A Study of Diurnal Patterns
of Depressed Mood

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The study investigated diurnal patterns of depressed mood in a sample of normal subjects. In all, 105 college undergraduates were followed for a period of 10 days, using a self-administered psychological diary. Eighty-four percent of the days in which feelings of depressed mood were reported involved some type of mood swing. The most frequent pattern of mood shift was a pattern of gradually increasing depressed mood, reaching its peak in the evening. Persons who reported days of constant depressed mood reported higher levels of physical symptoms and less pleasure in social interactions than persons who reported only depressed days involving mood swing.

Depressed affect may be assessed with a number of yardsticks. Two obvious measures are the frequency with which periods of depressed mood occur and the intensity with which such moods are experienced. Besides measures of "how often" and "how bad" depressed moods are, a third characteristic that may be of significance is the question of mood swing. We are not thinking, here, of the dramatic shifts of mood evident in bipolar depression, which have long been known as important benchmarks for diagnosis and treatment. Rather, we are considering, in a more microcosmic fashion, the shifts in depressive mood that may occur within a daily period. If depressed feelings arise during the day, do they persist with constant intensity? Or is

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there a swing in mood, perhaps evidencing a pattern of increasing intensity, decreasing intensity, or a curvilinearity?

While there has been a great deal of research relating to depression in recent years, relatively few studies have been carried out concerning the nature and implications of diurnal patterns of depressed mood. Some studies have been carried out on psychiatric patients. Researchers have conducted clinical studies of individual patients in which depressive mood was correlated with physiological measures. In one case, for example (Doerr, Von Zerssen, Fischler, & Schulz, 1979), a substantial correlation was reported between mood state and urinary free cortical excretion.

There have also been investigations using groups of patients. For example, Kitanishi, Graw, and Hole (1982) used questionnaires and autonomic measures on 40 hospitalized depressed patients, looking for correlates of diurnal variations in depressed mood. Stallone, Huba, Lawlor, and Fieve (1973) studied a group of 10 patients for periods up to 80 days. They found the most frequent pattern the patients reported was feeling "the same all day." These findings seem consistent with earlier data reported by Hall, Spear, and Stirland (1964). When Stallone et al. (1973) did find diurnal variation in depression, the most frequent tendency observed was for the patients to report feeling worse in the morning, better in the evening. The same tendency has been observed in some other studies (Kiloh & Garside, 1963; Clark & Teasdale, 1982). The later data were reported in the context of a study relating variations in depressive mood to memory.

The pattern of depressive mood swing (worse in the morning, better in the evening) is listed in DSM-III (American Psychiatric Association, 1980) as a sign of the subtype of depression, depression with melancholia. This "worse in morning" pattern has been viewed as an indicator of endogenous depression (e.g., Kiloh & Garside, 1963) and is included in checklists used in the study and classification of depressive disorders (Overall & Zisook, 1980).

In trying to establish whether certain patterns of diurnal mood swings are typical of samples of depressed patients, it would be useful to know more about the patterns of depressed mood swing that occur in a sample of normal subjects. Without such data, one cannot be certain that the specific patterns of mood swing identified (e.g., worse in the morning) are characteristic only of clinically depressed patients. The pattern could be characteristic of normal samples as well.

The purpose of the present study was to supply some of this needed baseline information. The plan was to make a close examination of the "natural history" of depressive moods within a normal sample. Our objective was not to test any particular theoretical model relating to depression; rather, we hoped to supply needed information that has thus far been

neglected, in the effort to develop a more comprehensive picture of depressive moods.

Two sets of questions were posed: (1) What is the frequency with which different patterns of diurnal depressive mood are reported, and how do these patterns relate to the frequency and intensity of reported depressed feelings? (2) How do individuals who report periods of constant depressive mood compare with individuals who exhibit only variable mood patterns, in terms of measures of psychological functioning? Three disparate types of indicators of functioning were used: physical symptoms, reported frequency and pleasure of social relationships, and reports of productivity.

METHOD

Subjects were 105 students recruited from undergraduate psychology classes at George Washington University. The students chose to participate in the research project as one option in meeting certain course requirements. The sample included 52 males and 53 females.

An estimated level of depression in this sample was obtained using the Beck Depression Inventory. Applying cutoff points used by previous researchers (less than 10, not depressed; 10–15, mildly depressed; 16–23, moderately depressed; and 24 or more, severely depressed), 76% of the sample fell within the not-depressed range, 16% were mildly depressed, 6% were moderately depressed, and 2% were severely depressed. These figures were roughly comparable to figures reported by Oliver and Burkham (1979) in a survey of college students in a midwestern university.

The instrument for data gathering was a structured psychological diary that has been used in previous studies on psychosomatic relationships, drug use, and depression (e.g., Robbins, 1974; Robbins & Tanck, 1982, 1984).

The diary, completed by the subjects in the evening, asks a number of questions about the events of the day. The responses to these qustions yield four measures based on factor analyses (physical complaints, interpersonal stress, depression-isolation, and positive social relationships), and additional quantitative and qualitative information. In the present study, the diary was completed for a period of 10 consecutive evenings.

The present study, which focused on patterns of depressed mood, utilized the following sequence of questions:

"Did you at any time feel depressed today?" The response alternatives presented were "yes" or "no." If *yes,* how depressed did you feel?" The alternatives presented were "just a little bit depressed," "fairly depressed," "moderately depressed," and "very depressed." "When did you feel most

depressed?" The alternatives presented were "morning," "afternoon," "evening," "about the same all day long." "When did you feel least depressed?" The alternatives presented were identical to those presented for "When did you feel most depressed?" "What do you think was causing these depressed feelings?" The responses here were open-ended and treated as qualitative data.

In scoring the intensity of the depressed feelings reported, no depressed mood was scored 0, "just a little bit" 1, "fairly" 2, "moderately" 3, and "very" 4. In defining intradiurnal patterns of depression, seven mutually exclusive patterns were coded from the responses to the parallel questions asking about the most and least depressed parts of the day.

These patterns were (1) most depressed morning, least depressed afternoon; (2) most depressed morning, least depressed evening; (3) most depressed afternoon, least depressed morning; (4) most depressed afternoon, least depressed evening; (5) most depressed evening, least depressed morning; (6) most depressed evening, least depressed afternoon; (7) same all day long.

The question about physical symptoms asked, "Did you have any of these complaints today?" A checklist of symptoms followed that included headaches, nausea, diarrhea, back pain, head cold, skin flare-up, weakness, and dizziness. The score, based on previous factor analyses, was the total number of symptoms reported. In our major analysis, this was summated over the 10-day period.

The two questions used to assess social relationships were "Did you get together with friends or family today?" "How much pleasure or satisfaction did you feel in your social interactions today?" The alternatives presented for the latter item, "a great deal," "a fair amount," and "little or none," were scored 2, 1, and 0, respectively. Once again, aggregate scores were calculated for both items by summing the daily responses for the 10-day period.

The question asking about productivity was worded, "Look back at your activities today. Compared to most days, how productive was today for you?" The alternatives presented, "more productive than usual," "about the same as usual," and "less productive than usual," were scored 2, 1, and 0, respectively. The question was then asked, "If *more* productive, what things did you do today that made the day seem more productive?" The follow-up question was included to require the subjects to provide some documentation for their answers. A summated score was calculated over the 10-day period.

Intercorrelations were computed between the various indicators of functioning. There was a substantial correlation ($r = .56$) between the two indicators of social relationships. All other correlations were of zero order.

RESULTS

Ninety-five of the 105 subjects who completed the diaries reported feeling depressed on at least 1 day of the reporting period. A frequency distribution of the number of days in which subjects reported feeling depressed suggested a somewhat skewed tendency, with fewer subjects at the higher levels.

Using the intensity scale, which ranged from 0 through 4, the mean level of depression for each subject was computed for the periods in which he or she reported feeling depressed. These mean depressive mood levels were plotted as a function of number of days in which depressed feelings were reported. While there was some tendency for the average intensity of the depressed mood to increase as a function of the number of days in which depressed feelings were reported, an analysis of variance indicated that the relationship was not significant. Therefore, in this sample, frequency and intensity of depression were treated as independent variables.

Patterns of Mood Swings

Data relating to the frequency with which the seven patterns of depressive mood were reported are presented in Table I. The first column

Table I. Report of Diurnal Patterns of Depression

		% of subjects reporting at least one instance of this pattern (N = 95)	% pattern reported for total number of depressed periods in entire sample (N = 348)
Pattern 1	(Most morning, least afternoon)	9	3
Pattern 2	(Most morning, least evening)	37	16
Pattern 3	(Most afternoon, least morning)	35	12
Pattern 4	(Most afternoon, least evening)	35	15
Pattern 5	(Most evening, least morning)	55	24
Pattern 6	(Most evening, least afternoon)	33	14
Pattern 7	(Same all day long)	34	16

gives the percentage of the 95 subjects who reported experiencing the pattern at least once during the 10-day reporting period. An analysis of these data, carried out separately for males and females, revealed no significant sex differences in the presence or absence of these seven patterns. The second column pools the data from all subjects, using as a base the total number of depressive periods (347) reported by the 95 subjects. The numerators used in calculating these percentages were the total number of times a given pattern was used by all the subjects.

The two estimates lead to similar observations. The most frequent pattern observed for intradiurnal depressive mood (pattern 5) was a period of gradual increasing depressive mood during the day — starting at a low point in the morning and reaching its high point at night. The least frequently observed pattern of diurnal depressive mood (pattern 1) was one of morning depression followed by a rapid lifting of mood. Periods of "about the same all day long" (constant) depression occurred in about one-third of the subjects and accounted for 16% of the total instances.

Data exploring the relationship between frequency of days reported with depressed mood and patterns of depressed mood are presented in Table II. The percentages listed are based on the total number of observations within a time period (number of days) in which depressed mood was reported. The rank orders indicate the relative ordering for particular patterns of mood swing within a given time period. Rank-order correlations between time periods ranged from .13 to .60 but in no case were significant. In looking for possible shifts in patterns, the largest shift observed in ordinal position occurred for pattern 7. For 1 or 2 days in which depressed mood was reported, pattern 7 was tied for next to lowest frequency of occurrence. For 7 or more days in which depressed mood was reported, pat-

Table II. Pattern of Depression as a Function of Frequency of Depression

| | N days in which depression is reported | | | | | | | |
| | 1 or 2 | | 3 or 4 | | 5 or 6 | | 7 or more | |
	%	R.O.	%	R.O.	%	R.O.	%	R.O.
Pattern								
1	3	7	3	7	4	7	2	7
2	8	5.5	20	2	13	5	22	2
3	13	3	11	6	14	3.5	13	5
4	18	2	15	4	12	6	18	4
5	41	1	23	1	25	1	19	3
6	10	4	16	3	19	2	9	6
7	8	5.5	13	5	14	3.5	27	1
N observations (Total 347)		39		80		118		110
N subjects (Total 95)		27		27		25		16

tern 7 was the most frequently occurring pattern. The total number of days in which a subject reported having depressed feelings was positively correlated ($r = .32$, significant $< .01$) with the percentage of those days the subject identified as pattern 7. These data, then, point to a relationship between the frequency of days in which depressed mood was reported and the likelihood of the experience being one of constant level of depressed mood.

Intensity Level of Depressed Mood for the Different Patterns of Depression

The mean levels of depression for each of the seven patterns were computed for the pooled sample of 347 observations. For the six patterns of depresssion that involved mood swings (patterns 1 through 6), the mean intensity values were not far apart, ranging from 1.50 to 1.80. The mean intensity level for pattern 7 was 2.27. Pooling all of the observations for the six variable mood patterns, we found that 59% of these depressed periods had the basal intensity level of 1 ("just a little bit depressed"). In contrast, only 34% of the depressed pattern 7 periods were reported at this low intensity level.

To test for a relationship between the presence of pattern 7 and the intensity ratings for depressed mood, the 33 subjects who reported at least 1 day of pattern 7 depression and the 62 subjects who did not report such a pattern were compared in terms of the mean intensity ratings obtained for the days in which they reported depressed feelings. The difference was significant (at $< .05$, $t = 2.09$).

Comparison of Subjects Reporting Days of Constant Depressed Intensity and Subjects Reporting Only Days with Mood Swings

We have presented some exploratory analyses concerning the natural history of depressive mood swings. Now we will turn to the second set of issues, comparing subjects who reported 1 or more days in which depressive mood remained constant throughout the day with subjects who reported only depressive mood swings (patterns 1 through 6) on several indicators relating to functioning: physical complaints, social relationships, and productivity.

Because the presence of pattern 7 appeared to be related to both the number of depressed days and the intensity of depressed mood, it was necessary to assess the relationship of these two variables to our measures of functioning (symptoms, social relationships, and productivity) before pro-

ceeding with the analyses for pattern 7 depression. Correlations were computed between the measures of frequency and intensity of depressed affect and the measures of functioning. Significant correlations were found between the number of days in which depressed feelings were reported and the total number of symptoms reported ($r = .32$, sig. $< .01$) and mean intensity of depressed mood and total number of symptoms reported ($r = .40$, sig. $< .01$). These two measures of depression were not significantly related to the indices of social relationships or reports of productivity.

In comparing the subjects who experienced pattern 7 depression with those who did not in terms of the report of physical symptoms, a matched-pairs technique was used to control for frequency and intensity of depressed mood. It was possible to match 25 pairs (one subject with pattern 7, the other without) on both frequency and intensity of depression. A t test for matched pairs indicated that the subjects who experienced pattern 7 reported more physical symptoms ($t = 2.39$, sig. $< .05$).

For the other measures of functioning, t tests were computed, comparing the 33 subjects who reported experiencing pattern 7 and the 62 subjects who did not. For the question asking about the frequency of getting together with friends or family, the difference was not significant. For the question asking about pleasure or satisfaction in social relationships, persons reporting pattern 7 depression had lower scores ($t = 2.78$, $< .01$). The two groups did not differ significantly on reports of productivity.

Intraindividual Analyses

The preceding analyses compared subjects who reported experiencing pattern 7 depression with those who did not. We will now look only at the sample of subjects reporting pattern 7, comparing instances of pattern 7 with instances of other depressive patterns.

Twenty-eight subjects reported one or more periods of constant depression (pattern 7) and one or more periods of variable depressive mood (any other pattern). Mean depressive intensity ratings for these two conditions were computed for each individual. The mean intensity value was somewhat higher for pattern 7, but the t value (of 1.89) was not significant ($< .10 > .05$).

The two conditions were then compared for mean level of symptoms, the indicators of social relationships, and reports of productivity. There was no tendency observed for physical complaints to be higher on pattern 7 days than other days in which depression was reported. Reports of productivity were somewhat lower on pattern 7 days, but the difference was not

significant (t = 1.85, < .10 > .05). Reports of social encounters did not differ for the two conditions, but there was a significant difference in the level of pleasure obtained in social interactions. During pattern 7 days, the level of pleasure reported was lower (t = 2.70, sig. < .01). The finding was confirmed in a secondary analysis in which 2 days (1 with pattern 7, the other without) were matched on depressive intensity. These days were compared on pleasure obtained in social relationships. The difference was significant once again (t = 2.30, sig. < .05).

Some Observations Based on the Qualitative Data

The final question in the sequence asking about depression was "What do you think was causing these depressed feelings?" Our principal interest was in the responses advanced as explanations for days of constant depression (pattern 7). The most frequent explanations offered for these depressed periods were problems with schoolwork — concerns about studying, exams, papers, and grades. About half of the students gave such explanations for experiencing such depression. The second most frequent explanations — occurring in about one-quarter of the students — were problems relating to boyfriends or girlfriends. In addition to the above explanations, several students described a feeling of general malaise, such as "don't know — maybe uncertainty — feeling nothing is a challenge any more, just a grind — no satisfaction from getting anything done."

Whatever the nature of the problem — schoolwork, boyfriend, or both — in the majority of cases, the problem was mentioned not only on pattern 7 days but on other depressed days as well. That is, in most cases, the content of the problem tended to be lingering — not unique to pattern 7 days. For example:

Pattern seven day	"problem of boyfriend"
Other depressed days	"boyfriend problem as usual"
	"jealously about boyfriend"

While the problems reported tended to be lingering ones, about one-third of the subjects could point to specific events that seemed to precipitate the period of constant depressed affect. Some of these events had recently occurred, e.g., "a big test that I did poorly on," "a fight with a friend." In other instances, the event was one that was anticipated in the near future, e.g., "a term paper due tomorrow." These cases constitute a minority, the general tendency observed being an absence of specific, clear-cut precipitating events.

DISCUSSION

The purpose of this investigation was twofold: to explore something of the natural history of diurnal depressive mood swings in a sample of normal subjects, and to compare individuals who experienced days of constant depressed mood with those who experienced only variable mood swings in terms of indicators of functioning.

In some respects, the problems considered in the present research are similar to problems that have been studied by the experimental induction of depressive mood. These studies have induced a temporary depressive mood by such techniques as remembering past unpleasant events or reading depressing statements about the self (Goodwin & Williams, 1982). Both the experimental studies and the current naturalistic approach permit an analysis of the relationship of depressed mood and behaviorally oriented measures. As such, the two methods can be complementary, offering researchers the possibility of corroborating findings and extending their generalizability.

The findings of the present study are, of course, limited by the nature of the sample used — college students — and by the instrument employed, which relies on self-reports. Using an older sample or observation as a method might lead to different conclusions.

Some possible biases in the measuring instrument should be noted. First, the selection of patterns of diurnal variations in depression given the students (e.g., most in the evening, least in the morning) represents a fairly wide sample of possibilities but is by no means exhaustive. One could envision other patterns, such as a constant nondepressed mood throughout most of the day, and a sudden depressive reaction in the evening. The comparative data we presented are, of course, restricted to the alternatives that were used.

Second, data collection was retrospective, carried out toward the end of the day. The method has the advantage of affording the subject a holistic view of the day and the possibility of making comparisons of mood intensities. However, the method introduces the possibility of selective recall for depressed mood within the diurnal period. If the subjects used had been markedly depressed, such as hospitalized patients, research (e.g., Lloyd & Lishman, 1975; Clark & Teasdale, 1982) suggests that we might expect a bias toward characterization of experiences as unpleasant, with some distortion of our results. Almost all of our subjects, however, were not clinically depressed, and research on the relation of depressed mood and recall of experiences in normal samples has produced inconsistent results (e.g., Fogarty & Hemsley, 1983; Zuroff, Colussy, & Wielgus, 1983). Nonetheless, it seems important to verify the conclusions of the present study using a data-

gathering technique in which mood assessments are made at several points during the day.

Within these limitations, the data suggest that, over a ten-day period, the great majority of subjects reported experiencing some days with depressed mood. The experience of a period or periods of depressed mood was, then, a typical rather than an atypical experience for our sample of normal subjects. It should be stressed that the intensity of the depressive moods reported tended to be *mild* and are obviously of a very different magnitude from the clinically depressed samples that have been cited.

Subjects' reports indicated that mood swings in depressive feelings were much more frequent than days of constant depressive affect. Eighty-four percent of the total number of days in which depressed affect was reported involved some type of mood swing. This figure appears much larger than reports from parallel studies conducted with hospitalized depressed patients (Stallone et al., 1973). These researchers reported that diurnal mood swing occurred about 40% of the time. These rather large differences suggest that the presence or absence of diurnal mood swings may be a differentiating characteristic between minor depressive experiences and clinically depressive problems.

In regard to mood swings, in our sample the most typical pattern of diurnal changes in depressive mood was a low point in the morning and a gradual increase during the day, reaching a high point in the evening. One may observe that this modal pattern for a normal sample appears to be the opposite to that reported by some investigators in studies of hospitalized depressed cases, listed in DSM-III as a sign of depression with melancholia. One wonders to what extent this "worse in the evening" pattern of diurnal mood swing might be useful as an indicator differentiating mild from more serious kinds of depressive problems.

Our data did not permit us to examine the type of events that was associated with the reported shifts in diurnal mood. In subsequent research, it would be interesting to question subjects about these mood shifts in regard to recognizable precipitating events. The factors identified by Lewinsohn and Amenson (1978), using the Pleasant and Unpleasant Events Schedules, might serve as a convenient framework for such a study. Following Lewinsohn's studies, it would be interesting to see whether the report of pattern 2 would be associated with the occurrence of pleasant events during the day and the report of pattern 5 would be associated with the occurrence of unpleasant events.

Our data suggest that the tendency to report periods of constant depressed mood bears some relationship to both frequency and intensity of depressive mood. As the numbers of days in which depressive mood is reported increase, there seems to be a greater likelihood that the depressive mood reported will be constant rather than fluctuating. This constant pat-

tern is also the one that is most clearly linked to higher intensity levels of depression. One may recall that the constant pattern is the pattern most evident in some of the parallel studies carried out on hospitalized depressed patients (e.g., Stallone et al., 1973).

In our sample of normal subjects, the presence of days in which mood has a constant depressed level seems to relate to measures of functioning. Controlling for measures of both frequency and intensity of depressed mood, persons who report constant levels of depressed mood tend to report higher levels of physical complaints. They also report less pleasure in social relationships. The first finding may reflect personality differences since there is no indication that variations in the subjects' mood are related to greater or fewer symptoms. Differences in pleasure relating to social relationships, however, show both between-individual and within-individual differences. During days in which the individual reports constant depressed mood, pleasure in social relationships seems diminished. It is noteworthy that the presence of pattern 7 depression did not relate to our measure of the amount of time spent with other people. It rather related to the quality of these experiences, i.e., the gratification obtained.

The reasons reported by the subjects for days of constant depressed mood — school pressures and romantic problems — are not at all unusual for college students. Both types of problems involve potential loss and threats to self-esteem. Both concerns tend to be lingering ones for these subjects — not something that came out of the blue. What caused the lingering concern to develop on certain occasions into constant depressive mood is not clear and requires further investigation.

Since a variety of data suggest that the presence of pattern 7 may be of value in helping to differentiate between relatively mild and more serious depressive problems, it may prove useful for investigators to note the presence of periods of constant depressed mood in their routine assessment procedures. Used in conjunction with such criteria as the frequency, intensity, and duration of depressed mood and the depressive symptoms listed in DSM-III, questions asking about pattern 7 may contribute to our further understanding of the depressive picture.

It will be noted that the present study was undertaken within a largely empirical framework. A principal reason for this was that current theories of depression are targeted to predict the presence or level of depression. These theories were not specifically designed to make differential predictions on a molar level as to which of the several patterns of diurnal variation in depressed mood a given subject would experience. With the finding, however, that pattern 7 may be an indicator for severity of depressed mood, it would be interesting to apply these theories in our further study of pattern 7: to see, for example, whether this pattern is preceded by, or at least correlated with, such theoretically important variables as negative thought pat-

terns (e.g., Beck, 1967), lack of contingent reinforcement (e.g., Lewinsohn, 1974), and/or the depressogenic attributions of reformulated learned helplessness theory (Abramson, Seligman, & Teasdale, 1978).

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