Lack of Seasonal Mood Change in the Icelandic Population: Results of a Cross-Sectional Study

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Objective: The prevalence of seasonal affective disorder—as measured by the Seasonal Pattern Assessment Questionnaire—has been found to be unexpectedly low among Icelanders. The aim of this cross-sectional study was to measure seasonal variations in the prevalence of anxiety and depression among Icelanders assessed with the Hospital Anxiety and Depression Questionnaire. **Method:** Four 1,000-person cohorts, age 20–70 years, selected at random from the Icelandic National Register, were sent the Hospital Anxiety and Depression Scale by mail in either January, April, July, or October. Only responses from the 4-week period after each mailing were considered in the subsequent analysis. **Results:** The mean anxiety and depression scores in winter were not higher than those in summer for either sex. There was no significant difference between winter and summer in rates of actual or borderline cases of anxiety or depression or for the two categories combined. **Conclusions:** This lack of seasonality in anxiety and depression is in sharp contrast to findings from similar cross-sectional studies and may reflect the low propensity for seasonal affective disorder that has been described in the Icelandic population.

(Am J Psychiatry 2000; 157:234–238)

The epidemiology of seasonal affective disorder has been intensively studied in recent years, with three major approaches having been used. One approach has been to examine patient populations by searching case registers for individuals with a clear seasonal pattern in their relapses and remissions. A second approach has been to screen populations for current symptoms at different parts of the year, then examine seasonal changes. A third approach has been to survey populations with an instrument that focuses directly upon seasonal changes in mood and behavior. The Seasonal Pattern Assessment Questionnaire (1) is such an instrument and has been used to identify subjects with seasonal affective disorder as well as its milder form, subsyndromal seasonal affective disorder (2, 3).

Most studies have found seasonal affective disorder and subsyndromal seasonal affective disorder to be more common in women than in men and that the incidence of both conditions decreases with age. Several studies have also found that the prevalence of seasonal affective disorder increases with latitude (4–8). However, some studies have suggested that people may acclimatize to the long winters experienced at higher latitudes (7, 9). The question that needs to be addressed is whether the propensity for seasonal affective disorder differs among genetically diverse groups. Seasonal affective disorder and subsyndromal seasonal affective disorder have been studied in Iceland (latitude 64°N – 67°N), where, unexpectedly, they were found to be less common than at much lower latitudes along the East Coast of the United States (39°N –42.5°N) (10, 11). When compared to the rate reported in the Montgomery County study in the United States (3), the prevalence of seasonal affective disorder has been found to be lower than expected in Japan (5, 12). Furthermore, in contrast to other populations, seasonal affective disorder is less prevalent among women and the young within the Japanese population (12–14). Genetic factors have been suggested as an explanation for these differences (13).

To test the hypothesis of a significant, etiological genetic component, seasonal affective disorder was studied in a population of immigrants of wholly Icelandic descent in Canada (10). The prevalence of seasonal affective disorder and subsyndromal seasonal affective disorder was significantly lower in this immigrant population than in the aforementioned East Coast popula-

Received Feb. 12, 1998; revisions received Nov. 30, 1998, and May 28, 1999; accepted June 30, 1999. From Therapeia; the Research Forum and Department of Psychiatry, Ullevål Hospital, Oslo; and the Department of Physiology, University of Iceland, Reykjavík. Address reprint requests to Dr. Oskarsson, Therapeia, Sudurgata 12, 101 Reykjavík, Iceland; hoegni@mmedia.is (e-mail).

Supported by two grants from the Icelandic Research Council.

The authors thank Professor Tomas Helgason for his support and Helgi Sigvaldason for statistical advice.

tion. We have recently shown a striking difference in the prevalence of seasonal affective disorder between descendants of Icelanders in Winnipeg and other citizens of Winnipeg (15). All of these studies used the Seasonal Pattern Assessment Questionnaire. The advantage of this tool is that it focuses directly upon seasonal variations in mood and behavior. The disadvantage is that it relies upon the participants' long-term recall of their seasonal mood swings. The reliability of recall of affective episodes may be poor (16), and the recall of seasonal pattern of depressive episodes may also be poor (17).

The aim of the present study was to examine seasonal variations in mood in the Icelandic population by methods that do not depend on the long-term recall of the participants. For this purpose, we used the Hospital Anxiety and Depression Scale (18) to measure the prevalence of anxiety and depression during summer, autumn, winter, and spring in a representative sample of the Icelandic population. The results are compared to cross-sectional studies from other countries.

METHOD

Four cohorts of 1,000 persons each, aged 20–70 years, were selected at random from the Icelandic National Register. After obtaining necessary ethical approval, each cohort was mailed the Hospital Anxiety and Depression Scale in either January, April, July, or October of 1987. A cover letter and a self-addressed stamped envelope were enclosed. The participants were asked to rate their state of well-being in the week before receiving the questionnaire. The dates were specified. Two follow-up letters were mailed. Only responses from the 4-week period after the first mailing were included in the analysis.

The Hospital Anxiety and Depression Scale is a 14-item self-assessment scale for anxiety and depression (18–21). Each item is scored from zero to three. Scores for both depression and anxiety range from 0 to 21, with a score of 11 or higher indicating caseness, a score of 8–10 rated as borderline, and scores below 8 indicating no disorder is present. The Icelandic version of the Hospital Anxiety and Depression Scale has been described elsewhere (22), and a recent review of its psychometric properties has found it to be both a valid and reliable instrument (23).

Data Analysis

The software package used was BMDP (24). The tests used were t test, F test, and chi-square test. Double-sided p values and a significance level of 0.05 were used. Bonferroni correction was used for multiple tests. Analysis of covariance was applied to evaluate seasonal differences in mean Hospital Anxiety and Depression Scale scores for anxiety and depression. The mean values were adjusted for covariates, and the equality of slopes was tested. These analyses were also tested on logarithmic transformed Hospital Anxiety and Depression Scale scores; however, since the results were not appreciably different, they are not presented.

RESULTS

Response Rates

Sixty-one letters were returned unopened. In 29 instances the code number had been removed, which precluded further analysis. Correcting for this, the total response rate was 57.8%. Questionnaires returned later than 4 weeks after the first mailing and questionnaires with less than four items answered for either anxiety or depression were excluded. Thus, a total of 2,262 (56.5%) questionnaires were included in the analysis (table 1).

TABLE 1. Rates of Response to Seasonal Surveys of Four 1,000-Person Cohorts From the Icelandic National Register by Gender, Age, and Residency

	October		January		April		July	
Characteristic	N	%[a]	N	%[a]	N	%[a]	N	%[a]
Gender								
Men	269	51.3	237	43.4	278	52.8	275	54.2
Women	315	66.4	296	60.5	298	63.0	293	59.4
Age (years)								
20–35	211	49.4	199	47.3	215	50.6	221	51.2
36–54	242	66.5	209	57.1	232	65.2	214	58.3
55–70	132	63.2	125	58.7	129	58.9	133	63.0
Residency								
Reykjavík	309	53.3	289	50.7	334	58.7	315	56.9
Other	276	65.7	244	56.7	242	56.1	253	56.7
Total responding	585	58.5	533	53.3	576	57.6	568	56.8

[a] Percentages based on number of individuals in a particular category to whom the survey was originally sent.

There were no significant differences in response rates across seasons for either the total sample or within groups. However, across all four mailings the response rate of the youngest group was lower than that of the oldest group (49.6% versus 60.9%; χ^2=34, df=1, p<0.001). Response rates were also lower for men than for women (50.4% versus 62.3%; χ^2=45, df=1, p<0.001). The response rate of subjects in the Reykjavík area was marginally lower than that of subjects in rural areas (54.9% versus 58.8%; χ^2=4.6, df=1, p<0.03).

Seasonal Variations

Table 2 shows the pattern of caseness. The rates of anxiety or depression did not show a statistically significant difference between winter and summer, either for actual cases, borderline cases, or for the two categories combined. Covariance analyses of Hospital Anxiety and Depression Scale scores showed 1) a nonsignificant gender effect for anxiety and depression, 2) anxiety scores were higher in the youngest age group (F=104.86, df=1, 2260, p<0.001), and 3) the depression scores were higher in the oldest age group (F= 43.8, df=1, 2260, p<0.001) and in the rural population (F=19.1, df=1, 2260, p<0.001).

The average Hospital Anxiety and Depression Scale score for each season is shown in table 3. The mean scores in winter were not higher than those in summer. In fact, after correcting for age and residency (urban versus rural), the only statistically significant difference in mean scores across seasons was that the depression scores in January were lower than those in all other seasons combined. However, this did not remain statistically significant after correcting for multiple tests. We examined specifically whether the youngest age group (20–35 years) had more seasonal variations

TABLE 2. Seasonal Prevalence of Actual and Borderline Anxiety and Depression Cases Among Four 1,000-Person Cohorts From the Icelandic National Register

Hospital Anxiety and Depression Subscale Score	October (N=585)		January (N=533)		April (N=576)		July (N=568)		Test of Independence		
	N	%	N	%	N	%	N	%	χ^2	df	p
Anxiety									2.84	6	0.83
0–7 (no disorder indicated)	504	86.2	450	84.4	484	84.0	477	84.0			
8–10 (borderline)	45	7.7	52	9.8	58	10.1	58	10.2			
11–21 (disorder indicated)	36	6.2	31	5.8	34	5.9	33	5.8			
Depression									4.73	6	0.58
0–7 (no disorder indicated)	526	89.9	482	90.4	519	90.1	514	90.5			
8–10 (borderline)	34	5.8	32	6.0	43	7.5	33	5.8			
11–21 (disorder indicated)	25	4.3	19	3.6	14	2.4	21	3.7			

TABLE 3. Hospital Anxiety and Depression Scale Scores by Month for Four 1,000-Person Cohorts From the Icelandic National Register

	Hospital Anxiety and Depression Scale Score					
	Anxiety			Depression		
Month	Mean	SD	Mean Adjusted for Age[a]	Mean	SD	Mean Adjusted for Age and Residency[b]
October (N=585)	4.34	0.14	4.35	3.33	0.13	3.31
January (N=533)	4.34	0.14	4.35	3.26	0.13	3.25
April (N=576)	4.43	0.14	4.43	3.33	0.13	3.35
July (N=568)	4.48	0.14	4.47	3.31	0.13	3.31

[a] Equality of adjusted mean value: F=0.18, df=3, 2260, p=0.91.
[b] Equality of adjusted mean value: F=0.10, df=3, 2260, p=0.96.

than the older age groups. Even in this age group, the mean anxiety and depression scores in winter were not higher than those in summer (anxiety: 5.02 in January and 5.34 in July; depression: 2.48 in January and 2.94 in July).

This study would have had a 90% chance of detecting a significant ($p<0.05$) difference if the real underlying difference in mean scores between summer and winter had been more than 10% for anxiety and 12% for depression.

DISCUSSION

The absence of seasonal anxiety and depression found in the present study contrasts markedly with similar studies from other countries.

We are aware of 10 studies that have measured mental symptoms sequentially through the year. All had found seasonal variations with a peak for depression or anxiety in autumn or winter (table 4). The pattern was complex in a few of these studies, but the general trend was quite consistent. Mersch and collaborators (32) mailed the Center for Epidemiologic Studies Depression Scale to a random sample in the Netherlands at different parts of the year. The average depression score was 8.5 in June and 12.4 in December. Murase and colleagues (14) had 242 Japanese who were residing in Stockholm fill out the Beck Depression Inventory in summer and winter. The scores were 65% higher in winter than in summer. In the United States, Harris and Dawson-Hughes (30) found 28% and 16% higher scores in winter than in summer for anxiety and depression, respectively. Two of the studies listed in table 4 used the same questionnaires as the present study (21, 33). Furthermore, they were postal surveys with very similar study designs as ours. Both of these studies found higher depressive symptom scores in winter. Thus, our cross-sectional study is one of the few studies that finds no seasonal variations in either anxiety or depression, although it had many more participants than most, as shown in table 4. It is remarkable that all of the studies listed in table 4 find seasonal variations in mood even though they use a wide variety of instruments and different study designs.

This report is not a direct study of seasonal affective disorder but rather of seasonal mood variations. However, it is tempting to compare our results with those from a previous survey of seasonal affective disorder in the Icelandic population that used the Seasonal Pattern Assessment Questionnaire (11). That study found that Icelanders exhibit seasonal affective disorder and subsyndromal seasonal affective disorder, albeit at prevalences that were unexpectedly low given Iceland's high latitude. By contrast, the present study, which was based upon much shorter recall periods than those of studies that used the Seasonal Pattern Assessment Questionnaire, detected no seasonal variations in anxiety and depression whatsoever in this population.

This discrepancy may have several explanations, such as the long-term recall bias toward magnifying symptoms (21) and the possibility of populations being artificially sensitized by the media to particular symptoms or disorders, such as seasonal affective disorder (34).

The low or even absent seasonality of depression is puzzling in itself and may reflect some unique features of the Icelandic population, possibly genetic in nature (10, 11, 35).

To address these issues a study that is longitudinally following a defined cohort, focusing on seasonal affective disorder, and using both the Hospital Anxiety and Depression Scale and the Seasonal Pattern Assessment Questionnaire is now in progress.

TABLE 4. Cross-Sectional Studies That Assessed Seasonal Variations in Symptoms of Depression and Anxiety

Study	Year	Location	N	Study Period	Instruments	Main Findings
Lacoste and Wirz (25, 26)	1987 and 1989	Switzerland (47.5°N)	284	Monthly for a year	Freiburger Personality Inventory and Beck Depression Inventory	Early winter and late spring peaks of self-rated depression and fatigue
Terman et al. (27)	1989	New York (40°N)	274	Continuous throughout the year	Psychiatric Epidemiology Research Interview	Seasonal variation in seasonal affective disorder symptoms, not in other psychopathological measures
Haggag et al. (28)	1990	Tromsø (69°N)	909	June and December	Modified Zung Self-Rating Depression Scale	Higher depression scores in winter; more pronounced seasonal difference in women
Schlager et al. (29)	1993	Pennsylvania (41°N)	1,870	Continuous throughout the year	Hopkins Symptom Check List with additional items specific to seasonal affective disorder	Wintertime worsening of anxiety and depression in women but not men
Harris and Dawson-Hughes (30)	1993	Boston (41°N)	250	Five times during 1 year	Profile of Mood States	Tension-anxiety and depression-dejection scores higher in winter than in summer
Nayha et al. (31)	1994	Northern Finland	1,251	Continuous for 1 year	Cornell Medical Index Questionnaire	Prevalence of a variety of mental disorders peaked in spring and autumn
Mersch et al. (32)	1995	North Netherlands (53°N)	2,887	Monthly for 13 months	Center for Epidemiologic Studies Depression Scale	Significantly higher depression scores in winter
Murase et al. (14)	1995	Stockholm (59°N)	242	Summer and winter	Beck Depression Inventory	Significantly higher depression scores in winter
Nayyar and Cochrane (21)	1996	Birmingham, U.K. (52°N)	25	Monthly for 1 year	Hospital Anxiety and Depression Scale	Depression scores 44% higher in winter
Suhail and Cochrane (33)	1997	Birmingham, U.K. (52°N)	75	Monthly for 1 year	Hospital Anxiety and Depression Scale	Depression scores 54% higher in winter than in summer

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