

Self-reported mental distress under the shifting daylight in the high north

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ABSTRACT

Background. The validity of the concept of seasonal affective disorder and the causal link to lack of daylight in winter is controversial. There is a need for investigations in large samples of the general population at different latitudes and within general research contexts to avoid selective response bias and sensitization of the population.

Methods. During a study of health effects of the air pollution from Russia in a small community at 70° north, a self-administered questionnaire was filled in by 3736 inhabitants, 60·8% of the total population between 18 and 69 years. Three questions concerned depression, sleeping problems and other problems related to the two contrasting seasons with regard to daylight.

Results. Twenty-seven per cent reported to have some kind of problem in the dark period. Most frequently reported were sleeping problems during winter, in 19·9% of women and 11·2% of men. Self-reported depression in winter was found in 11·1% of women and 4·8% of men. Sleeping problems increased with age, while depression was most often reported by middle-aged people. The only other reported problem in winter was fatigue. The adjusted relative risk (RR) for winter depression in women compared to men was 2·5 (95% confidence interval: 1·9–3·2). Very few had problems in summer.

Conclusions. In the high north, one-third of the women and one-fifth of the men experience problems with sleep, mood or energy related to season. The prevalence of self-reported depression was surprisingly low in winter considering the lack of daylight.

INTRODUCTION

Seasonal changes, especially in sleep and energy, have always been well known to the populations in the north as a common experience. Sleeping-problems in the winter season are quite common in northern Norway, and the first scientific report on this phenomenon came in 1957 (Devold *et al.* 1957). Treatment-studies of this condition with benzodiazepines were published by Lingjærde *et al.* (Lingjærde & Bratlid, 1981; Lingjærde *et al.* 1983) from 1981, and the first trial of treatment with bright artificial light was carried out in 1984 (Lingjærde *et al.* 1985). At that time depression had not been noted to be particularly prevalent in the dark winter season, and the impression was that persons with

midwinter sleeping-problems usually were not depressed (Lingjærde & Bratlid, 1981). The first epidemiological investigation of the prevalence of mental distress related to winter was carried out in northern Norway in 1980, the results were published 10 years later (Husby & Lingjærde, 1990; Hansen *et al.* 1991). Since the introduction of the term seasonal affective disorder (SAD) by Rosenthal *et al.* in 1984 (Rosenthal *et al.* 1984a), the research focus shifted towards recurrent winter depression. From the very beginning, the concept of SAD was closely linked to a causal connection with amount of daylight. Consequently, SAD has been studied during different times of the year and at different latitudes (Potkin *et al.* 1986; Terman, 1988; Kasper *et al.* 1989; Rosen *et al.* 1990; Booker & Hellekson, 1992; Lingjærde & Reichborn-Kjennerud, 1993; Magnusson & Axelsson, 1993; Magnusson & Stefansson, 1993; Partonen *et al.* 1993; Schlager

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et al. 1993; Näyhä *et al.* 1994; Muscettola *et al.* 1995). However, no simple relationship between SAD and latitude of living has been established. Furthermore, within psychiatry there is still considerable controversy concerning whether depressions showing seasonal variations should be considered as being a separate entity (Christensen & Dowrick, 1983; Eastwood & Peter, 1988; Easton, 1990). This uncertainty is reflected both in the diagnostic system of the American Psychiatric Association (1994) and of the World Health Organization (1992), where depressions showing seasonal recurrent pattern are not assigned any separate coding-numbers. Despite these controversies, the idea that winter depression caused by lack of daylight is very common in the north, is gaining widespread recognition in the minds of both health workers and the general public.

Since the validity of the construct of SAD is not firmly established, we regard it to be important to investigate the occurrence of such problems within research-contexts not related to mental distress and season, to minimize response-bias and sensitization of the population. During a study of health effects of the air pollution in Sør-Varanger community in northern Norway, at 70° N, we had the opportunity to do so. Here, the population lives under some of the most extreme variations in daylight found in the world. In winter, the sun does not rise above the horizon for 2 months, and for an equally long period in summer, it never disappears. Despite its very northern location, mean temperature in winter and summer is not very different from that in Oslo, 1800 km more south at 60°, approximately 5° C below zero in January and 10° C above zero in July. This is owing to the warm Gulf-stream from the Caribbean that goes along the northern Norwegian coast-line. Consequently, the population is excellently suited for studying the possible relationship between mental symptoms and amount of daylight.

METHOD

In 1994, all inhabitants of Sør-Varanger 18–69 years-old were invited to participate in a health screening for possible effects of sulphur dioxide and nickel pollution from the Russian border – near smelters in the industrial town of Nikel.

Table 1. Sex and age distribution of the population participating in the ‘Pollution and Health Study in Sør-Varanger’ 1994, and response rates (%)

Age (years)	Male		Female	
	N	(%)	N	(%)
18–29	325	(35.4)	462	(55.6)
30–39	372	(50.1)	439	(66.9)
40–49	404	(57.7)	439	(73.4)
50–59	313	(68.2)	344	(81.7)
60–69	314	(76.4)	324	(79.6)
Total	1728	(53.5)	2008	(68.9)

Sør-Varanger is a rural community of approximately 10000 inhabitants, with an ethnically mixed population of people with Norwegian, Sami and Finnish descent. Together with the letter of invitation they received a four-paged questionnaire. When the participants arrived for the screening, the questionnaire was handed in, they underwent lung function and allergy testing, and samples of blood and urine were taken for measurement of heavy metals. The survey took place on two occasions, in April/May and in September/October. These two periods are the most ‘normal’ periods of the year regarding the balance between light and darkness.

A total of 3736 persons, 60.8% of the total population between 18 and 69 years, inclusive, completed the questionnaire. The age and sex distribution of the study population is given in Table 1. The participation rate was lowest among young men.

The four-paged questionnaire contained questions about social status, ethnicity, living habits and different symptoms and diseases. Regarding seasonal changes four questions were asked. The first was ‘have you any problems during the polar night or the midnight sun period?’, with response alternative ‘yes’ or ‘no’. The next paragraph in the questionnaire was: ‘if “yes,” what kind of troubles: depression, sleeping problems, other (mention)’. For each of these three questions, they should specify if the problem occurred in the dark period, the midnight sun period, or both, making it possible to state more than one problem during both seasons.

Statistical analyses of relative risks for prevalence of symptoms was based on the Mantel–

Haenzel procedure and logistic regression analysis as given in the statistical package of SAS (SAS Institute Inc. 1987).

RESULTS

Of the 3736 participants, 33% of the women and 20.2% of the men reported problems related to the two contrasting seasons, or 27.1% for both sexes combined. Table 2 shows that the most frequent complaint was sleeping-problems during the polar night period, with 19.6% of women and 11.2% of men suffering from this condition.

Self-reported depression was only half as common; 11.1% in women and 4.8% in men, or 8.2% for both sexes combined. A few people

had other complaints, almost exclusively fatigue, without mentioning weight gain or change in dietary habits as a problem. During the midnight sun period the only reported problem was sleeping-problems, in 2–3%. Almost none of the subjects reported depression in both seasons, while a few had sleeping-problems both in winter and in summer.

Depression and sleeping-problems had different age relationship, Table 3. Depression was more common in the middle-aged than both in the young and the elderly, while sleeping-problems increased with age in both sexes. For depression, we compared the relative risk in the middle aged (30–59 years-of-age) with the youngest ones, aged 18–29. In men, the relative risk was 2.4 (95% CI: 1.2–4.9) and for women 1.4 (95% CI: 1.0–1.9).

Table 4 shows that the crude relative risk of having winter depression for women compared with men was 2.4, for winter sleeping-problems 2.1, and for summer sleeping-problems 1.6. These sex differences were virtually unchanged after adjustment for age. The effect of having had a short education (i.e. less than 10 years) had no strong impact on either of the three conditions when adjusted for age and sex. Similarly, neither Sami ethnicity nor shorter stay (i.e. less than half of the life) in the north (Sør-Varanger) had any effect. Of the total group, 150 subjects (4.1%) had both depression and sleeping-problems in the dark period. For this subgroup we found a slightly higher age-adjusted relative risk in women *v.* men, 2.7 (95% CI 2.0–3.8). This relative risk was unaffected by additional adjustments.

Table 2. *Self-reported complaints during the polar light cycle. More than one answer from each participant possible*

	Polar night only		Midnight sun only		Both seasons	
	N	(%)	N	(%)	N	(%)
Depression						
Male	81	(4.8)	2	(0.1)	3	(0.2)
Female	218	(11.1)	2	(0.2)	5	(0.3)
Insomnia						
Male	189	(11.2)	44	(2.6)	42	(2.5)
Female	390	(19.9)	66	(3.4)	93	(4.7)
Other*						
Male	42	(2.4)	2	(0.1)	1	(0.1)
Female	48	(2.5)	1	(0.1)	0	(0.0)

* Fatigue, none with eating disorders.

Table 3. *Self-reported depression and insomnia according to age, in the dark polar night period*

Age group (years)	Depression*		Insomnia**	
	Male %	Female %	Male %	Female %
18–29	2.5	9.3	7.8	11.9
30–39	5.5	12.6	11.2	17.0
40–49	7.0	11.0	11.3	20.1
50–59	4.9	14.9	12.7	27.4
60–69	3.3	7.7	13.0	27.1
Total	4.8	11.1	11.2	19.9

* Male, $\chi^2 = 9.92$, $df = 4$, $P = 0.04$; female, $\chi^2 = 11.04$, $df = 4$, $P = 0.03$.

** Male, $\chi^2 = 5.52$, $df = 4$, $P = 0.24$; female, $\chi^2 = 42.46$, $df = 4$, $P = 0.001$.

DISCUSSION

We found that one-fifth of the men and one-third of the women in Sør-Varanger experienced problems in the dark period or the midnight sun period, related to sleep, mood or energy. In the light period of summer, there were some minor sleeping problems, and in the dark time of winter, about one-fifth of the women had sleeping-problems. Less than one in ten experienced depression in winter, and about 4% experienced both sleeping-problems and depression in that season.

The response rate of about 35% among males under 30 years was lower than expected, but we

Table 4. Relative risks (RR) with 95% confidence intervals (95% CI) for winter depression, winter insomnia and summer insomnia. Relative risks based on prevalence figures

	Winter depression		Winter insomnia		Summer insomnia	
	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)
Sex (unadjusted)						
Female v. male	2.4	(1.9–3.2)	2.1	(1.7–2.4)	1.6	(1.3–2.2)
Sex (age-adjusted)						
Female v. male	2.5	(1.9–3.2)	2.1	(1.8–2.5)	1.6	(1.2–2.1)
Education*						
< 9 years v. > 10	1.0	(0.8–1.4)	1.2	(1.0–1.4)	1.0	(0.7–1.4)
Ethnicity*						
Sami v. Norwegian	1.3	(1.0–1.7)	0.9	(0.7–1.1)	1.1	(0.8–1.5)
Years lived in Sør-Varanger*						
< 50% v. ≥ 50	0.8	(0.6–1.0)	0.9	(0.8–1.2)	0.8	(0.6–1.1)

* Adjusted for sex and age.

have no reasons to believe that participation in the screening should be biased according to self-reported seasonal symptoms, since the purpose of the study was a well known and debated air pollution. Nevertheless, we cannot exclude the possibility that the low prevalence of depression in young men may be influenced by the low response rate. In men of 30 years and older, the response rate was satisfactory, 61% for the group as a whole.

Four other studies exist from northern Norway on self-reported mental distress during winter, in populations living at 69° north. Based on the findings of Lingjærde *et al.* (1986) and Haggag *et al.* (1990), an impression has been created that the prevalence of winter depression in northern Norway is very high, at the level of 25% of the adult population. However, the findings of Lingjærde *et al.* have only been presented in a preliminary form and seem to be based on a rather small sample. In the study of Haggag *et al.* 27% of a sample of 359 persons were reported to be depressed in December. However, because of a low response rate (40%) and publicity in the local mass media about the possible connection between season and well-being when their questionnaire was sent out, it is likely that their sample is subject to selection bias. The two other studies, however, are based on a large and representative sample of the total population in one community. Furthermore, they were done within the context of a population-survey for coronary heart disease, and 4 years before the concept of SAD was formulated. Thus, they are probably not

hampered by any serious response-bias. In Husby & Lingjærde's (1990) study, a prevalence of midwinter sleeping-problems of 9% in men and 17.6% in women was found. Hansen *et al.* (1991) found a prevalence of depression in winter of 10% in men and 12% in women. The findings from these two studies correspond well with our findings, apart from the quite low prevalence of depression in winter in men in Sør-Varanger, 4.8% (95% CI: 3.8–5.9).

The level of self-reported depression found in this study is of course difficult to compare with studies of SAD as assessed by the self-administered questionnaire constructed by Rosenthal *et al.* (1984b) the Seasonal Pattern Assessment Questionnaire (SPAQ). In the SPAQ, people are asked if they experience seasonal changes in six areas: sleep length, social activity, mood, weight, appetite and energy level, with five alternatives ranging from no changes to extremely marked changes. The scores are summarized as a 'Global Seasonality Score' (GS-score), with possible scores from 0 to 24. To conclude that a seasonal affective disorder is present requires a GS-score of 10 or 11, that one should feel worst in January and February, and the seasonal variations in the six areas mentioned should be experienced as a problem of at least moderate degree. Since any combination of symptoms may, depending on the severity of the problem in question, result in a GS-score of 10 or 11, it follows that it is possible to be classified as having a SAD without being depressed. Hence, it seems reasonable to assume that people are more likely to be designated as having SAD according to the

SPAQ than to report depression in the dark period in our questionnaire. In relation to SPAQ then, one should perhaps expect a somewhat lower prevalence of winter depression with our methods. Even so, we consider that our finding of a prevalence of self-reported depression in winter similar to the prevalence of SAD in US-studies of populations at about 42° N (Rosen *et al.* 1990) should serve as a further stimulus for rethinking the concept of seasonal depression, and especially the theory of a strong biological link to the amount of daylight.

The present evidence for an increasing prevalence of SAD with higher latitude is not strong. The studies that have used the SPAQ have, in general, less than satisfactory recruitment-procedures, quite low response-rates, and a high possibility for selective response-bias (Kasper *et al.* 1989; Rosen *et al.* 1990; Muscettola *et al.* 1995). The methodologically best studies (Booker & Hellekson, 1992; Magnusson & Axelsson, 1993) have yielded conflicting results in populations living at approximately the same latitude, and studies using other methods than the SPAQ have not confirmed the hypothesis (Christensen & Dowrick, 1983; Hansen *et al.* 1991; Partonen *et al.* 1993; Näyhä *et al.* 1994). In the present study, one source of selection bias could be migration due to self-experienced seasonal problems. People with more problems during winter time could move south, and of those moving north only people accepting the seasonal changes could stay over time. Depending on the pattern of moving, our prevalence figures might be underestimations.

Due to its construction, the SPAQ questionnaire is less suited to use in populations at high latitudes, where general living conditions change considerably during the seasons as a natural result of the great changes in daylight and climate. If we compare New York to Sør-Varanger with regard to living-conditions, it becomes quite clear that in Sør-Varanger everybody has to change activities according to the seasons, due to the very different conditions imposed upon them by weather and climate in the dark and the light period. As mentioned, changes in sleeping-pattern are also quite prevalent, especially in women. This would automatically give a higher score in the SPAQ-questionnaire. Similarly, appetite and energy could be affected by the changing climate,

varying from moderate summer temperature to the long and cold winter. Nobody in our survey spontaneously answered that weight gain in winter was a concern, but they might have done so if asked specifically about this, as is done in the SPAQ questionnaire.

Thus, SPAQ is not validated for differing climatic and geographic conditions. Since the seasonal changes in living conditions are both very strong and easily recognizable, local lifestyle has adapted to it in northern Norway. In many places at these latitudes schools have different opening times according to season. People adjust their sleeping pattern to the season, with shorter periods of sleep during summer, and small children are allowed to play outdoors at night in summer. We find it important not to use the word disorder to describe changes that the majority of people in a specific area think of as normal adjustments to the natural surroundings. Such a connotation is very far from the local experience of living in the north and it may contribute to the medicalization of ordinary problems of life.

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REFERENCES

- American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorder, 4th edn.* American Psychiatric Association: Washington, DC.
- Booker, J. & Hellekson, C. (1992). Prevalence of seasonal affective disorder in Alaska. *American Journal of Psychiatry* **149**, 1176–1182.
- Christensen, R. & Dowrick, P. W. (1983). Myths of mid-winter depression. *Journal of Community Mental Health* **19**, 177–186.
- Devold, O., Barlinghaug, E. & Backer, J. (1957). Sleep-disturbances in the dark period. (In Norwegian.) *Journal of the Norwegian Medical Association* **77**, 836–837.
- Easton, M. (1990). Seasonal affective disorders. *Current Opinion in Psychiatry* **3**, 54–57.
- Eastwood, M. & Peter, A. (1988). Epidemiology and seasonal affective disorder. *Psychological Medicine* **18**, 799–806.
- Haggag, A., Eklund, B., Linaker, O. & Gøtestam, K. (1990). Seasonal mood variation: an epidemiological study in northern Norway. *Acta Psychiatrica Scandinavica* **81**, 141–145.
- Hansen, V., Jacobsen, B. & Husby, R. (1991). Mental distress during winter. An epidemiological study of 7759 adults north of Arctic Circle. *Acta Psychiatrica Scandinavica* **84**, 137–141.
- Husby, R. & Lingjærde, O. (1990). Prevalence of reported sleeplessness in northern Norway, in relation to sex, age and season. *Acta Psychiatrica Scandinavica* **81**, 542–547.
- Kasper, S., Wehr, T., Bartko, J., Gaist, P. & Rosenthal, N. (1989). Epidemiological findings of seasonal changes in mood and behaviour. *Archives of General Psychiatry* **46**, 823–833.
- Lingjærde, O. & Bratlid, T. (1981). Triazolam (Halcion) and flunitrazepam (Rohypnol) against midwinter insomnia in Northern Norway. *Acta Psychiatrica Scandinavica* **64**, 260–269.

- Lingjærde, O. & Reichborn-Kjennerud, T. (1993). Characteristics of winter depression in the Oslo area (60 degrees N). *Acta Psychiatrica Scandinavica* **88**, 111–120.
- Lingjærde, O., Bratlid, T., Westby, O. & Gordelaze, J. (1983). Effect of midazolam, flunitrazepam, and placebo against midwinter insomnia in northern Norway. *Acta Psychiatrica Scandinavica* **67**, 118–129.
- Lingjærde, O., Bratlid, T. & Hansen, T. (1985). Insomnia during the 'dark period' in northern Norway. An explorative, controlled trial with light treatment. *Acta Psychiatrica Scandinavica* **71**, 506–512.
- Lingjærde, O., Bratlid, T., Hansen, T. & Gøtestam, K. (1986). Seasonal affective disorder and midwinter insomnia in the far north. Studies on two related chronobiological disorders in Norway. *Proceedings of the Collegium Internationale Neuro-Psychopharmacologicum* **9**, 187–189.
- Magnusson, A. & Axelsson, J. (1993). The prevalence of seasonal affective disorder is low among descendants of Icelandic emigrants in Canada. *Archives of General Psychiatry* **50**, 947–951.
- Magnusson, A. & Stefansson, J. (1993). Prevalence of seasonal affective disorder in Iceland. *Archives of General Psychiatry* **50**, 941–946.
- Muscettola, G., Barbato, G., Ficca, G., Beatrice, M., Puca, M., Aguglia, E. & Amati, A. (1995). Seasonality of mood in Italy: role of latitude and sociocultural factors. *Journal of Affective Disorders* **33**, 135–139.
- Näyhä, S., Vaisanen, E. & Hassi, J. (1994). Season and mental illness in an Arctic area of northern Finland. *Acta Psychiatrica Scandinavica Supplement* **377**, 46–49.
- Partonen, T., Partinen, M. & Lonnqvist, J. (1993). Frequencies of seasonal major depressive symptoms at high latitudes. *European Archives of Psychiatry and Clinical Neuroscience* **243**, 189–192.
- Potkin, S., Zetin, M., Stannekovic, V., Kripke, D. & Bunney, W. (1986). Seasonal Affective Disorder: prevalence varies with latitude and climate. *Journal of Clinical Neuropharmacology* **9**, 181–183.
- Rosen, L., Targum, S., Terman, M., Bryant, M., Hoffmann, H., Kasper, S., Hamovit, J., Docherty, J., Welch, B. & Rosenthal, N. (1990). Prevalence of seasonal affective disorder at four latitudes. *Psychiatric Research* **31**, 131–144.
- Rosenthal, N., Sack, D., Gillin, J., Lewy, A., Goodwin, F., Davenport, Y., Mueller, P., Newsome, D. & Wehr, T. (1984a). Seasonal affective disorder. A description of the syndrome and preliminary findings with light therapy. *Archives of General Psychiatry* **41**, 72–80.
- Rosenthal, N., Bradt, G. & Wehr, T. (1984b). *Seasonal Pattern Assessment Questionnaire*. National Institute of Mental Health: Bethesda, MD.
- SAS Institute Inc. (1987). *SAS Users Guide: Basics. 5th Version*. SAS Institute Inc.: Cary.
- Schlager, D., Schwartz, J. E. & Bromet, E. J. (1993). Seasonal variations of current symptoms in a healthy population. *British Journal of Psychiatry* **163**, 322–326.
- Terman, M. (1988). On the question of mechanisms in phototherapy: considerations of clinical efficacy and epidemiology. *Journal of Biological Rhythms* **3**, 155–172.
- World Health Organization (1992). *The ICD-10 Classification of Mental and Behavioral Disorders*. World Health Organization: Geneva.