British Journal of Psychiatry (1995), **166**, 320–327

Prevalence of Depression After Stroke: The Perth Community Stroke Study

P. W. BURVILL, G. A. JOHNSON, K. D. JAMROZIK, C. S. ANDERSON, E. G. STEWART-WYNNE, and T. M. H. CHAKERA

Background. The Perth Community Stroke Study (PCSS) was a population-based study of the incidence, cause, and outcome of acute stroke.
Method. Subjects from the study were assessed initially, by examination and interview, and at four- and 12-month follow-ups to determine differences in prevalence of depression between the sexes and between patients with first-ever and recurrent strokes.
Results. The prevalence of depressive illness four months after stroke in 294 patients from the PCSS was 23% (18–28%), 15% (11–19%) major depression and 8% (5–11%) minor depression. There were no significant differences between the sexes or between patients with first-ever and recurrent strokes. With a non-hierarchic approach to diagnosis of those with depression, 26% of men and 39% of women had an associated anxiety disorder, mainly agoraphobia. Nine per cent of male and 13% of female patients interviewed had evidence of depression at the time of the stroke. Twelve months after stroke 56% of the men were still depressed (40% major and 16% minor), as were 30% of the women (12% major and 18% minor).
Conclusion. The prevalence of depression after stroke was comparable with that reported from other studies, and considerably less than that reported from in-patient and rehabilitation units.

There is no unequivocal information on the nature, frequency, and natural history of the psychiatric sequelae of stroke (House *et al*, 1991). Stroke is a common condition, and depression is the most commonly reported post-stroke psychiatric condition. Quoted rates of post-stroke depressive disorder have ranged from 18% to 61% (House, 1987*a*). Robinson & Starkstein (1990), for example, have stated, on the basis of studies of in-patients, that up to 50% of patients with stroke develop depression during the acute post-stroke period, and another 30% of patients do so during the first two years after the stroke. The highest prevalences have come from studies examining patients with stroke admitted to acute hospitals or to rehabilitation units (Johnson, 1991). The lowest reported figures have come from the two community-based studies by Wade *et al* (1987) and House *et al* (1991), in which all patients with stroke in a defined population, whether in hospital or not, were assessed.

The following explanations of the wide discrepancy in the reported frequency of depression have been suggested by various authors (House, 1987*a*; Primeau, 1988): different settings from which patients have been derived, with selection bias toward in-patients and long-term out-patients; small numbers of subjects; the use of different and, at times, ill-defined selection criteria and different assessment instruments; and uncertainty about the validity of the methods used to measure psychiatric symptoms. Most studies have failed to examine control groups (Johnson, 1991), the Oxfordshire Community Stroke Project (House *et al*, 1991) being a notable exception. Furthermore, after reviewing a number of studies, both House (1987*b*) and Primeau (1988) concluded that it was unproved that depression was more common in an unselected group of patients after strokes than it was among the elderly with other physical illnesses.

The Perth Community Stroke Study (PCSS) was a population-based study of the incidence, cause, and outcome of acute stroke undertaken by a multidisciplinary team in a geographically defined segment of metropolitan Perth, Australia (Anderson *et al*, 1993). This paper deals with the initial results of the psychiatric component of that study.

The aims of this report are as follows: (a) to report the prevalence four months after stroke of depressive illness and of emotional lability in those cases of stroke studied in the PCSS, using the Present State Examination (PSE; Wing *et al*, 1974) and DSM–III (American Psychiatric Association, 1980) diagnostic systems (both the customary hierarchic system and a non-hierarchic diagnostic system were used in reference to the latter); (b) to determine whether there were any differences in the prevalence of depression in cases of first-ever and recurrent stroke; (c) to determine the outcome, in psychiatric

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

diagnostic terms, 12 months after stroke, of all those surviving patients given a diagnosis at the four-month post-stroke survey of depression or emotional lability.

Method

Ascertainment and initial assessment

Details of case ascertainment and base-line assessment of patients seen in the PCSS have been described in full by Anderson *et al* (1993). Briefly, all residents of a geographically defined segment of the Perth metropolitan area (estimated population 69 008 males and 69 700 females at 30 June 1989) who had a stroke between 20 February 1989 and 19 August 1990 were included in the PCSS. Various overlapping sources of case ascertainment were used. These included notifications from general practitioners; scrutiny of all attendances at and admissions to all acute hospitals, rehabilitation centres, and nursing homes; coroners' reports and death registrations; and monitoring of computerised hospital discharge statistics. All patients were seen as soon as possible after an event by the study registrar (CSA), who conducted a standardised interview and physical examination, and confirmed that they had had a stroke. Stroke was defined according to World Health Organization criteria (Hatono, 1978) and the new special report from the Institute of Neurological Disorders and Stroke (Whisnant *et al*, 1990). A total of 492 patients were detected, of whom 408 were interviewed by CSA. Sixty-nine per cent had had first-ever strokes. Eighty-three patients had died before being seen by the registrar, and only one patient refused to take part in the study. Evaluation of cognitive state with the Mini-Mental State Examination (MMSE; Folstein *et al*, 1975), of physical disabilities with the Frenchay and Barthel Indices (Mahoney & Barthel, 1965) and of aphasia with the Token Test (De Rerzi & Vignolo, 1962) was undertaken. Twenty per cent of all strokes were managed entirely outside hospital, either at home or in a nursing home. The case fatality rate was 24% at 28 days and 38% at 12 months after stroke.

GAJ interviewed 108 control subjects in their homes, conducting a psychiatric assessment with the Psychiatric Assessment Schedule (PAS; Dean *et al*, 1983) – a modification of the PSE – like that for the assessment at four months of survivors of stroke. The controls were selected from available electoral rolls, matching those patients seen four months after stroke for age, sex and residence in the PCSS area. Enrolment to vote is compulsory for Australian citizens.

Follow-up

The stroke patients were seen at four and 12 months after the index events. Four months after stroke, there were 318 patients from the original cohort still alive, but seven of these had emigrated from Australia. The remaining 311 patients were physically assessed by CSA, of whom 248 were seen for psychiatric assessment by either PWB or GAJ. Four patients died shortly after assessment by CSA and before being seen by the psychiatrists, and 13 refused to see a psychiatrist. Forty-three patients were severely demented, and three were so severely aphasic that full psychiatric assessment was not made. In calculating the prevalence rates of depression, we used a denominator of 294 patients at risk, this being composed of the 248 (84%) seen by the psychiatrists, the 43 (15%) patients with severe dementia, and the three (1%) with severe aphasia. In addition to the 318 patients alive at four months, there were another 22 patients living in the catchment area who had had a stroke within the specified period, but who had not been reported to the PCSS research team until well over four months after stroke. None of these 22 patients were included in this report.

Patients were seen in their own homes, in nursing homes, or occasionally in the psychiatrist's office. Each patient was assessed psychiatrically with the PAS. Both psychiatrists had been trained in the use of the PSE. The PAS enabled a diagnosis of depressive and anxiety disorders to be made according to both DSM–III and PSE criteria. Careful enquiry was made by the psychiatrists of each patient and of relatives where available, as to the presence or absence of any psychiatric disorder, especially of depression or anxiety disorder, at the time of the index stroke.

At 12 months, all surviving patients were reassessed by CSA. Those patients who had been given a psychiatric diagnosis at four months and were alive at 12 months (131 men and 103 women) were reinterviewed by PWB or GAJ and assessed psychiatrically with the PAS.

Analysis. All data were collected on precoded interview forms and entered onto a database held in a minicomputer. The data were analysed with the SAS (1991) and EGRET (1991) statistical packages. A non-hierarchic approach to diagnosis was used with the PAS data so that patients were assigned all the DSM–III diagnoses for which they satisfied the criteria. Depressive disorders were categorised as either major depression (DSM–III) or minor

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

depression. Patients with minor depression were those who satisfied the DSM-III diagnostic criteria for dysthymia, but not the requirement for a duration of two years, in accordance with the criteria adopted by Robinson and his colleagues in their studies of post-stroke depression in Baltimore (Starkstein & Robinson, 1989). In addition, the PAS data were analysed with the CATEGO-ID program (Wing *et al*, 1978) to derive a psychiatric diagnosis with the nomenclature of ICD-9 (WHO, 1978). The Fisher exact probability test was used to test statistical differences between groups, rather than the χ^2 test, because of the small numbers involved. Prevalence rates are reported with 95% confidence intervals (CI).

Results

Of the original 492 patients in the PCSS, 340 were alive at four months, but only 248 of these were assessed psychiatrically. Those not seen by a psychiatrist were in two groups; firstly, those who were severely demented (43) or aphasic (3), and, secondly, those who were reported to the PCSS team well over four months after stroke (22), who had emigrated within the first four months (7), or those who refused to see a psychiatrist (13). In addition, four patients died after been seen by CSA but before their psychiatric assessment. These two groups were compared over a number of indices of socio-demographic variables, mobility, and level of daily functioning. There was no statistical significance between the two groups on any of these variables. The first group had a higher proportion of patients aged less than 75 years (93%) than did the second group (86%). The first group of 46 demented and aphasic patients was combined with the 248 (140 male, 108 female) patients seen by the psychiatrists to form the 294 patients at risk. Most patients were seen in their own homes, and the remainder in various nursing homes, hostels and other institutions.

The age range of the 294 patients was 26–90 years, of whom 50 (17%) were aged less than 60 years, 62 (21%) were aged 60–69 years, 104 (36%) were aged 70–79 years and 78 (26%) were aged 80 years or older (Table 1). Of the 294 patients, 221 (75%) had had a first-ever stroke, 124 (56%) of these being men and 97 women (Table 1).

Prevalence

There was an almost equal prevalence of depression (combined major and minor) in men (23%) and women (24%), with a slightly higher prevalence of major depression in men (16%) than women (14%), and of minor depression in women (10%) than men (7%) (Table 1). The age distribution of major and minor depressive patients differed between sexes. In men, the highest proportion of both major and minor depression was in those under 60 years of age, with a decrease with increasing age. The opposite applied in women, the highest proportion of major depression being in the two oldest age groups. There was not much variation of minor depression with age

Table 1
Prevalence of DSM-III depressive disorders

		%	Male (95% CI)	%	Female (95% CI)	%	Total (95% CI)
DSM-III diagnoses							
Major depression	first-ever	17	(10–23)	12	(6–18)	15	(10–20)
	recurrent	15	(4–26)	18	(5–31)	16	(8–26)
	total	16	(10–22)	14	(8–20)	15	(11–19)
Minor depression	first-ever	7	(3–11)	12	(6–8)	9	(5–13)
	recurrent	5	(0–12)	3	(0–9)	4	(0–8)
	total	7	(3–11)	10	(5–15)	8	(5–11)
All depressive disorders	first-ever	24	(17–31)	24	(16–32)	24	(18–30)
	recurrent	20	(8–32)	21	(7–35)	20	(11–29)
	total	23	(17–29)	24	(17–31)	23	(18–28)
PSE diagnosis							
Depression	all strokes	19	(13–25)	26	(18–34)	20	(15–25)
Total strokes	first-ever		(n = 124)		(n = 97)		(n = 221)
	recurrent		(n = 40)		(n = 33)		(n = 73)
	total		(n = 164)		(n = 130)		(n = 294)

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

in women except for a much higher proportion (25%) in the 60–69 year group.

The proportions of depression did not vary significantly between the first-ever and recurrent strokes, except that, among women, there was a much lower prevalence of minor depression in patients with recurrent stroke (3%) than in those with first-ever stroke (12%). Only seven of 27 male patients and one of 18 female patients with major depression had a diagnosis of major depression with melancholia. There was a higher proportion of major than of minor depression in both men (2.5:1) and women (1.4:1). By a non-hierarchic approach to diagnosis, of the 27 men and 18 women with major depression, 10 (37%) and seven (39%), respectively, had additional diagnoses of agoraphobia, generalised anxiety disorder, or both of these. These additional diagnoses were divided between both first-ever and recurrent strokes in women, but were confined to first-ever strokes in men. One man and five women with minor depression also had agoraphobia.

When men and women were combined, there was a significantly greater prevalence of major ($P=0.0023$) but not minor depressive disorders in the patients with stroke than in the controls, with the Fisher exact probability test (Table 2). If the sexes were considered separately, these differences were significant for major depression in men ($P=0.0002$) and for minor depression in women ($P=0.0596$).

With the PSE-CATEGO diagnostic system, an ICD-9 diagnosis of depression (296.2 or 300.4) was made in 32 men (19%) and 26 women (20%), giving an overall prevalence of depression of 20% (Table 1). All of these depressed patients had PSE-ID of 5 or more.

Pre-stroke depression

Overall, 12 (9%) of the male patients and 14 (13%) of the female patients interviewed had been depressed at the time of the stroke. Significantly more of the women (39%) but not men (16%) depressed four months after stroke had been depressed at the time of their stroke (Table 3). This was similar for both major and minor depression in men, but in women 50% of those with major depression, in contrast to 23% of those with minor depression at follow-up, were also depressed when they had the stroke.

Outcome at 12 months

Between the four-month and the 12-month surveys, 14 of the 248 patients (nine men and five women) died. Proportionately more patients with depression (5/69, 7.2%) and an anxiety disorder (4/33, 12.1%) than those with no diagnosis at four months (5/179, 3.4%) died in that period. Table 4 shows the psychiatric diagnosis, including emotional lability, made at the 12-month follow-up interviews of those who had been given a diagnosis of major or minor depression at the four-month post-stroke survey. Of those with a diagnosis of major depression at four months, 28% of men and 47% of women had no psychiatric diagnosis at the 12-month follow-up, 56% of men and 30% of women had either major or minor depression, and the remainder had either agoraphobia or emotional lability. For those men who originally had minor depression, 50% had no diagnosis at 10 months, 12% had minor depression, and 38% had major depression. Corresponding figures for women with minor depression were 43% no diagnosis, 36% minor depression, and 14% agoraphobia.

Overall, of the 69 patients who were depressed four months after stroke, with either major or minor depression, 28 (41%) were still depressed at follow-up. Of those 28 depressed, 15 (12 men and three women) had major depression, of whom five (four men and one woman) had major depression with melancholia at follow-up. There was an indication

Table 2
Prevalence of depressive disorders in survivors of stroke and in community controls

		Stroke patients (M=164, F=130) %	(95% CI)	Controls (M=56, F=50) %	(95% CI)	P
Major depression	M	16	(10–22)	0		0.0002
	F	14	(8–20)	10	(2–18)	0.338
	Total	15	(11–19)	5	(1–9)	0.0023
Minor depression	M	7	(3–11)	4	(0–9)	0.3117
	F	10	(5–15)	2	(0–6)	0.0596
	Total	8	(5–11)	3	(0–6)	0.0421
Total depressive disorders	M	23	(17–29)	4	(0–9)	0.0003
	F	24	(17–31)	12	(3–21)	0.056
	Total	23	(18–28)	8	(3–13)	0.0001

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

Table 3
Post-stroke depression by prestroke depression, sex specific

Prestroke depression	Depressed at time of stroke					
	Men		Significance P	Women		Significance P
	n	%		n	%	
Major depression	4/27	15	0.1292	9/18	50	0.000
Minor depression	2/11	18	0.1745	3/13	23	0.020
All depression	6/38	16	0.0687	12/31	39	0.000
No depression	6/102	6		2/77	3	

of a worsening of severity of depression between the two surveys in five men – three with minor depression at four months had major depression at 12 months, one of these with melancholia; two patients with major depression at four months had major depression with melancholia at 12 months. Of those who were depressed at 12 months, two men (11%) but no women were depressed at the time of the stroke. This contrasts with figures of 16% for men and 39% for women who were depressed at four months.

Discussion

The PCSS aimed at a very thorough ascertainment and documentation of all episodes of stroke in a population of a defined geographic area. Except in one variable, there was no statistical difference between the 294 patients considered to be at risk in the calculation of prevalence rates and the group of four-month post-stroke survivors not seen because of refusal of interview, emigration, or detection too late for inclusion in the four-month survey. Thus it was considered that the exclusion of the last group did not bias the findings of the psychiatric assessment. As such, the data obtained are representative of the four-month survivors of all strokes occurring in a defined community.

Most studies of post-stroke depression have focused upon first-ever strokes. In this study, 78% of the 248 persons interviewed had suffered a first-ever stroke. Analysis of the findings failed to show any major differences in the prevalence of depression between first-ever and recurrent strokes. For this reason, all the results, except those in Table 1, include first-ever and recurrent strokes grouped together, and it seems very reasonable to compare the total of 248 patients with stroke directly with other published investigations which have looked only at first-ever strokes.

The prevalence for all depressive disorders (23%) in this study is lower than those reported from the only other two published community-based studies of post-stroke depression (Wade *et al*, 1987 (32%); House *et al*, 1991 (32%)). The rate of major depression (15%) is intermediate between the

Table 4
Those depressed four months after stroke by psychiatric diagnosis at 12-month follow-up (%)

4-month diagnosis	(n)	Psychiatric diagnosis at 12 months						Total
		Nil	GAD	Agoraphobia	Minor depression	Major depression	Emotional lability	
Male								
Major depression	(25)	28	4	8	16	40	4	100
Minor depression	(8)	50	0	0	12	38	0	100
Female								
Major depression	(17)	47	0	12	17	12	12	100
Minor depression	(14)	43	7	14	36	0	0	100
Total								
Major depression	(42)	35	2	10	17	29	7	100
Minor depression	(22)	46	4	9	27	14	0	100

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

findings of severe or major depression found in these two studies (20% and 13%, respectively). The figures in all three of these studies are considerably lower than those reported from surveys based in hospital or rehabilitation units, which tend to be biased by inclusion of patients with more severe initial strokes and more persistent disabilities, factors likely to have promoted depression (Johnson, 1991).

Amalgamating men and women with major and minor depression in this study gave a community prevalence to the controls of 7.5%, very similar to the figure from Oxfordshire (House *et al*, 1991). The relatively small size of the control group possibly accounts for the low rates of depression in men, producing a sampling bias. Although the frequency of depression was significantly higher than that found in control subjects from the same community, we do not have equivalent data for a representative sample of patients four months after a comparable acute, potentially life-threatening, but non-cerebral illness, such as an acute myocardial infarction or a fractured neck of femur. Such a group would probably be a more valid control group than the customary age-matched community controls.

While the prevalence of PSE depression (20%) is very similar to that found by House *et al* (1991) (19%) six months after stroke in the Oxfordshire Community Stroke Project, the prevalence of DSM-III major depression (9%) in that study was much less than the figure in Perth, Australia, of 16%. A high proportion (8%) of the Oxfordshire patients were diagnosed as adjustment disorder (depressed); that is, a much less severe degree of depression than that reported in our study.

Unfortunately, the design of this study did not include a measure of severity of depression, such as the Hamilton Depressive Scale (Hamilton, 1967). However, it was our clinical impression that, although many of the cases of major depression fulfilled the DSM-III criteria, in most instances the severity of the major depression was not great, and many patients did not show such a range of physiological shift symptoms that the prescription of antidepressant medication would be clearly indicated. Only three patients, all men, had major depressive illness with melancholia. There were no cases of major depression with psychosis.

A surprisingly high proportion of the patients with post-stroke depression had a history of some degree of depressive illness before the stroke, and this was especially true of women with major depression at follow-up. If patients who were depressed at the time of the stroke were removed from the prevalence figures, the cumulative incidence of major depression after stroke was only 13%, of minor depression 8%, and of depressive illness of any type 21%. These are the episodes which might be reasonably attributed to the effects of the stroke.

We took the uncustomary step of adopting a non-hierarchic approach in applying the DSM-III criteria (Table 3), allowing more than one diagnosis to be made if all of the relevant criteria were met for each diagnosis. Almost a quarter of the men and two-fifths of the women had an additional diagnosis of agoraphobia, generalised anxiety disorder, or both of these. The additional diagnosis was mainly that of agoraphobia. DSM-III excludes both agoraphobia and generalised anxiety disorder in the presence of a major depressive episode, but in DSM-III-R (American Psychiatric Association, 1987) no such exclusion criteria for agoraphobia are listed. The question of non-hierarchic diagnoses is considered in more detail in a companion paper on post-stroke anxiety disorder (Burvill *et al*, this issue).

Unfortunately, the study was not designed to follow up at 12 months all those patients psychiatrically assessed at four months, but only those who were depressed at that time. Thus, it could not detect other patients who may have become depressed at a later stage in the 12-month post-stroke period. The 12-month follow-up showed a much poorer prognosis in men than women, with over half of the men but fewer than one-third of the women still having some depressive illness. Most of the men depressed at follow-up had major depression, whereas most women had minor depression. Furthermore, five (13%) of those men with any degree of depression at four months had a more severe problem at 12 months, having progressed to either major depression or major depression with melancholia. We observed that the men who were living alone coped much worse than their female counterparts. The general standard of their accommodation and their social outlets, range of activities, and personal grooming and dress appeared to be distinctly inferior to those of women living alone, and to those of both men and women who were living with spouses. The inferior coping abilities of the men may have contributed significantly to the poorer outcome of their depression.

Those who were depressed at the time of the stroke generally had a better outcome with fewer depressed four months after stroke and only two men and no women depressed at 12 months. These results suggest that this group was quite different, in both cause and outcome of the depression, from those who developed depression after stroke. It would be reasonable to predict that the addition of such a major life event as a stroke to pre-existing depression would have led to a poorer rather than better

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

prognosis. However, the result was quite different from such predictions.

Various authors have reported marked differences in the outcome of post-stroke depression, possibly reflecting both differences in the initial selection of patients and in the design of the follow-up. House (1987*a*) claimed that earlier reports of the persistence of post-stroke depression were sometimes based on follow-up studies with unacceptably high attrition rates. Whereas our results depict a much better prognosis than that reported by Starkstein & Robinson (1989), it is difficult to compare them with the findings of Morris *et al* (1990), because the latter reported the average duration of episodes of post-stroke depression, while our study measured outcome of the depression at one point in time, i.e. 12 months after stroke. Although Robinson *et al* (1984) found that only 5% of depression detected 2–4 weeks after stroke had recovered by six months, the comparable proportion in the community studies by Wade *et al* (1987) and House (1988) were one-third and the majority, respectively. On the basis of the follow-up phase of the Oxfordshire Community Stroke Project, House (1988) described a process whereby some patients develop a post-stroke mood disorder early and settle down, others become depressed later in the first six months after stroke and also settle down, and a comparatively few have a consistently maintained disorder throughout the six-month period. Our results are not in accord with this relatively favourable description and point to a prognosis at 12 months that is intermediate between those described by Robinson *et al* (1984) and that by House (1988).

In conclusion, the prevalence of depression after stroke in the PCSS is comparable with that reported from the two other community-based studies, and considerably less than that reported from in-patient and rehabilitation units. The frequency of depression can be inflated and follow-up results distorted if the presence of any mood disorder at the time of the stroke is not taken into account. The use of a non-hierarchic approach to diagnosis has shown a considerable amount of anxiety disorder, mainly agoraphobia, associated with the depression which has not been reported previously. Insufficient attention has been paid to sex differences in the study of post-stroke depression, in terms of both prevalence and prognosis.

Clearly, the follow-up results of depressed patients in this study are much more favourable than those of the Baltimore group, especially for minor depression, by the criteria for major and minor depression. It appears that community studies reveal considerably lower frequencies of depression than studies of in-patients: the degree of depression overall is probably less severe and the prognosis much better. Whether it is quite as good as that claimed by House is debatable, as may be judged by our results, even taking into consideration the differences in criteria used for defining depression and in the design of the follow-up protocols.

Although there is now a fairly precise account in the literature of the prevalence of post-stroke depression in various settings, the natural history of this depression is still far from clear and warrants further investigation. Different settings, diagnostic criteria, measuring instruments, and study designs make it difficult to compare the follow-up studies reported thus far.

Acknowledgements

The research was supported by grants from the National Health and Medical Research Council (Australia), the Australian Brain Foundation, and the Royal Perth Medical Research Foundation (Australia). We thank Mrs R. Broadhurst, Mr F. Grout, and Mr D. Brown for their assistance in this study.

References

American Psychiatric Association (1980) *Diagnostic and Statistical Manual of Mental Disorders* (3rd edn) (DSM-III). Washington, DC: APA.

—— (1987) *Diagnostic and Statistical Manual of Mental Disorders* (3rd edn, revised) (DSM-III-R). Washington, DC: APA.

Anderson, C. S., Jamrozik, K. D., Burvill, P. W., *et al* (1993) Ascertaining the true incidence of stroke: experience from the Perth Community Stroke Study, 1989–1990. *Medical Journal of Australia*, **158**, 80–84.

Burvill, P. W., Johnson, G. A., Jamrozik, K. D., *et al* (1995) Anxiety disorders after stroke: results from the Perth Community Stroke Study. *British Journal of Psychiatry*, **166**, 328–332.

Dean, C., Surtees, P. G. & Sashidharon, S. P. (1989) Comparison of Research Diagnostic Systems in an Edinburgh community sample. *British Journal of Psychiatry*, **142**, 247–256.

De Renzi, E. & Vignolo, L. A. (1962) The Token Test: a sensitive test to detect receptive disturbances in aphasics. *Brain*, **85**, 665–678.

Egret, statistical package (1991) Seattle, WA: Statistics and Epidemiology Research Corporation.

Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975) Mini-mental state: a practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, **12**, 189–198.

Hamilton, M. (1967) Development of a rating scale for primary depressive illness. *British Journal of Social and Clinical Psychology*, **6**, 278–296.

Hatono, S. (1978) Experience from a multicentre stroke register: a preliminary report. *Bulletin of the World Health Organization*, **54**, 541–553.

House, A. (1987*a*) Depression after stroke. *British Medical Journal*, **294**, 76–78.

—— (1987*b*) Mood disorders after stroke: a review of the evidence. *International Journal of Geriatric Psychiatry*, **2**, 211–221.

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press

——— (1988) Mood disorder in the first six months after stroke. In *Current Approaches. Affective Disorders in the Elderly* (eds E. Murphy & S. W. Parker). Southampton: Duphar Laboratories.

——— DENNIS, M., MOGRIDGE, L., *et al* (1991) Mood disorders in the first year after stroke. *British Journal of Psychiatry*, **158**, 83–92.

JOHNSON, G. A. (1991) Research into psychiatric disorder after stroke: the need for further studies. *Australian and New Zealand Journal of Psychiatry*, **25**, 358–370.

MAHONEY, F. I. & BARTHEL, D. W. (1965) Functional evaluation: the Barthel index. *Maryland State Medical Journal*, **14**, 61–65.

MORRIS, P. L. P., ROBINSON, R. G. & RAPHAEL, B. (1990) Prevalence and course of depressive disorders in hospitalised stroke patients. *International Journal of Psychiatry in Medicine (Farmingdale NY)*, **20**, 349–364.

PRIMEAU, F. (1988) Post-stroke depression: a critical review of the literature. *Canadian Journal of Psychiatry*, **33**, 757–765.

ROBINSON, R. G. & STARKSTEIN, S. E. (1990) Current research in affective disorders following stroke. *Journal of Neuropsychiatry and Clinical Neurosciences*, **2**, 1–14.

———, STARR, L. B., LIPSEY, J. R., *et al* (1984) A two-year longitudinal study of post-stroke mood disorders: dynamic changes in associated variables over the first six months of follow-up. *Stroke*, **15**, 510–517.

SAS USERS' GUIDE (1991) Version 6.7. Durham, NC: SAS Institute.

STARKSTEIN, S. E. & ROBINSON, R. G. (1989) Affective disorders and cerebral vascular disease. *British Journal of Psychiatry*, **154**, 170–182.

WADE, D. T., LEGH-SMITH, J. & HEWER, R. A. (1987) Depressed mood after stroke: a community study of its frequency. *British Journal of Psychiatry*, **151**, 200–205.

WHISNANT, J. P., BASFORD, J. R., BERNSTEIN, E. F., *et al* (1990) Classification of cerebrovascular diseases. III. *Stroke*, **21**, 637–676.

WING, J. K., COOPER, J. E. & SARTORIUS, N. (1974) *The Measurement and Classification of Psychiatric Symptoms*. Cambridge: Cambridge University Press.

———, MANN, S. A., LEFF, J. P., *et al* (1978) The concept of a case in psychiatric population studies. *Psychological Medicine*, **8**, 203–217.

WORLD HEALTH ORGANIZATION (1978) *Mental Disorders: Glossary and Guide to their Classification in Accordance with the Ninth Revision of the International Classification of Diseases (ICD-9)*. Geneva: WHO.

P. W. Burvill, FRANZCP, **G. A. Johnson**, FRANZCP, Department of Psychiatry and Behavioural Science, University of Western Australia; **K. D. Jamrozik**, FAFPHM, Department of Public Health, University of Western Australia; **C. S. Anderson**, FRACP, Department of Neurology, Royal Perth Hospital (Current address: Department of Medicine (Neurology), Flinders Medical Centre, Bedford Park, S. A. 5042; **E. G. Stewart-Wynne**, FRACP, Stroke Unit, Royal Perth Hospital, Wellington Street, Perth, W. A. 6000; **T. M. H. Chakera**, FRACR, Department of Diagnostic Radiology, Royal Perth Hospital, Australia

Correspondence: Professor Burvill, Department of Psychiatry and Behavioural Science, University of Western Australia, Perth, W. A. 6009, Australia

(First received 10 January 1994, final revision 23 May 1994, accepted 7 June 1994)

https://doi.org/10.1192/bjp.166.3.320 Published online by Cambridge University Press