The Development of Depressive Symptoms in Elderly Following Onset of Severe Physical Illness

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This study followed a group of elderly patients (ill group) with recent onset of life-threatening or severely debilitating illness to determine development of depressive symptoms. Age- and sex-matched control patients were included for comparison. Depressive symptoms increased significantly in the group of ill male patients when compared with controls. Depressive symptoms did not show an increase in the group of ill female patients. Other variables also predicted increased depression: (1) an initial placement in nursing home, (2) a prior history of depression or higher initial level of depressive symptoms, (3) the presence of larger numbers of additional medical illnesses, and (4) following the occurrence of stressful life events. The increase in depression in the male test group was still present and significant when controlling for these additional four factors.

There is an old adage that states, "Old age does not come alone." While this likely refers to physical problems, recent studies indicate that depression is also a frequent companion to the physical illnesses of older persons. A recent population survey of individuals aged over 55 years found that one half of men and one third of women with kidney and bladder problems, heart trouble, lung trouble, hardening of the arteries, or stroke reported depression, while those who had hypertension, stomach ulcers, cancer, or diabetes did not report an increase in depression.[1]

Clinical studies of patients with specific medical conditions are consistent with the population findings: Chronic obstructive pulmonary diseased (COPD) patients are reported to have a high prevalence of depression[2,3]; stroke is known to be complicated by depression,[4] and depression following stroke is more likely to occur with certain anatomic locations of lesions[5]; rheumatoid arthritis is associated with depression[6]; and myocardial infarct results in significant anxiety and depression.[7] Physical consequences of accidents can also be associated with depression, as evidenced by the high prevalence of depression in elderly patients with hip fracture.[8]

One interpretation from these studies is that depression may be a consequence of the physical illness. Many other factors have been shown to influence depression or its expression, however. Such factors as stress of life events, amount and quality of social support, and individual coping skills influence depression.[9] That they are operative in elderly populations is evidenced by a recent study of adults aged over 55 years showing increases in depression over time being limited to those individuals exposed to the combined conditions of weak social resources and high levels of undesirable life events.[10] To demonstrate that depression is a consequence of physical illness, it would be necessary to control for these psychosocial factors.

One of the purposes of the study reported here was to control the psychosocial variables so that the causal pathway between physical illness and depressive symptoms could be clarified. In any determination of causality, temporal direction of effect is an important factor. In many studies it is difficult to determine whether the illness precedes depression or whether the depression precedes the illness and to what extent depression might have led to distorted reporting. To increase clarity of temporal events and minimize reporting errors, prospective studies are preferred. Accordingly, patients were followed from the onset or worsening of a physical illness to determine the temporal course of onset of depression relative to time of psychosocial and illness stresses.

METHODS

Sample Selection

The study was designed to select a group of elderly patients with recent onset of life-threatening or severely debilitating

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TABLE 1. REASONS FOR NONENTRY INTO STUDY

Reason	Potential Test Cases (n = 85) No (%)	Potential Controls (n = 39) No (%)
Patient refused with no reason given	36 (42.4)	23 (59.0)
Did not meet criteria for study		
Organic brain syndrome	16 (18.8)	2 (5.1)
Died prior to study admission	5 (5.9)	1 (2.6)
Depressed at initial contact	9 (10.6)	1 (2.6)
Other	19 (22.4)	12 (30.8)
Did not meet criteria as ill enough for test or well enough for control	9	5
Deaf, could not speak English	2	1
Too ill to be interviewed	3	0
Lived outside 50-mile radius	3	3
Miscellaneous	2	3

TABLE 2. SAMPLE CHARACTERISTICS OF STUDY COMPLETERS

Characteristics	Test (n = 51) No. (%)	Control (n = 56) No. (%)
Sex		
Male	28 (55)	26 (46)
Female	23 (45)	30 (54)
Mean age (years ± SD)	76.2 ± 8.8	71.7 ± 7.4
Mean number of medical diagnoses other than test type (±SD)	2.8 ± 8.8	3.3 ± 1.5
Total mean number of medical diagnoses (including test type) (±SD)	3.7 ± 2.0	3.9 ± 1.8
Type of test illness		
Arthritis	6 (11.8)	—
Chronic obstructive pulmonary disease	5 (9.8)	—
Fractured hip	15 (29.4)	—
Myocardial infarction	9 (17.6)	—
Stroke	10 (19.6)	—
Cancer	10 (19.6)	—
Other	15 (29.4)	—
Number of interviews		
2	6 (11.8)	2 (3.6)
3	17 (33.3)	31 (55.4)
4	28 (54.9)	23 (41.1)

SD—standard deviation

illness and follow them for development of depression over a two-year period at six-month intervals. This patient group was to be contrasted with an age- and sex-matched control from the same population of attenders at a medical clinic. Variables that might lead to depressive symptoms, such as organic brain syndromes, or preexisting depression were to be eliminated by patient selection. Variables such as social support, psychosocial stress, medications, and other illnesses were to be controlled by measuring these factors over the course of the study and using these measures in statistical analyses such as multiple regression.

The sample of elderly patients (aged 60 years and older) was selected from the patients of family physicians in the Muscatine (Iowa) area. Most of the physicians were associated in a group practice, but several were in solo practice. The physicians were asked to refer elderly patients for the study who had had a recent onset of a severe, life-threatening, or debilitating medical condition (or a serious worsening or complication of a chronic condition such as diabetes). Medical conditions included severely crippling arthritis, chronic obstructive pulmonary disease (COPD), fractured hip, myocardial infarct, stroke, carcinoma, or diabetic complications such as limb amputation. These patients made up the test group.

Control patients were recruited from those attending the group family practice and were individuals who were matched for age and sex with those in the test group. In addition to the severe illness criterion for admission to the test group, all patients were selected so as to eliminate those who (1) were depressed at initial contact, (2) had evidence of organic brain syndrome, (3) lived outside a 50-mile radius of Muscatine, (4) and were unable to cooperate and be interviewed (eg, did not speak English).

The breakdown of those who were considered for the study but were not admitted is shown in Table 1. The largest number are those who refused for no known reason. The remaining subjects did not meet one or more of the study criteria enumerated above. Of the 109 patients who started the study, 107 completed the study in having at least two interviews. Of the two who did not complete the study, one dropped out after one interview (a control patient) and one (a test patient) died shortly after the intake interview.

Permission of the family physician was always obtained prior to contact of the patient. The protocol for this study was approved by the Institute Review Board of the University of Iowa College of Medicine.

Characteristics of the sample who completed the study are shown in Table 2. The test group differs from the control group in several characteristics. First and most important is the older average age of the test group (t of difference = 2.86, df = 105, .01 > P > .001), which indicates a failure to match on age. In large part this failure occurred because of the difficulty of finding matches for older test cases. Many older individuals (in their 70s and 80s) attending the clinic were in poor general health. To control for the age difference between the test and control patients, age was included in the regression analysis. The

second difference is some disparity in distribution of individuals with regard to numbers of interviews. The mean number of interviews given those in the test group compared with those given in the control group is similar (3.4 vs 3.4), however. Other relevant variables, such as mean number of total diagnoses, were similar. The number and type of diagnoses that qualified a subject for the test group are shown in Table 2. No patient was dropped from the study because of development of an organic brain syndrome.

In general, subjects were interviewed in their homes by a research assistant who administered a structured research instrument having the following sections.

1. Background and demographic data including current medication and problem list from medical record
2. Social support assessment covering amount of contact with family, friends, and organized groups
3. Assessment of ability to perform activities of daily living such as meal preparation, shopping, self-care
4. Mini-Mental Status from the Diagnostic Interview Schedule (DIS)[11]
5. Holmes-Rahe list of stressful life events[12]
6. Depression assessment from DIS

This interview covered events of the preceding six months; however, questions about depression in the initial interview referred to the subject's entire previous life.

Medications and illness type and severity were documented from patients' clinic records.

The entire interview was repeated at six-month intervals on each subject. The study extended over a two-year period; accordingly, individuals entering the study later would have fewer than four interviews. The number of subjects receiving two, three, and four interviews is displayed in the last three lines of Table 2.

Other information was collected from nursing homes, where many patients were living. Nurses were asked about adjustment of the patients, their ability to perform self-care, and whether they appeared to be depressed.

Data Analysis

Data were computerized and analyzed using the Statistical Analysis System.[13] The outcome of depression diagnosis and number of depressive symptoms during the course of the follow-up were analyzed by logistic regression or multiple regression or by simple *t* tests or chi-square for univariate analyses. Because of known differences between male and female patients in reported numbers of depressive symptoms, sex was included as a variable in the analyses. Two clinical definitions of depression were used. The first was the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III)[14] definition. The second clinical definition was liberalized to include, in addition to DSM-III depressed patients, those who (1) told the family physician they were depressed, (2) told another professional they were depressed, (3) took antidepressants, (4) had so-called depressive spells that interfered with life activities, or/and (5) had a medical chart diagnosis of depression.

The Holmes and Rahe checklist was scored using the weighted values published by Masuda and Holmes.[12] This score was computed for each six-month period. The Mini-Mental Status was scored in the standard way for each administration. The DIS portion dealing with depression was used to diagnose major depression according to DSM-III criteria. The DIS was also used to get a count of depressive symptoms reported at each interview. This number was used as a dependent variable in the multiple regression analyses. Social support was quantitated for the analyses by counting numbers of visits during a set time from different sources of support (children, other relatives, friends). For discrete analyses, score distributions were dichotomized; for continuous data analyses, the number of visits per unit of time were used. Similar scoring was used for amount of contact with organized social events such as church attendance.

Physical treatments were quantitated for analysis by noting the presence or absence during each six-month period of medicines categorized into the following classes: antibiotics, analgesics, antihypertensives (including β-blockers), psychotropics, and others. The total number of different classes of medications was used in analyses as well as the presence or absence of a particular class of compounds.

Diagnoses of study patients were tabulated from the problem list in the medical records. Diagnoses were categorized into two types: test-type diagnoses (eg, cancer, COPD, myocardial infarction, stroke, etc) and non-test-type (eg, arteriosclerotic cardiovascular disease, psoriasis, etc). Many controls had test-type diagnoses, such as COPD, but were not seriously disabled by the condition. A count of "test type" and non-test-type diagnoses was made for each person over the course of the study and were summed to get total diagnoses. These counts were used as variables in the regression analyses. Other than the test type–non-test type dichotomy, no other qualitative breakdown of the diagnoses was made.

RESULTS

Depression outcome during the study was assessed by the three measures outlined in the Methods section. These results are shown in Table 3 divided by sex and by membership in the test or control group. When a discrete clinical diagnosis of depression is used (lines 1 and 2), the men appear to show increased depression under the test condition, but this difference does not reach significance at the 5 percent level. The test group of men does show a significant increase in average number of maximum

depressive symptoms when compared with the control, as shown in Table 3, line 3 (3.4 test vs 2.1 in control, t difference = 2.4, $df = 52$, $.02 > P > .01$). Thus, one analysis shows increased depression occurring in the test group of men.

This difference was found with data uncorrected for the effect of a wide variety of factors that could be confounded with test group and could of themselves increase the number of reported depressive symptoms. Some of these factors are presence of other physical illnesses, use of medications with depressive side effects, psychosocial factors such as poor social support, stressful life events, reactivation of a previously occurring depressive illness, or the difference in average age demonstrated between the test and control groups. To control for these variables and examine the data for an increase in depression in the test group, a multiple regression was used. The following continuous or discrete variables were entered into the analysis in which the dependent variable was the maximum number of depressive symptoms reported during the course of the study:

1. Age of individual at start of study
2. Sex of subject
3. Treatment group (test or control)
4. Interaction term: sex × treatment group
5. Nursing home placement at start of study
6. Maximum number of depressive symptoms experienced prior to study
7. Holmes and Rahe score for six-month period prior to report of maximum number of depressive symptoms during study
8. Holmes and Rahe score at time of first interview
9. Social support score contributed by subject's children at first interview
10. Social support score contributed by subject's children for the six-month period prior to report of maximum number of depressive symptoms during study
11. Social support score contributed by subject's relatives (other than children) at start of study
12. Social support score contributed by subject's relatives (other than children) for the six-month period prior to maximum depressive score
13. Social support score contributed by friends at the start of the study
14. Social support score contributed by friends for the six-month period prior to report of maximum number of depressive symptoms during study
15. Number of test-type diagnoses of stroke, arthritis, etc, currently present in subject
16. Number of non-test-type diagnoses currently present in subject
17. Total of 10, 12, and 14
18. Number of analgesic medications taken over course of study

TABLE 3. DEPRESSION OUTCOME DURING STUDY

Outcome	Test Group		Control Group	
	Male (n = 28) No. (%)	Female (n = 23) No. (%)	Male (n = 26) No. (%)	Female (n = 30) No. (%)
Depressed by DSM-III criteria	6 (21.4)	3 (13.0)	0 (0)	3 (10.0)
Depressed by liberalized criteria	9 (32.1)	8 (34.8)	2 (7.7)	8 (26.7)
Maximum number of depressive symptoms during study (±SD)	3.4 ± 2.1	3.5 ± 2.2	2.1 ± 1.6	3.7 ± 2.1

SD—standard deviation

19. Number of antihypertensive medications taken over course of study
20. Number of β-blocking medications taken over course of study
21. Number of anti-inflammatory medications taken over course of study
22. Number of different types of medications (items 18 through 21) taken over course of study
23. Subject expressed need for someone to confide in (lonely)
24. Other demographic information such as marital status, patient's location (home or nursing home)

These variables were added in a stepwise regression. Variables that either entered in this analysis or were kept in for reasons of control interest (such as age of subject) are shown in Table 4. In this model the variables shown account for 46 percent of the total variance in maximum depression scores. The most powerful predictor is the Holmes and Rahe stressful events score for the six-month period just prior to the time of report of maximum number of depressive symptoms. Other important variables predicting maximum depression scores are patient initially in nursing home, maximum number of depressive symptoms occurring in patient's lifetime prior to study period, number of other medical diagnoses recorded during the study, and self-report of lonely in the sense of wishing to have someone close to confide in.

Despite the control of these additional factors, the treatment and sex interaction term remains highly significant ($P = .004$), indicating that differences in depressive symptoms of men are different from those of women. To demonstrate the effect of controlling for these additional variables, least square means for maximum depression symptoms were computed for men, women, and for both test and control (Table 5). The difference between test and control in the men is significant ($P < .005$) but not

TABLE 4. MULTIPLE REGRESSION OF MAXIMUM NUMBER OF DEPRESSIVE SYMPTOMS AND PSYCHOSOCIAL VARIABLES (n = 107)

Source of Variation	Type III Sum of Squares	P Value
Age	1.39	.47
Sex	5.02	.17
Treatment group	2.90	.29
Sex by treatment group	22.45	.004
Lonely	19.33	.008
Nursing home placement at start of study	16.32	.01
Prior number of depressive symptoms	12.84	.03
Holmes and Rahe score by maximum number of depressive symptoms	75.58	.0001
Number of other medical diagnoses	13.65	.02

$R^2 = .46$

in the women (P = .22). Thus, when controlling for other variables likely to be associated with depressive symptoms, the men in the test group still appear to develop more depressive symptoms than the control patients over the course of the study. Although age was not a significant predictor of the maximum number of depressive symptoms, it was nevertheless kept in the model to control statistically for the differences in average age found between the test and control groups (Table 2).

Some idea of the relative importance of each of the factors found in the model can be found in Table 4. Column 2 contains the type III sum of squares and indicates the contribution of that factor when controlling for all other variables. The Holmes and Rahe score was the most significant contributor to prediction of maximum depression symptom score.

The factor of ability to perform activities of daily living was not used in the analysis, since it was found that scores indicating severe problems with activities of daily living were almost completely confounded with test group membership. This correlation was not unexpected, as test individuals were selected on the basis of a severe debilitating physical illness.

To determine whether these same variables in the regression model shown in Table 4 would predict clinical depression, they were entered as independent variables in a logistic regression analysis with either DSM-III definition of depression or the liberalized clinical definition of depression as the dependent variable. With DSM-III-defined depression as outcome (Table 3, line 1), numbers were too small to detect any significant effects. With the more liberal definition (Table 3, line 2), the variable of placement in nursing home predicted depression (P < .01) as did the presence of a previous depression (P = .01) and the psychosocial variable of self-report of lonely (P = .03). These variables were significant in the multiple regression analysis reported above.

TABLE 5. LEAST SQUARE MEAN ESTIMATES OF MAXIMUM DEPRESSIVE SYMPTOMS (± standard error) CORRECTED FOR VARIABLES IN REGRESSION MODEL

Group	Male	Female
Test	4.78 ± .43	4.30 ± .44
Control	3.47 ± .46	4.91 ± .49

DISCUSSION

The results of this study show that in elderly men depressive symptoms are higher following the onset of a life-threatening or seriously debilitating illness. This relationship was demonstrated mainly in the multiple regression analysis in which a large number of factors relevant to depression were held constant. Although clinically diagnosed depression appeared to occur more frequently in the male test patients than in control patients, the difference did not achieve statistical significance. The lack of significance is in part the result of small numbers and that the discrete multivariate technique was not so powerful as the multiple regression, which used a quasi-continuous variable (number of depressive symptoms) as a dependent variable. That men showed an increase of depressive symptoms but women did not suggests a possible sex difference in vulnerability to depression under the study circumstances. Because of small numbers it was not possible to show that depression was more likely to occur in men after a particular test-type illness. One can only speculate as to the reason for this sex difference in depression. Possibly men are more reactive to some factor that is confounded with being in the ill group. Such factors as inability to carry out activities of daily living or lack of physical mobility may be more stressful or "depressogenic" for men who are accustomed to greater independence.

These results suggest that as a matter of practice, physicians should be alert to the development of increased depressive symptoms following onset of severe life-threatening or debilitating physical illness, especially in men. The depression does not appear to be related to medication, but is more likely when a larger number of medical conditions are present. While treatment will be directed primarily at the medical illness, the symptoms of depression might be dealt with by judicious use of antidepressant medication. It was noteworthy in the present study that very few patients who developed increased depressive symptoms received an antidepressant.

The study showed that predictors of depression other

than severe illness were important. Placement in a nursing home at the start of the study predicted significant addition to the number of depressive symptoms later. It is not clear whether the nursing home placement as such led to later depression or whether nursing home placement was confounded with some other unmeasured variable. It is of interest, however, that studies of elderly people who are living in dependent situations show that their contribution to the household has a significant impact on their level of depression.[15] In a nursing home there is little possibility of reciprocal care giving with another family member, which could constitute a depressogenic social situation, especially in a severely ill person who is not in a condition to administer care. Emotional disability and depression have been reported in elderly populations,[16] and functional disability is likely to end up with a dependent living situation, such as a nursing home.

The presence of a larger number of depressive symptoms (including clinical depression) earlier in life also predicted increased depression during the study period, which indicates that depressive conditions repeat themselves, as multiple depressions are the rule for many people. It could also indicate an increased lifetime tendency to complain about symptoms. The most important predictor was the Holmes and Rahe score for the six-month period prior to the time of the maximum depressive symptoms. It is not clear to what degree the Holmes and Rahe score represents actual events or possibly over-reporting as a result of depressive cognitions.[17] Studies of attributional models of depression suggest that depression may cause cognitive distortion rather than the reverse.[18] Although the study was not designed to pursue these interpretations, it is interesting to note that the inclusion of the Holmes and Rahe score in the model still controls for social stresses. The failure of social support variables to correlate with depression may indicate that the quantitative measure used of number of contacts does not relate to depression as much as some other measure such as quality of support.

The presence of additional medical diagnoses also predicted increased depression. This finding serves to underscore the main result in this study—that physical illness can increase depressive symptoms. Although medication variables were entered into the regression analysis and were not significant, it is possible that a medication effect related to these additional illnesses could be responsible for the increased number of depressive symptoms. The picture of depression that emerges from the multiple regression model is that depression in physically ill elderly men is determined by a wide variety of physical and psychosocial factors. Some of these, such as stressful life events and lack of a confidant (lonely) have been reported in many other studies.[9,10,19,20] The regression analysis indicates that these factors act independently, but the numbers of observations in this study were too small to test for possible interactive effects of factors, eg, whether higher levels of undesirable life events were equally depressogenic in those with and without good social support.

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