Eur Arch Psychiatry Clin Neurosci (1993) 243:189–192

European Archives of Psychiatry and Clinical Neuroscience

© Springer-Verlag 1993

# Frequencies of seasonal major depressive symptoms at high latitudes

**Timo Partonen**[1,3], **Markku Partinen**[2,3], **Jouko Lönnqvist**[1]

[1] National Public Health Institute, Department of Mental Health, Mannerheimintie 166, SF-00300 Helsinki, Finland
[2] Kivelä Hospital, Department of Neurology, Helsinki, Finland
[3] Ullanlinna Sleep Disorders Clinic and Research Centre, Helsinki, Finland

Received April 13, 1993

**Summary.** A modified depression rating scale was distributed to a sample of the adult Finnish population ($n = 1000$) in November 1991. No dependence on latitude (60°N–70°N) was seen in the occurrence of depression. The depressed subjects ($n = 54$) were reevaluated the following May, and four cases with seasonal affective disorder were found. The results suggest that high latitudes with large variations in the daily lightperiod may not be responsible for high prevalence of major depression with a seasonal pattern.

**Key words:** Depressive symptoms – Seasonal affective disorder

## Introduction

Seasonal affective disorder (SAD), is characterised by recurrent major depressive episodes the onset of which occurs during winter months (Rosenthal et al. 1984). The shortening period of daylight is hypothesised to be the most important aetiological factor of the syndrome. In regions with a strong seasonal contrast in luminosity, the prevalence of SAD is supposed to be high, e.g. in Scandinavia (Haggag et al. 1990).

The objectives of this study were: to evaluate the frequency of depressive symptoms in a sample representative of the general population in the autumn, and then to follow up to course of symptoms of the depressed subjects the following spring. The lengthening of the natural daylight period was expected to improve symptoms of winter depression.

## Subjects and methods

### *Subjects*

The material of this questionnaire study consisted of 1000 randomly selected subjects (801 women, 199 men) from the employee register of the Union Bank of Finland covering a nationwide network. The selection was adjusted to the age structure of the present population of working age and balanced to the population density of different geographical areas. The study compassed a latitude range from 60°N to 70°N.

*Correspondence to:* Timo Partonen

### *Methods*

The questionnaire contained a modified version of the Structured Interview Guide for the Hamilton Depression Rating Scale-Seasonal Affective Disorders Version Self-Rating Format (SIGH-SAD-SR, Williams et al. 1991). It is an instrument for 1-week retrospective self-rating of the classical and atypical symptoms of depression. The validity of the scale, as tested against the psychiatric interview, is relatively high.

Questionnaires were mailed on 11 November, 1991. The length of day was the 7 h 53 min in southern Finland (60°N) and 4 h 49 min in northern Finland (70°N). Remailing of the questionnaire (12 May, 1992) concerned the depressed subjects. The length of day was 16 h 59 min in the south and 21 h 26 min in the north on the remailing day.

A Hamilton Depression Rating subscale (HDRS) score of 19 or greater was used to define caseness in this study (Philipp et al. 1992). Reactive and recurrent brief depressions (Angst and Dobler-Mikola 1985; Kasper et al. 1992) were excluded by checking notes in the questionnaire forms or interviewing the subjects via telephone, when necessary. Of the depressed cases, a structured clinical interview was administered by a psychiatrist for those whose residence was situated close enough to maintain adequate communication, in October 1992 (Spitzer et al. 1990).

For quantifying the change in depressive symptoms from November to May, a dual remission criterion was used: a 50-% decrease in the HDRS subscale score and in the total score (criterion I), and in addition the HDRS subscale score $< 9$ points and the total score $< 10$ points (criterion II). The limits were analogous with the criteria used for evaluating the response to light treatment in patients with SAD (Terman et al. 1990) and indicative of minimal residual symptomatology. The lengthening of natural lightperiod was thought to be at least as efficient as light treatment in reducing the depression scores.

Standard statistical tests, including correlations, chi-square tests, nonparametric tests (Kruskal-Wallis one-way ANOVAs) and multiple stepwise (forward) regressions, were used for analysis of the data (Wilkinson 1990). Tests were based on the number of subjects for whom data on each characteristic were available. The 0.05 level was considered as indicating a significant difference. Pearson correlation matrices were tested using Bonferroni probabilities. The minimum tolerance for entry into multiple general

**Table 1.** Predictors of depressive symptoms in the adult population ($n = 1000$) living at high latitudes (60°–70° N)[a]

| Dependent variable | Predictors | Coefficient | SEE | $t$ | $P$ (2 tail) |
|---|---|---|---|---|---|
| Total score | Gender | −4.154 | 1.193 | −3.481 | < 0.01 |
| | Civil status | −0.896 | 0.524 | −1.708 | ns |
| HDRS subscore | Gender | −2.517 | 0.839 | −2.571 | < 0.05 |
| | Civil status | −0.642 | 0.369 | −1.741 | ns |
| Atypical subscore | Gender | −2.397 | 0.475 | −5.044 | < 0.01 |
| | BMI | 0.202 | 0.056 | 3.612 | < 0.01 |
| | Age | −0.043 | 0.019 | −2.211 | < 0.05 |

[a] SEE = standard error of estimate, HDRS = Hamilton Depression Rating Scale, BMI = body-mass index

**Table 2.** Scores of the depression rating scales of the subjects ($n = 445$) and the number of the depressed subjects at three latitudes in November[a, b]

| Depression ratings | Latitude | | |
|---|---|---|---|
| | 60°–62° N ($n = 365$) | 62°–64° N ($n = 53$) | 64°–70° N ($n = 27$) |
| SIGH-SAD-SR | 13.9 (10.6) | 12.7 (8.1) | 12.0 (7.4) |
| HDRS subscale | 9.7 (7.4) | 8.7 (5.5) | 8.5 (5.7) |
| Atypical subscale | 4.2 (4.2) | 4.0 (3.7) | 3.6 (2.8) |
| Depressed[c] $n$ (%) | 48 (13.2%) | 4 (7.5%) | 1 (3.7%) |

[a] SIGH-SAD-SR = Structured Interview Guide for Hamilton Depression Rating Scale-Seasonal Affective Disorders Version (Self-Rating Format), HDRS = Hamilton Depression Rating Scale
[b] Score values presented as the mean (standard deviation in parentheses)
[c] Defined as having a HDRS score of 19 or greater (difference between the groups: $\chi^2 = 3.23$, $df = 2$, $P$ = n.s.)

linear hypotheses (MGLH) of stepwise multiple regressions was 0.01, and alphas into and out of the models were 0.15.

## Results

Questionnaires ($n = 486$, 48.6%) were returned in the autumn. Of the subjects, 397 (81.7%) were women and 84 (17.3%) were men. The return rate differed nonsignificantly between the sexes. The mean age of the subjects was 41.7 years (range 20–61 years, SD 9.6).

The female subjects were significantly more depressed than men (Mann-Whitney U-test statistics; $P < 0.01$ atypical and total score, $P < 0.05$ HDRS score). The gender of the subjects correlated significantly with the atypical subscale score ($r = -0.202$, $P < 0.01$) and the total score ($r = -0.169$, $P < 0.05$). No correlation was found between the three depression scores and the place of residence, age, or body-mass index of the subjects.

Of the sociodemographic variables, gender of the subjects was seen to be the best predictor of the variation in the depression scores in multiple stepwise regression models (Table 1). The place of residence did not predict the variation among the subjects.

The depression scores did not differ significantly between the subjects living at different latitudes (Table 2).

**Table 3.** Relation of the sociodemographic characteristics to seasonal depression ($n = 23$) and other depressive disorders ($n = 18$)

| Characteristic | Depressive episode | | $\chi^2$ | $P$ |
|---|---|---|---|---|
| | Seasonal[a] | Other | | |
| Gender | | | 2.69 ($df = 1$) | 0.10098 |
| women | 23 | 16 | | |
| men | 0 | 2 | | |
| Education | | | 3.01 ($df = 2$) | 0.2202 |
| level 1 (low) | 1 | 4 | | |
| level 2 | 16 | 13 | | |
| level 3 (high) | 3 | 1 | | |
| Civil status | | | 1.95 ($df = 2$) | 0.37719 |
| married[b] | 15 | 13 | | |
| single | 3 | 3 | | |
| divorced | 5 | 1 | | |
| Place of residence | | | 0.09 ($df = 1$) | 0.76418 |
| the Helsinki area | 10 | 7 | | |
| others | 13 | 11 | | |
| Migration | | | 1.60 ($df = 4$) | 0.80879 |
| southward | 12 | 10 | | |
| northward | 4 | 2 | | |
| westward | 12 | 6 | | |
| eastward | 2 | 3 | | |
| not moved | 7 | 6 | | |

[a] Subjects fulfilling criterion I (50-% decrease in the HDRS subscale score and in the total score)
[b] Includes cohabitants

The depression scores and the number of the depressed differ nonsignificantly at different latitudes.

Of the 54 depressed cases found, 41 (76%) returned the remailed questionnaire. Twenty-three subjects fulfilled either criterion I or II. No significant differences were seen between the two subsets formed (Table 3).

Ten subjects with seasonal depression were called for the interview, four of them refused, and six subjects were interviewed. Of the interviewed subjects, all were women and four of them had winter depression according to the DSM-III-R criteria for major depressive epi-

**Table 4.** Semi-annual depression ratings and assessments of diagnosis of four patients with seasonal affective disorder[a]

| Depression ratings | Scores[b] | | |
|---|---|---|---|
| | November 1991 | May 1992 | October 1992 |
| SIGH-SAD-SR | 32.3 (2.5) | 8.3 (3.8) | 24.0 (9.6) |
| HDRS subscale | 21.0 (2.7) | 5.3 (4.0) | 16.3 (6.4) |
| Atypical subscale | 11.3 (3.0) | 3.0 (5.4) | 7.8 (3.9) |

| Case | Age | DSM-III-R multiaxial assessments[c] | | | | |
|---|---|---|---|---|---|---|
| | | Axis I | II | III | IV | V |
| 1 | 44 | SAD + PMS | 301.82 + 300.23 | – | 1 | 70 |
| 2 | 29 | SAD + PMS | – | – | 3 | 70 |
| 3 | 41 | SAD + PMS | 301.82 | – | 2 | 70 |
| 4 | 45 | SAD + PMS | 301.82 | – | 1 | 65 |

[a] DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders, SAD = seasonal affective disorder, PMS = premenstrual syndrome, SIGH-SAD-SR = Structured Interview Guide for the Hamilton Depression Rating Scale-Seasonal Affective Disorders Version (Self-Rating Format), HDRS = Hamilton Depression Rating Scale

[b] Values presented as the mean (standard deviation in parentheses)

[c] Assessed in October 1992

sode with a seasonal (winter) pattern (APA 1987, Table 4).

## Discussion

The findings suggest that depressive symptoms during the autumn might be independent of the latitude at which subjects live. The place of residence neither predicted the variation in, nor correlate with, the depression scores. The finding that geographical location might not be a critical factor in subjects with seasonal depression disagrees with the results of previous US population surveys (Rosen et al. 1990; Booker and Hellekson 1992).

In Japan, however, a multi-centre study failed to find an association between the increase of the prevalence of SAD and the latitude (Sakamoto et al. 1993). No explanation has been proposed to resolve the discrepancy. The difference might be based on racial, or genetic, divergence in mechanisms related to coding the photoperiodic cues. General experience that mild depression is a rather accepted phenomenon during the autumn months, however, might also have influenced the low frequency of depressive symptoms reported by the subjects living in the northern regions. Adaptative mechanisms to a northern environment will be an essential focus of future studies.

Our finding in the sample studied is simlar to that for clinical populations in which a high predominance of women has been found among patients with seasonal depression. The coupling of habitual time of awakening and the circadian temperature oscillation may lose precision with age more easily among women (Czeisler et al. 1992), and there is some evidence that in women the entrainment of the sleep-wake cycle may depend more on the effect of daylight (Husby and Lingjaerde 1990). If so, it would be interesting to study whether the male circadian pacemaker is more sensitive to light by comparing of sensitivity for light suppression of pineal melatonin and circadian phase-shifting. Naturally, a lower social threshold for women to report their depressive symptoms may explain this difference as well, which is reflected in the difference in the female/male ratio of response rate in our study or in previous surveys (e.g. Lehtinen et al. 1990).

One caveat for the interpretation of our results is that the enrichment of the population studied by the selection procedure. The population was selected for their working conditions, indoors, to contain individuals predisposed to a low level of environmental illumination. The sample studied probably contained more subjects susceptible to depressive symptoms during the winter. However, a representative sample was randomly formed of the employees register in our study.

A precise prevalence rate of seasonal affective disorder(s) cannot be presented on the basis of our results. Instead, the frequency of winter depressive symptoms was estimated to be 1.5–2.0% in the population studies. The estimate is in agreement with the earlier point prevalence rates presented for affective disorders (Angst 1992). It is, unexpectedly, one of the lowest figures yet reported. The low figure was unlikely to be due to the process of recruitment or the response rate (48.6%). First, the subjects were randomly selected, and second, the response rate was higher than that of the two recent studies with equal sample size, 39.5% in the survey of Haggag et al (1990) or 35.4% in the study of Takahashi et al. (1991).

The possibility that subjects with winter depression were unable to reply because of severe episode of the illness cannot be excluded. First, retardation of such intensity, however, is not a usual sign of winter depression, and second, most of those who did not reply were men, not women. Therefore, the probability of the false-negative findings among subjects who did not reply was considered low.

Four subjects with winter depression were found in this study, and all four also had late luteal phase dysphoric disorder. In addition to these two syndromes, three subjects had DSM-III-R axis-II comorbidity, avoidant personality disorder combined with or without social phobia, requires further attention. We are currently collecting prospective data on the effect of light treatment on symptoms of personality disorders coexisting with winter depression.

Our results support the conclusion that symptoms of winter depression are frequent in subjects living in northern regions. However, the previously found risk factors, excluding gender, that would differentiate major depression with a seasonal pattern from other forms of depressive disorders were not found in our study.

*Acknowledgements.* The authors thank Dr. Anna-Stina Suhonen-Malm, M.D., Ph.D., and Dr. Matti Wallin, M.D., University

Central Hospital of Helsinki, Department of Psychiatry, Helsinki, for performing the clinical interviews of the patients.

## References

American Psychiatric Association (1987) DSM-III-R: Diagnostic and Statistical Manual of Mental Disorders, 3rd ed rev. American Psychiatric Press, Inc., Washington, DC

Angst J (1992) Epidemiology of depression. Psychopharmacology 106:S71–S74

Angst J, Dobler-Mikola A (1985) The Zurich study – a prospective epidemiological study of depressive, neurotic and psychosomatic syndromes. IV. Recurrent and nonrecurrent brief depression. Eur Arch Psychiatry Neurol Sci 234:408–416

Booker JM, Hellekson CJ (1992) Prevalence of seasonal affective disorder in Alaska. Am J Psychiatry 149:1176–1182

Czeisler CA, Dumont M, Duffy JF, Steinberg JD, Richardson GS, Brown EN, Sánchez R, Ríos CD, Ronda JM (1992) Association of sleep-wake habits in older people with changes in output of circadian pacemaker. Lancet 340:933–936

Haggag A, Eklund B, Linaker O, Götestam KG (1990) Seasonal mood variation: an epidemiological study in northern Norway. Acta Psychiatr Scand 81:141–145

Husby R, Lingjaerde O (1990) Prevalence of reported sleeplessness in northern Norway in relation to sex, age and season. Acta Psychiatr Scand 81:542–547

Kasper S, Ruhrmann S, Haase T, Möller H-J (1992) Recurrent brief depression and its relationship to seasonal affective disorder. Eur Arch Psychiatry Clin Neurosci 242:20–26

Lehtinen V, Joukamaa M, Lahtela K, Raitasalo R, Jyrkinen E, Maatela J, Aromaa A (1990) Prevalence of mental disorders among adults in Finland: basic results from the Mini Finland Health Survey. Acta Psychiatr Scand 81:418–425

Philipp M, Delmo CD, Buller R, Schwarze H, Winter P, Maier W, Benkert O (1992) Differentiation between major and minor depression. Psychopharmacology 106:S74–S78

Rosen LN, Targum SD, Terman M, Bryant MJ, Hoffman H, Kasper SF, Hamovit JR, Docherty JP, Welch B, Rosenthal NE (1990) Prevalence of seasonal affective disorder at four latitudes. Psychiatry Res 31:131–144

Rosenthal NE, Sack DA, Gillin JC, Lewy AJ, Goodwin FK, Davenport Y, Mueller PS, Newsome DA, Wehr TA (1984) Seasonal affective disorder. A description of the syndrome and preliminary findings with light therapy. Arch Gen Psychiatry 41:72–80

Sakamoto K, Kamo T, Nakadaira S, Tamura A, Takahashi K (1993) A nationwide survey of seasonal affective disorder at 53 outpatient university clinics in Japan. Acta Psychiatr Scand 87:258–265

Spitzer RL, Williams JBW, Gibbon M, First MB (1990) User's guide for the structured clinical interview for DSM-III-R. American Psychiatric Press, Inc., Washington, DC

Takahashi K, Asano Y, Kohsaka M, Okawa M, Sasaki M, Honda Y, Higuchi T, Yamazaki J, Ishizuka Y, Kawaguchi K, Ohta T, Hanada K, Sugita Y, Maeda K, Nagayama H, Kotorii T, Egashira K, Takahashi S (1991) Multi-center study of seasonal affective disorders in Japan. A preliminary report. J Affect Disord 21:57–65

Terman M, Terman JS, Rafferty B (1990) Experimental design and measures of success in the treatment of winter depression by bright light. Psychopharmacol Bull 26:505–510

Wilkinson L (1990) SYSTAT: The system for statistics. SYSTAT, Inc., Evanston, Illinois

Williams JBW, Link MJ, Rosenthal NE, Terman M (1991) Structured Interview Guide for the Hamilton Depression Rating Scale – Seasonal Affective Disorders Version (Self-Rating Format), rev. New York State Psychiatric Institute, New York, New York