Canadian Consensus Guidelines for the Treatment of Seasonal Affective Disorder

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Edited by
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On Behalf of the Canadian Consensus Group on SAD:
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Abbreviations Used

5-HT	5 hydroxytryptamine (serotonin)
ACTH	adrenocorticotropic hormone
BDI	Beck Depression Inventory
BDI-II	Beck Depression Inventory, version II
CBT	cognitive behavioural therapy
CES-D	Centres for Epidemiological Studies – Depression
CIDI	Composite International Diagnostic Interview
CRH	corticotropin-releasing hormone
DSM-III-R	Diagnostic and Statistical Manual for Mental Disorders, 3rd edition, revised
DSM-IV	Diagnostic and Statistical Manual for Mental Disorders, 4th edition
EOG	electrooculography
GSS	Global Seasonality Score
HAM-D	Hamilton Depression Rating Scale
HDRS	Hamilton Depression Rating Scale
HMU	head mounted unit
HPA	hypothalamic-pituitary-adrenal
ICD-10	International Classification of Diseases, 10th edition
IOP	intraocular pressure
IPT	interpersonal psychotherapy
ISV	Inventory of Seasonal Variation
LED	light emitting diode
m-CPP	m-chlorophenylpiperazine
MDD	major depressive disorder
MDE	major depressive episode
MeSH	Medical Subject Headings
NIH	National Institutes of Health
NIMH	National Institute of Mental Health
PMDD	premenstrual dysphoric disorder

RCT	randomized controlled trial
RDC	Research Diagnostic Criteria
RMR	resting metabolic rate
SAD	seasonal affective disorder
SCN	suprachiasmatic nucleus
SIGH-SAD	Structured Interview Guide for the Hamilton Depression Rating Scale, SAD version
SP	seasonal pattern
SPAQ	Seasonal Pattern Assessment Questionnaire
S-SAD	subsyndromal seasonal affective disorder
SSRI	selective serotonin reuptake inhibitor
T3	triiodothyronine
T4	thyroxine
TRH	thyroid releasing hormone
TSH	thyroid stimulating hormone

Preface

Dan A. Oren, MD
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The Book of Ecclesiastes records that "there is nothing new under the sun" (1:9). The story of winter depression (seasonal affective disorder) is eloquent testimony to this ancient dictum. The struggle to treat the sometimes disabling symptoms of this disorder occupies the minds of some of today's best psychiatrists and psychologists, much as it caught the attention of physicians as ancient as Hippocrates almost two and a half millennia ago. A record of Greco-Roman physicians treating depression and lethargy with sunlight dates back to the second century (Adams, 1856; Aurelianus, 1950). Post-Enlightenment descriptions of seasonal depression appeared in the medical literature sporadically during the past two centuries (Oren and Rosenthal, 1992; Wehr, 1989b). But such reports failed to stimulate a coherent line of scientific investigation of the clinical phenomena or the novel treatment.

Beginning in the late 1970s, however, a number of investigators developed an insight that disorders of the biological clock and the processing of light thought important to regulate that clock might play etiological or at least pathophysiological roles in some psychiatric illnesses. In 1981, Daniel F. Kripke published the first modern paper demonstrating that some patients with depression had clinical responses to bright-light treatment. What had probably played the catalytic role in bringing an obscure field of science to the pages of *Science,* however, was a groundbreaking paper in 1980 by Alfred J. Lewy and his colleagues at the National Institute of Mental Health (NIMH) in Bethesda, Maryland, USA. Demonstrating that bright light has the capacity to suppress melatonin production in humans, these researchers crossed a paradigmatic barrier and established that humans, like virtually every other animal ever studied, possess a functional "switch" that is acutely sensitive to bright light. In short order, Herbert A. Kern became aware of this work and approached the NIMH researchers with his own record of

recurrent winter depressions and the hope that their work with light might successfully treat his depression. The results were dramatic (Lewy et al., 1982). NIMH researcher Norman E. Rosenthal and colleagues' landmark papers demonstrating that winter depression or "seasonal affective disorder" can be considered a distinct subtype of major depression and that light therapy is an effective treatment for the disorder quickly attracted the attention of the media, patients, and researchers across the globe (Rosenthal et al., 1984a; 1985).

In the subsequent decade and a half, the number of papers about the subject has steadily increased. As a crude measure of this growth, a survey by this author of Medline-cited papers on the topics of "seasons" or "seasonal affective disorder" and "depression" shows that nine were published in 1985 whereas 45 were published in 1997! It would be conservative to state that by 1998 more than 1,000 patients worldwide had participated in controlled clinical trials of light or antidepressant medication therapy for the disorder. The great interest in the field led to the formation of the Society for Light Treatment and Biological Rhythms, an international academic and clinical society devoted partly to the understanding and treatment of winter depression.

We are now at an exciting threshold in the study of the phenomenon. Controversies that have beset the field have achieved some resolution or at least been addressed to allow new formulations of investigative directions. Perhaps the primary controversy has been whether light therapy is an effective treatment or just a placebo treatment for the disorder. Landmark papers just published by Michael Terman et al. (1998), Alfred J. Lewy et al. (1998b), and Charmane I. Eastman et al. (1998) take major steps toward putting this critical question to rest. Although the question still remains whether winter depression is a disorder whose etiology and treatment rest in the domain of delayed biological rhythms that are advanced by light or other interventions, much of the literature supports the basic elements of the circadian "phase-shift" hypothesis (Lewy et al., 1987a).

The molecular basis of the syndrome remains a mystery. While the work of Raymond W. Lam et al. (1996b) and others clearly demonstrates that serotonin regulation plays a role in the syndrome, other neurotransmitters may also play critical roles. The failure by basic and clinical researchers to establish which photoreceptors or photoreceptor molecules mediate light's effects in the syndrome led this author to propose that humoral factors may act as photoreceptors and transduce the antidepressant and rhythm-shifting effects of light (Oren et al., 1996; Oren,

1997). Although such a theoretical model remains to be proved or disproved, publication of the work of Scott S. Campbell and Patricia J. Murphy (1998), demonstrating that light applied to the popliteal skin (behind the knees) has the capacity to reset circadian rhythms in humans, is consistent with this construct.

Similar to the pace in so many areas of medicine, what we have learned in the past 15 years about this disorder surely equals or exceeds what was learned in the 1,500 years before. In this context, these consensus guidelines assembled by Raymond W. Lam and Anthony J. Levitt and their Canadian colleagues mark a culmination and summation of an era. The documents that follow are based on careful assessment of the strengths and weaknesses of virtually every known study ever conducted for the treatment of winter depression. By summarizing a world literature demonstrating the efficacy of light therapy, and now a pharmacotherapy for winter depression, these guidelines will surely reach landmark status in their own right. Having had the privilege to attend the authors' first consensus-gathering meeting on the subject, I can bear witness to their thorough review and their tough-minded insistence on valuing sound scientific data, while being appropriately cautious about rubber-stamping clinical impressions gathered without controlled trials. These consensus guidelines will surely be of value to Canadian health care providers and to clinicians the world over, for there is simply nothing to match this accomplishment.

I expect that in another 15 years Lam and Levitt will wish to reconvene their panel to integrate the results of studies still to come. If scientific interest remains at its current level, by then we will know not just what time of day is best to treat winter depression with light but also why. We will know not just the value of antidepressants for the disorder but also the specific neurotransmitters that are regulated to have the antidepressant effect. More exotic treatments currently under study will also emerge as either dramatic successes or disappointing failures. In the interim, any clinician interested in offering a patient with winter depression the best that medical science has to offer will surely be well advised to turn to these guidelines.

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INTRODUCTION

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In 1994, we organized a Canadian Consensus Group on seasonal affective disorder (SAD) to attend a workshop that was funded by grants from the Medical Research Council of Canada and Health and Welfare Canada. Clinicians-researchers from the major academic centres in Canada were invited to the Clarke Institute of Psychiatry in Toronto to present their work, develop consensus on the diagnosis and treatment of SAD, and discuss directions for future research. Although a major review of the literature arose from this workshop (Tam et al., 1995), the consensus then was that there were too few controlled studies to formulate treatment guidelines for SAD.

By 1998, the situation had changed. Several randomized, large-sample, placebo-controlled studies of light therapy and antidepressant therapy have since been published, and there has been new research on the diagnosis, epidemiology, and pathophysiology of SAD. Much of this research has been conducted in Canada, where SAD carries a significant burden for the health care system. We decided that it was timely to reconvene the Canadian Consensus Group on SAD to develop expert consensus guidelines for the treatment of SAD. Dr. Dan Oren of Yale University was invited to participate as an external consultant.

The purpose of the consensus guidelines project was to systematically review all available evidence regarding the diagnosis, clinical features, epidemiology, pathophysiology, and treatment of SAD and to produce a series of recommendations that were clinically and scientifically meaningful. The target audience for the guidelines included family physicians, psychiatrists, psychologists, nurses, and other health professionals who treat depression and SAD.

A rigorous method to reach consensus was adopted. A Medline search (updated as of June 1, 1999) was conducted for all indexed articles using MeSH and text word searches for papers relating to SAD, seasonal

depression, and light therapy. Additionally, consensus panel members reviewed the bibliography for omissions, and researchers in the Society for Light Treatment and Biological Rhythms were canvassed for studies completed or in press. Eventually, over 650 articles were reviewed.

Two consensus panel members were assigned to independently review each topic using level of evidence criteria (Steering Committee, 1998) and to summarize their findings in evidence tables. These levels of evidence are defined as follows:

Level 1 = randomized, controlled trials (RCTs) with sufficient numbers or good-quality meta-analyses based on RCTs

Level 2 = RCTs with smaller numbers (therefore insufficient power or limited generalizability of results)

Level 3 = Non-randomized, controlled or cohort studies, case series, case-controlled studies or high-quality retrospective studies

Level 4 = evidence based on the published opinions of expert committees, such as consensus/guidelines committees

Level 5 = evidence that expresses the opinions of the committee members who have reviewed the literature and guidelines, following discussion with peers (note that, following the consensus process, level 5 evidence becomes level 4 evidence).

The reports from the reviewers were then presented during a consensus meeting held during a joint meeting of the Society for Light Treatment and Biological Rhythms and the Society for Research in Biological Rhythms, at Amelia Island, Florida, in June 1998. Consensus on controversial areas was obtained, and a draft guidelines document was completed. In September 1998, the draft guidelines were ratified and adopted at a consensus meeting held during the annual meeting of the Canadian Psychiatric Association in Halifax, Nova Scotia. The draft guidelines were then reviewed by Dr. Dan Oren, Dr. Michael Terman at Columbia University in New York, and Dr. Anna Wirz-Justice in Basel, Switzerland.

In summary, these guidelines were arrived at by consensus and have undergone both internal review by the 14 members of the Canadian Consensus Group and by international consultants. Recommendations are based on the scientific literature and on the clinical experience of the consensus panel. To make the guidelines more accessible to the practising clinician, we chose to present the findings in a question-and-answer format followed by conclusions or recommendations. The levels

of evidence on which the recommendations are based are listed after each recommendation, so that areas where data are limited are apparent. There are sections on diagnosis, epidemiology, pathophysiology, light treatment, medication treatment, and management issues. Finally, a resource list and a full bibliography are included in the appendices. Note that we have used the term "SAD" in this document to indicate winter depression, and "light therapy" is used as per consensus in the field, to distinguish light therapy for SAD from other types of phototherapy (e.g., for hyperbilirubinemia).

Dissemination of clinical guidelines is also an important issue. An executive summary of these guidelines was completed to provide a quick reference for the clinician. This summary was published as a supplement to the *Canadian Journal of Diagnosis* (Lam and Levitt, 1998) to ensure the widest distribution of this information to physicians across Canada. The summary is also available on the Internet (see Resources).

These guidelines would not have been possible without the hard work of many people. We want to thank all the members of the Canadian Consensus Group on SAD and our external consultants for their dedication to the tight deadlines that we imposed. Thanks, too, to Arvinder Grewal and Julie Thomson for their management and secretarial support. We also thank Pfizer Canada for providing an unrestricted educational grant in support of these guidelines and Steven Kost for his encouragement throughout the project.

We hope that the information presented in these guidelines will assist clinicians to better identify patients with SAD and to manage the disorder more effectively. We also hope that the guidelines will help physicians to answer some of the many questions that patients and family members ask about SAD.

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SECTION 1:
Diagnosis, Epidemiology, and Pathophysiology

Section Editor: *Anthony J. Levitt*
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Part 1: Diagnosis

How should a "seasonal pattern" of depression be defined?

(1) Diagnostic Criteria

The first published criteria for seasonal affective disorder (SAD) were proposed by a group from the National Institutes of Health led by Rosenthal (Rosenthal et al., 1984a). Since then three additional sets of criteria for seasonal depression have been published. Both DSM-III-R and DSM-IV have included a "seasonal pattern" (SP) course specifier for affective/mood disorders, and ICD-10 includes the category of seasonal depressive disorder. A comparison of these diagnostic criteria is presented in Table 1. The four sets of diagnostic criteria are similar in their reliance on regular seasonal recurrences of depression with interepisode improvement as opposed to any specified symptomatic features. All of the diagnostic systems except ICD-10 exclude depressions that are apparently related to seasonally varying psychosocial stressors. Significant differences between the criteria include the specific definitions of the required seasonal pattern, the range of affective pathologies to which the criteria can be applied, and the inclusion versus exclusion of comorbid Axis I psychopathology.

(2) Onset and Duration

There has been some controversy in the psychiatric literature about the most appropriate criteria for defining a "seasonal pattern" (SP) (e.g., Bauer, 1992; Bauer and Dunner, 1993a; Blehar and Lewy, 1990). Despite the controversy, there are surprisingly few published studies that have systematically assessed the validity of the different sets of diagnostic criteria. The DSM-III-R criteria for SP attempted to be more precise and stringent in defining the temporal characteristics of seasonality

Table1

Comparison of diagnostic criteria for SAD/seasonal pattern

Rosenthal criteria for winter depression	DSM-III-R criteria for seasonal pattern modifier	DSM-IV criteria for seasonal pattern specifier	ICD-1O criteria for seasonal depressive disorder
Recurrent fall/ winter depressions	Regular onset within a 60-day period	Regular temporal relationship with a particular time of year	Regular onset of episodes within specific 90-day period
No seasonally varying psychosocial stressor	Excludes seasonal psychosocial stressors	Excludes seasonal psychosocial stressors	
Regularly occurring non-depressed periods in spring and summer	Full remission or switch to (hypo)mania within 60-day period	Full remission or switch to (hypo)mania at characteristic time of year	Remission within particular 90-day period
At least two of the depressions occurred during consecutive years	At least three episodes, two in consecutive years; ratio of 3:1 seasonal:nonseasonal episodes	Seasonal major depressive episodes occurred, and non-seasonal MDEs* did not occur, for the past two years; lifetime seasonal MDEs outnumber non-seasonal MDEs	Three or more consecutive episodes; seasonal episodes substantially outnumber any nonseasonal episodes
At least one of the depressions has met RDC** for major depression	May apply to bipolar disorders, recurrent major depression, depressive disorder not other-wise specified	Applies to bipolar disorder (type I or II) or major depressive disorder, recurrent	Applies to ICD-10 major depression
No other axis I pathology	Other diagnoses do not exclude application of the modifier	Other diagnoses do not exclude application of the specifier	Other mental and behavioural disorders do not exclude the diagnosis

*MDEs = major depressive episodes.
**RDC = research diagnostic criteria.

(i.e., 60-day onset and offset windows, 3:1 ratio of seasonal to non-seasonal episodes). Two studies using very different methods concluded that the 60-day window is unnecessarily restrictive (Dittman et al., 1994; Leonhardt et al., 1994). A longitudinal study using weekly self-reports of depressive symptoms in 26 SAD patients over an interval of at least two and a half years observed that the mean variability of onset and offset was 12 and 10 weeks respectively. None of the eight patients in this study who had experienced consistent winter seasonal depressions would have been diagnosed as SAD if the DSM-III-R 60-day window had been strictly applied (Leonhardt et al., 1994). A retrospective analysis of diagnostic stringency in relation to therapeutic response was carried out in a sample of 66 (Rosenthal defined) SAD patients (Dittman et al., 1994). The authors observed that a substantial number of patients (16 of 66) did not meet DSM-III-R criteria, principally because of the 60-day window criterion. However, the patients who did meet the more stringent DSM-III-R criteria did not differ significantly from the DSM-III-R (negative) group in terms of demographics, family history, prior antidepressant medication use, or response to a trial of light therapy. The authors also noted that a sizeable proportion of their SAD subjects was unable to retrospectively provide details of past depressive phases precisely. Dittman et al. thus concluded that the 60-day window criterion was invalid and that the DSM-III-R criteria were "unrealistic and impracticable." Discussions of the validity of SAD diagnostic criteria led to the deletion of the 60-day window in the reformulated DSM-IV criteria (Bauer and Dunner, 1993a), whereas ICD-10 adopted a 90-day window for onset and offset of episodes.

(3) Remission

Another important difference between the Rosenthal SAD criteria and the other diagnostic criteria is the specification of "full remission" (or switch to hypomania or mania) in the DSM criteria versus "nondepressed periods" in the spring and summer in the Rosenthal criteria. Danilenko and Putilov (1996) conducted a comparison of two groups of patients with winter depression, characterized by complete (two months) or incomplete summer remissions (n = 66 and 32 respectively). Their incomplete remission group was characterized by an older age of onset, lower female predominance, fewer reverse vegetative symptoms, and less consistent seasonal episodes. The authors commented that patients with incomplete summer remissions were more heterogeneous and differed from the typical demographic and clinical profile of SAD. They

concluded that the DSM-IV criterion of "full remission" was valid but suggested that the minimum duration for "remission" could be reduced to two months.

The process of developing criteria for the diagnosis of SAD/SP has gone through a cycle of broad definition (Rosenthal) to more stringent definition (DSM-III-R, ICD-10) and back to a relatively broad definition (DSM-IV). For research purposes, when the identification of homogeneous study populations is critical, the application of a stringent/narrow definition of seasonality will often be appropriate. In routine clinical practice, however, the application of excessively stringent diagnostic criteria could result in failure to offer a helpful treatment (e.g., light therapy) to patients who may benefit from it. (It has been suggested that even subsyndromal forms of SAD may respond to light therapy [Kasper et al., 1988; Kasper et al., 1989a].) Blazer and colleagues (1998) demonstrated the effect of applying successive DSM-III-R diagnostic criteria to a community sample of patients with seasonal onset of major depression using data from the National Comorbidity Survey. The prevalence of major depression with seasonal onset was 3.1%, but only 0.3% of the sample fulfilled all of the DSM-III-R criteria for major depression with a seasonal pattern (see also Part 2, Epidemiology, Table 4). The less restrictive criteria in DSM-IV should be more appropriate for clinical populations (Table 2).

What are the usual symptoms of depression in SAD?

A specific symptom cluster consisting of so-called reverse vegetative symptoms of depression (hypersomnia, hyperphagia, and weight gain) has been associated with SAD. A large number of descriptive studies of SAD/SP have reported the prevalence of reverse vegetative features in winter depression. Rosenthal's original report on 29 SAD patients indicated a prevalence of increased appetite of 66%, carbohydrate craving in 79%, weight gain in 76%, and hypersomnia in 97% (Rosenthal et al., 1984a). A larger sample (n = 366) described by Rosenthal's group had similar proportions of reverse vegetative symptoms (increased appetite 67%, carbohydrate craving 71%, weight gain 75%, hypersomnia 79%) (Oren and Rosenthal, 1992). A large-sample Canadian study (n = 454) also found that reverse vegetative symptoms predominated in SAD (increased appetite 57%, carbohydrate craving 77%, weight gain 53%, hypersomnia 71%) (Lam, 1998). Several additional descriptive studies have reported a high frequency of reverse vegetative symptoms, although

Table 2

DSM-IV criteria for major depressive disorder with a seasonal pattern (equivalent to seasonal affective disorder)

Major depressive episode

A. Five (or more) of the following symptoms have been present during the same two-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure:
   (1) depressed mood most of the day, nearly every day;
   (2) markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day;
   (3) significant weight loss or weight gain, or decrease or increase in appetite nearly every day;
   (4) insomnia or hypersomnia nearly every day;
   (5) psychomotor agitation or retardation nearly every day;
   (6) feelings of worthlessness or excessive or inappropriate guilt nearly every day;
   (7) diminished ability to think or concentrate, or indecisiveness, nearly every day;
   (8) recurrent thoughts of death, recurrent suicidal ideation, or a suicide attempt.

B. The symptoms do not meet criteria for a mixed episode.

C. The symptoms cause clinically significant distress or impairment in psychosocial functioning.

D. The symptoms are not due to the direct physiological effects of a substance or a general medical condition.

E. The symptoms are not better accounted for by bereavement.

With seasonal pattern

(Can be applied to the pattern of major depressive episodes in bipolar I disorder, bipolar II disorder, or major depressive disorder, recurrent.)

A. There has been a regular temporal relationship between the onset of major depressive episodes and a particular time of the year.

B. Full remissions (or a change from depression to mania or hypomania) also occur at a characteristic time of the year.

C. In the last two years, two major depressive episodes have occurred that demonstrate the temporal seasonal relationships defined in criteria A and B, and no nonseasonal major depressive episodes have occurred during the same period.

D. Seasonal major depressive episodes (as described above) substantially outnumber the nonseasonal major depressive episodes that may have occurred over the individual's lifetime.

the proportions of patients have been more moderate in most of these reports (Krauchi et al., 1990; Lingjaerde and Reichborn-Kjennerud, 1993c; Takahashi et al., 1991; Thompson and Isaacs, 1988; Wirz-Justice et al., 1986). Two reports comparing winter depression with summer depression found higher frequencies of reverse vegetative symptoms in the winter SAD groups (Boyce and Parker, 1988; Wehr et al., 1991). Three studies comparing patients with winter depression and those with nonseasonal depression (Allen et al., 1993; Garvey et al., 1988; Thalen et al., 1995a) also found higher frequencies of reverse vegetative symptoms in the seasonal groups. A significant criticism of these studies has been that the majority of subjects for the studies were obtained by media recruitment or referrals. Because "typical" symptom patterns are commonly described for advertising purposes, the possibility exists that self-selected samples concurring with the publicized description are recruited (Bauer and Dunner, 1993a; Blehar and Lewy, 1990; Sakamoto et al., 1993a; Shapiro et al., 1994). One report based on nonrecruited patients found similarly elevated frequencies of reverse vegetative symptoms (Garvey et al., 1988), and a second such report found an unexpectedly low percentage of SAD patients with reverse symptoms (21-32%) except for hypersomnia (54%) (Sakamoto et al., 1993b). Furthermore, two studies that directly compared retrospectively reported vegetative symptoms with prospectively recorded data found more marked intensity and seasonal variability in reverse symptoms in the retrospective data (Nayyar and Cochrane, 1996; Shapiro et al., 1994). Other studies report classic melancholic symptoms (e.g., morning worsening of depressed mood) in some SAD patients (Graw et al., 1991).

Overall there is general support for a specific symptom cluster, including reverse symptoms and carbohydrate craving in SAD/SP, but it is difficult to be precise about these symptom patterns because of significant variability across samples and the possible role of patient self-selection. It has been debated whether clinical features of the SAD syndrome should be incorporated into the diagnostic criteria (Blehar and Lewy, 1990). While reverse vegetative symptoms may be common in SAD, these symptoms do not appear to be specific enough to warrant inclusion in diagnostic criteria.

Is the diagnosis of SAD stable over time?

If SAD is a valid diagnostic category for a lifelong disorder, then longitudinal follow-up of patients diagnosed with SAD should demonstrate stability of the diagnosis over time. Several medium-term and long-term

follow-up studies of SAD, using a variety of follow-up methods and variable definitions of patient outcomes, have been reported.

Sugishita and colleagues (1993) reported retrospectively collected follow-up data (one to four years) in 105 subjects diagnosed with SAD using the Rosenthal criteria. Seventy subjects continued to be called SAD, whereas the diagnosis for 27 subjects was "undecided" because of loss of seasonality or lack of information. The diagnosis of six subjects was "cancelled," and two patients died in the follow-up period.

Leonhardt and colleagues (1994) reported a prospective follow-up study (2.5 to 8.25 years) of a select group of 26 SAD/SP patients who were able to comply with long-term weekly depression self-ratings using the Von Zerssen scale. They found that nine patients continued to experience seasonal depression (allowing for a broad window of onset and offset dates), whereas seven subjects showed a remitted pattern. Four patients evolved into chronic depression, and six patients had diffuse (i.e., not clearly seasonal) patterns of depressive symptoms. Note that this study did not rely on the application of diagnostic criteria; rather, it categorized outcomes according to the pattern of self-reported depression symptoms.

A British study using a narrower definition of SAD, and strictly applying the DSM-III-R 60-day onset and offset windows, was reported by Thompson and colleagues (1995). The study included 93 SAD subjects who had been diagnosed five to eight years previously with seasonal depression. Thirty-five subjects continued to have seasonal depression, 28 subjects had episodes that did not meet DSM-III-R criteria for seasonality, and 17 subjects had no further episodes.

A Japanese study of 41 retrospectively identified seasonally depressed patients, according to the Rosenthal criteria, was reported by Sakamoto and colleagues (1995). During the follow-up period (8.0 ± 5.4 years), nine patients showed a consistent fall/winter SAD pattern, 17 lost seasonality, and two were rediagnosed with schizoaffective disorder. Eleven patients who initially had nonseasonal depression changed to a seasonal pattern, and two patients with other nonaffective diagnoses were rediagnosed with SAD.

A follow-up study of the first 59 patients of the NIMH Seasonal Studies Program was reported by Schwartz and colleagues (1996). After a mean interval of 8.8 years, 25 of the 59 patients remained purely seasonal, 26 patients had varying degrees of nonseasonal depression, and eight patients had fully remitted.

Finally, a follow-up study (two to five years) of 39 Swiss SAD patients was reported by Graw and colleagues (1997). Ten subjects had ongoing SAD, and 17 had subsyndromal SAD (decreased severity or duration of episodes). In eight cases, the patients had recovered, and the diagnoses of four patients had been changed.

Collectively, the studies reviewed show evidence of both substantial change and relative stability of the diagnosis of SAD over time. These findings are in keeping with studies of other subtypes of major depression. For example, Nierenberg et al. (1996) report that 24% of subjects who present with an atypical major depression will not have atypical symptoms in the subsequent episode. With regard to the stability of SAD, most studies have found that approximately one-third of patients diagnosed with SAD still met criteria for the diagnosis at the time of follow-up (pooled data 88/258 = 34%) (Graw et al., 1997; Leonhardt et al., 1994; Sakamoto et al., 1995; Schwartz et al., 1996; Thompson et al., 1995). The exception was the study of Sugishita and colleagues (1993) that found the highest frequency of persistent SAD (67%). This study had the shortest follow-up period and used only questionnaires for follow-up. Several of these reports also indicated that the majority of study patients continued to suffer from fall and winter depressive symptomatology to a greater degree than at other times of the year (e.g., subsyndromal SAD, seasonal recurrent brief depression) (Graw et al., 1997; Leonhardt et al., 1994; Schwartz et al., 1996; Thompson et al., 1995). On the other hand, most studies indicated that a substantial proportion of SAD patients (approximately 20%) showed full remission of their conditions over the follow-up period (Graw et al., 1997; Leonhardt et al., 1994; Schwartz et al., 1996; Thompson et al., 1995). Arguably, some of these patients may not have had SAD at all (Thompson et al., 1995). Alternatively, a proportion of patients may have shown remissions because of ongoing treatment (light therapy or pharmacotherapy), as a sizeable proportion of patients used these treatments (naturalistically) in the years following diagnosis of SAD (Graw et al., 1997; Schwartz et al., 1996; Thompson et al., 1995). Furthermore, some patients may continue to have seasonal exacerbation of depressive symptoms (i.e., they continue to exhibit "seasonality") but remain depressed most of the year. Finally, it is possible that a seasonal pattern of depressive episodes is a phase of a depressive illness, much like rapid cycling may be a phase of bipolar illness. These suggestions are speculative and as yet untested.

In order to appreciate the significance of these observations, it is also useful to compare the observed temporal stability of the diagnosis of SAD/SP with the temporal stability of nonseasonal depressive disorders. Studies of patients with major depression have indicated a stability of 44% to 76% during follow-up periods ranging from five to seven years (Clayton et al., 1992; Lenz et al., 1991; Rice et al., 1992), with lower rates of stability (perhaps as low as 15%) in samples of depressed outpatients (Angst & Preisig, cited in Graw et al., 1997). The stability of SAD (approx. one-third) is therefore consistent with the general level of stability seen in outpatients with major depression. If both full SAD and subsyndromal SAD are considered as "stable" outcomes, then approximately two-thirds of SAD subjects are stable over follow-up – a figure consistent with depressed inpatients (Clayton et al., 1992; Lenz et al., 1991; Rice et al., 1992).

What instruments are useful for the diagnosis and measurement of SAD?

Some of the unique features of SAD/SP present measurement challenges that have necessitated the development of specific instruments for use in SAD/SP. The diagnosis of SAD depends not only on the identification of a characteristic depressive syndrome but also on the regular recurrences of the syndrome at a characteristic time of year. Also, though a wide range of instruments is available for the measurement of depression, most of them do not assess some of the most common symptomatic manifestations of SAD/SP. For example, commonly used measures of depression such as the Hamilton Rating Scale for Depression (HRSD, an observer rating [Hamilton, 1967]) and the Beck Depression Inventory (BDI, a self-report instrument [Beck and Steer, 1987]) do not contain items reflecting increased appetite/weight gain, carbohydrate craving, or hypersomnia. Following is a review of the instruments used for assessment in SAD/SP.

The Seasonal Pattern Assessment Questionnaire (SPAQ) (Rosenthal et al., 1987d) is a self-report questionnaire that retrospectively assesses the magnitude of seasonal change in sleep, socialization, mood, weight, appetite, and energy. A score reflecting global seasonality (GSS) is obtained by summing up the scores on these six items, yielding a number between 0 and 24 (Table 3). The SPAQ also asks respondents to rate impairment due to seasonal changes from "no problem" to "disabling." The pattern of seasonal change is assessed by having the subjects note

the months during which they feel best/worst, socialize most/least, and gain/lose the most weight.

The SPAQ has been the primary instrument used in the majority of epidemiological studies of SAD (e.g., Eagles et al., 1996; Kasper et al., 1989b; Magnusson and Stefansson, 1993; Terman, 1988; Terman et al.,

Table 3

Seasonal Pattern Assessment Questionnaire

The purpose of this questionnaire is to find out how your mood and behaviour change from season to season. We are interested in *your* experience, *not that of others* you may have observed.

1. To what degree do the following change with the seasons?

	No change	*Slight change*	*Moderate change*	*Marked change*	*Extremely marked change*
Sleep length	0	1	2	3	4
Social activity	0	1	2	3	4
Mood (overall feeling of well-being)	0	1	2	3	4
Weight	0	1	2	3	4
Appetite	0	1	2	3	4
Energy level	0	1	2	3	4

Global Seasonality Score (GSS) = total score summed from the six items.

2. If you experience changes with the season, do you feel that these are a problem for you?

☐ No ☐ Yes – If yes, is this problem:

mild	1
moderate	2
marked	3
severe	4
disabling	5

A GSS of 11 or more on the first question, and a seasonal problem score of moderate (2) or greater on the second question, indicate a positive screen for seasonal affective disorder.

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1989c). Cases of SAD and S-SAD have been identified in these studies by using a combination of GSS cut-off scores and the rating of the individual's problem with seasonal changes. Cut-off scores were originally developed by Rosenthal's research group based on SPAQ data and personal experience with the instrument in 168 patients with SAD (Kasper et al., 1989b). The proposed SPAQ criteria to"diagnose" SAD were a GSS of 11 or higher and a response to the degree of seasonal impairment question of moderate or greater. These criteria were used to estimate the prevalence of SAD in Montgomery County (near Washington, DC) as 5.3% (Kasper et al., 1989b). A cluster analytic study of SPAQ results from 416 subjects identified clusters of patients with demographic characteristics, symptomatic patterns, and GSS closely corresponding to groupings of SAD and S-SAD subjects and thus provided some evidence of the validity of the suggested cut-off scores (Bartko and Kasper, 1989).

Several studies examining the reliability, validity, and internal consistency of the SPAQ have been reported. Thompson and colleagues (1988) reported one-year test-retest reliabilities for the SPAQ in a group of 20 SAD patients. The median reliability for the six severity of clinical change scales was $r = 0.51$ (range 0.37 to 0.72), indicating only modest test-retest reliability. The global impairment rating showed good reliability at 0.79. Hardin and colleagues (1991) reported eight-month test-retest reliabilities for 50 SAD patients. Their results were somewhat more favourable with a median reliability of $r = 0.72$ for the six severity of seasonal change items (range 0.67 to 0.80), and the reliability of the global impairment rating was 0.80.

A clinical evaluation study of 81 people who had participated in a community study of SAD reported that the SPAQ had an estimated sensitivity of 94%, specificity of 73%, and positive predictive value of 45% for detecting "winter problems" (i.e., a combined group of SAD and S-SAD) (Magnusson, 1996). The SPAQ showed poor discrimination between SAD and S-SAD, and as a result the authors concluded that it had a poor "case-finding" ability for winter depression. A follow-up study (five to eight years) of 47 patients reported fair test-retest reliability for the GSS of the SPAQ ($r = 0.62$) (Raheja et al., 1996). More detailed analyses of the study results suggested that higher seasonality scores were more likely to indicate persistent seasonality (i.e., high scores are traitlike), whereas subsyndromal seasonality scores were particularly unreliable and tended to fall during follow-up. These results require cautious interpretation in view of the lengthy follow-up duration of

the study; long-term outcome studies of SAD/SP have found that a substantial proportion of patients diagnosed with SAD do not show persistence of SAD over a period of three to eight years (see earlier review). The internal consistency of the six severity of seasonal change items of the SPAQ was evaluated in a group of 587 subjects (a random sample of the general population) (Magnusson et al., 1997). A high degree of internal consistency (*alpha* = 0.82) was observed.

The SPAQ has also been criticized because of the highly skewed distribution of SPAQ GSS in the general population (Spoont et al., 1991). The possible range of GSS on the SPAQ is between 0 and 24, but the observed range of scores in the general population is narrower (between 0 and 18), with 80% of the population scoring between 0 and 8 (Kasper et al., 1989b). These features of the SPAQ are not particularly problematic when it is used for screening purposes (i.e., higher sensitivity for the upper 20% of the population). However, Spoont and colleagues (1991) have noted that dimensional measurement of seasonality for other research purposes (e.g., examining the relationship of seasonality to other continuous variables) requires more evenly balanced psychometric properties. For such purposes, these authors developed the Inventory of Seasonal Variation (ISV), and their initial report provided evidence of the internal consistency, external validity, and sensitivity of the measure. Unfortunately, searches of Medline and PsycLit databases did not yield any subsequent publications assessing the validity of this instrument.

In summary, the SPAQ has been a very popular screening tool in SAD research, particularly epidemiological studies. Reports on the reliability of the instrument have been mixed, and there have been criticisms of the psychometric properties of the instrument. However, it remains popular because of its early development and dissemination, a high degree of face validity, and the absence of better-validated alternative measures.

The Hamilton Rating Scale for Depression (HRSD) (Hamilton, 1967) has been the dominant observer-rated instrument for the measurement of depressive disorders in clinical trials. In their preliminary report on SAD and light therapy, Rosenthal and colleagues (1984a) noted that "the HRSD does not fully reflect the severity of depression in SAD. Hypersomnia, overeating, weight gain and carbohydrate craving, which are commonly found in SAD, are not represented at all on the HRSD, and fatigability is given little weight." Nevertheless, early reports on the outcome of light therapy were able to demonstrate treatment efficacy

using the standard HRSD (e.g., Rosenthal et al., 1984a; Wirz-Justice et al., 1986). Supplementary items were subsequently developed for the HRSD to provide a more representative and valid measurement tool (Rosenthal et al., 1987a). A structured interview to elicit the symptoms measured by the HRSD for SAD more reliably was then developed (Structured Interview Guide for the Hamilton Depression Rating Scale, SAD version; SIGH-SAD [Williams et al., 1988]). The SIGH-SAD combines the 21 Hamilton Scale questions with an additional eight items for the "atypical" symptoms. The new scale thus benefits from the established validity, reliability, and wide acceptance of the Hamilton scale and has excellent face validity and reliability (Terman et al., 1998). Evidence of the validity of the SIGH-SAD is also indirectly provided by a substantial number of treatment studies. Studies using a wide range of treatment modalities have demonstrated that the SIGH-SAD is a sensitive instrument for detecting clinical change in patients with SAD (e.g., Lam et al., 1995; Schlager, 1994; Teicher et al., 1995; Terman et al., 1996). Furthermore, scores on the supplementary items of the instrument may be associated with light therapy treatment outcome – thus providing evidence of predictive validity (e.g., Nagayama et al., 1991; Terman et al., 1996). There also exists a self-report version of the SIGH-SAD (Terman et al., 1994). However, there are few data regarding reliability and validity of this version of the scale.

One of the most widely used self-rating instruments for depression is the Beck Depression Inventory (Beck and Steer, 1987). Although most psychiatric investigators have relied more heavily on observer-rated measures of depression, there may be significant advantages in using self-rating instruments in some contexts (e.g., time savings, ease of obtaining frequent assessments in long-term studies, ease of comparing results between study centres). The original BDI does not contain items reflecting atypical symptoms of depression. One group of investigators developed an "addendum" to the BDI (BDI-add) consisting of five items reflecting the atypical symptoms of SAD (Meesters and Jansen, 1993). Their report indicated a high correlation ($r = 0.67$) between BDI-add scores and the atypical items from the SIGH-SAD in a group of 76 SAD patients. No follow-up reports on this instrument were identified. However, Beck and colleagues (1996) developed a newer version of the BDI (BDI-II), which also includes items measuring reverse symptoms. Several reports have indicated that the new version is both reliable and valid (Steer and Clark, 1997; Steer et al., 1997).

Is SAD distinct from other mood/affective disorders?

A number of conditions need to be considered in the differential diagnosis of SAD. Much of this differential diagnosis is similar to that of major depressive disorder in general. SAD shares features with other mood/affective disorders. In particular, it has been observed that the reverse vegetative features seen in SAD resemble atypical depression and that SAD patients are slightly more likely to have bipolar illnesses as compared with nonseasonal depressed patients. These two issues will be considered in more detail below.

(1) Is SAD distinct from depression with "atypical features"?

The symptom pattern in depression with "atypical features" as described in DSM-IV includes mood reactivity plus at least two of the following four symptoms: weight gain/increased appetite, hypersomnia, leaden paralysis, and long-standing rejection sensitivity. DSM-IV also notes that reverse vegetative symptoms are more common in major depression occurring in a seasonal pattern (see prior section for review). Given the overlapping symptom picture of SAD/SP and atypical depression, the ability to distinguish between depression with atypical features and seasonal depression is important in establishing the validity of SAD.

Three papers addressing the distinction between these two forms of major depression were identified. First, Stewart and colleagues (1990) conducted a comparison of light therapy responsiveness in SAD patients versus patients with nonseasonal atypical depression. They found that bright artificial light was significantly less effective in treating eight patients with atypical depression than 25 SAD patients. However, significant weaknesses of the trial included the smaller group of atypicals, the exclusion of "seasonal" atypicals, and the use of raters who were not blind to patient diagnosis. Second, Pande and colleagues (1992) examined whether patients with atypical depression demonstrated a seasonal pattern in their mood-related symptoms and went on to compare those patients with and those without seasonal features. They observed that over half of their atypical depression patients had high seasonality scores (19 of 30 patients had SPAQ scores > 10). However, seasonal atypical depression patients did not differ from nonseasonal patients on a variety of demographic and symptom measures. A significant weakness of the study was the failure to include a control or comparison group in the design. Nevertheless, the findings of the report did not support a clear distinction between atypical and seasonal

depression. And third, a study examining the prevalence of a wide range of atypical symptoms in patients with SAD and nonseasonal major depressive disorder was reported by a group of Canadian investigators (Tam et al., 1997). As expected, increased appetite and hypersomnia were significantly more frequent in the seasonal group. Mood reactivity and leaden paralysis did not differ between groups, whereas rejection sensitivity was significantly more frequent in the nonseasonal depression group. Only 26% of the 53 SAD patients also met criteria for DSM-IV atypical depression. These results suggested that the overlapping features of SAD and atypical depression are limited to reverse vegetative symptoms and do not include the entire set of criteria for atypical depression. Other investigators, however, have reported that up to 93% of patients with SAD meet criteria for atypical depression (Terman and Stewart, 1993).

(2) Do SAD patients frequently have bipolar illnesses?

One of the most variable features of patients with seasonal depression in the published literature has been the reported frequency of bipolar mood disorders. Three groups of investigators in particular reported a high frequency of bipolar II disorder (i.e., spring/summer hypomania) in their case series, ranging from 51% to 83% (Rosenthal et al., 1984a; Rosenthal and Wehr, 1987; Thompson and Isaacs, 1988; Wirz-Justice et al., 1986). These reports also indicated a high frequency of bipolar I disorder (spring/summer mania), ranging from 6% (Rosenthal et al., 1987) to 20% (Thompson and Isaacs, 1988). In contrast, the majority of published studies indicates a substantial predominance of unipolar disorders (Allen et al., 1993; Lam et al., 1989; Lam et al., 1997b; Lingjaerde and Reichborn-Kjennerud, 1993c; Sakamoto et al., 1995; Takahashi et al., 1991; Thalen, et al., 1995; Wehr et al., 1991; White et al., 1990; Yerevanian et al., 1986); moreover, estimates of the frequency of bipolar disorders (bipolar I and II combined) have been as low as 8% (White et al., 1990). Comparisons of winter SAD patients with nonseasonal depressed groups (Garvey et al., 1988; Thalen et al., 1995a) and summer seasonal depressed groups (Wehr et al., 1991) have failed to demonstrate an elevated frequency of bipolarity in winter SAD.

Studies reporting a high frequency of bipolar disorders have generally applied the Research Diagnostic Criteria (RDC). The RDC are consid-

ered rather lenient in the diagnosis of hypomania (i.e., allowing the diagnosis during a period of improved social or professional functioning) (Blehar and Lewy, 1990). Investigators who previously reported high rates of bipolarity now recognize lower rates using the more stringent DSM criteria (Rosenthal NE, Wirz-Justice A, personal communications, 1998). Better instruments are also now available to diagnose hypomania and hyperthymic states, such as the Hypomania Interview Guide (including Hyperthymia) for Seasonal Affective Disorder (HIGH-SAD) (Goel et al., 1999).

What is the differential diagnosis for SAD?

Clinicians need to consider a variety of conditions in the differential diagnosis of SAD. As with other affective illnesses, primary medical conditions (e.g., hypothyroidism) need to be ruled out. Nonseasonal mood disorders, of course, may also present with depression in the fall or winter; in fact, some patients with chronic depression (dysthymia or chronic major depression) experience winter worsening of their symptoms (Danilenko and Putilov, 1996). A significant number of patients with winter depression experience elated mood phases in the spring or summer. A longitudinal history is therefore necessary to identify those SAD patients with bipolar I or II disorders (the presence of a bipolar diagnosis has important treatment implications – e.g., the role of mood-stabilizer medications; see section on treatment). Seasonally recurrent psychosocial stressors (e.g., fall/winter unemployment, anniversary grief reactions during the fall or winter) may produce symptoms that mimic SAD. Some people experience marked changes in sleep, appetite, weight, and energy during the winter but do not meet criteria for a major depressive episode – such patients are generally considered to have "subsyndromal" SAD. Preliminary reports suggest that such patients may also have a good response to light therapy (Kasper et al., 1988, 1989a). Finally, a number of reports have indicated that conditions other than major mood disorders may be subject to significant seasonal influences. These conditions include eating disorders (Brewerton et al., 1994; Lam et al., 1996a; Levitan et al., 1996), premenstrual syndrome (Maskall et al., 1997), anxiety -panic disorders (Marriott et al., 1994), obsessive compulsive disorder (Yoney et al., 1991), and posttraumatic stress disorder (Solt et al., 1996).

Conclusions: Diagnosis of Seasonal Affective Disorder (SAD)

(1) The DSM-IV criteria for recurrent major depressive disorder, seasonal pattern (equivalent to SAD), are appropriate for use in clinical settings.
(2) The DSM-IV criteria specifying that seasonal major depressive episodes occurred in the past two (consecutive) years and that nonseasonal major depressive episodes did not occur in the past two years should be used with discretion. For example, a patient who has had winter depressions for five of the preceding six years – but not the past year – could reasonably be considered to have a seasonal pattern.
(3) A time period of two months is sufficient to define a "full remission" for the diagnosis of seasonal pattern.
(4) The atypical or reverse vegetative symptoms of depression are commonly found in SAD. However, the diagnostic criteria for SAD are based on identifying a specific pattern of depressive episodes and not on specific symptomatic features of the depressive episodes.
(5) At least one-third of patients with SAD continue to have seasonal episodes of depression and are therefore likely to require ongoing intervention.
(6) The Seasonal Pattern Assessment Questionnaire is an appropriate *screening* instrument for SAD but is not adequate for the diagnosis of SAD.
(7) Most patients with SAD have a unipolar depressive disorder, but seasonal patterns can also occur in bipolar disorder.

Part 2: Epidemiology

What is the prevalence of SAD?

There have been more than 25 community-based investigations of the epidemiology of seasonal depression or SAD. These studies have significant differences in the method of sampling and diagnostic approach. Most of these studies have focused specifically on seasonal change in symptoms of SAD, without necessarily making a clear diagnosis of major depression. Almost all these studies have employed the Seasonal Pattern Assessment Questionnaire (SPAQ; Rosenthal et al., 1987d) to

estimate the prevalence of SAD. Most studies have been completed in North America (Blazer et al., 1998; Booker et al., 1992; Carskadon and Acebo, 1993; Dam et al., 1998; Hegde and Woodson, 1996; Kasper et al., 1989b; Magnusson and Axelsson 1993; Potkin et al., 1986; Rosen et al., 1990; Schlager et al., 1993; Swedo et al., 1995; Terman, 1988; Williams and Schmidt, 1993). A smaller number have been undertaken in Europe (Blacker et al., 1997; Haggag et al., 1990; Lingjaerde and Reichborn-Kjennerud, 1993; Magnusson and Stefansson, 1993; Mersch et al., 1995; Murase et al., 1995; Partonen et al., 1993b; Wicki et al., 1992) and Asia/Australia (Ito et al., 1992; Morrissey et al., 1996; Okawa et al., 1996; Ozaki et al., 1995a; Partonen et al., 1993b; Suhail and Cochrane, 1997).

Community-based surveys in North America have reported the prevalence of SAD between 0.7% and 9.7%, with some evidence that prevalence increases with higher latitude (i.e., more northern in the northern hemisphere). European community-based studies that have used the SPAQ estimate prevalence at 1.3% to 3% of the population, and studies in Asia report rates of 0% to 0.9%. The discrepancies in these findings may be attributable to different designs, methods of distribution, sociocultural issues, and possibly latitude. In addition, the time of year that the survey is conducted influences estimates of lifetime prevalence of SAD using the SPAQ; in one study, mean depression ratings were 46% higher in those respondents interviewed in December as compared with respondents interviewed in July (Mersch, 1995). Most importantly, most studies report crude prevalence rates without standardization for the gender or age distribution of the population sample.

The most serious limitation of many of the studies to date, however, is probably the use of the SPAQ as a diagnostic instrument. The SPAQ was developed as a screening questionnaire designed to detect SAD in clinical populations (Kasper et al., 1989b). The positive predictive capacity of the SPAQ has been reported as less than 50% in both a clinical sample (Raheja et al., 1996) and a community sample (Magnusson, 1996; Mersch et al., 1995). The reduced ability to detect the presence of the disorder may be due to several factors:

(1) The SPAQ includes only four symptoms (appetite/weight, mood, sleep, energy) of the nine symptoms required to make a DSM-III-R or DSM-IV diagnosis of major depressive disorder.

(2) The SPAQ does not directly assess impaired function that may result from each of these symptoms.
(3) The SPAQ does not distinguish symptoms that might result from medical or physical conditions or drugs.
(4) The SPAQ does not determine the number of major depressive episodes that the individual may have experienced in the past, nor their relationship to one another or to the seasons. For a diagnosis of SAD, DSM-III-R requires that three such episodes have occurred, two in consecutive years, and the DSM-IV requires two episodes in the past two years.
(5) The SPAQ does not determine whether episodes were followed by complete remissions.
(6) The month(s) in which mood is "best" or "worst" is(are) reported, but not when mood may be "depressed" or "high" or "normal." Therefore, hypomanic or manic episodes cannot be detected, and bipolar disorders cannot be diagnosed.

Overall, the SPAQ gives insufficient data for diagnosis and for adequate epidemiological conclusions. A more appropriate estimate of prevalence would result from determining both the presence of major depression and the seasonality of such a disorder, with sampling equally across the seasons. Three such studies have been completed to date, and they are reviewed below.

Levitt et al. (1995, 1997) and Blazer et al. (1998) have studied the prevalence of the seasonal subtype of major depression in the community using structured diagnostic instruments, with added sections to determine the seasonality of the major depression episodes. Levitt et al. (1995), using a validated and structured telephone interview based on the Composite International Diagnostic Interview (CIDI), found that the lifetime prevalence of SAD (DSM-III-R defined) in the city of Toronto, Canada, was 2.2%. In a subsequent study, they used the same instrument to sample across the province of Ontario, Canada, and found that the prevalence of SAD was 1.7% (Levitt et al., 1997).

Blazer et al. (1998) used data from the CIDI collected during the US National Comorbidity Survey to derive a diagnosis of SAD. Table 4 demonstrates how prevalence estimates from that study change according to the use of successively more stringent diagnostic criteria. Note that this study used the DSM-III-R criterion that requires a 60-day "window"

for onset and remission of the seasonal depressive episodes. This criterion was widely thought to be overly restrictive and was dropped from the DSM-IV criteria for seasonal pattern.

What is the female-to-male ratio in people with SAD?
Virtually all studies to date have demonstrated a female preponderance in this condition. Only one study (Blazer et al., 1998) reports that men are more likely than women to suffer from SAD. In some clinical samples, the ratio of females to males is close to 4 to 1; however, when all community studies are taken together, the female-to-male ratio is about 1.6 to 1.

What is the prevalence of SAD with respect to age?
Most studies to date report increasing prevalence of SAD from teen years through the mid-50s and then a decline in rates in the elderly. Blazer et al. (1998), in contrast, is the only study to find that prevalence continued to increase with increasing age. This observation may be related to the fact that the investigators only included subjects between 15 and 54

Table 4

Lifetime prevalence estimates of DSM-III-R major depression with a seasonal pattern, using successively more strict criteria

Successive criteria	Number with criteria	% of total sample (8,098)
Onset of depressive symptoms occur at same time of year	248	3.1
Remission of depressive symptoms occur at same time of year	145	1.8
≥ three episodes start within same three-month period	105	1.3
≥ three episodes end within same three-month period	64	0.8
≥ 66% of episodes show seasonal pattern	22	0.3

Source: Blazer DG, Kessler RC, Swartz MS. Epidemiology of recurrent major and minor depression with a seasonal pattern: the National Comorbidity Survey. Br J Psychiatry 1998; 172:164-7.

years of age. Other studies found that prevalence declines sharply in older subjects. For example, Levitt et al. (1995, 1997) reported a significant decline in prevalence after age 60. Since Blazer and colleagues did not include anyone over 54, they may not have observed the expected decline in rates.

What is the effect of time of year of interview on prevalence?
The season of interview affects prevalence estimates for a lifetime diagnosis of seasonal depression. In the Levitt et al. (1995) study, lifetime estimates for SPAQ-defined SAD were significantly higher for subjects interviewed in the winter as compared with subjects interviewed in the summer. Other investigators have also found an increase in prevalence estimates for subjects interviewed in the autumn as compared with subjects interviewed in the summer.

Does latitude influence the prevalence estimate of SAD?
One US study examined the prevalence of SAD, based on SPAQ criteria, in middle-aged subjects in four cities from Florida to New Hampshire and found that the rate of SAD increased with more northern latitude (Rosen et al., 1990). In a Canadian study, a population in the province of Ontario was sampled, using a telephone interview, equally across eight degrees of latitude (Levitt et al., 1997). In contrast to the US study, there was no significant effect of latitude on prevalence of SAD using SPAQ or DSM-III-R diagnostic criteria. In fact, there was a significant negative correlation between overall seasonality of depressive symptoms and latitude: that is, as latitude increased, the seasonality of depressive symptoms among the general population decreased. Blazer et al. (1998) also failed to show an impact of latitude on prevalence of SAD.

What is the impact of other demographic variables on prevalence of SAD?
There is controversy regarding the roles of various "risk factors" for SAD. Blazer et al. (1998) reported that SAD subjects tend to be more educated and that subsyndromal SAD subjects tend to have higher incomes than subjects without the condition. They also found a higher risk of SAD in rural compared to urban settings. These findings remain to be confirmed in other surveys and in other regions of the world.

Conclusions: Epidemiology of Seasonal Affective Disorder (SAD)

(1) The prevalence of SAD by DSM-III-R or DSM-IV criteria is between 1.7% and 2.2% in Canada and between 0.8% and 2.2% in North America.
(2) In the most comparable studies in Asia, the prevalence may be less than 1%, and in Europe the prevalence may be 1% to 3%.
(3) Women outnumber men with the disorder 1.6 to 1.
(4) The prevalence of SAD increases with age until the mid-50s and is uncommon in older age groups.
(5) Subjects are more likely to recall lifetime winter difficulties when they are interviewed in the winter.
(6) The prevalence of SAD may increase with higher latitude, but this effect needs further study to confirm results.

Part 3: Etiology and Pathophysiology

Is SAD simply due to decreased light?

The superficial similarity of the SAD syndrome to the process of hibernation in animals has led to the speculation that SAD may reflect an exaggerated response to seasonal changes in the day-and-night cycle. Early work with animals demonstrated that seasonal rhythms are cued to length of day or photoperiod (Aschoff, 1984). Pittendrigh (1989) suggested that animals use length of day as a cue to season via innate pacemaking systems entrained to the external cycle, which in the daily case is the cycle of light and dark. According to this model, animals use the duration of nighttime darkness as a signal of seasonally appropriate behaviours. For example, hibernation is initiated by the photoperiod signal of longer nights that mark the approach of winter.

Consistent with a photoperiod hypothesis, several studies have found a relationship between prevalence rates of SAD and latitude (see section on epidemiology). In England, Suhail and Cochrane (1997) used the SPAQ to compare seasonality in indigenous white and nonindigenous Asian populations and found that, among the environmental and psychosocial factors examined, hours of daylight was the best predictor of seasonal variations in mood. Oren et al. (1994c) used light monitors

worn by SAD patients and controls to examine the relationship between ambient light and depression. Among patients, severity of depression was inversely related to photoperiod, and a trend indicated a correlation between severity of depression and a later onset of morning light exposure.

To further explore the possible role of photoperiod in SAD, Young et al. (1997) examined the relative contribution of photoperiod, mean daily temperature, and hours of daily sunshine to the onset of SAD. Based on a pooled sample of 387 subjects, they report a relationship between decreased photoperiod and risk of onset, regardless of whether the decreased photoperiod is determined by latitude or calendar date. In a second study of 190 subjects, none of the climatic factors accounted for the onset of SAD, but photoperiod again correlated highly with risk of onset. The use of interviews rather than self-report surveys, the large numbers of subjects, and the study design make these findings more valid than many past studies. These results offer strong support in favour of the photoperiod hypothesis.

Other authors have reported findings that do not support a photoperiod model of SAD. For example, prevalence studies have not always shown an increase with higher latitude (see section on epidemiology). Also, the effectiveness of bright-light exposure is not limited to "extending" the photoperiod. Finally, studies that monitor light exposure have not found any differences between SAD patients and normal subjects in winter (Eastman, 1990a; Graw et al., in press), although SAD patients spend more time outdoors in the summer (Graw et al., in press). Similarly, no differences in total light exposure were found in people with and without subsyndromal SAD (Guillemette et al., 1998).

What is the role of melatonin in SAD?

Given the importance of melatonin in the entrainment of biological rhythms in animals, researchers have examined the possible role of abnormal melatonin secretion in SAD. This work has been based on the observation that exposure to bright light suppresses nocturnal pineal melatonin secretion (Lewy et al., 1980; Terman et al., 1987, 1988). Studies in SAD have focused on melatonin levels and on the pattern of melatonin secretion as an indicator of circadian phase.

Partonen et al. (1996, 1997) found no differences in melatonin levels between SAD patients and controls, both before and after light treatment.

They also noted that response to light was not associated with changes in melatonin levels. The antidepressant effects of light treatment are also not dependent on nocturnal melatonin suppression (Rosenthal et al., 1986b). Conversely, Danilenko et al. (1994) reported differences in melatonin levels in untreated depressed SAD patients compared with controls. They also found that light treatment resulted in a phase advance of melatonin rhythms in SAD, a finding that has been observed by other researchers (Dahl et al., 1993). However, Checkley et al. (1993) examined 24-hour melatonin rhythms in SAD patients and controls and found no significant differences between the two groups. A phase advance in the timing of nocturnal melatonin secretion in SAD has not been shown to differentiate between responders and nonresponders to light treatment (Rice et al., 1995). The timing of melatonin secretion also does not predict whether SAD patients respond to morning or evening light (Wirz-Justice et al., 1993).

Several investigators have examined the role of melatonin in the treatment of SAD. Rosenthal et al. (1988a) compared the effects of a placebo and atenolol, a beta-adrenergic blocker that inhibits melatonin secretion, in a double-blind crossover study. They found no therapeutic difference between atenolol and placebo, a finding that goes against a melatonin hypothesis. However, Schlager (1994) attempted to truncate the morning melatonin secretion curve (in a manner similar to bright light) by giving a short-acting beta blocker, propranolol. He successfully treated patients using open-label propranolol; during a double-blind placebo-substitution phase, only the patients switched to placebo relapsed. In another approach using melatonin as potential treatment, neither nighttime administration (to increase amplitude and thus zeitgeber strength) nor morning administration (to elongate the melatonin duration of secretion and/or to phase delay) had any effect on SAD symptoms (Wirz-Justice et al., 1990). In contrast, Lewy et al. (1998a) reported a study showing beneficial effects of low-dose melatonin timed during the afternoon to provide a corrective circadian phase advance. These findings suggest that any abnormalities of melatonin in SAD reflect changes in circadian phase – that is, a circadian phase shift hypothesis – rather than directly implicating melatonin levels.

What is the role of circadian rhythm disturbance in SAD?

An internal pacemaker that matches internal rhythms to the 24-hour

day drives circadian (daily) rhythms. "Phase shifting" (Aschoff, 1984) refers to advancing rhythms (the internal cycle shifts to an earlier clock time) or delaying rhythms (the internal cycle shifts to a later clock time) and can be done reliably with exposure to bright light. The direction and magnitude of phase shifting depends on when the bright light occurs within the circadian cycle.

Given some of the melatonin results in SAD, and that bright light clearly has effects on the circadian system, there has been much interest in a circadian rhythm hypothesis for SAD. The phase shift hypothesis (Lewy et al., 1986) postulates that the therapeutic effect of light in SAD is due to a corrective phase shifting of delayed endogenous circadian rhythms. In a phase shift hypothesis, exposure to bright light must be timed appropriately within the circadian cycle to correct a specific phase shift. For example, morning exposure to bright light should correct a phase-delayed circadian rhythm, whereas evening light exposure should worsen those rhythms.

Several studies, including Lewy et al. (1987a), Sack et al. (1990), Dahl et al. (1993), Endo et al. (1993), and Avery et al. (1997), have found that SAD patients have a phase delay in circadian rhythms correctable by morning bright-light treatment. Teicher et al. (1997) demonstrated that circadian rhythms are not only phase delayed in SAD but also poorly entrained (synchronized) to the 24-hour day. Thompson et al. (1997) speculated that the instability of circadian rhythms in SAD is due not to a fixed phase abnormality but to a high-amplitude phase-response curve. Glod et al. (1997) examined children with SAD and found evidence of dysregulated circadian rhythms in this population. Interestingly, children with SAD were found to have blunted circadian rhythms, whereas adults have been shown to demonstrate delayed and poorly entrained rhythms. The circadian time of morning light exposure has been shown to have a significant effect on the magnitude of the antidepressant response to light therapy (Terman, 1998). Finally, three recent large-sample studies found that morning light exposure was superior to evening light exposure (Eastman et al., 1998; Lewy et al., 1998b; Terman et al., 1998) and that the morning light caused phase advances in circadian rhythms whereas the evening light caused phase delays (Lewy et al., 1998b).

While these observations have lent strong support to the phase shift hypothesis, contrary evidence has also been reported. The effectiveness of light therapy may not depend solely on morning timing (e.g., Lee et

al., 1997a; Wehr et al., 1986; Wirz-Justice et al., 1993) or on the initial circadian phase of a patient (Wirz-Justice et al., 1993). Several studies have not found abnormalities of phase or circadian rhythms in SAD (Eastman et al., 1993; Oren et al., 1996; Rosenthal et al., 1990). In the studies reporting phase-delayed circadian rhythms, not all SAD patients had phase delays, and there were no clear relationships between individual improvement and the circadian effects induced by light. These findings argue against a circadian phase delay hypothesis as the sole factor in the etiology of SAD and against the necessity of a phase advance by morning light for treatment efficacy.

Is the eye involved in the etiology of SAD?

Research on the role of the visual system in SAD was stimulated by the finding that the antidepressant effects of light are greater with exposure to the eyes than to the skin (Wehr et al., 1987b). Additionally, there is a direct neural pathway, the retinohypothalamic tract, that leads from the retina to the suprachiasmatic nucleus (SCN) of the hypothalamus. The SCN functions as the circadian pacemaker in humans, and the circadian effects of light appear mediated via the retinohypothalamic tract. Therefore, it is possible that the light signal may be attenuated at the level of the eye or retina.

In a study using electrooculography (EOG) to measure retinal light responses, Lam et al. (1991a) found significantly lower EOG ratios in SAD patients than in normal controls. These results were replicated by Ozaki et al. (1993), who found low EOG ratios in SAD patients both before and after light treatment and during the summer. Lam et al. (1992a) also described lower b-wave amplitude on another measure of retinal light sensitivity, flash electroretinography, in female SAD patients, with normalization of results after light therapy (Tam et al., 1998). These findings point to a possible abnormality in SAD at the level of the retina. Stojek (1991) tested intraocular pressure (IOP) in depressed SAD patients, finding significantly lower IOP in female SAD subjects than in controls. Other retinal mechanisms have been explored in SAD (Ozaki et al., 1995b), but large intersubject variability and low subject numbers limit the validity of such findings. Another negative study was reported by Oren et al. (1993), who found no ophthalmic changes in SAD patients on measures of retinal dark adaptation, intraocular pupillary size, colour vision, and pattern electroretinography.

Which neurotransmitters contribute to SAD?

(1) Serotonin

Many researchers have examined a possible role for the neurotransmitter serotonin (5-hydroxytryptamine, or 5-HT) in the etiology/pathophysiology of SAD. Animal studies and human postmortem studies have demonstrated clear seasonal changes in serotonin metabolism (Brewerton et al., 1988; Carlsson et al., 1980; Lacoste and Wirz-Justice, 1989), with the overall evidence pointing to decreased serotonergic metabolism in the winter period. Serotonergic agents working via different mechanisms to enhance serotonin neurotransmission, including d-fenfluramine (O'Rourke et al.,1987), l-tryptophan (Ghadirian et al., 1998; Lam et al., 1997a; McGrath et al., 1990), and selective serotonin reuptake inhibitors (Lam et al., 1995; Moscovitch et al., 1995), have been found to be effective in the treatment of SAD. Additionally, rapid depletion of the serotonin precursor, tryptophan, can reverse the antidepressant effect of light therapy in SAD (Lam et al., 1996b; Neumeister et al., 1997a, 1998a). Patients with SAD report increased activation following high carbohydrate meals, whereas normal controls feel more sedated (Rosenthal et al., 1989b). This finding may be consistent with altered tryptophan and serotonin metabolism in the SAD population, since dietary carbohydrates are believed to enhance serotonin synthesis and transmission via increased tryptophan uptake into the brain (Wurtman and Fernstrom, 1976; Wurtman et al., 1989).

There is significant evidence for abnormal neuroendocrine responses to a variety of serotonergic agents in SAD. Abnormal responses to the nonselective serotonergic agonists 5-hydroxytryptophan (Jacobsen et al., 1987a) and d,l-fenfluramine (Coiro et al., 1993) have been reported, although one study with d,l-fenfluramine was negative (Yatham and Michalon, 1995). The postsynaptic 5-HT_{1C} agonist m-chlorophenylpiperazine (m-CPP) has been found to produce abnormal hormonal and mood responses in SAD patients compared to controls (Garcia-Borreguerro et al., 1995; Jacobsen et al., 1994; Joseph-Vanderpool et al., 1993; Levitan et al., 1998a; Schwartz et al., 1997b). Blunted growth hormone responses to the 5-HT_{1D} receptor agonist sumatriptan have also been reported (Yatham et al., 1997).

Taken as a whole, these various lines of evidence point to a significant role for serotonin in the pathophysiology of SAD, with both presynaptic and postsynaptic mechanisms likely involved.

(2) Dopamine and Noradrenaline

Dopamine and noradrenaline dysregulation has also been postulated to play a role in SAD. The evidence for noradrenaline is less robust. Rosenthal et al. (1987c) found blunted plasma noradrenaline responses to an orthostatic challenge, and Anderson et al. (1992) found decreased levels of urinary noradrenaline and metabolites after light therapy. Other studies, however, have not found noradrenaline abnormalities in cerebrospinal fluid or plasma (Rudorfer et al., 1993).

As for dopamine, measures of prolactin have typically been used as a measure of dopaminergic function, and authors have interpreted observed prolactin abnormalities as evidence of dopamine deficiency (Jimerson, 1984). Several studies have found that plasma prolactin is decreased in SAD patients (Depue et al., 1989, 1990; Oren et al., 1996). This decrease is evident across seasons and is unaffected by light therapy, suggesting that it may be a trait marker for the disorder. Additional evidence in favour of dopamine dysfunction has been supplied by studies that examine thermoregulatory heat loss. Arbisi et al. (1989, 1994) found that thermoregulatory heat loss in SAD patients was blunted in the winter, compared to controls, and similar to controls after light therapy and in the euthymic state. They postulate that light and summer may facilitate central dopamine functioning and normalize thermoregulatory heat loss in depressed SAD patients. Neumeister et al. (1998b) reported on a study in which SAD patients in remission with light therapy underwent both catecholamine depletion and tryptophan depletion. Both techniques reversed the antidepressant effect of light therapy, suggesting that light acts through effects on both serotonin and catecholamines (dopamine and/or noradrenaline). A dopaminergic mechanism has also been suggested to explain the reduced eye-blink findings in SAD (Barbato et al., 1993; Depue et al., 1989) and the alterations in the b-wave on electroretinography (Lam et al., 1992a). Contrary to the dopamine hypothesis, Oren et al. (1994b) did not find any therapeutic effect of l-dopa+carbidopa over placebo. There is also some evidence, however, that dopaminergic abnormalities (and response to dopaminergic drugs) may be limited to premenopausal women (Tam et al., 1998).

Are there genetic vulnerability or protective factors in SAD?

There is emerging evidence that one or more genetic factors establish

vulnerability to or protection from seasonality and SAD. Magnusson and Axelsson (1993) and Magnusson and Stefansson (1993) found that the prevalence of SAD was significantly lower among Icelanders and their descendants living in North America than among Americans living on the east coast of the United States. They suggest that a genetic adaptation in Icelandic populations may establish increased tolerance to winter darkness. Madden et al. (1996) surveyed 4,639 Australian twins to examine the relative contributions of genetic and environmental factors to the development of seasonal symptoms. Genetic effects were found to account for at least 29% of the variance in seasonality based on the Seasonal Pattern Assessment Questionnaire (SPAQ). Jang et al. (1997a) used the SPAQ in 339 Canadian twin pairs and found that genetics accounted for 69% of the variance in Global Seasonality Score (GSS) in males and 45% in females.

Genetic association studies of SAD have begun to emerge. Rosenthal et al. (1998) reported an association between the short allele of the serotonin transporter gene and the trait of seasonality. Levitan et al. (1998c) found a preliminary association between tryptophan hydroxylase polymorphism, increased eating behaviour, and SAD in a small sample with family-based controls. Ozaki et al. (1996) reported a lack of association between two naturally occurring amino acid polymorphisms of the serotonin 5-HT_{2A} gene and the expression of SAD.

What are the hormonal and metabolic changes in SAD?

Overactivity of the hypothalamic-pituitary-adrenal (HPA) axis has been well documented in nonseasonal unipolar depression (Chrousos and Gold, 1992), but few studies of HPA-axis activity in SAD have been conducted. James et al. (1986) found that, unlike patients with melancholia, SAD patients have robust cortisol suppression following oral dexamethasone. Joseph-Vanderpool et al. (1991) found significantly delayed and reduced ACTH and cortisol responses to corticotrophin-releasing hormone (CRH) in SAD patients compared to controls, despite normal baseline plasma cortisol levels. These findings returned to control values after treatment with light therapy. The symptoms of fatigue were interpreted as indicating deficient activity of the arousal-producing CRH system in SAD. Schwartz et al. (1997a) examined pituitary volume to determine whether changes in size would be found as in nonseasonal depression. Using magnetic resonance imaging of the pituitary gland,

they found that neither SAD nor a change in the seasons is associated with pituitary size.

Bauer et al. (1993b) found no difference in thyroid function between SAD patients and controls. Lingjaerde et al. (1995) examined T3, Free T4, and TSH and found no correlation between the severity of winter depression and levels of these hormones. Furthermore, most patients were found to have hormonal levels well within the normal reference ranges. On the other hand, when Coiro et al. (1994) examined the nocturnal TSH surge and TSH response to thyroid releasing hormone (TRH), they found that euthymic and depressed SAD patients did not show the normal nocturnal surge compared to controls. In addition, the mean peak response of TSH to TRH was lower in patients, regardless of season. Raitiere (1992) also reported low TSH responses and lack of nocturnal surge, providing further evidence of thyroid dysfunction in SAD.

Since many of the winter symptoms of SAD could be construed as having an energy-conserving function, Rosenthal et al. (1987b) hypothesized that resting metabolic rate (RMR) might be reduced in SAD. Interestingly, Gaist et al. (1990) found significantly higher RMRs in SAD patients than in controls, which were normalized after light treatment. This finding was replicated in another report, and SAD patients were found to have accelerated postglucose glycemia (Krauchi et al., 1999). These findings go against a simple hibernating model of SAD.

Other authors have postulated that vitamin abnormalities may contribute to SAD. Oren et al. (1994a) assessed vitamin D3 levels in SAD patients and found no differences versus controls. They also examined the efficacy of vitamin B_{12} in a randomized controlled trial and found that it was not effective in the short-term treatment of depression in SAD (Oren et al., 1994b).

Are there psychological and/or personality factors associated with SAD?

While it is generally thought that biological changes triggered by decreased environmental light underlie the symptoms of SAD, research to date has not conclusively ruled out a role for psychological mechanisms in the onset and treatment of this disorder (Eastman, 1990b). By exposing subjects to symbolic light, Bouhuys et al. (1994) found altered cognitive sensitivity to light in patients with SAD and suggested that the

observed sensitivity was a key factor in the onset of depressive episodes. O'Brien et al. (1993), using tests of attention, memory, and learning, found slow response rates in SAD subjects that reflected not only simple sensory or motor slowing but also slowed information processing. Levitan et al. (1998b) found that negative attributional style predicted poor response to pharmacotherapy in non-seasonal depression but failed to predict response to light therapy in SAD patients. Although highly preliminary, these various studies suggest that SAD patients might in fact have a unique cognitive vulnerability profile that is distinct from other subtypes of depression.

In terms of personality variables, Reichborn-Kjennerud et al. (1994) found that 23% of SAD patients met DSM diagnostic criteria for personality disorders. Although further analyses revealed that the two disorders are distinct, with independent causes, the high rate of personality disorders in SAD lends credence to a possible link between personality and seasonality. Later, Reichborn-Kjennerud and Lingjaerde (1996) examined factors that affect treatment outcome and found that temperament accounts for 25% of the variance in response rates, whereas personality disorders are generally associated with poor treatment outcome. They also demonstrated a significant association between personality disorders and the depressed and nondepressed states in SAD (Reichborn-Kjennerud and Lingjaerde, 1997).

Dimensional aspects of personality, as opposed to discrete personality disorder diagnoses, have also been described in relation to SAD and seasonality. One study compared 24 SAD patients to 17 patients with nonseasonal major depression (Schuller et al., 1993). The SAD group had lower scores on the self-criticism and dependency dimensions of the Depressive Experiences Questionnaire and significantly higher scores on three personality trait scales (schizotypal, narcissistic, and avoidant) of the Millon Clinical Multi-Axial Inventory. These findings suggest that personality characteristics of SAD patients might differentiate them from nonseasonal depressive patients. Several studies have shown that neuroticism is significantly correlated with seasonality (Murray et al., 1995), but these personality factors accounted for only 15% of the total variance in seasonality scores (Jang et al., 1997a). In contrast, using the Freiburg Personality Inventory and Giessen Test in 240 diagnosed SAD patients (tested in summer when free of symptoms), no abnormal personality variables or any correlation between personality dimensions and seasonality could be documented (Schule, 1995).

Conclusions: Etiology and Pathophysiology of Seasonal Affective Disorder (SAD)

(1) The etiology and pathophysiology of seasonal affective disorder remains unknown. However, SAD is likely a heterogeneous condition because no one factor has accounted for the onset and course of SAD.

(2) The major hypotheses for SAD include phase-delayed circadian rhythms that are corrected by exposure to bright early morning light and serotonergic dysregulation that is corrected by serotonergic medications and light therapy. These hypotheses may not be mutually exclusive.

(3) Genetic research suggests that there are significant heritable factors for SAD and seasonality, with preliminary studies implicating serotonin candidate genes.

(4) Photoperiod may be involved in the onset of SAD, but it remains unclear what influence that photoperiod plays in the pathophysiology of SAD.

(5) Less consistent evidence has suggested abnormalities relating to reduced retinal light sensitivity, melatonin, other neurotransmitters (dopamine, noradrenaline), and other hormones (thyroid, corticotrophin-releasing hormone).

(6) SAD may be a psychologically distinct subtype of depression, with preliminary evidence that psychological mechanisms and/or personality factors may be important in the expression of SAD and in response to treatment.

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SECTION 2:
Light Treatment

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What is light therapy?

Light therapy, also called light treatment or phototherapy, involves daily scheduled exposure to bright artificial light. The term "light therapy" is used by consensus in the field to differentiate light therapy for SAD from phototherapy for other conditions, such as hyperbilirubinemia or psoriasis. The initial use of light therapy in psychiatry arose from circadian rhythm hypotheses for seasonal and nonseasonal depression (Kripke, 1981). It was known that exposure to room light (less than 500 lux, a unit of illumination intensity) could alter circadian rhythms in animals and that manipulating the daily light-dark cycle, or photoperiod, could change many seasonal behaviours. These effects were often mediated through light-induced suppression of nocturnal melatonin secretion. Room light, however, did not seem to have the same circadian or melatonin-suppressing effects in humans. Researchers then discovered that suppression of human melatonin generally requires much higher intensities of light (greater than 2,000 lux) than those for animals (Lewy et al., 1980). A patient who experienced recurrent winter depressive episodes was seen as analogous to an animal whose seasonal behaviours were linked to the shorter winter photoperiod, prompting the use of bright light to extend the photoperiod (Lewy et al., 1982). The successful treatment of this patient led to the first systematic description of SAD and the first controlled study of light therapy by Rosenthal and colleagues (1984a). In that study, a large bank of fluorescent light tubes was used to expose the patients to 2,500 lux white light for three hours in the morning and three hours in the evening, to simulate the longer summer photoperiod. Dim (500 lux) yellow light was used as the control condition in a crossover study design. The results were impressive: seven of nine patients had a marked response within one week with the bright-light condition, compared to one of nine with the dim light.

Is light therapy an effective treatment for SAD?

Since the first study of light therapy in SAD (Rosenthal et al., 1984a), there have been more than 60 controlled studies published by researchers around the world. The fluorescent light box is the most studied light device, with more than 40 studies using similar fluorescent light boxes. Many studies with fluorescent light boxes have shown superiority against a number of different placebo controls, although each individual study can be criticized for the type of placebo used, the relatively small sample sizes (usually fewer than 15 patients per condition), and the short treatment periods (usually one to two weeks). Despite these limitations, the multiple replications of positive results by independent research groups provide some assurance of efficacy. Several qualitative reviews of the literature (e.g., Blehar and Lewy, 1990; Lam et al., 1989b; Rosenthal et al., 1988b; Tam et al., 1995; Wesson and Levitt, 1998) have concluded that light therapy, administered by fluorescent light boxes with illumination exposures of greater than 2,500 lux, is an effective treatment for SAD, with response rates of 60% to 90%. Additionally, two quantitative meta-analyses of fluorescent light boxes (Lee, 1995; Terman et al., 1989b) have demonstrated significant superiority of bright-light boxes over putative placebo conditions (usually dim-light conditions). Another meta-analysis, conducted under the rigorous procedures of the Cochrane Collaboration (Chalmers, 1993), also confirmed that bright-light boxes are superior to dim-light conditions (Thompson et al., 1999). Finally, two recent large-sample studies have shown smaller effect sizes (i.e., standardized differences between conditions) but clear superiority in rates of clinical response of fluorescent light boxes over plausible placebo control conditions (inactivated or low-density negative ion generators) (Eastman et al., 1998; Terman et al., 1998). Large case series suggest that about 65% of patients with SAD have a good clinical response to bright-light therapy (Lam et al., 1997b).

What light devices are available?

Published studies have utilized various light devices for light therapy, including fluorescent light boxes, a light box using incandescent light, a portable and flexible fluorescent "light lamp," an incandescent head-mounted unit or "light visor," a head-mounted unit using a red LED or "light cap," and a "dawn simulator" device.

The fluorescent light box is the "gold standard" device for light therapy, with reasonable Level 1 evidence for clinical efficacy. The efficacy of other light devices, however, is less clear. A head-mounted unit, the

incandescent light visor, ranks with fluorescent light boxes as well-studied devices in light therapy. Each of three studies used a very similar light visor, and these studies had larger sample sizes than any single light-box study (Joffe et al., 1993; Rosenthal et al., 1993; Teicher et al., 1995). The visor studies have the added benefit of multicentre designs, which usually enhance generalizability of the results. The effect sizes (i.e., standardized differences between pre- and posttreatment) and response rates of the light visors were large and comparable to light-box studies. However, the results are problematic because the putative placebo conditions in the light-visor studies, consisting of very dim light (30 to 60 lux), also led to good responses, and there were no differences between the dim-light and bright-light conditions. The possible explanations for these findings are that (1) the light visors are no more effective than placebo conditions, (2) the placebo responses in these studies are considerably higher than the light-box studies, or (3) the dim lights are not suitable placebo controls for light visors. Of note for the third possibility is that even dim light of less than 100 lux can produce biological effects such as melatonin suppression under certain conditions (Brainard, 1998).

The red LED light cap was used in two studies. One had a reasonable sample size (43 patients in two conditions) (Levitt et al., 1994), whereas the other had smaller samples in each condition tested (Levitt et al., 1996). Again, although response rates were good, and comparable to light-box studies, there was no differentiation between any active light condition with any putative control. Even a "no light" condition did as well as the bright-light box in the smaller sample study. Therefore, as with the light visor, efficacy has not yet been demonstrated for the light cap. The results of these studies were summarized in a meta-analysis that showed no evidence of effectiveness for head-mounted units (Thompson et al., 1999).

Dawn simulation is a technique used to simulate the effects of a summer dawn during the winter by gradually increasing ambient light while patients are sleeping (Terman et al., 1989a). Compared with light therapy, dawn simulation uses much lower light intensities, and the light is administered while patients are sleeping (with their eyes closed). Dawn simulation using a maximum illumination of 250 lux was shown in two small parallel studies to be superior to very-dim-light conditions (less than two lux) (Avery et al., 1993, 1994). However, another study by the same group showed no difference between a gradual and a rapid 275 lux dawn (Avery et al., 1992b). Thus, it remains unclear whether

the gradual ramping of the light intensity is actually necessary. A recent study also found that bright-light therapy for six days was superior to dawn simulation for two weeks (Lingjaerde et al., 1998).

Although clinical efficacy has not been conclusively demonstrated for these other light devices, the clinical response rates for head-mounted units and dawn simulators may be similar to those for other treatments for SAD. The panel consensus was that some patients may benefit from these devices, though they were not recommended. For example, in situations in which patients require greater portability than that afforded by light boxes, head-mounted units or dawn simulators may be considered for treatment.

Recommendations: Light Devices

(1) Light therapy is an effective first-line treatment for seasonal affective disorder. [Level 1 evidence]
(2) The fluorescent light box, with light intensities of greater than 2,500 lux, is the preferred device for light therapy. [Level 1 evidence]
(3) Some patients may respond to other light devices, such as head-mounted units and dawn simulators. [Level 5 evidence]

What are the relevant parameters of light therapy?

The four basic parameters commonly used to describe light therapy are intensity, wavelength, duration of daily exposure, and timing of light exposure. Intensity is usually expressed in lux, a photometric unit of illuminance that corrects for the visual spectral responsiveness of the eye. As references, living room evening lighting is usually less than 100 lux, bright office lighting is in the order of 300 lux to 500 lux, outdoors on a cloudy day ranges from 1,000 lux to 5,000 lux, and direct midday sunlight can reach 50,000 lux or higher. Lux has been shown to have relevance in studies of light on circadian rhythms and other biological parameters (e.g., light suppression of nocturnal melatonin secretion). Nonetheless, there is still controversy about whether a photometric unit is the best measure of the biological and therapeutic effects of light. Other possibilities include the use of radiometric measures such as irradiance and quantum density, which are based exclusively on the physical properties of light (Brainard, 1998). The "dose" of light can also be varied by changing the daily duration of exposure. However,

there are practical limits to the amount of time used for light therapy, given that the treatment requires sitting in front of a light box.

Until recently, the biological effects of light on the human circadian system were thought to be mediated solely through the eyes. A well-established neural pathway, the retinohypothalamic tract, connects the retinas with the suprachiasmatic nucleus of the hypothalamus, the site of the biological pacemaker. Similarly, one small study found that the antidepressant effects of light therapy were apparent with eye exposure but not skin exposure (Wehr et al., 1987b). However, a recent report suggests that transdermal light exposure can alter human circadian rhythms (Campbell et al., 1998). This finding raises the possibility that light exposure through the skin may also be relevant to the antidepressant response of light therapy for SAD.

What "dose" of light therapy should be used?

In terms of intensity, most controlled studies with light boxes have compared bright light (greater than 2,000 lux) to a dim-light (less than 500 lux) control condition. Most have shown superiority of bright light (Isaacs et al., 1988; James et al., 1985; Magnusson and Kristbjarnarson, 1991; Rosenthal et al., 1984a; Rosenthal et al., 1985; Winton et al., 1989), although some have not (Grota et al., 1989; Wirz-Justice et al., 1986). Analysis of pooled results shows clear evidence of greater efficacy with bright light (Lee 1995; Terman et al., 1989b). Other studies have compared bright light (5,000 lux to 10,000 lux) to a nonlight placebo control. Although two smaller studies found no difference (Eastman et al., 1992; Levitt et al., 1996), two larger studies showed superiority of the bright light over the placebo condition (Eastman et al., 1998; Terman et al., 1998).

Within the bright-light range, a meta-analysis also suggested that high-intensity light (6,000 lux to 10,000 lux) was superior to medium-intensity light (1,700 lux to 3,500 lux), which in turn was superior to low-intensity light (1,000 lux or less) (Lee, 1995). One direct comparison found 10,000 lux to be superior to 3,000 lux using 30 minutes of daily exposure (Terman and Terman, 1990c).

In terms of daily duration of light exposure, the majority of studies used 2,500 lux light that was usually administered for two to six hours per day. Comparisons of different treatment durations have shown some evidence of a dose-response relationship in that two hours and one hour of daily exposure were superior to half an hour (Wirz-Justice et al., 1986b).

However, superiority of four or six hours compared with two hours is not consistently shown (Doghramji et al., 1990; Winton et al., 1989).

Follow-up studies have shown that compliance with light therapy protocols involving two or more hours per day of treatment is poor (Schwartz et al., 1996). One study found that one hour of 2,500 lux was as effective as two hours (Wirz-Justice et al., 1986b). However, other studies have used higher-intensity light for shorter daily treatment durations. Studies of 10,000 lux fluorescent light given for 30 minutes per day produced similar results to protocols using 2,500 lux for two hours (Magnusson et al., 1991; Terman et al., 1990a). The 10,000 lux fluorescent light box has thus become the standard in clinical practice. There are no studies comparing other levels of illumination, so it is not known whether there is a linear relationship between intensity and duration for effective light therapy.

Moreover, lux, as a measure of illuminance, varies as the inverse square of the distance to the light source. Because the lux level drops precipitously with increasing distance, it is vital to properly position the patient in relation to the light source, to ensure that the proper "dose" of light is given. Gazing at the light source is not necessary or recommended. Patients can read or work under the lights if they are properly positioned.

Should light therapy be given in the morning, evening, or both?

There has been an ongoing debate regarding the optimal timing of light therapy. The original theoretical model of SAD was based on studies of seasonal changes in animals, which are mediated through changes in circadian rhythm and photoperiod. Light therapy was administered both morning and evening in order to lengthen the winter day and simulate a summer photoperiod (Isaacs et al., 1988; Rosenthal et al., 1984; Rosenthal et al., 1985; Winton et al., 1989; Wirz-Justice et al., 1986). However, circadian changes have not been consistently associated with therapeutic effects, and twice-daily dosing may not be a crucial factor (Wirz-Justice et al., 1993). Issues of practicality and compliance favour once-a-day dosing. One meta-analysis showed some superiority of twice-a-day exposure over morning or evening alone (Lee et al., 1997a), but that study did not account for the different intensities of light used in the studies of daily timing. Another grouped analysis did not find any superiority of morning plus evening light over morning light alone (Terman et al., 1989b).

In terms of optimal timing of a single dose of light, many studies have found morning light exposure superior to evening light exposure (Avery et al., 1990a, b; Avery et al., 1991; Eastman et al., 1998; Lewy et al., 1987a; Lewy et al., 1998b; Sack et al., 1990; Terman et al., 1990c; Terman et al., 1998), whereas others have found no difference (Hellekson et al., 1986; Jacobsen et al., 1987; Lafer et al., 1994; Meesters et al., 1995; Wirz-Justice et al., 1993). No controlled study has found evening light exposure to be superior. Light exposure during the late evening may also cause insomnia. An analysis of pooled results from 29 earlier studies showed some superiority of morning light over evening light (Terman et al., 1989b). There was initial concern that studies with crossover designs favoured morning light because of a sequencing effect, but recent large-sample, controlled, parallel-design studies have confirmed superiority of morning light exposure for SAD (Eastman et al., 1998; Lewy et al., 1998b; Terman et al., 1998). Although morning light was found superior to evening light, evening light exposure was also significantly superior to placebo (Eastman et al., 1998; Terman et al., 1998). A rigorous meta-analysis also showed superiority of morning light over light at other times of the day (Thompson et al., 1999).

What wavelength of light should be used?

The optimal wavelength for therapeutic effect of light therapy has been explored based on evidence that maximum melatonin suppression is attained with green light near 509 nm (Brainard, 1998) and given the adverse effects of ultraviolet light on the eye and skin. Comparisons of colour (wavelength) have shown some superiority of green light over red light (Oren et al., 1991a) and white light over blue and red light (Brainard et al., 1990) and over green light (Stewart et al., 1991), although the results were limited by complex interactions of order of treatment. These findings, however, were generally supported by a meta-analysis showing that short wavelengths (blue, green, yellow) were superior to red light (Lee et al., 1997b), although that analysis did not control for different duration or intensity of light treatment. The panel consensus was that white light is recommended for light therapy.

Both broad-spectrum ("full spectrum") fluorescent light and cool-white fluorescent light seem to be equally effective (Bielski et al., 1992). Although an initial study found bright fluorescent light with ultraviolet wavelengths to have some benefit over bright light with the ultraviolet blocked (Lam et al., 1991b), a larger follow-up study showed both to be equally effective (Lam et al., 1992b).

What constitutes an adequate length of time for a trial of light therapy?

Response to light therapy generally occurs within two to four days, and measurable improvement is often seen in one week. Most of the initial studies used one-week treatment periods because statistically significant improvement could be noted within that time. Similarly, most patients (but not necessarily all) experience recurrence of symptoms after discontinuing light therapy, within the same time period. Such rapid response and relapse have enabled studies with crossover designs, in which different treatments are applied to the same patient over an extended period of time.

Even though many patients show a clinical response at one week, the response rate increases after two weeks of light therapy (Labbate et al., 1995). The few studies with treatment for more than two weeks also show incremental increases in response rate at three weeks to five weeks (Bauer et al., 1994; Eastman et al., 1998; Ruhrmann et al., 1998). Thus, the length of time for an adequate trial of light therapy should be two to four weeks. More gradual improvement, especially later in the winter season, may indicate nonspecific spontaneous remission and may not be due specifically to light treatment.

Are there predictors of outcome for light therapy?

Several studies have shown that atypical symptoms such as hypersomnia, increased appetite, weight gain (Lam, 1994a; Nagayama et al., 1991; Oren et al., 1992), increased consumption of carbohydrates (Krauchi et al., 1993), and younger age (Lam, 1994a) are associated with good response to light therapy. Similarly, an atypical balance score (the score on the eight "atypical symptom" items on the SIGH-SAD, divided by the total SIGH-SAD score) was found to predict response to light therapy in SAD (Terman et al., 1996).

The presence of a personality disorder may also be associated with a poorer treatment outcome (as is the case in nonseasonal depression). Reichborn-Kjennerud et al. (1996) found that five of eight (63%) of the SAD patients who did not respond to light were also diagnosed with avoidant personality disorder (versus 1 of 18 [6%] of responders), and the presence of any DSM-III-R personality disorder was significantly associated with a poor response. Practically, however, the high prevalence of personality disorder decreases the prognostic value of these diagnoses in the individual SAD patient for whom light therapy is being contemplated.

How do patients obtain light devices?

Commercial light boxes and other light devices are now widely available without prescription in medical supply stores and via mail order. Patients are cautioned against constructing their own light boxes because of the electrical hazards, the difficulty in determining light intensity, and the size of the light box required. Because the industry is not regulated, the usual *caveat emptor,* or "let the buyer beware," applies to the purchase of a light device. Vendors should market light devices that meet electrical safety standards (Canadian Standards Association or US Underwriters Laboratory) and that have been tested in reputable clinical trials. The intensity should be specified for a particular distance from the light source, and the light device should be constructed with a filter for ultraviolet wavelengths.

Many vendors have a short-term rental program with rent applied to purchase price, and others have a 30-day return policy. These programs allow patients to determine whether they will respond to light therapy before purchasing a light device. Some clinics and clinicians purchase light boxes to lend to patients, again to determine whether they will respond to light therapy before buying a light box. The cost of a light box ranges from CDN$300 to CDN$500.

What practical tips are there for using light therapy?

Most patients use the light box at home while reading or watching television. Others use light therapy at work, setting up, for example, a light box by their computers or on their desks. Some hospitals and clinics have set up "light rooms" where patients can go to receive light therapy, but these rooms require daily visits to the clinic and are obviously less convenient than a light box at home or work.

Because of the rapid rates of response and relapse with light therapy, patients can become involved as active participants in determining the optimal dose of light. For example, if patients respond to early morning light exposure, but the time is inconvenient for them, they can try shifting the exposure to other times of the day. Similarly, if they respond to 30 minutes of light exposure, they may be able to maintain their responses with 15 minutes of light therapy per day. Or some patients are able to maintain their responses by using light therapy on weekdays. Patients should be advised to make one change at a time and to allow a week or two to assess the effects of a change.

There are many misconceptions about light therapy that often need to be addressed with patients. It is very difficult to raise the level of

illumination in a room to more than 600 lux, so it is not possible to treat SAD simply by increasing room lighting. A special type of light source is not necessary to treat SAD, as light intensity appears to be the critical factor. Tanning salons have never been investigated as a treatment for SAD. However, tanning should not be used to treat SAD because the antidepressant effects of light are thought to be mediated through the open eyes and not through skin exposure, the ultraviolet wavelengths are not necessary for the antidepressant effects, and there are risks associated with long-term exposure to ultraviolet light (e.g., cataracts).

What are the side effects of light therapy?

The common side effects of light therapy reported by patients include headache, eye strain, and agitation or feeling "wired" (see Table 5). These side effects are generally mild and do not appear to be related to light intensity. It is uncommon for patients to discontinue treatment because of side effects, which often subside with time or a decreased dose of light. Hypomania and mania have also been reported as uncommon but serious side effects of light therapy (Bauer et al., 1994; Chan et al., 1994; Levitt et al., 1993b). Because these reactions may be more common in bipolar disorder, patients with bipolar disorder, type I (those with previous manic episodes), should be treated with mood-stabilizing medications and monitored closely during light therapy.

Can light therapy produce ocular damage?

Bright-light treatment can theoretically lead to changes in the eyes and retinas, through either ultraviolet or visible-spectrum exposure. Although fluorescent lighting emits little in the ultraviolet wavelengths, the output is not negligible. Estimates for recurrent daily use of a fluorescent light box (without an ultraviolet filter) during the winter, over 20 years, can lead to lifetime ultraviolet exposures in the toxic range (Oren et al., 1990; Reme et al., 1996). Since ultraviolet exposure can lead to ocular and skin damage, and since the ultraviolet wavelengths do not add to the antidepressant effects of light therapy (Lam et al., 1992b), an ultraviolet filter is recommended for all commercial light devices.

In animals, the visible spectrum can lead to retinal damage under certain conditions of sustained exposure. The retina is especially sensitive to light in the blue wavelengths, the so-called blue-light hazard. Light-induced damage may also be potentiated by preexisting retinal disease or by medications that increase retinal sensitivity to light (Reme et al., 1996; Terman et al., 1990b).

Table 5

Reported side effects of light therapy for SAD

Study:	Kogan and Guilford (1998)	Labbate et al. (1994)	Levitt et al. (1993b)
Light therapy method:	10,000 lux fluorescent light box x 30 min/day x 5 days, *n* = 70	2,500 lux fluorescent light box x 2 hrs/day x 2 weeks, *n* = 30	60, 600, or 3,500 lux incandescent light visor x 30 min/day x 2 weeks, *n* = 105
Side effect:			
Headache	21%	13%	19%
Eye or vision problem	19%	27%	17%
Nausea or vomiting	7%	–	13%
Hypomania or agitation	6%	13%	–
Sedation	6%	7%	4%
Dizziness	3%	–	11%
Anxiety/"feeling wired"	3%	–	14%
Irritability	1%	–	–
Tightness in chest	1%	–	–
Sleep disturbance	–	13%	10%
Sweating	–	7%	2%
Palpitations	–	3%	–
Rash	–	1%	–
Muscle pains	–	–	10%
Abdominal pain	–	–	5%

These conditions would rarely be encountered in usual clinical use of light therapy, and 10,000 lux fluorescent light is regarded as relatively safe. Incandescent halogen lights have a greater risk of blue-light hazard with direct gazing (which is why halogen light fixtures are designed for indirect illumination) and should be avoided in commercial light devices, unless special diffusers are used. There are isolated reports of ocular damage during light therapy (Gallenga et al., 1997; Vanselow et al., 1991). However, two studies with five-year follow-up periods showed that chronic use of light therapy does not lead to any ophthalmological change or damage (Gallin et al., 1995; Gorman et al., 1993).

What ophthalmological screening should be done in patients prescribed light therapy?

The potential risks of bright-light therapy must be balanced against the inconvenience and cost of obtaining routine ophthalmological consultation and the measurable risks of repeated bright-light ophthalmological examinations such as indirect ophthalmoscopy and slit-lamp examination.

All patients considering light therapy should be asked about previous eye conditions or retinal disease. The following patients should be referred for baseline ophthalmological examination (including visual acuity, intraocular pressure, indirect ophthalmoscopy, and slit-lamp examination) and periodic monitoring:

(1) patients with preexisting retinal disease (e.g., retinal detachments, retinitis pigmentosa) or eye disease (e.g., glaucoma);
(2) patients with systemic illnesses that affect the retina (e.g., diabetes mellitus, systemic lupus erythematosis);
(3) patients with cataract surgery and lens removal;
(4) patients taking medications that have photosensitizing effects in humans:
    - lithium
    - phenothiazines such as thioridazine (antipsychotics, antiemetics)
    - chloroquine (antimalarial)
    - hematoporphyrins (used in photodynamic therapy for cancer)
    - 8-methoxypsoralen (used in ultraviolet treatment for psoriasis)
    - melatonin
    - hypericum (St. John's Wort)
    - (*Note:* animal studies show retinal changes with drugs, including beta blockers, tricyclic antidepressants, and tryptophan. The panel consensus was that ophthalmological assessment for patients on these drugs is not required unless patients have other risk factors.);
(5) elderly patients, who have a greater risk of age-related macular degeneration, which may be asymptomatic.

There are no absolute contraindications to light therapy. However, using light therapy in higher-risk individuals requires assessment of the risk-benefit ratio for each patient. For example, if a patient with retinitis pigmentosa is sensitive or intolerant to antidepressants, then light therapy can be considered with close ophthalmological monitoring.

Recommendations: Parameters for Light Therapy

(1) The starting "dose" for light therapy using a fluorescent light box is 10,000 lux for 30 minutes per day. [Level 1 evidence]
(2) Alternatively, light boxes emitting 2,500 lux require one to two hours of exposure per day. [Level 1 evidence]
(3) Correct positioning is important for the proper dose of light: i.e., sitting close enough to the light box to obtain the correct illumination. Patients should avoid looking directly into the light, as doing so may increase eye discomfort with no added benefit. [Level 3 evidence]
(4) Light boxes should use white, fluorescent light with the ultraviolet wavelengths filtered out. [Level 2 evidence]
(5) Patients should be cautioned against using incandescent halogen lights, since they may have a greater "blue-light hazard" with direct gazing. [Level 5 evidence]
(6) Light therapy should be started in the early morning, on awakening, to maximize treatment response, but exposure at other times of the day may be effective for some patients. [Level 1 evidence]
(7) Response to light therapy often occurs within one week, but some patients require two to four weeks to show a response. [Level 2 evidence]
(8) Patients can be encouraged to become active participants in establishing an optimal light protocol. [Level 5 evidence]
(9) Common side effects of light therapy include headache, eye strain, nausea, and agitation, but these effects are generally mild and transient or are resolved with a reduction in the dose of light. [Level 2 evidence]
(10) There are no absolute contraindications to light therapy, and there is no evidence that light therapy is associated with ocular or retinal damage. [Level 3 evidence]
(11) Patients with ocular risk factors should have a baseline ophthalmological consultation prior to starting light therapy, and periodic monitoring is warranted. [Level 5 evidence]

Can light therapy be used in children?

SAD has been described in children and adolescents (Carskadon and Acebo, 1993; Giedd et al., 1998; Glod et al., 1997; Rosenthal et al., 1986a; Swedo et al., 1995), so there is interest in using light therapy for these

groups. There are several case series of open light treatment showing beneficial effects of light in pediatric age groups (Cooke and Thompson, 1998; Giedd et al., 1998; Meesters, 1995; Rosenthal et al., 1986a). Two placebo-controlled studies have been published. Sonis et al. (1987) compared light therapy and relaxation therapy in 19 children in four diagnostic groups, including five children with SAD. Only the SAD group improved with light therapy and relapsed with relaxation therapy. Swedo et al. (1997) studied 28 SAD patients, aged seven to 17 years, and found that one hour of bright light plus dawn simulation were superior to a placebo condition. Although the studies have small sample sizes, the positive results are encouraging evidence that light therapy may be effective for pediatric SAD.

How does light therapy affect people without SAD?

No mood effects were found in normal subjects exposed to light therapy (Kasper et al., 1988, 1989a, 1990b; Rosenthal et al., 1987b). However, a longer study of light therapy found some suggestion of increased mood in normal subjects (Bauer et al., 1994). Bright light also has effects on the human circadian system independent of any effects on mood (see section below).

Some people have been identified as having "subsyndromal SAD": that is, they have many of the vegetative symptoms of SAD but do not meet the criteria for a major depressive disorder. In small-sample studies, light therapy was found beneficial for people with subsyndromal SAD (Kasper et al., 1988, 1989b; Norden and Avery, 1993). Since the prevalence of subsyndromal SAD is likely higher than that of SAD (11% to 25% in studies), more research about the effectiveness of light therapy in this condition is important.

Is light therapy effective for nonseasonal depression?

Before light therapy was known to be effective in treating SAD, it was investigated as a treatment for nonseasonal depression, to test a hypothesis of phase-advanced circadian rhythms in melancholic depression (Kripke, 1981). There have been fewer controlled studies of light therapy in nonseasonal depression than in SAD. An open trial of hospitalized depressed patients found benefits with light therapy (Wirz-Justice et al., 1999). A recent review (Kripke, 1998) indicated that there are more studies showing significant positive effects of light therapy (Kripke et al., 1992; Yamada et al., 1995; Yerevanian et al., 1986) than studies showing no effects (Mackert et al., 1991; Thalen et al., 1995b).

However, the clinical responses in nonseasonal depression have not been as dramatic as those seen in SAD. Differences in recruitment of patients, severity of depressions, and patient expectations may explain the smaller effect sizes seen in studies of light therapy for nonseasonal depression. Comparison with antidepressant studies in nonseasonal depression is difficult because the light therapy studies have had short treatment periods, usually one to four weeks. Further study to determine which patients are likely to respond to light therapy is necessary before it can be recommended as a sole treatment for nonseasonal depression. Light therapy may also prove useful as an augmentation of or combination strategy for refractory nonseasonal depression (Kripke, 1998; Levitt et al., 1991) or to prolong the antidepressant effect of sleep deprivation (Neumeister et al., 1996).

What other psychiatric disorders can be treated with light therapy?

Light therapy has been studied for a number of other psychiatric disorders, including bulimia nervosa, panic disorder, premenstrual depressive disorders, behavioural disorders in dementia, alcoholism, and obsessive-compulsive disorders. A recent book summarized the research and clinical studies in these and other areas, including nonseasonal depression, circadian sleep disorders, jet lag, and shift work (Lam, 1998a).

In general, these studies have small sample sizes and provide encouraging results. However, there is as yet insufficient evidence to recommend light therapy as a sole treatment for these disorders. It may be useful, however, as adjunctive treatment in these conditions. It may be particularly beneficial for patients who have seasonal exacerbations of a non-SAD disorder, such as seasonal bulimia nervosa (Lam and Goldner, 1998).

How can light therapy be used to treat other circadian disorders?

Light is one of the strongest zeitgebers (synchronizers) of the circadian rhythm system, and bright light can reliably shift human circadian rhythms. Light therapy has thus been used to treat conditions associated with disruptions of circadian rhythms, including jet lag, shift work, and circadian sleep disorders. A joint task force of the American Sleep Disorders Association and the Society for Light Treatment and Biological Rhythms published a consensus report on the use of light for treating sleep disorders in a theme issue of the *Journal of Biological Rhythms* (Terman et al., 1995b). Using light to treat these conditions is complex because of the intricate effects of timing of light exposure on the circadian

system. For example, light in the early morning leads to a phase advance of circadian rhythms and therefore corrects a delayed sleep phase disorder (e.g., Rosenthal et al., 1990). However, evening bright-light exposure can lead to a significant phase delay and thus counteract the effects of morning light. In these conditions, it is important not only to properly time the exposure to bright light to shift circadian rhythms in a desired direction but also to *avoid* bright light at other times in the circadian cycle that can worsen symptoms. Studies of jet lag and shift work are preliminary (reviewed in Boulos, 1998).

The cognitively impaired individual (e.g., with dementias including Alzheimer's disease) may be susceptible to weakened circadian rhythms of sleep and wakefulness due to degeneration of the SCN (Swaab et al., 1985). Behavioural disturbances resulting from these disturbances in circadian rhythm (night wandering, insomnia, "sundowning") may be helped by bright-light exposure to increase zeitgeber strength (Lovell et al., 1995; Mishima et al., 1994; Okawa et al., 1991; Satlin et al., 1992; van Someren et al., 1997). Light treatment may also be helpful for the sleep-maintenance insomnia that occurs in the elderly (reviewed in Campbell, 1998).

Recommendations: Light Therapy for Other Disorders

(1) Studies of light therapy for pediatric seasonal affective disorder, subsyndromal seasonal affective disorder, nonseasonal depression, bulimia nervosa, panic disorder, and premenstrual dysphoric disorder show encouraging results, but further studies are required before light therapy can be recommended as a first-or second-line treatment. [Level 2 evidence]

(2) Light therapy may also be useful in combination with other treatments in these conditions. [Level 5 evidence]

(3) Light therapy may be useful in some disorders of the circadian system, including jet lag, shift work, circadian sleep disorders, and behavioural sleep-wake disturbances in dementia. [Level 2 and Level 4 evidence]

What novel treatments have been studied in SAD?

One well-conducted study has shown that high-density negative ions are superior to low-density negative ions in SAD, with response rates similar to those of light boxes (Terman et al., 1998). Another small-

sample study found that a one-hour outdoor walk in the morning was more effective than a placebo dim-light-box condition (Wirz-Justice et al., 1996). Total sleep deprivation was also effective in improving symptoms in 6 of 11 women with SAD, although the therapeutic effects of sleep deprivation are usually temporary (Graw et al., 1998).

Recommendations: Novel Treatments for SAD

(1) High-density negative ions and sleep deprivation protocols are promising treatments but require further study before being recommended as a treatment option. [Level 2 evidence]

(2) Regular morning outdoor walks, although not of proven efficacy, are low cost, convenient, readily available, and have no side effects. They may be suggested as adjuncts to regular treatment or as initial treatment for people with mild or subsyndromal symptoms. [Level 3 evidence]

What is an appropriate placebo condition for light-treatment studies?

Conclusions from clinical trials of light therapy studies have been generally limited by three factors: small sample size, short duration of treatment, and difficulty in establishing a "true" placebo-control condition. The placebo response encompasses all of the nonspecific factors in treatment, as opposed to any specific effects of an intervention. The placebo response is generally regarded as comprising three major factors: spontaneous improvement (including regression toward the mean), nonspecific treatment effects (including relief in obtaining treatment, contact with professionals who are interested and caring, educational information about the disease, etc.), and expectation effects. Various control conditions, ranging from "no treatment" to "sugar pills," have been devised to deal with these "placebo" factors, and all have limitations. The placebo response is generally high; meta-analyses of double-blind antidepressant studies have shown that at least one-third of patients respond to a placebo drug, and many individual antidepressant studies report placebo response rates of 40% to 50%. Of interest in this context is that a seasonality in placebo response has been documented in controlled drug trials of depression, with placebo response rates averaging 11% in winter and 33% in summer (Terman et al., 1989c).

A treatment such as bright-light exposure is particularly difficult to "blind." Many studies have used relatively dim light (e.g., 500 lux or less) as a control treatment, in part because 500 lux is presumed to be biologically inactive (i.e., it does not reliably suppress melatonin) while still being bright enough to be a plausible treatment for patients. In fact, dim light may be biologically active in some patients, since light as low as 100 lux has been shown to suppress melatonin under certain conditions. Other studies have used different novel conditions, such as negative-ion generators, to control for nonspecific therapeutic effects. In some of these studies, the negative-ion generator did not emit any ions, whereas in others low-density negative ions were used. Although these conditions can control for the nonspecific effects, they may still engender different expectations by patients and investigators.

In summary, there are a number of factors included in what is termed placebo and a number of different methodologies to control for these placebo effects. Any putative placebo condition has strengths and limitations. Because the limitations are different for different methodologies, one must be cautious when comparing "placebo response" between studies. This is especially true for treatments such as light therapy or psychotherapy, in which the treatments cannot be fully disguised. Finally, researchers try to minimize placebo effects because they are trying to determine specific treatment effects. However, clinicians try to maximize placebo effects because they want patients to get better.

Recommendation: Placebo Response

Clinicians should be aware of the "placebo response" and optimize those nonspecific factors that help patients to improve, including explaining treatments, regular follow-up, and an enthusiastic expectation of improvement. [Level 3 evidence]

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SECTION 3:
MEDICATION TREATMENT

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Are antidepressants effective in the treatment of SAD?
The best evidence for efficacy of antidepressants in SAD involves the selective serotonin reuptake inhibitors (SSRIs). Two multicentre, double-blind, randomized, placebo-controlled studies of sertraline (187 patients) and fluoxetine (68 patients) confirm that these medications are effective in the treatment of SAD. The first placebo-controlled study of antidepressants in SAD that had sufficient numbers of subjects and that involved an appropriate design was published by Lam and coworkers (1995). In this study, the season of recruitment was tightly defined and taken into account in the data analysis. In addition, there was a week-long placebo washout/run-in period. In this study, 86 subjects were recruited over two seasons in five Canadian centres. Only 68 remained depressed following single-blind placebo treatment. Thirty-six subjects were randomly assigned to 20 mg of fluoxetine for five weeks, and 32 were randomized to placebo. Mean change in HAM-D over the five weeks was not significantly different between the two treatment groups, but response rates, defined as greater than 50% improvement in SIGH-SAD scores, were significantly different (fluoxetine 59%, placebo 34%). Two major methodological issues limited this study. First, sample size, although larger than that of any previous SAD antidepressant study, was still somewhat small for an RCT. However, the effect size of the difference in improvement in depression between fluoxetine and placebo was 0.5, an effect size consistent with an effective antidepressant. Second, the trial lasted only five weeks. If the data are extrapolated to the sixth week, then fluoxetine would have appeared significantly superior to placebo using mean severity scores. In addition, this was a fixed-dose study, and it is not known whether a higher or lower dose may have

been more effective. Therefore, this study can be considered strongly suggestive that fluoxetine is effective in the treatment of SAD.

Moscovitch et al. (1995) completed the largest of the antidepressant studies in SAD. Nineteen centres in Canada and Europe participated to recruit 187 patients. Again, care was taken to recruit subjects during the appropriate season, and there was both a washout and a one-week placebo run-in period. Ninety-three subjects were randomized to sertraline and 94 to placebo. Treatment spanned eight weeks, and the dose of sertraline could be titrated up to 200 mg. The mean final dose for sertraline was 111 mg, and the most common dose was 100 mg. The response rate, defined as a rating of "improved" or "much improved" on the Clinical Global Impression scale, to sertraline (63%) was significantly superior to that of placebo (46%). Furthermore, the improvement in depression score was also significantly greater for sertraline by the end of the study. Although sertraline was superior to placebo for all outcome measures, the effect size was approximately 0.4, in the same range as that for antidepressant trials in nonseasonal depression.

Ruhrmann et al. (1998) conducted another controlled study with fluoxetine. Forty SAD patients were randomized to five weeks of treatment with either fluoxetine, 20 mg per day, plus a dim-light box (placebo light condition), or placebo drug plus a bright-light box (3,000 lux for two hours per day). Thus, the study compared active drug versus active light therapy conditions. The overall response rate, as defined by greater than 50% reduction in SIGH-SAD scores, was similar for both conditions (fluoxetine 65%, light therapy 70%). Note that this study did not have a true placebo condition.

Other antidepressant studies have been conducted but included too few subjects, selected subjects in an idiosyncratic fashion, were not placebo-controlled, or were not controlled for season of treatment. Partonen and Lonnqvist (1996a) examined 581 consecutive depressed subjects from outpatient clinics and health centres in Europe. Of these subjects, 183 patients were eligible (nonpsychotic, not on medications, not medically ill, not acutely suicidal), and only 32 subjects had DSM-III-R seasonal mood disorder. Subjects were randomly assigned to treatment with either moclobemide or fluoxetine in a double-blind fashion. Of 11 subjects with SAD treated with 300-450 mg of moclobemide over six weeks, 7 (64%) responded, and of 18 treated with 20-40 mg of fluoxetine over six weeks, 8 (44%) responded. There were no significant differences in response rate. However, the sample size was small,

and the response rate to fluoxetine was poor overall and hard to explain. Unfortunately, the absence of a placebo group makes conclusions from this study limited.

Lingjaerde et al. (1993b) published a study with few subjects and with a very complicated design. In short, it involved a three-week placebo-controlled trial of moclobemide in doses of 200 mg bid. Response rate in the moclobemide group was 44% (7 of 16), as it was in the placebo group (8 of 18). However, few antidepressant studies demonstrate a difference between active medication and placebo at the third week. No conclusions regarding the potential benefit of moclobemide may be drawn from this small study.

Dilsaver et al. (1990b) studied 11 consecutive outpatients with DSM-III-R seasonal depression treated with the monoamine oxidase inhibitor tranylcypromine. The endpoint of treatment was considered the maximum improvement achieved within five weeks of treatment. This means that early or placebo responders may be overrepresented in the subjects considered to be responders. All 11 subjects had a favourable response at some time within the first five weeks of treatment with 30-40 mg of tranylcypromine. All seven subjects with chronic pain and SAD also had remission of pain. The same group (Dilsaver et al., 1992b) published another open study of 15 consecutive subjects who agreed to take bupropion in an open trial for up to five weeks in an unspecified dose (the manuscript abstract suggests 200-400 mg per day). Again virtually all subjects responded, and again the design favoured early or placebo responders. Bupropion and tranylcypromine may be effective in SAD; however, these studies are small, and treatment was not placebo controlled, so the results are only suggestive.

What is the usual effective dose of antidepressants in SAD?

There are no "dose finding" antidepressant studies in patients with SAD. Clinical experience suggests that the starting dose of the antidepressant in SAD depends on several factors. The clinician should start at a lower dose and increase the dose cautiously in (1) patients with previous sensitivities to antidepressants, (2) adolescent or elderly patients, (3) patients with a concurrent medical illness, or (4) patients who are taking other medications that interact with and increase the blood levels of the antidepressant.

From the data that do exist, some inferences may be drawn. The sertraline study (Moscovitch et al., 1995) was a flexible-dosing study

using doses of 50 mg to 200 mg per day. Most patients took 50 mg or 100 mg per day, and the average dose of sertraline was 111 mg per day. The fluoxetine study (Lam et al., 1995) used a fixed dose of 20 mg per day. The response rates and doses in these two studies are similar to those found in antidepressant studies of nonseasonal depression, using similar methodologies. Most clinicians agree that the antidepressant doses required for treatment of SAD are probably the same as those required for nonseasonal major depression.

What are the side effects of antidepressants?

The only studies to have systematically reported on side effects with antidepressants are the two double-blind studies involving serotonin reuptake inhibitors. Lam et al. (1995) reported that 97% of fluoxetine-treated and 91% of placebo-treated subjects reported one or more side effects. The most frequently reported side effects in fluoxetine-treated subjects were headache, flulike syndrome, rhinitis, and pharingitis. The most frequent side effects in the placebo group were headache, insomnia, and dyspepsia. Two patients (5.5%) treated with fluoxetine terminated that study as a result of side effects; one became hypomanic, and one had abdominal pain and flu symptoms. The one subject (3.1%) in the placebo group who terminated the study as a result of side effects had severe flu, fever, and nausea.

In the Moscovitch et al. (1995) study, 82% of sertraline-treated and 50% of placebo-treated subjects had at least one adverse event. Withdrawal from the study occurred in 7.5% of sertraline-treated and 4.3% of placebo-treated subjects. The most common side effects in the sertraline group were nausea, insomnia, and diarrhea. The most common side effects in the placebo group (similar to those in the fluoxetine study) were headache, insomnia, and nausea.

There are no data available regarding whether side effects to antidepressants are specifically different in SAD as compared with nonseasonal depression. The side effects reported in the two studies above seem to suggest that side effects are similar in SAD patients as compared to patients with nonseasonal depression.

How long should an acute trial of antidepressant last?

Patients in the fluoxetine study were treated for five weeks, but not all

the outcome measures favoured fluoxetine. If the study is extrapolated to the sixth week, then all outcome measures would have been significant. The sertraline study treated patients for eight weeks and showed superiority of sertraline over placebo in all outcome measures. Therefore, an adequate trial of antidepressants should last six to eight weeks, similar to that recommended for nonseasonal depression.

Have other medications been studied in the treatment of SAD?
Several studies have looked at nonantidepressant medications in the treatment of SAD. Studies with negative results, although small sample sizes could not definitively rule out Type II errors, include B12 and levodopa. Melatonin has been investigated for SAD, given the relationship between melatonin and many seasonal animal behaviours. One study of open-label melatonin, given in the morning or the evening, was negative (Wirz-Justice et al., 1990). Preliminary results of a placebo-controlled study using a lower dose of melatonin and an afternoon dosing schedule were reported as positive (Lewy et al., 1998a). Beta adrenergic antagonists suppress nocturnal melatonin secretion in a manner similar to light, so several studies have examined beta blocker medications for SAD. One study with atenolol, a long-acting beta blocker, was negative (Rosenthal et al., 1988a). However, another study using propranolol given in the early morning (theoretically to truncate a phase-delayed melatonin-secretion curve, similar to morning light therapy) was positive (Schlager, 1994). However, efficacy cannot be definitively established with the placebo-substitution design used in that study.

Other positive studies with small sample sizes include two studies of d-fenfluramine (O'Rourke et al., 1987, 1989). Unfortunately, because of severe adverse side effects, d-fenfluramine was voluntarily withdrawn from the North American market. One study of l-tryptophan found it superior to pill placebo, and similar in response to evening light therapy, but the sample size was very small (McGrath et al., 1990). Another study found that l-tryptophan had similar response rates to bright-light therapy, but response took four weeks for l-tryptophan, compared to two weeks for light therapy (Ghadirian et al., 1998). Finally, a small study showed beneficial effects of hypericum (St. John's Wort) plus a dim-light box, compared to a pill placebo plus a bright-light box (Martinez et al., 1994).

Recommendations: Medication Treatment

(1) Sertraline and fluoxetine are effective first-line treatments for seasonal affective disorder (SAD). [Level 1 evidence]
(2) The effective doses of these antidepressants are similar to those used in the treatment of nonseasonal depression. [Level 2 evidence]
(3) These two antidepressants are well tolerated by SAD patients. [Level 1 evidence]
(4) Other antidepressants may also be effective in the treatment of SAD, using doses similar to those recommended for nonseasonal depression. [Level 5 evidence]
(5) An adequate trial of antidepressants involves at least six weeks of treatment. [Level 2 evidence]
(6) Other medications (propranolol, l-tryptophan, hypericum, melatonin) require further study before they can be recommended for treatment of SAD. [Level 2 evidence]

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SECTION 4:
Management Issues

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How do you choose between light therapy and medications?
The current evidence for efficacy of treatments does not conclusively indicate which treatment should be considered "first line" for every patient with SAD. Some experts have suggested that light therapy is the treatment of choice for SAD, given that the response is rapid, that side effects are minimal, and that the effect sizes of light therapy studies have been greater than those in antidepressant studies (Wirz-Justice, 1998). The methodological differences between light therapy and antidepressant studies, however, make it difficult to directly compare results. Different placebo conditions, for example, may engender different expectations by patients and therefore generate different placebo responses. There are more studies demonstrating efficacy of light therapy than of antidepressants, but the antidepressant studies have larger sample sizes. All of the light-box studies have been conducted at single centres, whereas the antidepressant studies were multicentre trials. Multicentre study designs usually show greater variability of results and, hence, smaller effect sizes. One advantage of multicentre studies is that results may be more generalizable to clinical practice.

Unfortunately, there is only one published study directly comparing light therapy and antidepressants. Ruhrmann and colleagues (1998) conducted a study comparing bright-light therapy (3,000 lux for two hours per day) plus pill placebo to fluoxetine at 20 mg per day plus dim-light therapy (100 lux for two hours per day). Twenty SAD patients in each condition were treated for five weeks. The response rates (defined as greater than 50% reduction in SIGH-SAD scores) were not significantly different between bright-light therapy (70%) and fluoxetine (65%). When defining strict remission rates (posttreatment SIGH-SAD scores in the normal range), there was a trend ($p > 0.10$) to superiority of the

light therapy (50%) over fluoxetine (25%). However, the small sample size in this study limited the ability to determine a true difference between treatments.

Without direct comparisons showing clear superiority in efficacy, tolerability, or safety of one treatment over another, the decision for first-line treatment must be based on an individual assessment of benefits and risks and on patient preference. Factors to consider when making this decision are summarized in Table 6 and discussed below. Note that none of these factors is absolute. For a given patient, the relative importance of each factor should be taken into account.

In patients with less severe depression, in whom compliance is reasonable, light therapy can be considered as the first choice for treatment. Patients with atypical symptoms of depression may have better responses to light therapy, whereas those with more melancholic features may

Table 6

Factors to consider in the choice between light therapy and antidepressant medications as first-line treatments

Light therapy	Medications
• Depression less severe	More severe depression
• More atypical symptoms	More melancholic symptoms
• Good compliance for light therapy	Low interest or motivation for light therapy
	Light therapy too inconvenient
• Warrants nonpharmacological treatment (e.g., pregnancy, breast feeding)	
• Able and willing to make time commitment for light therapy	Unable to make time commitment for light therapy
• Relative contraindications to drug therapy (e.g., hepatic disease, allergies)	Relative contraindications to light therapy (e.g., retinal disease, photosensitizing drug)
• Intolerant to medication side effects	Intolerant to light therapy side effects
• Assessing costs: greater initial cost but less expensive ongoing costs	Assessing costs: less initial cost but greater ongoing costs
• Assessing costs: light box covered by insurance?	Assessing costs: medications covered insurance?

Note: None of the factors is absolute.

not respond as well (Terman et al., 1996) and may do better with medications. For more severe depressions, medication alone, or a combination of antidepressants and light therapy, is recommended. A study of fluoxetine found greater separation between active drug and placebo in those patients who were more severely depressed (Lam et al., 1995). The advantage of combining treatments is that some patients may experience more rapid responses to the light therapy, but if not, then treatment with an antidepressant would not be delayed. Severely depressed patients, however, usually have greatly impaired energy and motivation, so they find it difficult to obtain and use a light box. Family support is usually required to include light therapy in the treatment regimen. The disadvantage of combining treatments, however, is that one cannot be sure which treatment is actually producing the clinical responses or side effects (see next subsection).

Patient preference and compliance are also very important factors. Many patients prefer a nonpharmacological treatment, and light therapy is an understandable treatment that "makes sense" to SAD patients. Women of child-bearing age are particularly interested in nondrug treatments, even though there are no data on effects of light therapy during pregnancy, or on the fetus, or with breastfeeding. On the other hand, light therapy involves a commitment to spend at least 30 minutes a day, even with the newer protocols, under a light box. Many patients find this commitment inconvenient, and medications are a better choice for them.

Side effects should also be considered when deciding on a treatment. Although the newer medications are well tolerated by most patients, the side effects of light therapy are generally more mild than those of antidepressants. Some patients have risk factors for using light therapy, such as retinal disease or use of photosensitizing medications, and others have risk factors for use of antidepressants, such as medication sensitivity, liver disease, or potential drug interactions.

Cost is another issue for many patients. Commercial light boxes cost between CDN$300 and CDN$500. Although this is the equivalent of the cost of one season's treatment with the newer antidepressants, the light box is potentially more cost effective because it can be used over many seasons. However, light boxes may not be covered under health insurance plans, whereas most of the costs of some medications are reimbursed. Some patients may not be able to afford a light box if they are not covered by insurance. Others may not be covered for medications, so the light box is less expensive in the long run.

When should you combine medications and light therapy?
There are no studies of combined treatment with light therapy and antidepressants. For the vast majority of patients with SAD who are receiving treatment for the first time, it makes the most clinical sense to start one treatment – either light therapy or antidepressant medications. Commencing both simultaneously introduces clinical confusion in terms of determining which treatment has been beneficial and/or which treatment has produced side effects. Furthermore, if the treatment is only partially effective, it may not be clear which treatment to alter. Finally, as detailed in the "ocular effects" subsections, some antidepressants or psychotropic medications may increase the risk of ocular complications of light. However, there are circumstances when both light therapy and antidepressants may be given at the same time, and they are outlined below.

For patients who are already taking an antidepressant that is only partially effective, adding light therapy is an option. In this case, the usual dose of light therapy is used, and the antidepressant dose does not usually need to be reduced. When the combination is effective, some clinicians will recommend that patients remain on both treatments for the duration of the treatment. Alternatively, it may be possible to reduce and discontinue the antidepressant and to remain on the light therapy alone. However, the opportunity to treat winter depression is limited by the duration of episodes. By the time that a patient has sought treatment, failed to completely respond to an antidepressant, and undergone a trial of light therapy, the winter is usually over. In addition, if the patient relapses following cessation of the antidepressant, then there is usually little time left to reintroduce the antidepressant. Therefore, most patients will remain on the combination for the duration of the winter season. In contrast to discontinuing the antidepressant, there is no utility in discontinuing the light therapy and having the patient remain on the antidepressant alone, since the antidepressant alone was insufficient in the first place.

For patients who are already receiving light therapy that is only partially effective, it may also be reasonable, once every effort has been made to optimize the light therapy, to add an antidepressant (see "How do you manage patients who do not respond to light therapy?"). There does not need to be a dose reduction in light, and usual doses of antidepressant may be given. The issue of what to do when a patient responds is similar to that described in the previous paragraph: it is most reasonable to keep the patients on both treatments until the end of the

treatment period, but some clinicians may also suggest to patients that the light therapy be tapered or withdrawn. In this circumstance, since any effects of light therapy are quickly lost but also quickly regained, a trial discontinuation of light therapy may be a reasonable alternative.

For patients who have demonstrated a partial response to light therapy alone and a partial response to antidepressant alone in the past, using the combination may provide a more robust antidepressant effect, and the combination may allow lower doses of antidepressant to be used. The combination treatment is especially useful for patients who have been unable to take full doses of antidepressants due to side effects.

For some patients who have failed to respond to a variety of treatments for SAD and have a significant treatment-resistant form of the disorder, using a combined treatment may prove helpful. For highly treatment-resistant patients, it may also be reasonable to commence both treatments simultaneously, since these patients may be severely ill and have prolonged dysfunction. When commencing treatment simultaneously, it is usually wise to commence the antidepressant at a lower dose and increase it more cautiously.

Recommendations: Light Therapy, Antidepressants, or Both?
There are only preliminary studies comparing the efficacy of light therapy and antidepressants, no studies of combined treatment, and therefore few data to guide decisions about the first-choice treatment. Recommendations are therefore based on clinical experience and panel consensus. [Level 5 evidence]

(1) Factors to consider when deciding on a first-line treatment include severity of depression, symptom profile, side effects, safety, patient preference, patient compliance, and cost.
(2) Generally, one treatment should be used at a time to minimize clinical confusion about the therapeutic effects and the side effects of treatment.
(3) Clinical situations in which combined light therapy and antidepressants would be considered include (a) partial response to light therapy alone, (b) partial response to antidepressants alone, (c) partial response to light therapy or antidepressants in past episodes, and (d) severe or treatment-refractory depression associated with prolonged dysfunction.

How long is an adequate trial of light therapy or medications?
The data are unclear about the optimal length of a trial of light treatment. Most studies have used a treatment length of one week, with fewer studies using two-week trials (Labbate et al., 1995) or longer (Bauer et al., 1994; Eastman et al., 1992; Eastman et al., 1998; Ruhrmann et al., 1998). One study (Labbate et al., 1995) showed that the response rates and remission rates were higher after two weeks (65% and 62% respectively) than after one week (62% and 27% respectively). After two weeks, but not after one week, 15% of the patients showed a response. The longer studies (four- and five-week studies) also suggest that a longer length of treatment results in a greater proportion of subjects responding (Bauer et al., 1994; Eastman et al., 1998; Ruhrmann et al., 1998). However, other studies show no advantage to light treatment beyond two weeks (Terman et al., 1998). There is a suggestion that recovery from atypical symptoms may be slower than recovery from more typical symptoms (Terman et al., 1994).

For those who do not respond optimally after one or two weeks of treatment, the recommendation is to continue acute treatment for up to four weeks. As is consistent with recommendations for nonseasonal depression, one would be more likely to pursue this course if there were at least a partial response in the first two weeks.

In a five-week, double-blind study of fluoxetine and placebo, fluoxetine was not statistically superior on the termination depression scores, but fluoxetine was superior on the rate of clinical responses (Lam et al., 1995). In this study, the placebo and fluoxetine groups started to separate by the fourth week of treatment, but differences were not significant by the fifth week. In an eight-week, placebo-controlled study, sertraline was found to be superior to placebo in both the depression scores and the clinical response rate (Moscovitch et al., 1995). An optimal trial of medication should therefore be at least six weeks long for the acute phase. Of interest for longer trials is that the response rates of both fluoxetine and placebo began to increase by March (Lam et al., 1995). Therefore, the rate of spontaneous remission can increase dramatically after the end of February, so one must be cautious when interpreting results of light or drug treatment in late winter.

How long should a patient with SAD be treated within a season?
The data are sparse for strategies on managing the patient once response occurs. North American reports suggest that rapid relapse is common,

usually within a week or two, after discontinuation of light therapy (Rosenthal et al., 1984a; Terman et al., 1994). In fact, that observation was critical to the successful use of crossover study designs using brief (one-week) treatment lengths in light therapy studies (Terman et al., 1989b). A few European studies, however, suggest that some patients show sustained remission after a brief course of light therapy (Partonen and Lonnqvist, 1995; Wirz-Justice et al., 1986). Others have suggested that a short course of treatment early in the season can have a preventative effect (Meesters et al., 1993a), though this finding has not been consistently replicated (Meesters et al., 1994).

Patients sometimes choose to continue treatment at a reduced schedule. Relapse following discontinuation of treatment is more common if treatment occurs early in the season (Terman et al., 1994), and response is more common if treatment occurs late in the season (Lam et al., 1995). It is possible that hypomania becomes more common the longer that patients are treated with light or medication. One study found that 4 of 12 patients developed hypomanic symptoms during a four-week trial of light therapy, but these symptoms remitted when the daily light exposure was reduced or temporarily discontinued (Bauer et al., 1994). There are also reports of hypomanic responses to antidepressant medications in SAD (Lam et al., 1995).

In the absence of clear data, the clinical opinion of the consensus panel is that treatment for SAD should continue for the duration of the season, until the time of usual spring remission, which should be determined individually. There are no data on discontinuation effects of light therapy or antidepressants in SAD. Light therapy can usually be discontinued abruptly, but clinical experience suggests that antidepressants should be tapered because of possible discontinuation effects, unless there are specific reasons for rapid discontinuation (e.g., allergy or toxicity).

Should treatment continue throughout the summer?

There are currently no published studies in SAD pertaining to either light or antidepressant therapy continuation or maintenance through the summer. The potential benefit, in accordance with maintenance therapy in recurrent unipolar depression (e.g., Kupfer et al., 1992), would be protection against an anticipated depressive episode in the next fall-winter season. Potential disadvantages include lack of need (during spring and summer), cost, inconvenience (light therapy), and risk of exacerbating spring-summer hypomania and/or accelerating cycle frequency.

One small study showed that patients felt slightly better in the summer when off treatment compared to when treated with light therapy during the winter (Postolache et al., 1998). In the absence of relevant data, the consensus panel recommendation is that most patients with a clear diagnosis of SAD can discontinue treatment during the summer and restart it in the autumn/winter.

In some situations, year-round treatment may be indicated. For example, patients may have difficulty recognizing early symptoms of depression and miss starting their treatment in the winter, leading to a depressive episode with impairment of function. For others, where compliance is difficult, it may be easier to keep them on an antidepressant medication throughout the year rather than starting and stopping it. Some patients require a longer period to taper medications on and off, and it may be easier simply to continue them throughout the summer. Other patients experience mild, transient symptoms during the summer (especially during extended periods of cloud cover) and find it helpful to use light therapy during those times or to continue their medications.

When should treatment be restarted in the year following successful treatment?

Restarting treatment in subsequent years should be based on individual assessment by the clinician and patient. Many patients are comfortable holding off treatment until first onset of symptoms. This is particularly true for light therapy because many patients experience rapid relief of symptoms. That way, they will not require treatment if they happen to skip a winter depressive episode. Some patients treated with medications, however, will have a two-week to four-week lag time before response. These patients, and those who find it difficult to gauge initial onset of symptoms (and thus are at risk of "sliding" into a depressive episode), may wish to start treatment prior to the usual onset of symptoms. For example, patients with predictable time of onset may restart light therapy two weeks prior to the expected onset of symptoms and restart antidepressants four weeks prior to onset. For SAD patients in whom timing of onset varies by several weeks from year to year, treatment can be reinitiated prior to the earliest date that a past episode began. Some may choose to remain on effective treatment year-round for an indefinite period and not bother trying to determine the usual onset of symptoms. Others may choose to "wait and see" if a new winter depressive episode occurs before restarting treatment.

Recommendations: Length of Treatment

(1) A therapeutic trial of light therapy should be two to four weeks long. [Level 2 evidence]
(2) A therapeutic trial of antidepressants should be six to eight weeks long. [Level 2 evidence]
(3) Because of risk of relapse, patients should continue with treatment for the entire winter season, until the time of their natural spring or summer remission. Treatment is not generally recommended during the summer months. [Level 2 evidence]
(4) Light therapy can be discontinued abruptly. When possible, antidepressants should be tapered instead of abruptly discontinued. [Level 5 evidence]
(5) Following a season of successful treatment, the treatment should be restarted in subsequent years either with onset of mild symptoms or in advance of the usual onset of symptoms. [Level 5 evidence]
(6) Intermittent light therapy may be helpful during the summer for occasional transient symptoms. [Level 5 evidence]
(7) Preventative year-round antidepressant treatment (including the summer) should be considered when (a) patients are poorly compliant or motivated, (b) they take a long time to taper off and on medications, (c) they are unable to recognize early signs and symptoms of depression, (d) they have very early onset or very late offset of symptoms, and (e) they experience transient symptoms during the summer. [Level 5 evidence]

How do you manage comorbidity?

Psychiatric comorbidity has been reported in patients with SAD since the syndrome was first described by Rosenthal and colleagues in 1984. Unfortunately, comorbidity has not been well characterized in large studies, and the literature is mostly in the form of single-case reports or small case series. In considering the issue of comorbidity, it may be useful to review the different types of comorbidity:

Type I: A comorbid psychiatric disorder that may also have a seasonal pattern (e.g., seasonal bulimia nervosa or panic disorder).
Type II: A comorbid psychiatric disorder that has no apparent seasonal component (e.g., obsessive compulsive disorder, pain syndromes) worsened by winter depression.

A number of psychiatric disorders may have Type I comorbidity and may be responsive to the same treatments as SAD. The most extensively studied disorder is bulimia nervosa. Over a dozen studies have reported significant seasonal worsening of mood symptoms and eating behaviours (binge eating and purging) (as reviewed in Lam and Goldner, 1998). Comorbid SAD may occur in up to one-third of patients with bulimia nervosa. Two controlled studies of light therapy for bulimia nervosa have shown significant improvement in mood and bulimic symptoms (Blouin et al., 1996; Lam et al., 1994).

Other disorders that may have significant seasonal patterns include premenstrual dysphoric disorder (PMDD, previously known as late luteal phase dysphoric disorder) (Maskall et al., 1997) and panic disorder (Marriott et al., 1994). In a small-sample study of SAD patients, PMDD was the most common comorbid diagnosis, reported in 70% of patients (Partonen and Lonnqvist, 1995). The investigators noted that patients with comorbid PMDD preferred evening light treatment to morning sessions. Response to light therapy in patients with PMDD (not comorbid with SAD) remains controversial, with conflicting results found within the same research group (Parry et al., 1987, 1989, 1993). Comorbid panic disorder was found to occur in 24% of a small sample of 38 consecutive patients with SAD (Halle and Dilsaver, 1993). The panic attacks were present only in the context of depression and were thus restricted to the fall and winter months. A subset of these patients with panic disorder was treated and improved with open-label trials of light therapy or pharmacotherapy.

The specificity of the finding of seasonality in bulimia nervosa, PMDD, and panic disorder is bolstered by data that seasonality is not associated with obsessive-compulsive disorder (Yoney et al., 1991) or anorexia nervosa (Lam et al., 1996a). Of interest is that several of these disorders (e.g., bulimia nervosa, PMDD) share common symptoms (e.g., depressive mood, overeating behaviours, oversleeping) and common treatments (response to SSRI antidepressants and light therapy) with SAD. This commonality has led to speculation that there are common pathophysiological factors, such as serotonergic dysfunction or circadian dysregulation, in their etiologies (Lam and Goldner, 1998).

An example of Type II comorbidity is Axis II (personality) disorders. Personality disorders have been reported in SAD clinic samples, including avoidant personality disorder (Partonen and Lonnqvist, 1995) and other cluster C disorders (includes avoidant, dependent, obsessive-compulsive, and passive-aggressive personality disorders) (Reichborn-Kjennerud et al., 1994). However, the prevalence of personality disorders

was similar to that reported in nonseasonal depression. Follow-up of patients with comorbid avoidant personality disorder found that they often chose to continue light therapy until late spring, suggesting that light therapy may also be treating the mood/temperament component of personality disorder (Partonen and Lonnqvist, 1995). A small, but not statistically significant, decrease in personality disorder diagnoses was noted after light therapy, but the presence of a personality disorder was also associated with a poorer clinical response to light therapy (Reichborn-Kjennerud et al., 1994).

Other evidence for Type II comorbidity comes from scattered case reports of seasonal worsening in disorders such as trichotillomania ($n = 1$), obesity ($n = 4$), cocaine abuse ($n = 2$), and obsessive-compulsive disorder ($n = 1$). Some authors have suggested the possibility that SAD might represent a media-popularized somatoform-spectrum disorder (similar to somatization disorder, environmental hypersensitivity, or chronic fatigue syndrome) (Eastwood and Peter, 1988). There is little support for this view in the literature. Two small case series of SAD with chronic fatigue syndrome (Lam, 1991) and with environmental hypersensitivity and somatization (Hotopf, 1994) found that the patients improved with light therapy. In contrast, one report found that seasonality scores were significantly lower in patients with chronic fatigue compared to patients with SAD, or nonseasonal major depression, or atypical depression (Zubieta et al., 1994). However, a more extensive study showed that up to 37% of patients with chronic fatigue syndrome have a pattern of atypical symptoms that is indistinguishable from SAD (Terman et al., 1998b). Furthermore, the seasonal-pattern patients were more likely to have experienced a recent major depressive episode than the nonseasonal patients. Thus, chronic fatigue syndrome may be an example of Type I comorbidity.

In summary, comorbidity may be commonly found in SAD, especially with eating disorders (bulimia nervosa), anxiety disorders (panic disorder), and personality disorders. There are few data on management of comorbidity in SAD. Some studies have shown that light therapy may treat both the symptoms of SAD and the symptoms of the comorbid disorder. Some comorbid diagnoses (e.g., personality disorder) may be associated with poorer response to treatment, as found in studies of nonseasonal depression. There are no studies of medication treatment for SAD with comorbid conditions, although many of the comorbid conditions also respond to medications, especially SSRI antidepressants.

The clinical consensus is that comorbid conditions should be identified because these patients may require additional treatment to the primary treatment for SAD. For example, cognitive therapy may be indicated for comorbid panic disorder or bulimia nervosa.

Recommendations: Managing Comorbidity

(1) Comorbid diagnoses are common with seasonal affective disorder (SAD), especially bulimia nervosa, premenstrual depressive disorder, panic disorder, and personality disorders, but there is insufficient research to determine prevalence rates. [Level 2 evidence]

(2) Comorbid diagnoses should be identified because there are treatment implications for these patients:
   - Comorbid diagnoses that also have a seasonal component or pattern may benefit from light therapy (e.g., seasonal bulimia nervosa, seasonal panic disorder). [Level 3 evidence]
   - Comorbid diagnoses may be associated with a poorer treatment response (e.g., personality disorders). [Level 3 evidence]
   - Comorbid diagnoses may require additional treatment specific to that disorder (e.g., cognitive therapy for panic disorder). [Level 5 evidence]
   - Comorbid diagnoses may require combination treatment with light therapy and antidepressants (e.g., bulimia nervosa). [Level 5 evidence]

Can psychotherapy serve as an adjunct to light therapy or medications for SAD?

Surprisingly, the use of psychotherapy for SAD has not been the subject of empirical study. Most clinicians agree that counselling and advice for issues such as physical exercise, maintaining a regular sleep-wake cycle (sleep hygiene), and attention to nutrition and stress reduction produce benefits for patients with SAD. Certainly, encouragement to adhere to a schedule for light treatment or to spend more time in bright ambient outdoor light (Wirz-Justice et al., 1996) may lead to disorder-specific improvement. However, there are no data on more formal, manualized psychotherapies such as cognitive-behavioural therapy (CBT) or interpersonal psychotherapy (IPT).

There is considerable evidence showing that nonseasonal depression may improve with brief psychotherapy such as CBT or IPT (for review, see Thase, 1997). These psychotherapies can also be used in conjunction with somatic therapies to enhance compliance or treat residual symptoms. The panel consensus was that psychotherapy might also benefit some patients with SAD. However, the specific type of psychotherapy that may be effective, the duration of treatment, or the relationship between the timing of therapy and the season of onset is not known.

How do you manage patients who do not respond to treatment?
Patients may have a full response, partial response, or nonresponse to treatment. To operationalize these definitions, scores on depression rating scales (e.g., the Hamilton Depression Rating Scale, 29-item SAD version, or the Beck Depression Inventory II) are often used. A clinically significant response to treatment is often defined as greater than 50% reduction in depression scores compared with baseline. Clinical remission is usually defined more strictly, such as greater than 50% improvement in depression scores and a posttreatment depression score that is within the normal range. A partial response can be defined as between 25% and 50% reduction in scores from baseline or as a posttreatment depression score that is still in the symptomatic range. Finally, nonresponse is usually considered to be less than 25% improvement in baseline depression scores.

There are few studies to guide clinical decisions for limited response to treatment, and, indeed, treatment studies use varied definitions for clinical response, making comparisons difficult. The consensus panel recommends a step-by-step approach similar to that described for "treatment resistant depression" (e.g., Thase and Rush, 1997). **Step 1** is to reverify the diagnosis of recurrent major depression with seasonal pattern. **Step 2** is to ensure that an adequate trial of treatment (i.e., an adequate dose and adequate length of time) has occurred and that the patient has adhered to the recommended treatment. **Step 3** is to consider factors that can contribute to treatment resistance. The numerous potential factors may be grouped in six subgroups:

(1) unrecognized subtype of major depression (e.g., psychotic depression, subtle bipolar II disorder);

(2) comorbid psychiatric disorders (e.g., undisclosed substance abuse, panic disorder, personality disorder);
(3) unrecognized medical illness (e.g., subclinical hypothyroidism);
(4) direct medication effects (e.g., glucocorticoids);
(5) chronic psychosocial stresses (e.g., ongoing abuse);
(6) pharmacokinetic or biological interactions with treatment (e.g., is patient a rapid metabolizer of antidepressants? are cataracts interfering with light therapy?)

Once these factors are assessed, specific interventions can be considered for patients who show limited response to either light therapy or antidepressant treatment.

(1) Limited response to light therapy?
The first therapeutic strategy for limited response is to optimize the antidepressant treatment. There are no studies that examine the effects of changing the treatment parameters to optimize light therapy in nonresponders, so recommendations are limited to the clinical opinions of the consensus panel. First, with partial or nonresponse, it is important that the clinician ensure that the patient has had an adequate trial of light therapy (see Section 2). If there is only a partial response after 14 days of adequate light therapy, then there are two treatment options to consider:

(1) *Increase the "dose" of light.* Increase in dose can be achieved for 10,000 lux light exposure by either increasing the duration of exposure time to as much as 45 minutes or one hour daily by extending the morning session or by adding a second period of light exposure in the afternoon or evening. Alternatively, the dose can be raised by increasing the intensity of the light being received (e.g., if patients are receiving only 2,500 lux light). Some light units have different settings, but for others moving closer to the light source will increase the intensity. Unfortunately, moving closer is an imprecise way of increasing the dose, and often the increased brightness or glare makes this alternative impractical.
(2) *Change the timing of light.* Although morning light appears to be superior to evening light for many patients, a small number of patients may respond better to evening light (Terman et al., 1990c; Terman et al., 1998). Therefore, if patients do not respond

fully to morning light, then it is reasonable to switch to evening light.

There are few data about managing nonresponders after optimizing light therapy. Only one study has examined the issue of partial responders to light therapy. Open-label l-tryptophan, 1 g t.i.d., was added to light therapy in 14 SAD patients showing no or limited response after two weeks of a standardized trial of light therapy (Lam et al., 1997a). Substantial improvement was found in 9 of the 14 patients with the combination treatment. Another option for partial responders, or patients who experience recurrence of symptoms after an initial response to light, is to add an antidepressant medication, as discussed in the subsection on combination treatment.

If there has been no response to treatment after two weeks of light therapy, then many clinicians recommend that light therapy be discontinued and an alternative treatment (e.g., antidepressant medications) commenced. This recommendation is based on the clinical observations that a majority of patients who eventually respond to light therapy show some response in the first week and that, among patients who fail to show even a partial response at two weeks, few will respond if treatment is extended. Furthermore, such an extension must be balanced against the risk of continued depression. Treatment with antidepressants and other agents is discussed in the section on medications.

(2) Limited response to antidepressants?

When the patient does not respond to an adequate trial of antidepressants, with appropriate increases in dose, the consensus panel recommends trying a combination of light therapy with the (previously ineffective) antidepressant as the first change in management. If this approach proves unsuccessful, then the light therapy should be discontinued and the usual stepwise approach for managing treatment-resistant depression (e.g., augmentation, switch to an antidepressant of a different class, combination with other antidepressants, electroconvulsive therapy, etc.) may need to be employed. Due to the (relatively) short seasonal length of the depression in such patients, the depressive symptoms should begin to lift before such alternative strategies can be systematically tried. In this case, the process may need to "start where last left off" during the next fall-winter depression, until an effective approach is reached.

Recommendations: Managing Limited Treatment Response
Because of lack of data, recommendations are based on clinical experience and panel consensus – that is, Level 5 evidence.

(1) Patients showing limited response to treatment should first be evaluated to ensure that they have adequate dosing of treatment (light therapy or medications) and that they are compliant with treatment.
(2) If treatment is adequate, then patients should be evaluated for factors that may contribute to a poor response, including depression subtypes, psychiatric comorbidity, unrecognized medical illness, other medication effects, chronic psychosocial stresses, and specific factors that interfere with treatment.
(3) Strategies for dealing with partial responses to light therapy include increasing the dose, changing the timing, and trying alternative therapies, such as l-tryptophan augmentation or combining with antidepressants.
(4) Strategies for dealing with partial responses to antidepressant medications include combining with light therapy, switching to another antidepressant, augmenting with another agent, combining with other antidepressants, and electroconvulsive therapy.
(5) In dealing with patients with refractory illness, it is important to take a methodical, stepwise approach with clear documentation of treatments.
(6) Psychological treatments, such as cognitive-behaviour therapy or interpersonal therapy, may be of benefit in some patients with SAD. Until evidence is accrued, psychotherapy cannot be considered a first-line treatment for SAD.

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Resources

Society for Light Treatment and Biological Rhythms (SLTBR)

SLTBR is an international, not-for-profit society dedicated to fostering research, professional development, and clinical applications in the fields of light therapy and biological rhythms.

Contact: Stephanie Argraves, Executive Director, SLTBR
842 Howard Avenue, New Haven, CT, USA 06519
e-mail: sltbr@yale.edu
Web site: http://www.websciences.org/sltbr/
(includes a list of corporate members that manufacture and distribute light devices)

Other Web Sites

Canadian Consensus Guidelines for the Treatment of Seasonal Affective Disorder

The summary of the report of the Canadian Consensus Group on SAD, as published in the Canadian Journal of Diagnosis supplement, October 1998.
http://www-fhs.mcmaster.ca/direct/sad.html

Dr. Lam's SAD Page at the University of British Columbia

http://www.psychiatry.ubc.ca/mood/md_sad.html

Dr. Terman's Winter Depression Research Program at Columbia University

Includes FAQ (frequently asked questions) about SAD.
http://www.columbia.edu/~mt12/

Center for Environmental Therapeutics

Includes information on recent research of treatment for SAD.
http://www.cet.org/cet2000/

Lou Puls's SAD Page
An excellent consumer-oriented page with SAD information and links.
http://www.geocities.com/HotSprings/7061/sadhome.html

Canadian Network for Mood and Anxiety Treatment (CANMAT)
This collaborative network has information for both patients and professionals.
http://www.canmat.org/

Depression Information Resource and Education Centre, Toll-Free (DIRECT)
Based at McMaster University, this information agency has a toll-free telephone information service about depression and a helpful Web site.
Toll-free number: 1-888-557-5051 (public), 1-888-557-5050 (physicians)
http://www-fhs.mcmaster.ca/direct

Books for Patients

Don't Be SAD: Your Guide to Conquering Seasonal Affective Disorder
By Celeste A. Peters
Script Publishing, Calgary, AB, 1994, $18.95

Winter Blues: Seasonal Affective Disorder and How to Overcome It
By Dr. Norman E. Rosenthal
Guilford Press, New York, NY, 1998, $22.95

Books for Clinicians and Researchers

Seasonal Affective Disorder and Beyond: Light Treatment for SAD and Non-SAD Conditions
Raymond W. Lam (editor)
American Psychiatric Press, Washington, DC, 1998

Seasonal Affective Disorders and Phototherapy
Norman E. Rosenthal, Mary Blehar (editors)
Guilford Press, New York, NY, 1989

Seasonal Affective Disorders
Chris Thompson, Trevor Silverstone (editors)
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