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ORIGINAL PAPER

Prevalence of seasonal depression in a prospective cohort study

Anna Wirz-Justice[1] · Vladeta Ajdacic[2] · Wulf Rössler[2,3] · Hans-Christoph Steinhausen[4,5,6,7] · Jules Angst[2]

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Abstract

The prevalence of autumn/winter seasonality in depression has been documented in the longitudinal Zurich cohort study by five comprehensive diagnostic interviews at intervals over more than 20 years ($N = 499$). Repeated winter major depressive episodes (MDE—unipolar + bipolar) showed a prevalence of 3.44% (5× more women than men), whereas MDE with a single winter episode was much higher (9.96%). A total of 7.52% suffered from autumn/winter seasonality in major and minor depressive mood states. The clinical interviews revealed novel findings: high comorbidity of Social Anxiety Disorder and Agoraphobia within the repeated seasonal MDE group, high incidence of classic diurnal variation of mood (with evening improvement), as well as a high rate of oversensitivity to light, noise, or smell. Nearly twice as many of these individuals as in the other MDE groups manifested the syndrome of atypical depression (DSM-V), which supports the prior description of seasonal affective disorder (SAD) as presenting primarily atypical symptoms (which include hypersomnia and increase in appetite and weight). This long-term database of regular structured interviews provides important confirmation of SAD as a valid diagnosis, predominantly found in women, and with atypical vegetative symptoms.

Keywords Seasonality · Affective disorders · Comorbid disorders · Zürich longitudinal cohort study

Introduction

Humans retain neurobiological responses to seasonal changes in the duration of daylight over the year in spite of a life-style usually independent of the external day–night signal [1]. Seasonality has been documented in many functions, from mood and cognitive function to sleep, hormones, brain neurotransmitters and gene expression [2]. The seasonality of affective illness has long been part of medical lore. However, it was the description of Seasonal Affective Disorder (SAD) in 1984 that triggered renewed interest in human seasonality [3]. Research into the effects of photoperiod on mammalian hibernation and reproduction provided the conceptual basis for using timed bright light to treat SAD [3].

SAD is defined as major depressive disorder with seasonal recurrence in autumn and winter and spontaneous remission in spring and summer (DSM-III-R) [4], its subsyndromal variant as minor depressive disorder or "winter blues". In spite of more than 30 years of research in SAD, the validity of the construct has recently been questioned [5], but soundly rebuffed [6, 7].

The epidemiology of SAD has been intensively studied in many different populations from Greenland [8] to Australia [9]. In an overview [10], prevalence estimates of SAD ranged from 1.4 to 9.7% in Northern America, 1.3 to 3.0% in Europe and 0 to 0.9% in Asia. Although there is the predicted latitude cline, prevalence does not show a linear increase above ca. 40°N. Additionally, SAD is rare in native populations of the far north, e.g. Lapps in Finland [11] and Icelanders in Canada [12], suggesting genetic and/

✉ Jules Angst
jules.angst@uzh.ch

1 Centre for Chronobiology, Psychiatric Clinics, University of Basel, Basel, Switzerland

2 Department of Psychiatry, Psychotherapy and Psychosomatics, Psychiatric Hospital, University of Zurich, Zurich, Switzerland

3 Department of Psychiatry and Psychotherapy, Charité University Medicine Berlin, Berlin, Germany

4 Department of Child and Adolescent Psychiatry, University of Zurich, Zurich, Switzerland

5 Clinical Psychology and Epidemiology, Institute of Psychology, University of Basel, Basel, Switzerland

6 Child and Adolescent Mental Health Centre, Capital Region Psychiatry, Copenhagen, Denmark

7 Department of Child and Adolescent Psychiatry, University of Southern Denmark, Odense, Denmark

or behavioural adaptations. The Tschuktschi in Siberia have 0% SAD compared with 11.7% found in non-natives in the same area [13]. Of interest, the Old Order Amish in Pennsylvania live a rural life without electric light and thus follow the natural day–night cycle and photoperiod. Their SAD prevalence is lower than that observed in a nearby population in Maryland: 0.84% compared with 4.3% SAD; the difference between sub-syndromal SAD prevalence is even greater—1.75 vs. 13.5% [14, 15], supporting the relevance of exposure to a natural pattern of outdoor light.

Three studies have been carried out in Switzerland (~47°N). A representative sample from all three language areas of Switzerland ($n=980$) was given a structured telephone interview using the Seasonal Pattern Assessment Questionnaire (SPAQ) [15]. 2.2% of the population presented with symptom severity of winter SAD, 8.9% with sub-syndromal SAD [16]. A community study using SPAQ in young adults yielded a weighted prevalence of 2.22% when combined with DSM-IV diagnostic criteria [17]. In the Zürich cohort study [18], seasonal patterns of several psychiatric and psychosomatic syndromes were investigated in two interviews over a period of 3 years. At the age of 27/28 years, 10.4% of the sample ($n=417$) suffered from seasonal and sub-syndromal depression over two consecutive years [18].

Here, we extend the previous information from the 1986/88 interviews in the Zürich cohort study [18] to analyse the combined data from all five interviews during 1986–2008 covering ages 27/28–49/50.

Methods

Study design

The initial Zurich Study sample (1978) consisted of 4547 subjects (men aged 19 years and women aged 20 years), representative of the canton of Zurich, where about one-fifth of the Swiss population lives. They were screened with the Symptom Checklist (SCL) 90-R [19]. A stratified sample (591 subjects) was selected for interview: 66% consisted of subjects who scored above the 85th percentile on the SCL-90 Global Severity Index (high-risk group) and 33% comprised a random sample of those scoring below the 85th percentile (low-risk group). Professional interviews in the subjects' homes were carried out in 1979, 1981, 1986, 1988, 1993, 1999 and 2008 from ages 20/21 to 49/50 (for methods see [18]). The semi-structured personal interview (SPIKE) covers 25 psychiatric and somatic syndromes including items on frequency and duration of symptoms experienced during the last year. For the definition of major depression (MDD), DSM-III criteria were applied. Questions about seasonality of each particular syndrome were introduced in 1986. This analysis combines data from the five interviews between 1986 and 2008.

Procedure

In the Zürich SPIKE interview, the introductory question about depression was: during the last 12 months, did you ever feel devoid of energy, depressed, sad, tired of living, or did you suffer from a loss of efficiency, feelings of inferiority, a complete lack of interests, or did you just "have the blues"? In the subsequent sections, a large number (30 or more) of depressive symptoms and the duration and frequency of episodes over the last 12 months were evaluated together with their consequences (distress, work impairment, etc.). Seasonality was assessed by the question related to the previous 12 months: do you tend to be particularly affected during a certain season or seasons, but not affected during some others? If yes, check Spring/Summer/Autumn/Winter (multiple answers possible). For the subsequent interviews, seasonality was assessed again in the same way. The seasonality question was only addressed to those with depressive syndromes and not to those with other diagnoses.

This single question yields a global estimate; it is not the same as the multi-item questionnaire that has been developed for and used in studies of seasonal depression, the Seasonal Pattern Assessment Questionnaire (SPAQ) [15]. In the SPAQ, seasonal variations in mood, energy, social contact, sleep, appetite and weight are codified and added together to give a 'global seasonality score' (GSS); this score, together with a rating on the extent of seasonal problems, provide criteria which have been developed as a cut-off for (probable) SAD or sub-syndromal SAD [15].

In our study, vulnerability to depression during any of the four seasons was first ascertained from the seasonality question. All depressive/bipolar episodes were included in the assessment of seasonality for depression. Seasonality of mania was not assessed. Then, case definition of seasonality required the presence of depressive symptoms in autumn and/or winter over the preceding 12 months in one or two of the five interviews that were carried out (1986, 1988, 1993, 1999, 2008). We decided to use all positives in autumn, winter and autumn/winter combined as a definition of winter seasonality. Recurrent autumn/winter depression required its presence in at least two interviews. This more stringent criterion approaches the DSM criterion for SAD of "at least two consecutive winter depressive episodes". Non-recurrent autumn/winter depression required its presence in one interview. In addition to the assessment of seasonality, family history and further clinical characteristics were assessed (including atypical symptoms, alcohol, drug and sedative abuse, phobias and anxiety).

Table 1 Distribution of seasonality of depressive episodes across five interviews (1986–2008, $N=499$)

Number of seasonal episodes	*N* persons			
	Spring	Summer	Autumn	Winter
*0	464	485	415	356
1	29	14	67	102
2	6		15	29
3			2	10
4				2
5				

No subject reported seasonality in all five interviews;
*0 = no seasonality but interviewed in that season

Subgroups

The interviews permitted attributing the prevalence of winter seasonality to the diagnosis of different disorders as described in Table 2. We then combined the groups into the following categories (see Box):

Box: Diagnostic subgroups

MDE = major depressive disorder, unipolar or bipolar, including double MDE with dysthymia;
Dysth = dysthymia - major depressive syndrome (5/9 symptoms) without considering duration or consequences
MinDD = minor depression
RBDR = recurrent brief depression without hypomania
All others = no diagnosis of depression

Data analyses

Non-parametric tests (χ^2 and Kruskal–Wallis tests) were used. The calculation of prevalence rates required weighting for stratified sampling.

Results

The total number of probands who remained in the study in the last five of seven interviews (1986, 1988, 1993, 1999, 2008) was 499. The sum of seasonals across five interviews is shown in Table 1. The number of subjects who had 2–4 autumn/winter episodes was 64 (12.8%).

Table 2 summarises the distribution among the depressive syndromes of individuals with at least two winter episodes during the five interviews in 1986–2008. A weighted prevalence of 3.02% in MDD and 1.89% in BP was calculated, with 1.66% in the minor BP diagnostic category. In total 7.52% suffered from seasonality in major and minor depressive mood states.

Differentiating unipolar and bipolar major depression revealed no difference in the occurrence of repeated winter episodes [29/131 (22.1%) vs. 19/66 (28.8%) $p=0.5$, n.s.], even though unipolar prevalence was greater than that of bipolar depression. All depressive syndromes had high winter seasonality compared with all others (Table 3). When all individuals with MDE or double MDE with dysthymia ($N=169$) were compared, there was no difference in the occurrence of single (48) vs. repeated (49) winter episodes (data not shown).

Finally, weighted prevalence rates of seasonality in males and females for major depressive episode from age 27/28 to 49/50 (Zürich cohort $N=499$) were calculated for those with ≥ 2 episodes in autumn &/or winter (MDE wi rep), those with a single autumn and/or winter episode (MDE wi one), and compared with episodes at other times of year and non-seasonal (MDE other) (Table 4). There was a strong gender difference in seasonality with females showing a higher prevalence rate, and a relatively high prevalence of seasonality across all subtypes. When single and multiple autumn and/or winter episodes were combined, the prevalence attained 13.4%.

Family history and clinical characteristics are summarised in Table 5. The different groups of MDE with and without seasonality did not differ in family history. However, there were significant clinical differences between the

Table 2 Repeated autumn/winter seasonality of depressive syndromes in diagnostic subgroups of depression (1986–2008)

	MDD	BPany	MinBPm	MinDD	All others	Total
N total	130	84	55	93	137	474
Winter seasonality n (%)	34 (26)	20 (24)	15 (27)	10 (11)	5 (4)	84
Prevalence %	3.02	1.89	1.66	0.95	0.71	8.23

All depressive/bipolar episodes were included in the assessment of seasonality for depression. Seasonality of mania was not assessed

MDD major depressive disorder; *BPany* BP-I, BP-II, manic syndrome according to DSM-IV; *MinBPm* minor depression, dysthymia or recurrent brief depression + hypomania, or hypomania alone; *MinDD* minor depression, dysthymia or recurrent brief depression without hypomania; *All others* no diagnosis of depression)

Table 3 Any autumn/winter depression by subtype of depression

	MDE	Double MDE	Dysth + MinDD	RBDR	All others
N (*N* total = 499)	137	32	32	68	230
N (%) with autumn/winter depression	77 (56.2)	15 (46.9)	16 (50.0)	31 (45.6)	51 (22.2)

MDE major depressive disorder, unipolar or bipolar; *double MDE* MDE with dysthymia; *Dysth* dysthymia—major depressive syndrome (5/9 symptoms) without considering duration or consequences; *MinDD* minor depression; *RBDR* recurrent brief depression without hypomania; *All others* no diagnosis of depression

Table 4 Seasonality in major depressive episode (MDE, UP + BP) with repeated and single winter depression vs. other MDE by gender

Prevalence % (*N*)	MDE wi rep	MDE wi one	MDE other	All others
M	1.12 (12)	5.43 (17)	14.90 (36)	78.45 (182)
F	5.75 (31)	14.46 (32)	12.43 (41)	67.36 (148)
Total	3.44 (43)	9.96 (49)	13.66 (77)	72.94 (330)

Unweighted frequencies: χ^2 $p < 0.0008$

wi rep repeated winter depressive episode, *wi one* single winter depressive episode

various groups. The group with ≥ 2 autumn and/or winter episodes significantly differed from the others with respect to higher rates of agoraphobia and social anxiety disorder, diurnal variation of mood (morning worse), oversensitivity to external stimuli, and atypical depressive symptoms. The latter, which includes hypersomnia and increased appetite and weight, is characteristic of SAD and occurred almost twice as often in the group with ≥ 2 episodes in autumn and/or winter, as in those with a single autumn and/or winter episode.

Discussion

This is the first documentation of the prevalence of autumn/winter seasonality in depression in a longitudinal cohort characterised by comprehensive diagnostic interviews conducted at intervals over more than 20 years. The question as to whether winter depression exists [5] can thus be answered under stringent definitions of both the diagnosis of major depressive disorder and the recurrence of at least two autumn/winter episodes, finding a weighted prevalence similar in unipolar and bipolar major depression (3.02 and 1.89%). When combining these as MDE with repeated winter episodes, a prevalence of 3.44% was found, whereas MDE with a single winter episode was much higher (9.96%). In total, 7.52% of the population suffered from seasonality in major and minor depressive mood states, showing that individuals with depressive syndromes are vulnerable to winter seasonality.

Gender differences were striking: five times as many women as men with ≥ 2 autumn and/or winter episodes, and nearly three times as many women as men with one winter episode. This is the highest reported gender asymmetry in the SAD literature, and quite different from a recent Austrian telephone survey where no gender differences were found [20]. In that study, a 3.5% SAD prevalence using the SPAQ criteria in 910 randomly selected subjects was documented, very similar to our 3.44% prevalence of MDE wi rep, with both countries being at similar latitudes. An earlier representative Swiss study of adults aged 20–89 years had found a 2.2% SPAQ-defined prevalence of SAD with no difference between the three Swiss languages and hence cultural regions, but twice as many women as men [16]. A Swiss community study in young adults yielded a SPAQ-defined weighted prevalence of 7.84% (which was reduced to 2.22% when combined with DSM-IV diagnostic criteria), with a 1.6 times higher rate in women than men [17]. The absence of a female–male difference in the non-seasonal group is interesting. Could previous reports of a higher female-to-male ratio in patients with depression derive from an undetected subgroup of patients with seasonality, given that the seasonality question has rarely been included in diagnostic interviews?

In our study, the detailed information on clinical characteristics revealed a very high incidence of diurnal variation of mood with evening improvement in both winter MDE groups compared with other MDE, that has not been documented in studies of SAD (though circadian rhythms of mood have been) [21]. This classic pattern of mood variation is characteristic rather of melancholic depression than the atypical depression of SAD. Yet strengthening the previous descriptions of SAD as presenting mostly atypical symptoms (which include hypersomnia and increase in appetite and weight) is the high concordance with the syndrome of atypical depression (DSM-V) found in MDE with repeated winter episodes, nearly double that found in the other MDE groups.

The individuals with two or more autumn/winter episodes seem to be a more pure sample of seasonal depression than the individuals with one episode, and more closely resemble previous descriptions of SAD, with the higher female-to-male ratio, and a higher prevalence of atypical symptoms.

Table 5 Family history and clinical characteristics

Group	1	2	3	5	1 vs. 3 $p <$	1 vs. 2 $p <$
Diagnosis	MDE wi rep	MDE wi one	MDE other	All others		
N	43	49	77	302		
Family history	%	%	%	%		
Depression	69.77	75.51	59.74	45.70	0.17	0.64
Mania	13.95	10.20	4.11	7.09	0.17	0.39
Anxiety/panic disorders	44.19	38.78	31.17	27.81	0.35	0.60
Phobias	44.19	36.73	32.00	26.86	0.42	0.47
Clinical characteristics						
Alcohol abuse	39.53	36.73	37.66	24.83	0.97	0.79
Drug abuse	25.58	18.37	12.99	8.61	0.22	0.41
Sedative abuse	16.28	8.16	16.88	6.62	0.36	0.24
Specific Phobia	46.51	36.73	27.27	21.19	0.10	0.35
Agoraphobia	**27.91**	4.08	7.79	4.97	**0.0007**	**0.002**
Social anxiety disorder	**39.53**	14.29	18.18	15.56	**0.008**	**0.006**
Any phobia	60.47	46.94	41.56	31.46	0.14	0.20
Suicide attempts	39.53	24.49	28.57	6.96	0.27	0.13
Atypical depr.[a]	**81.40**	48.98	49.35	–	**0.002**	**0.0002**
Melancholic depr.[a]	95.35	89.80	85.71	–	0.11	0.26
Morning worse	**65.12**	59.18	41.56	37.16	**0.03**	0.56
Oversensitivity[b]	**69.77**	48.98	48.65		**0.06**	**0.05**
Full remission[c]	18.60	32.65	29.87		0.28	0.13
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Distress (0–100)	79.6 (18.1)	79.9 (15.6)	75.6 (19.3)	41.4 (35.6)	0.47	0.94
Work impairment (0–100)	55.0 (26.9)	48.3 (28.8)	51.7 (27.3)	29.9 (25.6)	0.55	0.28

[a]DSM-5 criteria

[b]Oversensitivity to noise, light or smell

[c]Symptom free over the last 3 years

The latter group appears to be somewhat more heterogeneous, perhaps diluted with false positives.

The high rate of oversensitivity to external stimuli (light, noise, or smell) in the repeated MDE group is of interest, since it reflects an earlier finding that patients with SAD are more sensitive to odour detection than healthy subjects [22]. Novel also is the high comorbidity of Social Anxiety Disorder and Agoraphobia within the MDE group showing ≥ 2 autumn and/or winter episodes (i.e. the probable SAD)—nearly three and six times, respectively, more than the MDE with only one winter depression and four and two times more than non-seasonal MDE. Supporting this association is the known overlap of atypical symptoms in major depression with personality style, especially social anxiety [23].

A brief survey of the literature indicates how many countries in arctic latitudes are interested in SAD as a relevant diagnosis that needs treatment. In Greenland at 72°N, a mail survey of randomly selected subjects found that approximately 9% of 1707 respondents met the SPAQ criteria for SAD, with the incidence of SAD being particularly high in northern municipalities [8]. In an Inuit community at 71°N (88 people from randomly selected households) 6.3% had SAD [24]. In Alaska (64°N), 9.2% of 283 residents met diagnostic criteria for SAD, with a ratio of 3:2 women:men [25]. In contrast, Icelanders at 66°N show much lower rates of 3.8% SAD according to SPAQ [26], whereas even lower prevalence of 1.3%was found among Icelanders in Canada (50°N) [12]. In Umea, Sweden (63°N) 2.2% SAD was found with the SPAQ questionnaire (2620 adults) with women having 1.8 times higher prevalence than men [27]. A SPAQ survey across Japan ($N = 951$) revealed higher seasonality in the northernmost cities [28]. Similarly in the US, there was a latitudinal cline in SPAQ-defined SAD: 9.7% in Nashua, NH (43°N), 4.7% in New York, NY (41°), 6.3% in Montgomery County, MD (39°N), and 1.4% in Sarasota, FL (27°N) [29]. In a Netherlands (52°N) community study, 3% of 2817

responders met the SPAQ-criteria for SAD [30]. However, overall, the influence of latitude on prevalence is small and not linear [31].

In a SPAQ survey of patients attending an UK general practice, a prevalence of 10.7% in 809 subjects was found, that was reduced to 5.6% when DSM-IV criteria were added [32]. 27% of 183 patients in Aberdeen, Scotland (57°N), with a diagnosis of bipolar disorder fulfilled SPAQ criteria for SAD [33]. Both studies suggest higher rates in patient populations than in a representative sample. In a nationwide survey in outpatient clinics in Japan, however, SAD was reported to occur only in 1–3% of those with depression [34].

Diagnostic interview protocols have shown community prevalence rates of SAD of 1% in the USA [35], 3.5% in Scotland [36], and 2.4% in North Wales [37]. Telephone interviews in Toronto, Canada (43°N), yielded a 2.9% prevalence of SAD defined by DSM-III-R in 781 respondents [38].

To show the cross-cultural similarities, one can compare SPAQ surveys at similar latitudes: 4.3% SAD of 416 randomly selected households in Maryland, USA (39°N) [15] vs. 4.86% SAD in a cross-national survey in Turkey ($N=1749$, community-based samples) (37–41°N) [39]. In a Korean community sample (37°N, $N=552$), 1.9% of the sample were winter SAD [40]. The lowest rate according to SPAQ has been found in a random community sample in Melbourne (38°S) of 0.7% in 297 responders [9].

A limitation of our study is that the time intervals between interviews ranged from 2 to 9 years. There is no information from the last period 1999–2007, when theoretically subjects could have experienced a non-seasonal episode of depression. Even though the diagnosis of SAD implicitly predicts prospective recurrence, only 12.8% had 2–4 autumn/winter episodes during the 20-year interview period. This suggests that many factors modify the seasonal pattern. If we look at the interview by interview prevalence of those with ≥ 2 episodes in autumn &/or winter, this has some variability (1986: 14.8%; 1988: 7.0%; 1993: 7.2%; 1999: 12.7%; 2008: 6.3%).

In our previous long-term (2.5–8.25 years) follow-up with weekly depression self-ratings in 26 SAD patients [41], 31% remained stable with respect to repeated winter depression, 27% had remitted. In a second catamnestic study of 39 SAD patients, 26% continued to fulfill the criteria for SAD in a diagnostic interview 3–5 years after the initial diagnosis, 44% manifested sub-syndromal SAD (two patients also had recurrent brief depression, seasonal type), and 21% had recovered [42]. Thus, over a number of years, the clinical diagnosis changed for the better in many patients, suggesting that SAD is not a prodromal form of a more chronic major affective disorder, and that light therapy (and perhaps also light-oriented behaviour) reduced the incidence and depth of subsequent depressive episodes. Further evidence for this positive effect was the large reduction in use of conventional antidepressant drugs (from 17 to 1) during the follow-up period [42]. A Japanese follow-up study over 10 years found that 22% of 41 SAD patients consistently showed a winter pattern of recurrent depressive episodes [43]. The most recent study [44] interviewed 119 SAD patients 2–12 years after initial diagnosis and found 27% still fulfilled the DSM-IV criteria for SAD, with 59% in remission. The above data suggest that about a quarter of SAD patients retain their autumn/winter pattern and many improve with time. These changes are sometimes interpreted as questioning the reliability of SAD yet may be related to continuing treatment with light or more time spent outdoors (as well as other therapies). However, our long-term database of regular structured interviews provides important confirmation of the validity of SAD as a diagnosis with atypical vegetative symptoms, a predominance of women, diurnal variation of mood, and comorbidity.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest with the present study.

Ethical approval The study was approved (1978) by the Ethical Committee of the Zurich University Psychiatric Hospital and has, therefore, been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Informed consent All persons gave their informed consent prior to their inclusion in the study.

References

1. Wehr TA (2001) Photoperiodism in humans and other primates: evidence and implications. J Biol Rhythms 16:348–364
2. Wirz-Justice A (2018) Seasonality in affective disorders. Gen Comp Endocrinol 258:244–249
3. 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
4. Diagnostic and Statistical Manual of Mental Disorders Revised (DSM-III-R) (1987) American Psychiatric Association, Washington, DC
5. Traffanstedt MK, Mehta S, LoBello SG (2016) Major depression with seasonal variation. Is it a valid construct? Clin Psychol Sci 5:825–834
6. Young MA (2016) Does seasonal affective disorder exist? A commentary on Traffanstedt, Mehta, and LoBello. Clin Psychol Sci 5:750–754

7. Winkler D, Pjrek E, Spies M, Willeit M, Dorffner G, Lanzenberger R, Kasper S (2017) Has the existence of seasonal affective disorder been disproven? J Affect Disord 208:54–55
8. Kegel M, Dam H, Ali F, Bjerregaard P (2009) The prevalence of seasonal affective disorder (SAD) in Greenland is related to latitude. Nord J Psychiatry 63:331–335
9. Murray G (2004) How common is seasonal affective disorder in temperate Australia? A comparison of BDI and SPAQ estimates. J Affect Disorder 81:23–28
10. Magnusson A (2000) An overview of epidemiological studies on seasonal affective disorder. Acta Psychiatr Scand 101:176–184
11. Saarijärvi S, Lauerma H, Helenius H, Saarilehto S (1999) Seasonal affective disorders among rural Finns and Lapps. Act Psychiatr Scand 99:95–101
12. Magnússon A, Axelsson J (1993) The prevalence of seasonal affective disorder is low among descendants of Icelandic emigrants in Canada. Arch Gen Psychiatry 50:947–951
13. Booker JM, Hellekson CJ, Putilov AA, Danilenko KV (1990) Seasonal depression and sleep disturbances in Alaska and Siberia: a pilot study. Arct Med Res 50(Suppl. 5):281–284
14. Raheja UK, Stephens SH, Mitchell BD, Rohan KJ, Vaswani D, Balis TG, Nijjar GV, Sleemi A, Pollin TI, Ryan K, Reeves GM, Weitzel N, Morrissey M, Yousufi H, Langenberg P, Shuldiner AR, Postolache TT (2013) Seasonality of mood and behavior in the Old Order Amish. J Affect Disord 147:112–117
15. Kasper S, Wehr TA, Bartko JJ, Gaist PA, Rosenthal NE (1989) Epidemiological findings of seasonal changes in mood and behavior. A telephone survey of Montgomery County, Maryland. Arch Gen Psychiatry 46:823–833
16. Wirz-Justice A, Graw P, Kräuchi K, Wacker HR (2003) Seasonality in affective disorders in Switzerland. Acta Psychiatr Scand Suppl 418:92–95
17. Steinhausen HC, Gundelfinger R, Winkler Metzke C (2009) Prevalence of self reported seasonal affective disorders and the validity of the seasonal pattern assessment questionnaire in young adults. Findings from a Swiss community study. J Affect Disord 115:347–354
18. Wicki W, Angst J, Merikangas KR (1992) The Zurich Study. XIV. Epidemiology of seasonal depression. Eur Arch Psychiatry Clin Neurosci 241:301–306
19. Derogatis LR (1977) SCL-90. Administration, Scoring and Procedures Manual-I for the R (revised) version and other instruments of the Psychopathology Rating Scale Series. Johns Hopkins University School of Medicine, Chicago
20. Pjrek E, Baldinger-Melich P, Spies M, Papageorgiou K, Kasper S, Winkler D (2016) Epidemiology and socioeconomic impact of seasonal affective disorder in Austria. Eur Psychiatry 32:28–33
21. Wirz-Justice A (2008) Diurnal variation of depressive symptoms. Dialogues Clin Neurosci 10:337–343
22. Postolache TT, Wehr TA, Doty RL, Sher L, Turner EH, Bartko JJ, Rosenthal NE (2002) Patients with seasonal affective disorder have lower odor detection thresholds than control subjects. Arch Gen Psychiatry 59:1119–1122
23. Parker GB (2007) Atypical depression: a valid subtype? J Clin Psychiatry 68(Suppl 3):18–22
24. Haggarty JM, Cernovsky Z, Husni M, Minor K, Kermeen P, Merskey H (2002) Seasonal affective disorder in an Arctic community. Acta Psychiatr Scand 105:378–384
25. Booker JM, Hellekson CJ (1992) Prevalence of seasonal affective disorder in Alaska. Am J Psychiatry 149:1176–1182
26. Magnússon A, Stefánsson JG. Prevalence of seasonal affective disorder in Iceland (1993) Arch Gen Psychiatry 50:941–946
27. Chotai J, Smedh K, Johansson C, Nilsson LG, Adolfsson R (2004) An epidemiological study on gender differences in self-reported seasonal changes in mood and behaviour in a general population of northern Sweden. Nord J Psychiatry 58:429–437
28. Okawa M, Shirakawa S, Uchiyama M, Oguri M, Kohsaka M, Mishima K, Sakamoto K, Inoue H, Kamei K, Takahashi K (1996) Seasonal variation of mood and behaviour in a healthy middle-aged population in Japan. Acta Psychiatr Scand 94:211–216
29. 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
30. Mersch PP, Middendorp HM, Bouhuys AL, Beersma DG, van den Hoofdakker RH (1999) The prevalence of seasonal affective disorder in The Netherlands: a prospective and retrospective study of seasonal mood variation in the general population. Biol Psychiatry 45:1013–1022
31. Mersch PP, Middendorp HM, Bouhuys AL, Beersma DG, van den Hoofdakker RH (1999) Seasonal affective disorder and latitude: a review of the literature. J Affect Disord 53:35–48
32. Thompson C, Thompson S, Smith R (2004) Prevalence of seasonal affective disorder in primary care; a comparison of the seasonal health questionnaire and the seasonal pattern assessment questionnaire. J Affect Disord 78:219–226
33. Shand AJ, Scott NW, Anderson SM, Eagles JM (2011) The seasonality of bipolar affective disorder: comparison with a primary care sample using the Seasonal Pattern Assessment Questionnaire. J Affect Disord 132:289–292
34. 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
35. Blazer DG, Kessler RC, Swartz MS (1998) Epidemiology of recurrent major and minor depression with a seasonal pattern. The National Comorbidity Survey. Br J Psychiatry 172:164–167
36. Eagles JM, Wileman SM, Cameron IM, Howie FL, Lawton K, Gray DA, Andrew JE, Naji SA (1999) Seasonal affective disorder among primary care attenders and a community sample in Aberdeen. Br J Psychiatry 175:472–475
37. Michalak EE, Wilkinson C, Dowrick C, Wilkinson G (2001) Seasonal affective disorder: prevalence, detection and current treatment in North Wales. Br J Psychiatry 179:31–34
38. Levitt AJ, Boyle MH, Joffe RT, Baumal Z (2000) Estimated prevalence of the seasonal subtype of major depression in a Canadian community sample. Can J Psychiatry 45:650–654
39. Elbi H, Noyan A, Korukoğlu S, Unal S, Bekaroğlu M, Oğuzhanoğlu N, Türköz N, Abay E, Kumbasar H, Yurdakul S (2002) Seasonal affective disorder in eight groups in Turkey: a cross-national perspective. J Affect Disord 70:77–84
40. Baek JH, Kim JS, Huh I, Lee K, Park JH, Park T, Ha K, Hong KS (2015) Prevalence, behavioral manifestations and associated individual and climatic factors of seasonality in the Korean general population. Compr Psychiatry 57:148–154
41. Leonhardt G, Wirz-Justice A, Kräuchi K, Graw P, Wunder D, Haug HJ (1994) Long-term follow-up of depression in seasonal affective disorder. Compr Psychiatry 35:457–464
42. Graw P, Gisin B, Wirz-Justice A (1997) Follow-up study of seasonal affective disorder in Switzerland. Psychopathol 30:208–214
43. Sakamoto K, Nakadaira S, Kamo K, Kamo T, Takahashi K (1995) A longitudinal follow-up study of seasonal affective disorder. Am J Psychiatry 152:862–868
44. Cléry-Melin ML, Gorwood P, Friedman S, Even C (2018) Stability of the diagnosis of seasonal affective disorder in a long-term perspective. J Affect Disord 227:353–357