Psychiatry Research, 31:131-144
Elsevier

Prevalence of Seasonal Affective Disorder at Four Latitudes

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Received January 30, 1989; revised version received June 6, 1989; accepted July 21, 1989.

Abstract. The Seasonal Pattern Assessment Questionnaire (SPAQ) was mailed to a sample population balanced for sex and randomly selected from local telephone directories in four areas: Nashua, NH, New York, NY, Montgomery County, MD, and Sarasota, FL. On the basis of responses to this questionnaire, prevalence rates of winter seasonal affective disorder (winter SAD), summer seasonal affective disorder (summer SAD), and subsyndromal winter SAD were estimated for the four areas. Rates of winter SAD and subsyndromal SAD were found to be significantly higher at the more northern latitudes, while no correlation was found between latitude and summer SAD. The positive correlation between latitude and prevalence of winter SAD applied predominantly to the age groups over 35.

Key Words. Affective disorder, circannual rhythms, seasonal affective disorder, age.

The recognition that humans are subject to seasonal changes in mood and behavior dates back to classical times (Hippocrates, 1923-31). Modern researchers have documented seasonal rhythms in many human behaviors and functions, including weight, appetite, sleep, birth, death, and suicide (Aschoff, 1981). Recent studies of recurrent seasonal depressions (Rosenthal et al., 1984; Wehr et al., 1987) have enhanced interest in the possible clinical relevance of such seasonal changes.

Few studies of the epidemiology of seasonal change have been undertaken to date. Potkin et al. (1986) described a survey of readers of a national U.S. newspaper who replied to a brief questionnaire about winter problems. These researchers noted that the prevalence of such problems, based on data from 32 states, appeared to vary in direct proportion to latitude ($r = 0.85$) but bore no relationship to longitude. A

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similar study was conducted in Norway by Lingjaerde et al. (1986), who estimated that there is a higher prevalence of winter depression in the northern counties of Norway than in the southern counties.

Kasper and associates (Bartko and Kasper, 1989; Kasper et al., 1989*b*) surveyed the population of Montgomery County, MD, with a telephone version of the Seasonal Pattern Assessment Questionnaire (SPAQ), a screening instrument for evaluating seasonality in both normal and patient populations (Rosenthal et al., 1987). They found that only 7.6% of subjects reported no changes in mood and behavior across the seasons, while 17.3% reported changes as marked as those reported by 91% of winter SAD patients studied at the National Institute of Mental Health during the past 7 years. Using further restrictive criteria, such as months of the year when subjects felt worst and the degree to which seasonal change was experienced as a problem, Kasper et al. developed criteria based on the SPAQ for estimating the prevalence of winter SAD in Montgomery County. They found that 4.3% of the population met criteria for winter SAD and 0.7% met criteria for summer SAD.

Using the SPAQ in a survey of a random sample of New York City residents, Terman (1988) found a seasonal symptom trend in the general population, with depressed mood, weight, and sleep duration gradually increasing in the late fall, and peaking between December and February. Terman et al. (in press) also found increased severity of sadness and other SAD symptoms among New York residents interviewed during the winter months as compared with the summer months. This study was based on a secondary analysis of data collected by Dohrenwend et al. (1980), using the Psychiatric Epidemiology Research Interview (PERI). Thus seasonal symptom trends in the population established retrospectivly using the SPAQ were confirmed in a cross-sectional view of symptoms examined over time.

Thompson and Isaacs (1988) used the SPAQ to compare histories of seasonal change among SAD patients, nonseasonal bipolar depressives, and normal subjects. They found that the instrument discriminated successfully between the SAD population and the other two groups.

The present study extends the survey of Terman (1988) to three other centers so that symptomatic seasonal changes in mood and behavior can be compared at four different latitudes.

Methods

Subjects. Subjects were 1,671 men and women who voluntarily completed and returned the SPAQ to their appropriate centers. They comprised 401 subjects from Nashua, NH; 203 from New York, NY; 605 from Montgomery County, MD; and 462 from Sarasota, FL. These represent response rates of 40.1% from Nashua, 60.5% from Montgomery County, 46.2% from Sarasota, and 50.1% from New York City.

During the winter of 1986-87, SPAQs were mailed out to 400 residents of New York City randomly selected from the local telephone directory. The methods used to conduct the survey have been described more fully elsewhere (Terman 1988). In brief, one of two versions of an introductory letter were mailed out together with the SPAQ. One version asked that an adult male complete the questionnaire, while another asked that an adult female complete the questionnaire. To combat the underrepresentation of females in the directory, two steps were taken: When the name was listed as "Mr. and Mrs. John Doe," the female version of the letter was sent addressed to the wife. When initials were listed instead of a first name, the female version was sent. When an adult of the requested sex was not present, an adult of the opposite sex was asked to respond.

During the following winter of 1987-88, the survey method of Terman (1988) was applied to 1,000 subjects in each of the following three sites: Montgomery County, MD; Sarasota, FL; and Nashua, NH. The first mailing took place in December 1987. About 2 months after the first mailing, another SPAQ and letter were sent to all nonresponders. To prevent any possible contamination effects due to the advent of spring, SPAQs were included in the analysis only if they were returned on or before March 10. Very few SPAQs were actually returned after that date. The data from Montgomery County, Nashua, and Sarasota were combined with those collected in New York City for the purpose of conducting the present analysis across four centers.

Due to the elimination of 104 subjects who did not adequately complete the questionnaire, 1,576 subjects were included in the analyses: 382 from Nashua, 193 from New York, 576 from Montgomery County, and 426 from Sarasota.

The Instrument. The Seasonal Pattern Assessment Questionnaire (SPAQ) was developed as an instrument for evaluating retrospectively the degree of seasonal variation in mood and behavior among patients entering studies of SAD and phototherapy. The questionnaire elicits information on times of the year when subjects feel worst and feel best, the extent to which seasonal change is a problem, and the degree of seasonal change experienced across six parameters of mood and behavior—namely, sleeping, eating, weight gain, socializing, energy level, and mood. Scores on these six items are summed to form the global seasonality score. The score has a range of 0 to 24, with a higher score indicating a greater degree of seasonal change. Other questions in the SPAQ include responses to various types of weather conditions, number of hours slept during various seasons, and seasonal food preferences. On the basis of SPAQ profiles of 168 patients with SAD, SPAQ criteria for SAD were developed by Kasper and associates (Bartko and Kasper, 1989; Kasper et al., 1989*b*). These are as follows:

Winter SAD. Subjects are required to have a seasonality score of 10 or more, feel worst in January or February (plus any other combination of months excluding July and August), and report that seasonal change in mood and behavior is a problem in their lives at least to a moderate degree.

Summer SAD. Criteria are the same as for winter SAD except that subjects are required to feel worst in July or August (plus any other combination of months excluding January and February).

Subsyndromal Winter SAD. This group was delineated on the basis of findings by Kasper et al. (1989*a*) that subjects with mild winter problems who had never experienced a major depression could still benefit from treatment with bright artificial light. SPAQ criteria for subsyndromal winter SAD require that subjects have a seasonality score of 10 or more and experience seasonal change as no more than a mild problem, or that they have a seasonality score of 8 or 9 and experience seasonal change as at least a mild problem.

The criteria of Kasper et al. (1989*b*) were applied to subjects participating in a telephone survey of 416 subjects randomly selected in Montgomery County, MD. Ten percent of these subjects, representing a range of seasonal problems, were subsequently brought in for clinical evaluations. The authors found that four subjects met *DSM-III-R* criteria for SAD (American Psychiatric Association, 1987). Of these, two subjects met SPAQ criteria for winter SAD; one subject met criteria for subsyndromal winter SAD, but the fourth subject did not meet SPAQ criteria for either winter or subsyndromal SAD. On the other hand, all subjects meeting SPAQ criteria for winter SAD also met *DSM-III-R* criteria for winter SAD. Since these findings are based on a small sample, we must be cautious about drawing conclusions.

However, the evidence would suggest that SPAQ criteria for SAD have a high specificity in relation to clinical criteria, while the sensitivity of SPAQ criteria may be low. On this basis, the use of the SPAQ is likely to yield conservative estimates of prevalence rates of SAD.

During the clinical evaluation of the Montgomery County subjects, the SPAQ was readministered to the partcipants in the form of a self-report instrument. Subjects tended to score 1 point higher on the seasonality scale when the instrument was administered in this way. For this reason, criteria for seasonal affective disorder using the self-report version of the SPAQ have been adjusted accordingly in the present study

Results

Sociodemographic Characteristics of the Sample. Table 1 provides an overview of demographic attributes of the four populations. Sex ratios were approximately equal at all centers, except for Nashua which had a female to male ratio of 1.5:1. Residents of Sarasota were significantly older than those in Montgomery County, who were significantly older than those in New York, who in turn were significantly older than those in Nashua ($F = 92.45, p < 0.001$).

On average, residents of New York City had more years of education than the other groups in the sample, and residents of Sarasota had the fewest years of education ($\chi^2 = 105.58, p < 0.001$). New York also had the greatest number of single and divorced residents ($\chi^2 = 130.11$, $p < 0.001$). Residents of Sarasota reported living in that climatic area for significantly fewer years than residents of the three northern centers (see Table 1).

Global Seasonality Score (GSS). Table 2 presents the least squares means and standard errors of the GSS for the respondents from the four centers. An analysis of covariance (ANCOVA) was used to compare centers, controlling for sex and age. A post hoc Duncan multiple range test revealed that scores between Nashua and New York did not differ significantly. However, both Nashua and New York had significantly higher mean GSSs than Montgomery County, which in turn had a significantly higher mean GSS than Sarasota ($p < 0.05$).

The component scales of the GSS were examined individually using an ANCOVA controlling for age and sex. These variables measure the extent to which changes in seasons affect sleep length, social activity, overall mood, weight, appetite, and energy level. Variation in sleep length was lowest in Sarasota, which differed significantly from the other three centers. Montgomery County respondents reported significantly less variation in sleep length than Nashua respondents (see Table 2). New York City respondents reported greater seasonal mood variation than those in Montgomery County, who in turn reported greater seasonal mood variation than those in Sarasota. Respondents from Nashua and New York reported more seasonal variation in weight than those in Montgomery County, who in turn reported more variation than those in Sarasota. There were no significant seasonal variations in social activity, appetite, and energy among the four centers.

A significant sex $\times$ center interaction effect was found for the GSS, which was significantly higher for females than for males in all centers except for New York. In addition, GSS was negatively correlated with age both for females ($r = -0.26$, $p < 0.001$) and for males ($r = -0.26, p < 0.001$).

Table 1. Demographic characteristics of subjects at the 4 centers

	Nashua NH	New York NY	Montgomery Co. MD	Sarasota FL	
Latitude	42.5°N	40°N	39°N	27°N	
Number of SPAQs mailed	1000	400	1000	1000	
Response rate	40.1%	57.1%	60.5%	46.2%	
Sex distribution[1]					
Male *n* (%)	144 (38)	97 (50)	301 (53)	225 (53)	$\chi^2 = 23.85^3$
Female *n* (%)	231 (62)	96 (50)	263 (47)	198 (47)	
Age in years					
All subjects (mean ± SD)	40.5 ± 14	43.3 ± 14	47.2 ± 16	58.7 ± 16	$F = 92.45^3$
Male (mean ± SD)	44.3 ± 14	43.2 ± 15	49.3 ± 15	60.0 ± 16	NH < NY < MD < FL
Female (mean ± SD)	41.0 ± 14	43.3 ± 14	47.5 ± 16	59.2 ± 16	
Education					
< 4 years high school (HS) (%)	7	3	4	10	$\chi^2 = 105.58^3$
HS only (%)	21	8	14	25	
1-3 years post-HS (%)	31	18	23	30	
4 years or more post-HS (%)	41	70[2]	60[2]	35	
Marital status					
Single (%)	12	41	19	6	$\chi^2 = 130.11^3$
Married (%)	75	41	63	70	
Separated/divorced (%)	9	13	11	11	
Widowed (%)	4	5	7	13	
Years living in area (*mean* ± SD)	28 ± 18	29 ± 18	28 ± 19	14 ± 12	$F = 67.7^3$ NH, NY, MD > FL

Note. SPAQ ± Seasonal Pattern Assessment Questionnaire.

1. Data missing for 22 subjects.
2. Does not add up to 100% due to rounding.
3. $p < 0.001$.

Table 2. Global seasonality score and its subscales at 4 centers based on results of analysis of covariance controlling for age and sex[1]

		Nashua NH	New York NY	Montgomery Co. MD	Sarasota FL	Center effects
Global seasonality score						
All subjects	LSM(STE)	7.1 (0.23)	7.4 (0.33)	6.7 (0.18)	6.1 (0.22)	NH, NY > MD > FL[4]
Males[2]	LSM(STE)	6.5 (0.35)	6.6 (0.29)	5.4 (0.24)	5.5 (0.29)	
Females[2]	LSM(STE)	7.8 (0.31)	8.2 (0.48)	8.1 (0.28)	6.6 (0.34)	
Subscales						
0 = No change						
1 = Slight change						
2 = Moderate change						
3 = Marked change						
4 = Extreme chane						
Sleep length	LSM(STE)	1.0 (0.05)	0.9 (0.07)	0.9 (0.04)	0.8 (0.05)	NY, NY, MD > FL[3] NH > MD
Social activity	LSM(STE)	1.4 (0.06)	1.4 (0.08)	1.3 (0.05)	1.2 (0.06)	NS
Mood	LSM(STE)	1.3 (0.06)	1.6 (0.08)	1.3 (0.04)	1.2 (0.05)	NY > MD > FL[4] NH > FL
Weight	LSM(STE)	1.0 (0.04)	0.9 (0.06)	0.8 (0.03)	0.8 (0.04)	NH, NY > MD > FL[3]
Appetite	LSM(STE)	0.9 (0.05)	1.0 (0.07)	0.9 (0.04)	0.8 (0.05)	NS
Energy level	LSM(STE)	1.4 (0.06)	1.5 (0.08)	1.4 (0.05)	1.4 (0.06)	NS

1. Least squares means (LSM) and their standard errors (STE) are adjusted for age and sex.
2. Sex-specific LSMs are adjusted for age.
3. $p < 0.05$.
4. $p < 0.01$.

Months That Subjects Feel Worst. Overall, approximately 40% of all subjects reported feeling worst in the winter months (see Table 3). In Nashua 48.7% of respondents reported feeling worst in the winter, compared with 47.7% in Montgomery County, 46.9% in New York City, and 17.6% in Sarasota ($\chi^2 = 103.1$, $df = 3$, $p < 0.001$). On the other hand, only 6.5% of Nashua respondents reported feeling worst in the summer months compared with 14.1% in New York City, 11.6% in Montgomery County, and 17.6% in Sarasota ($\chi^2 = 21.37$, $df = 3$, $p < 0.001$). New York City had the lowest proportion of respondents who felt the same during all seasons (25.5%), while Sarasota had the highest proportion of such respondents (50.7%). The proportion of those feeling worst in both summer and winter was low, ranging from 0.5% in Sarasota to 2.1% in New York City.

Seasonality as a Problem. Seasonal changes in mood and behavior were experienced as a problem by 26.1% of respondents from Nashua, 24.2% from New York City, 22.0% from Montgomery County, and 13.5% from Sarasota ($\chi^2 = 20.34$, $df = 3$, $p < 0.001$) (see Table 3). The ratio of those with winter problems to those with summer problems varied greatly across centers: approximately 9:1 for Nashua, 2:1 for New York City, 3:1 for Montgomery County, and 1:1 for Sarasota.

Prevalence of SAD. On the basis of the criteria for winter SAD, subsyndromal SAD, and summer SAD described above, estimated prevalence rates for these conditions were determined for each center. In Nashua, New York, Montgomery County, and Sarasota, the rates for winter SAD were 9.7%, 4.7%, 6.3%, and 1.4%, respectively. The rates for subsyndromal SAD for the same centers were 11%, 12.4%, 10.4%, and 2.6%, respectively, while rates for summer SAD were 0.5%, 3.1%, 1%, and 1.2%, respectively.

An earlier study by Potkin et al. (1986) found a correlation of 0.85 between prevalence rates of SAD and latitude. For purposes of comparison with that study, we computed Pearson's product-moment correlations between prevalence rates and the four points of latitude and obtained coefficients of 0.78, 0.92, and 1.0 between latitude and winter SAD, subsyndromal SAD, and the combined rates of winter and subsyndromal SAD, respectively. These coefficients, though extremely high, are only useful by way of illustrating the steady increase in rates with increasing latitude, but do not really tell us the amount of variance accounted for by latitude in the prevalence of SAD. A more appropriate method of testing the relationship between prevalence and latitude is the point biserial correlation, which is based on a comparison of the mean latitudes of cases and noncases and is similar in principle to the *t* test. This type of correlation is specifically designed to test the relationship between dichotomous and continuous variables (Guilford, 1965). Results of this test yielded correlation coefficients that were rather low, though statistically significant, indicating that only a small proportion of the variance is attributable to latitude (see Table 3).

Age-Specific Prevalence Rates. One question that arises is whether the correlations between prevalence and latitude may be attributable to the correlation between age and latitude. As can be noted from Table 1, there is a steady decrease in

Table 3. Prevalence of seasonal problem by center

		Nashua ($n = 382$) 42.5°N	New York ($n = 193$) 40°N	Montgomery Co. ($n = 576$) 39°N	Sarasota ($n = 426$) 27°N	χ^2	t value[1]	Point[2] biserial R
Seasonality is a problem	(%)	26.1	24.2	22.0	13.5	20.8[4]	5.0[4]	0.11[4]
Feels worst in:								
Winter	(%)	48.7	46.9	47.7	17.6	119.4[5]	11.9[5]	0.27[5]
Summer	(%)	7.6	16.7	14.2	18.5	21.4[5]	-3.7[5]	-0.09[5]
No season	(%)	31.9	25.5	33.0	50.7	53.5[5]	-6.7[5]	-0.17[5]
Other	(%)	12.8	12.5	6.9	13.1	13.6[4]	-1.2	0.03
Summer + winter	(%)	0.8	2.1	1.7	0.5	5.1	1.2	0.03
Has a problem and feels worst in:								
Winter	(%)	18.6	12.0	15.3	4.2	43.1[5]	8.6[5]	0.16[5]
Summer	(%)	1.6	6.2	4.9	3.5	10.0[3]	-0.2	0
Meets SPAQ criteria for:								
Winter SAD	(%)	9.7	4.7	6.3	1.4	27.0[5]	7.3[5]	0.12[5]
Summer SAD	(%)	0.5	3.6	1.2	1.2	9.8[3]	0.6	0
Subsyndromal SAD	(%)	11.0	12.5	10.4	2.6	28.2[5]	7.5[5]	0.13[5]
Winter or subsyndromal SAD	(%)	20.7	17.2	16.7	4.0	53.6[5]	10.3[5]	0.18[5]

Note. SPAQ = Seasonal Pattern Assessment Questionnaire. SAD = seasonal affective disorder.

1. A t test on difference in mean latitude between cases and noncases. Negative t values indicate fewer degrees of latitude (i.e., further south) among cases. Positive t values indicate increased degrees of latitude (i.e., further north) among cases.
2. Point biserial correlation between prevalence and latitude.
3. $p < 0.05$.
4. $p < 0.01$.
5. $p < 0.001$.

mean age with increasing latitude north of the equator for the centers chosen for this study. The correlation between age and latitude was 0.39 ($p < 0.001$). Given the negative correlation between age and GSS both in our own study and that of Kasper et al., it is possible that SAD may be more commonly found among younger people, and therefore it is possible that the relationship between latitude and prevalence is a spurious one. To examine this question, we calculated age-specific prevalence rates for winter SAD, subsyndromal SAD, and the combined prevalence of winter and subsyndromal SAD (see Table 4 and Figs. 1-3). To obtain more or less balanced cell sizes, subjects were grouped by age into five categories: those aged 16-24 years, 25-34 years, 35-44 years, 45-54 years, and over 55 years. Point biserial correlations between rates of SAD and latitude were computed for each age group, revealing significant correlations with latitude for all groups except those aged 25-34. Correlations for the group under 25 were only marginally significant, although t tests comparing mean latitude for winter SAD cases versus noncases in this group were statistically significant (see Table 4). This implies that winter SAD cases in the under-25 age group were significantly more likely to come from more northern latitudes than noncases, even though a linear correlation with latitude was only marginally significant.

To clarify the relative contributions of variables related to prevalence of SAD, a logistic regression was performed. Prevalence was treated as the dependent variable, and sociodemographic characteristics as predictor variables. These included age, sex, marital status, education, latitude, and two interactions, age × latitude and sex × latitude. Only two variables emerged as significant ($p < 0.05$) predictors of prevalence—namely, age and age × latitude interaction. Sex was marginally significant ($p = 0.05$), indicating a higher prevalence among females. The interaction effect suggests that there is a significant correlation between age and latitude for certain age groups, but not for others (see Table 4).

Discussion

This is the second study attempting to estimate prevalence rates of SAD for Montgomery County using the SPAQ. Kasper et al. (1989*b*) obtained a 92% response rate in a telephone survey using a modified SPAQ. Prevalence rates for winter SAD and subsyndromal SAD in that study were 4.3% and 13.5%, respectively. In the present study, the prevalence of SAD in Montgomery County was estimated at 6.3% while that of subsyndromal SAD was 10.4%. The combined prevalence of winter SAD and subsyndromal SAD in the two studies is even closer—18% in the study of Kasper et al. and 16.7% in the present study. The demarcation between winter SAD and subsyndromal SAD on the basis of SPAQ criteria is not necessarily clear-cut, and both should be seen as falling along a continuum of winter problems that respond to bright light treatement (Kasper et al., 1989*a*). Although some people meeting SPAQ criteria for subsyndromal SAD will actually meet clinical criteria for winter SAD, on the basis of the study of Kasper et al., the reverse is not likely to occur. In view of the differences in data collection methods and response rates between the two studies, the similarity in prevalence rates suggests that the findings are valid and not the result of sample bias. The rate of summer SAD is higher in our study than in that of Kasper et al.—1.4% as compared with 0.7%.

Table 4. Age-specific prevalence rates for winter SAD and subsyndromal SAD

	Nashua NH % affected	New York NY % affected	Montgomery Co. MD % affected	Sarasota FL % affected	χ^2	t value[1]	Point[2] biserial R
Winter SAD							
Under 25	15.0	0	4.8	0	7.4	4.9[5]	0.17[3]
25-34	6.9	0	10.9	7.3	6.6	-0.2	0.01
35-44	8.7	9.8	5.3	1.9	3.8	2.4[3]	0.09
45-54	17.2	11.8	5.7	2.2	9.0[3]	3.4[4]	0.15[3]
Over 54	6.4	0	4.1	0.4	12.7[3]	3.0[4]	0.12[3]
Subsyndromal SAD							
Under 25	5.0	20.0	4.8	4.3	4.9	1.7	0.03
25-34	10.8	19.2	19.7	4.9	8.3[3]	-1.0	0.05
35-44	14.1	11.8	7.0	1.9	7.2	3.7[5]	0.13[3]
45-54	15.5	8.8	10.2	4.3	3.5	-1.7	0.11
Over 54	6.4	5.0	7.2	1.9	8.0[3]	2.7[4]	0.11[4]
Winter SAD + subsyndromal SAD							
Under 25	20.0	20.0	9.5	4.3	4.2	-0.4	0.15
25-34	17.7	19.2	30.7	12.2	9.8[3]	0.7	0.04
35-44	22.8	21.6	12.3	3.8	11.6[4]	4.3[5]	0.17[4]
45-54	32.8	20.6	15.9	6.5	12.3[4]	3.8[5]	0.18[3]
Over 54	12.9	5.0	11.3	2.3	18.5[4]	5.1[5]	0.17[5]

1. A *t* test on mean difference in latitude between cases and noncases. All significant differences show that cases are more likely to come from northern latitudes.
2. Point biserial correlation between prevalence and latitude.
3. $p < 0.05$.
4. $p < 0.01$.
5. $p < 0.001$.

Fig. 1. Age-specific prevalence of winter seasonal affective disorder

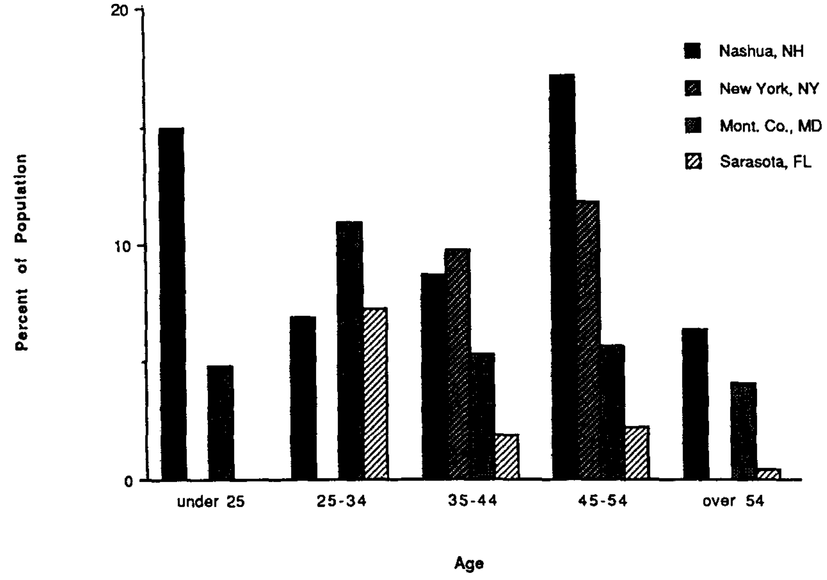


Fig. 2. Age-specific prevalence of subsyndromal seasonal affective disorder

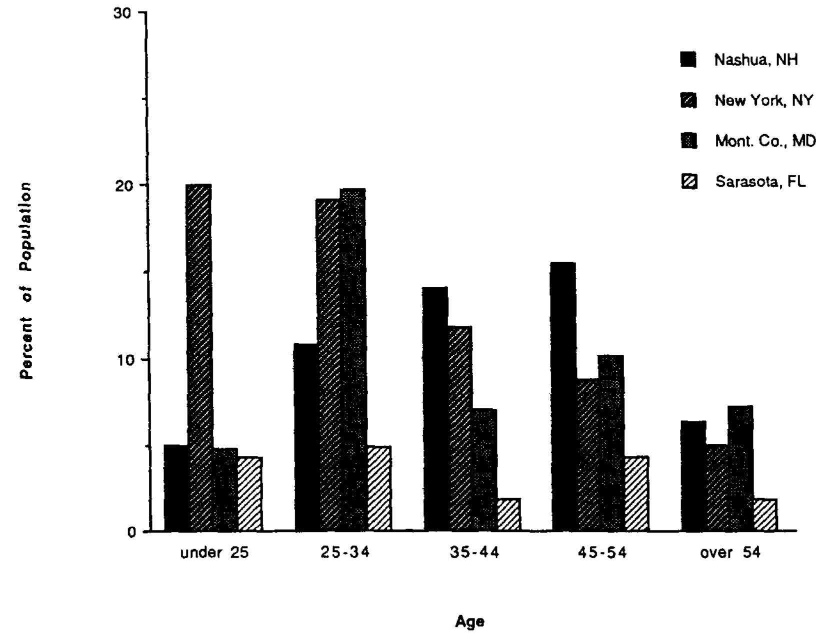
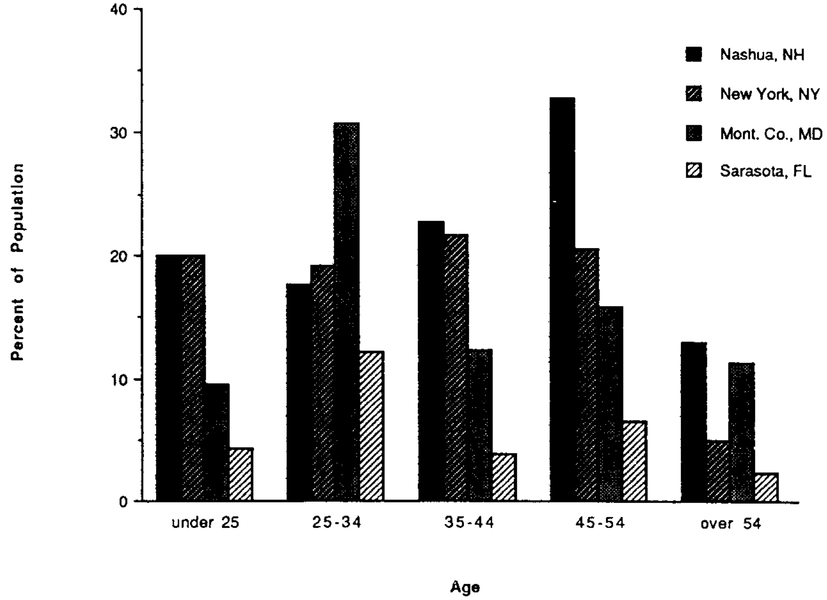


Fig. 3. Age-specific prevalence of winter plus subsyndromal seasonal affective disorder



However, SPAQ criteria for summer SAD may not be valid.

Another similarity between our study and that of Kasper et al. is in the ratio of female to male sufferers. In the study of Kasper et al., 71% of SAD sufferers were female, while in our study 68% were female. Both studies show a negative correlation between seasonality score and age, but whereas in the study of Kasper et al. this applied only to females, in the present study it applied to both sexes. Both studies found a higher female to male ratio for SAD as compared with the ratio for all depressive disorders reported in a recent major epidemiological study (Weissman et al., 1984). The female to male ratio for depressive disorders in this latter study was found to be 2.4:1, as compared with 3.5:1 for SAD.

Unlike other centers, there were no significant differences between mean GSS for males and females in New York, where males had a higher GSS than those in other centers. It is possible that New York males, being better educated, were more likely to recognize and report their symptoms.

Data from the Epidemiological Catchment Area (ECA) study (Robins et al., 1984) indicate the lifetime prevalence of all affective disorders, both major and minor, is between 6% and 10%, which is very close to the prevalence rates we found for SAD on the basis of SPAQ criteria. Furthermore, our estimates may be on the low side in view of the findings by Kasper et al. (1989*b*). A recent study by Garvey et al. (1988) found that around 28% of recurrent depressive patients presenting in a private practice setting met criteria for recurrent winter SAD. These findings, in combination with those of the ECA study, would lead us to estimate that approximately 2-3% (i.e., 28% of 10%) of the population may suffer from winter SAD. If our study has not overestimated the prevalence of winter SAD, it is possible that epidemiological studies of lifetime prevalence of depression may underestimate rates, particularly of the milder depressions which are more likely to be forgotten with time. Questions about symptoms of depression in relation to the seasons, however, may act as a powerful memory cue, helping subjects to recall past depressed states that they might not otherwise have recalled.

A similarity between epidemiological studies of seasonal depression and the ECA study is the low prevalence of depression among older people—those over 55. In the ECA study, this was considered to be either a cohort effect or the result of forgetting of events that occurred a long time ago. In the case of seasonal depression, it is possible that older people are less responsive to the effects of the changing seasons. This is consistent with unpublished findings of Genhart et al. (personal communication), who found low GSS ratings in a group of elderly subjects. Since the SPAQ only elicits information on recent seasonality, no data are available as to whether any of these older people suffered seasonal depression at some time in the distant past. Continued study of the natural history of SAD and the long-term followup of patients may eventually answer this question. The increase in the prevalence of winter SAD and subsyndromal SAD with latitude is consistent with the hypothesis that light deprivation is a major etiological factor in this condition. It appears that some individuals are so sensitive to decreases in ambient light that they develop the symptoms of SAD even at southern latitudes in the United States. On the other hand, at extreme latitudes such as the polar regions, where light deprivation in the winter is severe, it is conceivable that a substantial proportion of the population might suffer some SAD type symptoms. However, since our data were obtained from a mailed survey rather than through a systematic sampling procedure, it is possible that there are biases toward an oversampling of subjects with an interest in seasonal problems at higher latitudes.

Finally, the high correlation between age and latitude in this study deserves some comment. Since only four centers—all located along the Eastern seaboard of the United States—are represented in this study, it is not clear to what extent age is related to latitude, as opposed to certain specific characteristics of the four centers, such as employment opportunities, cost of living, or availability of resources for retired persons. Further data are required to establish how latitude, climatic conditions, and social conditions affect migration patterns of different age groups in the population.

Acknowledgment. This study was supported in part by a grant from the Psychiatric Institutes of America (PIA) and in part by National Institute of Mental Health grant K02 MH-00461 and R01 42931.

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