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# The Prevalence of Seasonal Affective Disorder in The Netherlands: A Prospective and Retrospective Study of Seasonal Mood Variation in the General Population

Peter Paul A. Mersch, Hermine M. Middendorp, Antoinette L. Bouhuys, Domien G.M. Beersma, and Rutger H. van den Hoofdakker

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**Background:** *The aim of the present study was to assess the prevalence of seasonal affective disorder (SAD) in The Netherlands.*

**Methods:** *The subjects (n = 5356), randomly selected from community registers, were given the Seasonal Pattern Assessment Questionnaire and the Centre for Epidemiological Studies Depression Scale over a period of 13 months. The response rate was 52.6%.*

**Results:** *Three percent of the respondents met the criteria for winter SAD, 0.1% for summer SAD. The criteria for subsyndromal SAD, a milder form of SAD, were met by 8.5%, 0.3% of whom showed a summer pattern. Younger women received a diagnosis of SAD more often than men or older women.*

**Conclusions:** *SAD subjects were significantly more often unemployed or on sick leave than other subjects. Respondents who met winter SAD criteria were significantly more depressed than healthy subjects, in both winter and summer. Finally, month of completion had no influence on the number of subjects meeting the SAD criteria. Biol Psychiatry 1999;45:1013–1022 © 1999 Society of Biological Psychiatry*

**Key Words:** Seasonal affective disorder, prevalence, epidemiology, mood variation

## Introduction

Data on the prevalence of seasonal affective disorder (SAD) have accumulated over the past 5 years. The use of the same instrument in nearly all studies, the Seasonal Pattern Assessment Questionnaire (SPAQ; Rosenthal et al 1987) and the application of (more or less) the same criteria [formulated by Kasper et al (1989)] facilitates the comparison of studies (Rosen et al 1990). Results from studies on samples from the general population in the USA (Kasper et al 1989; Rosen et al 1990;

Terman 1988; Booker and Hellekson 1992) show prevalence rates of 2.6–9.2%. This large range can partly be explained by latitude differences in samples studied (27° N–64° N) (Potkin et al 1986; Lingjaerde et al 1986).

Differences in prevalence rates in European studies are smaller than in the USA. In Switzerland (47° N; Wirz-Justice et al 1992), 2.2% of the population was estimated to suffer from SAD, while in Iceland (62° N–67° N; Magnusson and Stefansson 1993), the SAD criteria of the SPAQ were met by 3.8% of the responders. One study was performed at the same time in Sweden and Finland. In both countries the SPAQ was sent to a random sample of the population (Hagfors et al 1995). The prevalence rate in Sweden (55° N–69° N) was 3.9%, whereas this figure was almost twice as high in Finland (60° N–70° N). This high SAD rate in Finland (7.1%) not only deviates from the figures in Sweden and Iceland, but also from an earlier Finnish study (Hagfors et al 1992), which revealed a prevalence rate of 3.4%. In Italy (39° N–46° N; Muscettola et al 1995). The prevalence rate for winter SAD was 4.4% and for summer SAD 2.1%. The reliability of these figures is, however, doubtful, since the response rate was extremely low (13.6%). In most studies, more women than men met SAD criteria, and younger women more often than older women.

This study estimated the prevalence of SAD in The Netherlands. In addition, the role of demographic and social variables in SAD is studied. A special aspect of the study is that approximately 400 questionnaires were sent each month over a period of 13 months. This way, mood was both retrospectively as well as directly assessed at different points in time. The purpose of this design was twofold: 1) to study the influence of month of completion of the questionnaire on seasonality and on the prevalence rate of SAD; and 2) to study the variation of mood over the seasons.

## Methods and Materials

### Sample

A total number of 5356 subjects was selected randomly from the community registers of 15 communities in the three northern

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provinces of The Netherlands. The communities and the numbers drawn from each community were chosen in such a way that the sample was representative for the urbanization level of The Netherlands. The percentage of men and women was equal. The age range was chosen between 18 and 65 years.

### *Instruments*

The questionnaire package sent out contained three groups of variables:

**DEMOGRAPHIC VARIABLES.** In this section information on age, gender, marital status, education, work, sick leave, body length, and weight was asked.

**SEASONAL VARIABLES.** To assess (different aspects of) SAD, the SPAQ (Rosenthal et al 1987) was included. The SPAQ criteria (self-report version) for SAD, formulated by Kasper et al (1989), consist of three parts. The Global Seasonality (GS) score is a composite measure asking for change across the seasons on six aspects: mood, social activities, appetite, sleep, weight, and energy. Each item has Likert-type scales, ranging from (0) "no change" to (4) "extremely marked change." The total scale ranges from 0 to 24, with a suggested cutoff score of 11 for caseness.

The second part of the criteria for SAD is the question whether seasonal changes are considered a problem. The response categories are 0 = no problems, 1 = mild, 2 = moderate, 3 = marked, 4 = severe problems, and 5 = disabling. A score of at least 2 is necessary to reach the SAD threshold.

Finally, the timing of the seasonal problems (summer or winter) is determined by asking what months subjects feel worst (the "window"). This criterion differs from one study to the next. In the present study, a window from October through March delineates a winter pattern and a window from April through September a summer pattern.

Subsyndromal SAD (S-SAD) is characterized by inadequate functioning in certain seasons, while the symptoms are not severe enough to allow for a diagnosis of SAD. The criteria of S-SAD are: 1) a GS score of at least 11 and "no" or "mild" problems with the seasonal changes; or 2) a GS score of 9 or 10 and seasonal changes are experienced as "either a problem or not" (Kasper et al 1989). The window for S-SAD is the same as for SAD.

In addition to the items representing the criteria for SAD and S-SAD, several other relevant variables were included. Two items on the level of energy over the months were added. Likert-type scales were used to score hours of sleep in each season on a scale ranging from 1 (3 hours or less) to 12 (14 hours or more); hours spent outside in each season on a scale ranging from 1 (1 hour or less) to 10 (10 hours or more); and weight change over the year on a scale ranging from 1 (less than 2 kg) to 6 (more than 10 kg). Finally, the influence of climatic conditions on mood was assessed by seven-point scales, ranging from -3 (very low spirits or markedly slowed down) to +3 (markedly improved mood or energy level). Moreover, questions concerning the consequences of seasonal problems, including

consumption of medication and absenteeism, were added to the questionnaire.

### **DEPRESSIVE COMPLAINTS, INDEPENDENT OF SEASON.**

Several questions on episodes of depressed mood independent of season were included: on the number of episodes during the last 5 years (ranging from 0 to 4 times or more), on the symptoms associated with these episodes, and on the extent to which subjects were bothered by these symptoms (range: 0 "not at all bothered" to 4 "very much bothered").

To measure depression, the Centre for Epidemiological Studies Depression Scale (CES-D; Ensel 1986) was included. The CES-D measures the frequency of depressive feelings and behaviors over the past week. It consists of 20 Likert-type scales, ranging from 0 (rarely to never) to 3 (mostly or all the time). The range of the total scale is 0-60. A total scale score of 16 or higher is a rough indicator of depression and reflects possible caseness (Ensel 1986).

### *Procedure*

To control for urbanization in The Netherlands, the urbanization level was divided in five classes (from communities with fewer than 10,000 inhabitants to communities with more than 100,000 inhabitants). Fifteen communities were randomly selected in such a way that the sample was representative of the urbanization level in The Netherlands.

The questionnaires were mailed in 13 consecutive months to investigate the influence of the month in which prevalence studies are performed on results and to study mood variation over the seasons. The first week of March 1993 400 questionnaires were sent out. To control for nonresponse caused by change of address, the number of questionnaires sent was raised by two every first week of each following month: in April 1993 402 questionnaires were sent, in May 1993 404, etc. In the last month, March 1994, 424 questionnaires were sent. This way a total of 5356 questionnaires was reached. To make sure that each sample was representative with respect to urbanization level, each month a random sample was drawn from the remaining subjects of the research population of all 15 communities.

## **Results**

### *Responses*

The response rate per month varied from 49.0% to 56.8%. The total response was 2819 questionnaires (52.6%). Significantly more women than men responded (54.0% versus 45.8%; 0.2% of the data on gender were missing) ( $\chi^2 = 18.64, p < .0001$ ).

### *Seasonal Affective Disorder*

SAD criteria were met by 3.1% of the respondents ( $n = 88$ ), with 3% ( $n = 85$ ) showing a winter pattern. Using a 95% confidence interval (2 SD), 2.4-3.6% of the Dutch population between 18 and 65 years of age suffers from

Table 1. Demographic Variables of the Three Groups

	SADW ( <i>n</i> = 85) (3.0%)	S-SADW ( <i>n</i> = 230) (8.2%)	NSAD ( <i>n</i> = 2054) (88.8%)	Analyses	<i>p</i>
Gender					
Female	67 (78.8%)	155 (67.4%)	1299 (51.9%)	$\chi^2 (2) = 42.46$	<.00001
Male	18 (21.2%)	74 (32.2%)	1200 (47.9%)		
Mean age (SD)	36.5 (11.45%)	35.6 (12.43)	39.7 (13.18)	$F (2,2784) = 11.95$	<.0001
Level of education					
Low	24 (28.2%)	51 (22.2%)	709 (28.3%)	$\chi^2 (6) = 6.08$	ns
Medium	30 (35.3%)	84 (36.5%)	883 (35.3%)		
High	22 (25.9%)	67 (29.1%)	609 (24.3%)		
Very high	6 (7.1%)	25 (10.9%)	273 (10.9%)		
Civil status					
Married	45 (52.9%)	125 (54.3%)	1520 (60.7%)	$\chi^2 (2) = 3.13^a$	ns
Living together	14 (16.5%)	26 (11.3%)	263 (10.5%)		
Living alone	19 (22.4%)	65 (28.3%)	566 (22.6%)		
Divorced	4 (4.7%)	8 (3.5%)	81 (3.2%)		
Widow/widower	3 (3.5%)	5 (2.2%)	67 (2.7%)		

<sup>a</sup>This calculation was performed between the combined categories 1 and 2 and the combined categories 3, 4, and 5.

winter SAD. Criteria for S-SAD were met by 239 respondents (8.5%), of whom nearly all (*n* = 230) met criteria for winter S-SAD (95% confidence interval: 7.1–9.2%).

### Characteristics of SAD

To study the symptomatic, demographic, and social characteristics of SAD subjects, respondents were divided into three groups: winter SAD (SADW), winter S-SAD (S-SADW), and a group that did not meet the SAD/S-SAD criteria (NSAD).

Nearly four times as many women received a diagnosis of winter SAD as men (3.7:1); for S-SADW the proportion was 2.1:1 (Table 1). The difference between the three groups was highly significant. Both SADW and S-SADW groups were younger than the NSAD group, but no between-group differences in education level or civil status were found. Civil status concerned those subjects who were married or were living together with a partner and those who lived alone, since small numbers of divorced/widowed subjects precluded analysis.

**WORK AND ABSENTEEISM.** More people in the SADW group were unemployed than in the S-SADW or NSAD group (Table 2). The same applies to periods of sick leave. Of the employed SADW subjects 42.2% ascribed short periods of absenteeism to their seasonal problems, compared to 14.2% of the S-SADW and 4.1% of the NSAD groups. These differences were highly significant. The mean period of absenteeism was numerically longer in the SADW groups, but this difference was not significant.

Nearly two thirds (65.9%) of the SADW group sought treatment for their seasonal problems (Table 3), which was higher than the S-SADW and NSAD groups ( $\chi^2 (2) = 14.51, p < .001$ ).

Notably, 63.2% of subjects who had sought treatment for their seasonal problems received medication, in most cases prescribed by their general practitioner. Of SADW subjects 41.1% had consulted a psychologist, while 8.9% consulted a medical specialist.

Table 4 summarizes the results on different aspects of SAD in the SADW, S-SADW, and NSAD groups for men

Table 2. Employment and Absenteeism

	SADW	S-SADW	NSAD	Analyses	<i>p</i>
Unemployed	38 (44.7%)	74 (32.3%)	854 (34.1%)		
On sick leave	12 (14.1%)	19 (8.3%)	212 (8.5%)	$\chi^2 (4) = 10.07$	<.05
Employed	35 (41.2%)	136 (59.4%)	1437 (57.4%)		
If employed, absence because of seasonal problems					
No absence	19 (57.6%)	115 (85.8%)	1374 (95.9%)		
Absence	14 (42.4%)	19 (14.2%)	58 (4.1%)	$\chi^2 (2) = 108.13$	<.00001
Mean number of days	6.7	6.3	5.2	$F (2) = 0.567$	ns

Table 3. Help Received for Seasonal Problems

	Seasonal problems <sup>a</sup> [n (% of sample)]	Help received [n (% of seasonal problems)]	Kind of help received				
			Medication	General practitioner	Specialist	Psychologist	Other
SADW	85 (100%)	56 (65.9%)	34 (60.7%)	34 (60.7%)	5 (8.9%)	23 (41.1%)	11 (19.6%)
S-SADW	103 (44.8%)	42 (40.8%)	20 (45.5%)	31 (70.5%)	9 (20.5%)	10 (22.7%)	9 (20.5%)
NSAD	358 (14.3%)	160 (44.7%)	109 (66.1%)	112 (67.9%)	32 (19.4%)	36 (21.8%)	21 (12.7%)

<sup>a</sup>All subjects who reported having seasonal problems were asked whether they received help for these problems.

and women separately. Differences between groups on GS score and percentage of seasonal problems were highly significant, which is not surprising since both these variables were selection criteria.

Women in the SADW and the S-SADW group slept significantly more in the autumn and winter compared to the NSAD group. They also slept longer in winter than in summer. Moreover, women showed more weight change over the year. For men these results are only true for the S-SADW group. Exclusively in women, the actual weight at the moment of completion of the questionnaires was higher in the SADW group than in the other groups. As expected, this result is mainly due to the data of the women who completed the questionnaires in winter.

Both men and women in the SADW group spent more time outside in summer compared to those in the NSAD

group. This difference was also found in the S-SADW group, but only for women. Moreover, women also spent more time outside in summer than in winter. There were no significant differences between groups on any of these variables for men.

The results on climatic conditions are presented in Table 5. On the right the mean and standard deviation of the three groups are presented, as well as the results of an analysis of variance and a post hoc test. The scale ranges from -3 (negative influence) to +3 (positive influence). There were significant differences (at least  $p < .01$ ) between the groups on all variables but "high pollen count."

In most cases the scores of the two SAD groups were more extreme than those of the NSAD group. This is also demonstrated by the percentage of subjects who stated that

Table 4. Symptoms and Characteristics of the Different Groups for Men and Women

	Women								Men							
	SADW		S-SADW		NSAD		<i>p</i>	SNK	SADW		S-SADW		NSAD		<i>p</i>	SNK
	Mean	SD	Mean	SD	Mean	SD			Mean	SD	Mean	SD	Mean	SD		
Global seasonality	13.99	2.79	10.17	1.73	4.21	2.67	<sup>a</sup>	1>2>3	12.78	2.16	10.15	1.64	3.74	2.72	<sup>a</sup>	1>2>3
Seasonal problems [n (%)]	67	(100%)	64	(41.8%)	198	(15.5%)	<sup>a,b</sup>		18	(100%)	40	(54.1%)	164	(13.8%)	<sup>a,b</sup>	
Mean severity	2.84	0.77	1.94	0.85	2.10	0.92	<sup>a</sup>	1>2,3	2.78	0.88	2.08	0.94	2.12	0.88	<sup>c</sup>	1>2,3
Hours of sleep																
Winter	8.64	2.09	8.56	1.29	8.16	1.19	<sup>a</sup>	1,2>3	8.00	1.68	8.39	1.59	7.91	1.18	<sup>d</sup>	2>3
Spring	8.01	1.70	7.70	0.98	7.70	0.08	ns	—	7.11	1.28	7.53	1.25	7.46	1.04	ns	—
Summer	7.30	1.61	7.15	0.95	7.36	1.10	ns	—	6.78	1.40	7.00	1.24	7.17	1.13	ns	—
Autumn	8.64	1.98	8.22	1.14	8.01	1.14	<sup>a</sup>	1>2>3	7.50	1.50	8.05	1.32	7.74	1.12	<sup>c</sup>	2>3
Winter - summer	1.34	1.62	1.41	1.22	0.80	0.93	<sup>a</sup>	1,2>3	1.22	1.31	1.39	1.20	0.74	1.05	<sup>a</sup>	2>3
Weight change (kg)	2.75	1.63	1.91	0.96	1.53	0.84	<sup>a</sup>	1>2>3	1.78	1.11	1.88	0.98	1.46	0.76	<sup>a</sup>	2>3
Weight (kg/cm)	0.42	0.10	0.39	0.06	0.40	0.06	<sup>c</sup>	1>2,3	0.45	0.10	0.44	0.06	0.44	0.06	ns	—
Winter	0.45	0.12	0.39	0.07	0.40	0.06	<sup>d</sup>	1>2,3	—	<sup>e</sup>						
Summer	0.42	0.09	0.40	0.06	0.40	0.06	ns	—	—	<sup>e</sup>						
Hours spent outside																
Winter	2.15	1.21	2.11	1.42	2.16	1.41	ns	—	3.44	2.38	2.54	1.67	3.02	2.28	ns	—
Spring	4.15	1.86	4.11	1.90	3.92	1.88	ns	—	5.24	2.49	4.64	2.57	4.58	2.45	ns	—
Summer	6.48	2.22	6.37	2.19	5.77	2.23	<sup>d</sup>	1,2>3	7.12	2.18	5.99	2.66	6.04	2.50	ns	—
Autumn	2.91	1.54	2.94	1.71	2.98	1.63	ns	—	5.06	2.90	3.58	2.43	3.92	2.34	ns	—
Summer - winter	4.31	1.91	4.26	1.94	3.60	1.94	<sup>a</sup>	1,2>3	3.71	2.31	3.45	2.03	3.03	1.93	ns	—

SNK, Student-Newman-Keuls post hoc comparisons at the alpha  $\leq .05$  level; 1, 2, and 3 refer to the groups SADW, S-SADW, and NSAD, respectively. All analyses are ANOVAs unless otherwise indicated.

<sup>a</sup>Overall significance  $p < .0001$ .

<sup>b</sup>Differences in frequency are calculated by chi-square.

<sup>c</sup>Overall significance  $p < .05$ .

<sup>d</sup>Overall significance  $p < .01$ .

<sup>e</sup>The number of SADW and S-SADW subjects is too small to allow comparisons.

Table 5. Weather Conditions and Mood in the Three Groups

	Percentage "no effect on mood"				Scale means <sup>a</sup>						<i>F</i>	<i>p</i>	SNK
	SADW (%)	S-SAD (%)	NSAD (%)	<i>p</i>	SAD		S-SAD		NSAD				
					Mean	SD	Mean	SD	Mean	SD			
Cold weather	14.1	22.9	47.5	<sup>b</sup>	-0.98	1.62	-0.70	1.70	-0.02	1.73	27.59	<sup>c</sup>	1,2<3
Hot weather	9.4	8.9	28.6	<sup>b</sup>	1.25	1.87	0.93	2.22	0.51	1.98	9.70	<sup>d</sup>	1,2>3
Humid weather	8.3	13.9	34.0	<sup>b</sup>	-1.40	1.85	-1.05	2.04	-0.52	1.73	18.74	<sup>c</sup>	1,2<3
Sunny days	3.6	3.1	16.5	<sup>b</sup>	2.56	1.30	2.73	1.01	2.00	1.53	30.41	<sup>c</sup>	1,2>3
Dry days	15.5	18.1	36.5	<sup>b</sup>	1.55	1.61	1.69	1.42	1.32	1.55	6.70	<sup>e</sup>	2>3
Gray, cloudy days	10.6	17.0	38.8	<sup>b</sup>	-1.62	1.34	-0.93	1.98	-0.28	1.62	41.42	<sup>c</sup>	1<2<3
Long days	21.2	20.4	43.6	<sup>b</sup>	1.01	1.83	1.59	1.78	1.10	1.66	9.01	<sup>d</sup>	2>1,3
High pollen count	66.7	77.9	81.7	<sup>f</sup>	-0.22	1.65	0.09	1.51	0.11	1.55	1.93	—	—
Foggy, smoggy days	10.6	12.8	34.0	<sup>b</sup>	-1.86	1.14	-1.27	1.55	-0.63	1.54	42.64	<sup>c</sup>	1<2<3
Short days	14.3	22.6	56.4	<sup>b</sup>	-1.01	1.88	-0.92	1.77	-0.12	1.54	38.43	<sup>c</sup>	1,2<3

SNK, Student–Newman–Keuls post hoc comparisons at the alpha  $\leq .05$  level; 1, 2, and 3 refer to the groups SADW, S-SADW, and NSAD, respectively.

<sup>a</sup>Scale range: -3 to +3.

<sup>b</sup>Significant chi-square (df = 2) at  $p < .00001$ .

<sup>c</sup>Significant *F* at  $p < .0001$ .

<sup>d</sup>Significant *F* at  $p < .001$ .

<sup>e</sup>Significant *F* at  $p < .01$ .

<sup>f</sup>Significant chi-square (df = 2) at  $p < .01$ .

the weather does not affect their mood. In both SAD groups this percentage was significantly lower when compared to the percentage of the NSAD group.

The conclusion is that the mood of subjects who met the criteria of winter SAD or winter S-SAD depends more on the weather than that of subjects who did not meet these criteria. This dependence would seem to concern the weather in general, not specific types of weather.

Comparison of the three groups showed a relationship between SAD and depression at the moment the questionnaires were completed (Table 6). The SADW group scored significantly higher than the two other groups on the CES-D, and the S-SADW group scored significantly higher than the NSAD group.

By definition, winter SAD and winter S-SAD patients are expected to be depressed in winter and not in summer. To investigate this, the CES-D scores of the subjects who

completed the questionnaires in winter were compared with the scores of the subjects who did so in summer. To create groups that are as extreme as possible winter and summer were restricted to 3 months each (December, January, and February versus June, July, and August).

As expected, in the winter months both SADW groups scored significantly higher on the CES-D than the NSAD group. Unexpectedly, however, the three groups also differed significantly in the summer months. As shown before, there were annual differences in level of depression in the total population. Therefore, a small decrease in CES-D score for the NSAD group in the summer months was to be expected. The reduction was significant at the alpha = .001 level. The significantly decreased summer level of depression in the S-SADW group was something to be expected as well. A surprising finding, however, was that the decrease of mean CES-D score for the summer

Table 6. Depression

	SADW		S-SADW		NSAD		Between group analysis	<i>p</i>	SNK
	Mean	SD	Mean	SD	Mean	SD			
Depression at completion (CES-D)	22.42	11.28	13.77	8.69	8.87	7.99	$F(2,2765) = 139.91$	<sup>a</sup>	1>2>3
CES-D winter (Dec, Jan, Febr)	24.87	9.16	15.78	9.09	10.01	8.59	$F(2,636) = 42.61$	<sup>a</sup>	1>2>3
CES-D summer (June, July, Aug)	22.64	12.48	10.57	7.98	8.37	7.71	$F(2,627) = 25.20$	<sup>a</sup>	1>2,3
Between-group ANOVA (summer versus winter)	$F(1,38) = 0.42$		$F(1,89) = 15.78$		$F(1,1136) = 11.48$				
	ns		$p < .005$		$p < .001$				
Recurrent depressive mood <sup>b</sup> [ <i>n</i> (%)]	85 (100%)		192 (83.5%)		1187 (47.4%)		$\chi^2(2) = 190.93$	<sup>c</sup>	—
Frequency	3.60	0.73	3.53	1.00	3.18	1.32	$F(2,1461) = 9.53$	<sup>a</sup>	1,2>3
Mean number of symptoms	5.15	2.15	4.32	1.67	3.53	1.99	$F(2,1460) = 37.17$	<sup>a</sup>	1>2>3
Symptoms are a problem	3.32	0.94	2.72	0.88	2.59	0.86	$F(2,1451) = 28.59$	<sup>a</sup>	1>2,3

SNK, Student–Newman–Keuls post hoc comparisons at the alpha  $\leq .05$  level; 1, 2, and 3 refer to the groups SADW, S-SADW, and NSAD, respectively.

<sup>a</sup> $p < .001$ .

<sup>b</sup>Recurrent depressive mood = depressive episodes independent of season.

<sup>c</sup> $p < .0001$ .

months as compared to the winter months for the SADW subjects was small and not significant. The scores in summer were still more than two times as high in the SADW group than in the other two groups.

There was a significant difference between the groups in numbers of subjects reporting at least one episode of depressed mood over the last 5 years, independent of seasonal problems. All subjects who met winter SAD criteria reported such episodes. In the S-SADW and NSAD groups, these percentages are 83.5% and 47.4%, respectively. Also, the SADW group reported a significantly higher mean frequency of these episodes (more than three over the past 5 years), more symptoms, and more problems because of these symptoms than the other groups.

#### *Mood Variation over the Year*

March 1994 was a control month for March 1993. Since no significant differences between these two months were found on any of the variables, March data were pooled.

There were considerable differences between months in the mean score on the CES-D [ $F(11,2756) = 3.51, p = .0001$ ]. The lowest score was reached in July (mean = 8.5, SD = 8.33), the highest in December (mean = 12.4, SD = 10.34; see Figure 3). The difference between the winter and the summer months was significant [ $F(1,2766) = 3.99, p < .046$ ]. The significance was increased if the winter months were limited to December, January, and February, and the summer months to June, July, and August [ $F(1,1267) = 18.76, p < .0001$ ].

#### *Influence of Month of Completion on the SAD Criteria*

On the GS score there was a significant difference in the months of the year [analysis of variance (ANOVA):  $F(11,2782) = 2.104, p = .017$ ]. A post hoc test (Student–Newman–Keuls; SNK) showed that the mean scores in February and April were significantly higher than in November ( $\alpha \leq .05$ , Figure 1).

To test whether there was a relationship with mood, the GS scores were correlated with the CES-D scores. Although significant (Pearson  $r = .36, p < .001$ ; two tailed), the correlation accounted for only 13% of the variance. To test whether mood at the moment of completion of the questionnaire influenced the GS score, the ANOVA over the months was repeated with the CES-D as covariate. Apparently, mood fluctuation does not explain the differences on the GS score over the months; on the contrary, inclusion of the CES-D in the model increases the significance level of the difference [ $F(11,2731) = 2.544, p = .003$ ].

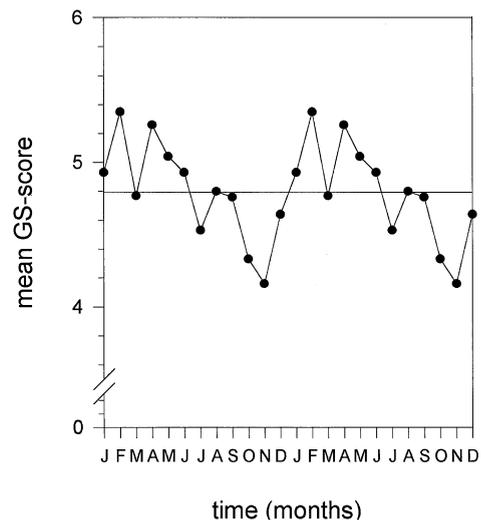


Figure 1. The influence of month of completion of the questionnaire on the mean GS score (double plot). The horizontal line shows the overall mean.

Comparison between winter window (October–March) and summer window (April–September) revealed no significant differences between GS scores. Figure 1 suggests that the GS scores were higher when the SPAQ was completed between December and May than between June and November. Comparison showed that this was in fact the case [ $F(1,2792) = 7.96, p = .005$ ].

The month of completion did not affect whether or not seasonal changes were experienced as a problem [ $\chi^2(11) = 7.911, p = .721$ ]. Also, the actual number of subjects meeting the SAD criteria each month did not differ from the expected number of subjects [ $\chi^2(11) = 12.54, p = .325$ ]. The same result was found if the seasons were compared. Thus, although GS score was influenced by month of completion, the combined SAD criteria of the self-report version of the SPAQ were hardly sensitive to the month or season in which the SPAQ was completed.

#### *Seasonality*

The mean GS score for the total population was 4.79 (SD = 3.51, median = 4.00), with 6.3% of the population scored  $\geq 11$ . Women (mean = 5.26, SD = 3.68) were significantly [ $F(1,2786) = 60.19, p < .0001$ ] more sensitive to seasonal changes than men (mean = 4.24, SD = 3.21). For women, and to a lesser extent for men, sensitivity to seasonal changes decreased with age [ $F(4,1486) = 17.99, p < .0001$  and  $F(4,1264) = 4.28, p < .002$ , respectively] (Figure 2A).

#### *The “Window”*

More than half of respondents (53.3%) had one or more months of the year in which they felt worst. As expected,

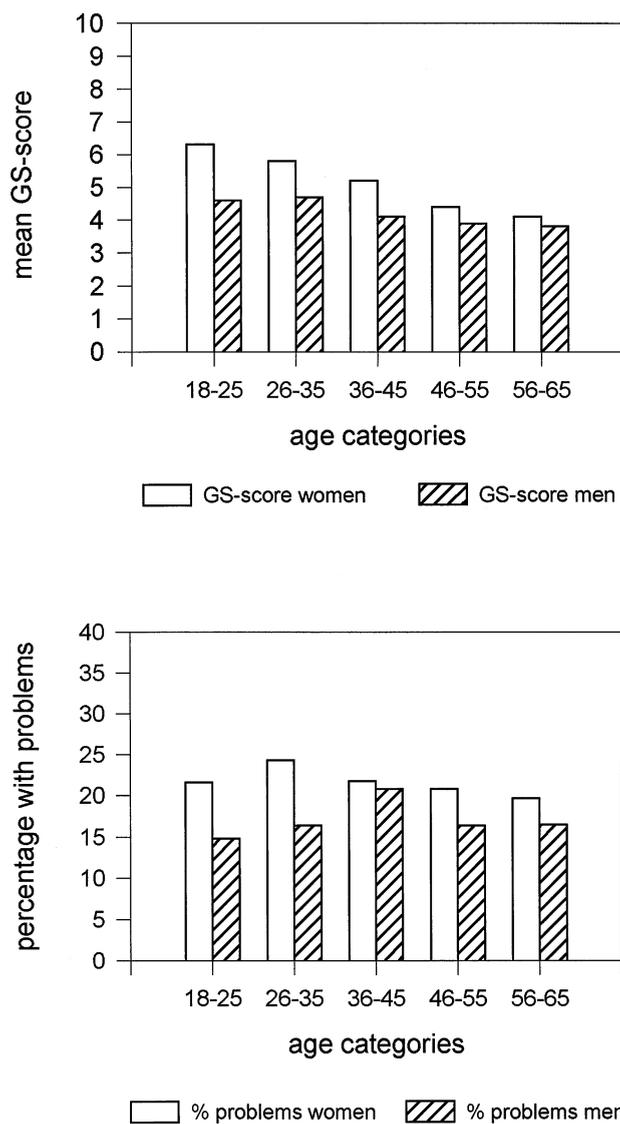


Figure 2. The relationship between GS score and age (A) and between seasonal problems and age (B), for male and female subjects separately.

the winter months (October–March) were mentioned significantly [ $\chi^2(1) = 432.12, p < .0001$ ] more often (79.3%) than the summer months (April–September) (20.7%). Figure 3 shows the percentages of subjects who retrospectively indicated that they felt worst at the respective time of the year. In addition, the monthly CES-D scores over the year are depicted, a state measure of mood. The synchronicity between the two curves can be considered as support of the convergent validity.

#### Problems with Seasonal Changes

Problems with the seasons were reported by 551 respondents (19.6%). More women (59.7%) than men experi-

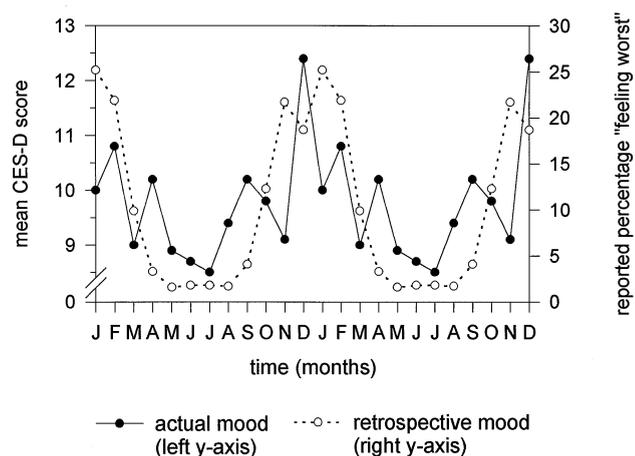


Figure 3. Retrospective mood and actual mood, assessed at the moment of completion of the questionnaire (double plot).

enced these problems [ $\chi^2(1) = 9.21, p < .003$ ] (Figure 2B). No differences between men and women in the severity of seasonal problems were found, and experiencing problems with seasons did not depend on age.

In Figure 4, the separate aspects of seasonality over the year are distinguished. The data were calculated according to methods used in other studies (Wirz-Justice et al 1992; Thompson et al 1988). Each point represents the percentage of the maximum obtainable score (4) on a specific seasonality item, multiplied by the difference between the months in which people felt worse and those in which they felt best; the months in which they slept most and slept least, etc. Results are presented separately for respondents with and those without seasonal problems.

At visual inspection there is a considerable difference between subjects with and those without seasonal problems with respect to the contribution of each aspect to the total seasonality score, but not with respect to the relative contribution of each aspect. To test whether this visual impression is valid, the absolute distances from each point to the x-axis were summed to obtain a measure of the area under each curve. The order of the magnitude of the areas under the curve is the same in both groups. "Mood" shows the largest variability over the year and "weight" and "appetite" the smallest. Analysis of variance showed that on all six items the differences between the groups are significant at the  $p < .0001$  level.

#### Discussion

In a number of respects the prevalence rate of SAD (3.1%) in the present study is in line with the expectations. In the first place, this figure strengthens the positive relationship between prevalence and latitude. In the USA this correla-

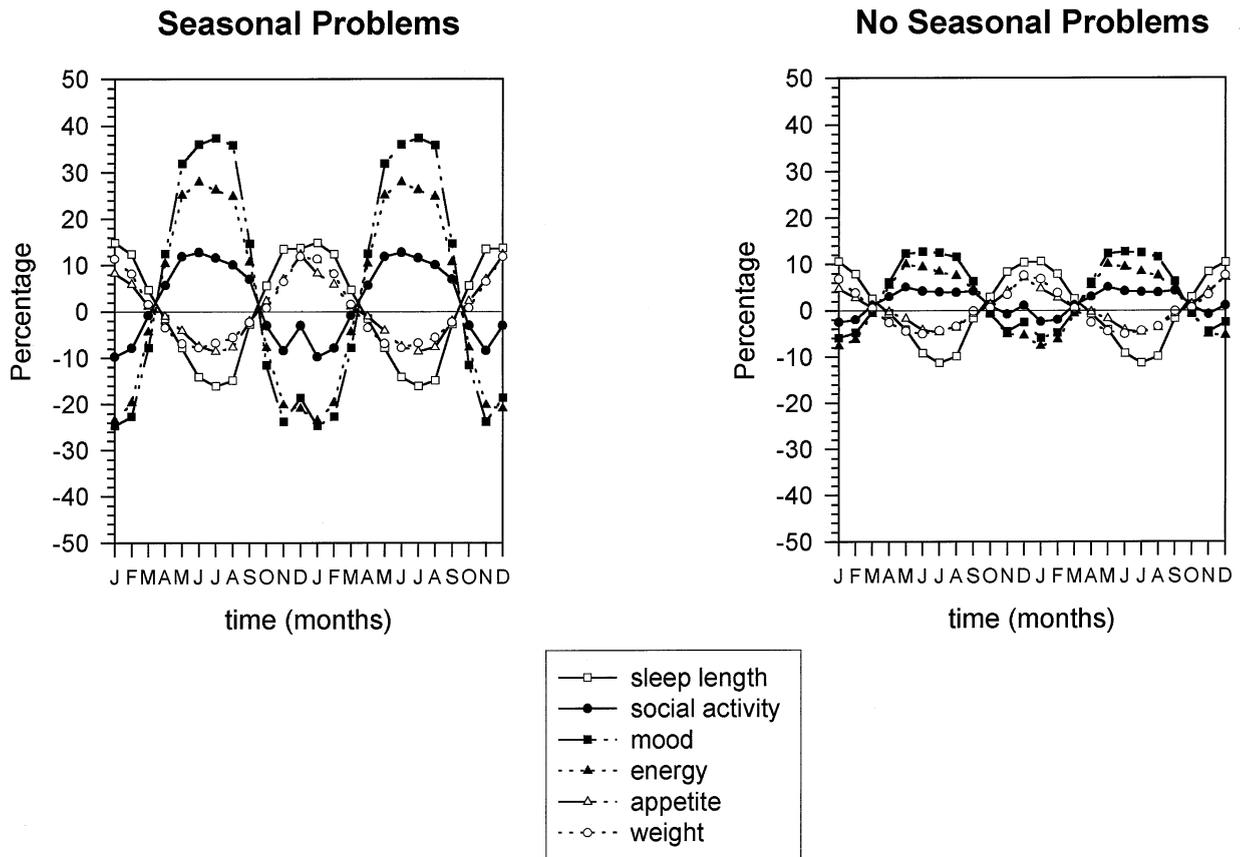


Figure 4. Percentage of the maximum obtainable score of each GS item for the months subjects feel worst and best over the year (double plot). (A) Subjects with seasonal problems. (B) Subjects without seasonal problems.

tion (Spearman  $r_s$ , one tailed) is  $r = .90, p = .003$  (Mersch et al in press). When we exclude the unreliable Italian data (Muscettola et al 1995), the prevalence rate of the present study raises the correlation in Europe from  $r = .45, p = .225$  to  $r = .70, p = .061$ . Second, our data are in line with the large differences between the prevalence rates in Europe and in the USA. A potential risk to all prevalence studies is the influence of nonresponders. Although the nonresponse in this study (47.4%) is higher than in surveys employing telephone interviews, in which nonresponse is reduced by redialing, the above results indicate that the study has not suffered more from this source of bias than other prevalence studies.

#### Seasonal Variation and Influence of Month of Completion

Several authors have emphasized that mood fluctuation over the seasons is not only present in SAD, but is—with smaller amplitude—also present in normal subjects as well (Terman 1988; Thompson et al 1988; Wirz-Justice et al 1992). The present study confirms these findings. Subjects with seasonal problems differed from subjects without in

the higher level of change they experienced over the year on the six seasonality items, but not in the order of severity with which the various items contribute to the seasonality score (Figure 4). These data are, like the data from other studies, retrospective in nature. As far as we know, this is the first study in which the influence of season on mood is measured directly each month in the general population. Results show that there is a clear seasonal pattern, with a peak in December. The maximum difference of 4 points implies an increase of almost 50% of the mean in December compared to July. This result confirms the notion that seasonal sensitivity is a “normal” phenomenon, which is experienced in an extreme way by SAD subjects (cf. Eastwood et al 1985; Lacoste and Wirz-Justice 1989). An important methodological aspect is that in prevalence studies on depression in the general population the season in which the study is performed is important and should be taken into account when interpreting the results. The CES-D data strongly suggest that the prevalence of depression in The Netherlands is higher in winter than in summer.

Mood may influence scores on questionnaires (cf.

Hirschfeld et al 1983). Although GS scores seemingly were influenced by completion in the different seasons, mood did not explain this variance. The influence of month of completion on prevalence was negligible, however, due to the other criterion of SAD, “problems with the seasons,” which was not affected by month of completion. This finding supports this aspect of the reliability of the SPAQ criteria for SAD.

### *Epidemiological Characteristics*

Younger women are more sensitive to seasonal changes than older women and men. Forty-one percent of the women who met the SAD criteria were between 26 and 35 years of age, which is in line with other prevalence studies. Level of education and civil status were unrelated to SAD.

Winter depression is a disabling condition, as shown by the higher percentage of subjects who are unemployed or on sick leave for a long period of time. Of subjects with a paying job, a considerable proportion reported absence from work. Since these figures are based on self-report only and rely heavily on the recollection of the respondents, they can merely be interpreted as indicative for the possible socioeconomic consequences of SAD.

Some interesting findings emerged from the data on the help subjects received for their seasonal problems. A small minority of the responders in the SAD group received help from medical specialists. Medication—largely prescribed by general practitioners—was the treatment of choice in 60.7% of SAD subjects. Remarkably, 41.1% of subjects with winter depression received help from clinical psychologists, although this profession rarely applies light treatment in The Netherlands, or prescribes medication.

As expected, the results show that subjects meeting the SAD and S-SAD criteria sleep more in autumn and winter and show more weight fluctuation during the course of the year. In winter, women who meet the SAD criteria weigh more than women who do not meet these criteria. The same result was found when SAD patients were compared to bulimic patients and normal control subjects (Lam et al 1991). Measured in the winter, SAD patients reported weighing significantly more than the other two groups. In the present study, women of the SAD group who completed the questionnaire in the summer were still slightly heavier than women in the other groups, but the difference did not reach significance.

### *Environmental Factors*

In a study by Wirz-Justice et al (1990), a comparison between light treatment and a 1-hour outdoor walk in the morning showed both interventions to be equally effective. The authors concluded that seasonal problems may be influenced by actual exposure to outdoor light. The present

study investigated whether the number of hours spent outdoors in the different seasons was connected with SAD. It was hypothesized that winter depressives spend less time outside in the winter. Surprisingly, women in the SAD and the S-SAD group did not differ in this respect from those in the NSAD group in winter, but instead spent more time outdoors in summer. If time spent outdoors has any influence in SAD, the contrast between summer and winter exposure to light may be critical, rather than the absolute amount of light received in winter.

Subjects meeting the criteria of SAD or S-SAD are more sensitive to weather conditions than subjects in the NSAD group. This is the case for all weather conditions except “high pollen count.”

### *SAD and Depression*

According to depression scores when completing the questionnaires, subjects with winter depression were more depressed, with 63.4% of winter depressives meeting the criteria for possible caseness ( $CES-D \geq 16$ ). This is not only the case in the winter months. An unexpected finding was that winter depressives who filled out the questionnaire in summer months (June, July, August), the time of year they ought to feel good, had high CES-D scores. Sixty percent of these 16 subjects met criteria for possible caseness. Moreover, 88.7% of subjects who reported having seasonal problems, and 100% of subjects meeting criteria for winter SAD, stated that they had had at least one depressive episode in the last 5 years, independent of the seasons.

Several longitudinal studies (Leonhardt et al 1994; Sakamoto et al 1995; Schwartz et al 1996; Thompson et al 1995; Wicki et al 1992) have shown that subjects with a diagnosis of SAD have a changing pattern of depressive episodes in the course of their illness. Between 59.8% and 74% of patients with an initial diagnosis of SAD in these studies did not fulfill the criteria of this disorder several years later. SAD had either fully remitted, or the pattern of depressive mood was not seasonal anymore. Although these longitudinal studies may be influenced by treatments subjects received (in most cases antidepressive medication and/or light treatment), results suggest that the diagnosis of SAD is not very stable over time. This conclusion is also suggested by two studies (Murray et al 1993; Wirz-Justice et al 1993) of test-retest reliability of the SAD diagnosis using the SPAQ. Of subjects who met the SAD criteria, 41.4% and 50%, respectively, were not diagnosed as such at the second assessment. In view of the long period between assessments, this result may be explained by the stability of the diagnosis rather than by the reliability of (the criteria of) the SPAQ. It is possible that subjects suffering from SAD are always more vulnerable

to episodes of depressive mood, but that the winter season provides more stressors, whether these are biological, psychological or social in nature.

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