression as opposed

Table 6. *Sex differences in the prevalence of depressive disorders by employment status*

	Full-time work		Part-time work		Unemployed		Economically inactive	
	Male N (%)	Female N (%)	Male N (%)	Female N (%)	Male N (%)	Female N (%)	Male N (%)	Female N (%)
No depression	3123 (94·3)	1541 (89·5)	262 (92·8)	1231 (89·0)	518 (89·3)	198 (73·8)	604 (88·7)	1354 (86·9)
Mixed anxiety/depression	151 (4·6)	161 (9·4)	16 (5·6)	122 (8·8)	46 (8·0)	55 (20·6)	52 (7·6)	146 (9·4)
Depressive episode	38 (1·2)	19 (1·1)	4 (1·6)	30 (2·2)	16 (2·7)	15 (5·6)	25 (3·7)	57 (3·7)
Total	3312	1721	282	1383	579	268	681	1558
χ^2 (2 df)	32·94 ($P < 0·01$)		3·92 ($P = 0·14$)		20·45 ($P < 0·01$)		1·76 ($P = 0·41$)	
Odds ratios								
Any depression in women (males = 1·0)	1·93		1·62		2·95		1·18	
Ratios of depressive episode to mixed anxiety/depression in women (male ratio = 1·0)	0·47		0·98		0·78		0·81	

Table 7. *Weighted logistic regression for presence of depression* (*depressive disorder and mixed anxiety/depression combined*)

Contrast	df	Wald F	P
Intercept*	—	—	—
Sex*	—	—	—
Age*	—	—	—
Work*	—	—	—
Children	1	6·99	0·01
Married	2	24·75	< 0·01
Sex by age	1	13·70	< 0·01
Sex by work	3	3·18	0·02

* Not tested in presence of interaction terms.

Table 8. *Weighted logistic regression for type of depression* (*depressive disorder or mixed anxiety/depression; non-cases omitted*)

Contrast	df	Wald F	P
Sex	1	6·51	0·01
Age	1	2·27	0·13
Children	1	0·34	0·56
Marital status	2	3·68	0·03
Work	3	6·73	< 0·01

to mixed anxiety and depression in the remaining subsample. What we are looking for in this model is the *absence* of a requirement for an age-sex interaction, as we could then infer that the age–sex interaction demonstrated in Table 7 was independent of the type of disorder. As summarized in Table 8, this is what we found in the second set of analyses, confirming our hypotheses equally for the two disorders.

DISCUSSION

The analyses presented here confirmed our hypothesis that the appreciable preponderance of female sufferers, both from depressive episodes and from mixed anxiety/depression, is evident only before the age of 55. In effect, the preponderance does not persist beyond the age when virtually all women have passed through the menopause. The fall in the F:M sex ratio is due to an absolute fall in female prevalences.

The National Household Survey of Psychiatric Morbidity offers considerable advantages for a study of this sort. First, because it is based on a random non-referred sample of the population, it escapes the problems of referral bias. Secondly, because it is a national sample it avoids the bias arising because most psychiatric community surveys involve city (usually inner-city) populations. Thirdly, the size of the sample in the current study is large, just under 10 000 respondents.

There must, however, be some caution in relation to the methods used. The diagnostic instrument, the CIS-R, is designed for use by lay interviewers, and deliberately offers no scope for clinical judgement. The validity of diagnosis might thus have been reduced. However, this issue is currently being studied in an empirical comparison of the CIS-R and SCAN (WHO, 1992) by Brugha *et al*. The CIS-R has been adapted for use with the Diagnostic Criteria for Research (DCR) of ICD-10 (WHO, 1993), and the rules governing the presence of depressive episode are explicit and clear. In the current paper, we have used an operationalized

diagnostic hierarchy to deal with the problem of co-morbidity. However, few cases of depressive episode were lost, as in most instances this category takes precedence over other classes of neurotic disorder.

The nosological status of our category mixed anxiety/depression is not clear, partly because the ICD-10 category to which it relates actually has no DCR definition. It probably forms the sort of near-threshold condition that in the wrong circumstances can proceed to a fully blown depressive episode (Romans *et al.* 1993), and this idea gains some support from the similarity of the sociodemographic correlates of the two conditions. It is, thus, of interest that the clear decline in the prevalence of depressive episodes in women after age 55 was paralleled both by mixed anxiety/depression, and by the individual symptoms that comprise depressive syndromes. In general, the research findings at this end of the lifespan are less consistent than those relating to childhood and adolescence, with some studies agreeing with ours that the high F:M ratio is restricted to the period of female fertility and declines afterwards due to a reduction in female prevalence. Thus, Brown *et al.* (1992) found no sex differences in depression in elderly African Americans. However, others suggest that the female excess is maintained even if at a lower level. Green *et al.* (1992) conducted a three year follow-up of a cohort of 1846 subjects aged over 65. Forty-four developed new episodes of depression, and a female preponderance was apparent even at this age. Stallones *et al.* (1990) also found a clear excess of depression in females in their community sample of over-65s interviewed by telephone.

Jorm (1987) carried out a meta-analysis of studies of depression over the age range, analysing separately those based on diagnosed cases of depression and those using continuous measures of depressive symptoms. The scatter of results indicated a non-linear relationship, and was best accounted for by a quadratic curve which cut the zero sex difference line at just over 10 years and just under 80. The equation accounted for 27% of the variance. Thus, the sex ratio was much reduced at the ends of the life span, but was maintained for some time after the menopausal years. Both men and women peaked in their early twenties, but the female peak was higher and declined more quickly. Our analysis is at variance with Jorm's (1987) review, but because of its size and methodological advantages, we feel it adds considerably to the argument in favour of a sharp fall in female prevalence in the 50s.

The picture is made more complex by the probability that the aetiology of depression in older groups differs from that in earlier adulthood. Schittecatte *et al.* (1994) found that the growth hormone response to clonidine differs in pre- and post-menopausal women with depression. However, in order to account for perimenopausal changes in prevalence of depression, we really require to identify differences in non-depressed women. Levkoff *et al.* (1987) showed a greater relationship between physical health and depression in the elderly than in the middle aged, but as the sex difference declines with age, and poor physical health is commoner in women, this would actually tend to increase the sex gap in the elderly. Wallace & Pfohl (1995) suggest that the association of guilt, reduced self-esteem and a sense of failure with depression becomes less with age, in both males and females. However, this could be a cohort effect. For more discussion of the aetiology of depression in the elderly, see Blanchard (1996).

Analysis of the age-specific frequency of depressive disorder invites us to focus on the question of peri-menopausal change, which in the past has been regarded as a time of increased vulnerability to depression. However, in prospective studies the effect of the menopause on depressive symptoms has been slight or non-existent (Hunter, 1990*a*; Matthews *et al.* 1990; Kaufert *et al.* 1992). In one of these (Hunter, 1990*a*) such depressive symptoms as did exist were largely related to a prior history of depression and negative attitudes towards the menopause. Community surveys of women around the menopause consistently reveal no excess of depressive disorders (Hallstrom & Samuelsson, 1985; Gath *et al.* 1987; McKinlay *et al.* 1987; Kaufert *et al.* 1988), and depressive symptoms at this time seem more likely to be related to life events and other social difficulties than to the fact of the menopause (Green, 1984; Cooke, 1985; McKinlay *et al.* 1987). Pre-existing levels of stress appear to determine whether women respond to the menopause with depressed mood (Hunter, 1990*b*; Kaufert *et al.* 1992). While many of these studies used less

than perfect methods of assessment, whether of psychiatric status or of the menopause itself, they are at least consistent in suggesting that the transition, narrowly defined, has little effect on mood symptoms.

As an epidemiological finding, the post-menopausal fall in sex ratio described in this paper encourages interpretation, but cannot assist in choosing between potential mechanisms. We have controlled for social variables that might comprise part of a social account of the findings, but this does not of course rule out the possibility of other social and psychological explanations. Thus, our failure to do this does not by default necessarily imply biological causation. While an interpretation in terms of the hormonal changes of the menopause has its attractions (perhaps mainly of a seductive simplicity), it remains one of many feasible alternatives. We have argued that the sex difference in incidence and prevalence of depressive disorders is a major and unsolved problem in psychiatric epidemiology, and one that almost certainly has a bearing on the overall aetiology of these conditions. Our results suggest that one way of approaching this problem is through a longitudinal study of women as they approach and pass through the menopause, using detailed social, psychological and biological measures.

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