



Research report

Seasonality of mood and behavior in the Old Order Amish



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ARTICLE INFO

Article history:

Received 26 September 2012

Accepted 23 October 2012

Available online 17 November 2012

Keywords:

Seasonal affective disorder

Seasonality

Amish

Epidemiology

ABSTRACT

Background/Objective: We examined seasonality and winter seasonal affective disorder (SAD) in the Old Order Amish of Lancaster County, Pennsylvania, a unique population that prohibits use of network electric light in their homes.

Methods: We estimated SAD using the seasonal pattern assessment questionnaire (SPAQ) in 1306 Amish adults and compared the frequencies of SAD and total SAD (i.e., presence of either SAD or subsyndromal-SAD) between men and women, young and old, and awareness of (ever vs. never heard about) SAD. Heritability of global seasonality score (GSS) was estimated using the maximum likelihood method, including a household effect to capture shared environmental effects.

Results: The mean (\pm SD) GSS was 4.36 (\pm 3.38). Prevalence was 0.84% (95% CI: 0.36–1.58) for SAD and 2.59% (95% CI: 1.69–3.73) for total SAD. Heritability of GSS was 0.14 ± 0.06 (SE) ($p=0.002$) after adjusting for age, gender, and household effects.

Limitations: Limitations include likely overestimation of the rates of SAD by SPAQ, possible selection bias and recall bias, and limited generalizability of the study.

Conclusions: In the Amish, GSS and SAD prevalence were lower than observed in earlier SPAQ-based studies in other predominantly Caucasian populations. Low heritability of SAD suggests dominant environmental effects. The effects of awareness, age and gender on SAD risk were similar as in previous studies. Identifying factors of resilience to SAD in the face of seasonal changes in the Amish could suggest novel preventative and therapeutic approaches to reduce the impact of SAD in the general population.

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1. Introduction

Changes in mood and behavior with changes in season, referred to as seasonality, have been recognized since ancient times (Wehr and Rosenthal, 1989). Winter seasonal affective disorder (SAD) was first defined in 1984 by Rosenthal et al.

(1984) as a syndrome characterized by recurrent episodes of depression in the autumn and winter with remission in the spring and summer. While patients with SAD must have at least one episode of Major Depression according to the Rosenthal criteria [Ibid.] or two episodes of Major Depression in two consecutive years according to DSM-IV-TR criteria (American Psychiatric Association, 2000), a form with shorter or milder forms of depression, often with predominant neurovegetative symptoms (sleep and appetite changes), has been described as subsyndromal SAD (s-SAD) (Kasper et al., 1989a).

The dual vulnerability hypothesis of SAD (Lam et al., 2001) proposes that SAD is a result of chronobiological vulnerability and

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vulnerability to affective dysregulation. A tendency toward an extension of nocturnal duration of melatonin secretion in response to shortened day length (photoperiod) (Wehr et al., 2001) and delays of circadian rhythms in response to limited (or reduced) exposure to morning light in fall and winter (Lewy et al., 2006) represent the major chronobiological mechanisms proposed for SAD. Symptoms of SAD resemble seasonal changes in photoperiodic mammals in response to shortening of photoperiod, including hyperphagia and weight gain, hypersomnia, anergia, and decreased libido (Wehr, 2001; Workman and Nelson, 2011). These symptoms of SAD respond favorably to treatment with bright light (Eastman et al., 1998; Lewy et al., 1998; Terman et al., 1998; Golden et al., 2005). Like photoperiodic mammals, patients with SAD, but not healthy controls, have a longer duration of melatonin secretion in winter than in summer (Wehr et al., 2001).

Lewy et al. (1980) have reported that light can suppress secretion of melatonin in humans, provided it is of sufficiently high intensity (about 2500 lx). More recent studies have demonstrated that exposure to even low levels of light corresponding to ordinary room light (about 180 lx) can affect the circadian pacemaker and suppress melatonin secretion (Boivin et al., 1996; Zeitzer et al., 2000; Gooley et al., 2011). It is therefore likely that, in modern societies, exposure to electric light may mask the exposure to longer nights in winter and thereby possibly reduce the observed prevalence of SAD. In fact, to our knowledge, all epidemiological studies of SAD to date have been conducted on populations that use network electric lighting (lighting powered by the electric grid) (Magnusson, 2000). By corollary, one could postulate that a population with limited use of electric light would be more susceptible to the seasonal effects of long nights and would potentially have a higher prevalence of SAD.

The Old Order Amish of Lancaster, Pennsylvania (40°N), are such a population. There are approximately 30,000 Old Order Amish in Lancaster County, about half of whom are over the age of 18 years, constituting a rural, primarily agrarian community (Kraybill, 2008). The Old Order Amish religion prohibits technologies – such as the use of telephones in the home, driving cars, and wrist watches – that are perceived as colliding with their beliefs and practices [ibid.]. This community has not linked to the electric power grid and does not use electric light in the home; rather they use relatively low-intensity propane-powered gas lighting and candles (Scott and Pellman, 1999). The Amish, thus, represent a convenient population to conduct a study on SAD in which the masking effects of artificial light on natural photoperiod are minimized.

The role of genetic factors in SAD was initially suggested by an increased prevalence of affective disorders and SAD in first degree relatives of SAD patients. Since then, a number of studies have suggested a genetic contribution for seasonality (Rosenthal et al., 1998; Willeit et al., 2003; Thierry et al., 2004; Roeklein et al., 2009). For instance, a study of 4639 adult twins in an Australian registry reported a 29% heritability of seasonality (Madden et al., 1996). To our knowledge, there is no study of heritability of seasonality in a population with limited exposure to modern artificial lighting, such as the Amish.

We thus conducted a cross-sectional study of seasonality of mood and prevalence of SAD based on the seasonal pattern assessment questionnaire (SPAQ) (Rosenthal et al., 1987) in the Old Order Amish. We hypothesized that the global seasonality score (GSS), a measure of magnitude of seasonal behavioral changes, and the prevalence of SAD would be higher in the Amish than in other populations previously studied at similar latitudes (Kasper et al., 1989b; Rosen et al., 1990). As reported in previous epidemiological studies (Magnusson, 2000), we further hypothesized that women would have a higher prevalence of SAD than men, and that awareness (whether or not the subject had ever

heard about SAD) and younger age would be associated with higher GSS and frequency of SAD. Since all Lancaster Amish are related through a well-documented 14-generation genealogy, we also estimated the heritability of GSS in the Amish.

2. Methods

2.1. Procedures and sample selection

We mailed the seasonal pattern assessment questionnaire (SPAQ) (Rosenthal et al., 1987) to 2260 Amish individuals, aged 18 and older, who had previously participated in studies of cardiovascular, metabolic, and bone health conducted at the University of Maryland (Streeten et al., 2006; Hseuh et al., 2007; Mitchell et al., 2008; Rampersaud et al., 2008). A letter was included with directions to complete the questionnaire and return it in a pre-stamped, addressed envelope. A \$1 bill was included as a token of appreciation. The letter sent to the participants explicitly stated that their completing the questionnaire would document their consent to participate in this study. This study and all previous studies were approved by the Institutional Review Board of the University of Maryland School of Medicine. The seasonal pattern assessment questionnaires were mailed in May, 2010 with a second mailing to non-responders to the first in September, 2010. A total of 1306 questionnaire responses, representing a response rate of 57.8%, were received back before December 31, 2011 and are included in the dataset.

2.2. Seasonal pattern assessment questionnaire (SPAQ)

The SPAQ (Rosenthal et al., 1987) is a research and screening tool that is widely used in studies of seasonality and SAD. The SPAQ evaluates severity of global seasonal changes, degree of functional impairment with those changes (“problem”), and seasonal pattern (summer vs. winter) if the other two criteria are met. The GSS was calculated based on responses to the six parameters of seasonality (sleep duration, social activity, mood, weight, appetite, and energy level) as rated on a 0 (“no change”) to 4 (“extremely marked change”) scale reflecting degree of change across the seasons (Kasper et al., 1989b). In a few cases where responses to one or more of the six items were left blank, the GSS was estimated using a proportion based calculation. A convenience sample analysis of test–retest reliability of the GSS and problem rating score (PRS) on the SPAQ in 68 study subjects yielded satisfactory results (GSS, $\alpha=0.87$, $p<0.001$; PRS, $\alpha=0.79$, $p<0.001$) (Kuehner et al., in press).

SAD was defined according to three criteria: (a) GSS score, (b) “problem” and (c) seasonal pattern (Magnusson, 2000). Subjects were classified as having SAD if they had a GSS of 11 or higher, if they experienced seasonal changes as a problem to at least a moderate degree, and if they reported a fall–winter pattern of mood disturbance, i.e., if they felt worst during one or more months from September to February. Subjects were classified as having s-SAD if they had a GSS of at least 11 but the problem score was less than moderate (i.e., mild or none) or if they had a GSS of 9 or 10 and considered seasonal changes as at least a mild problem. For subjects who met GSS and problem criteria for either SAD or s-SAD, and had a predominantly fall/winter pattern with one or more months falling outside the fall/winter range, we used the following criterion to classify the pattern: If subjects felt worst during months in both fall–winter (September–February) and spring–summer (March–August), then they were classified as having SAD or s-SAD only if the number of months in which they felt worst during the fall–winter period (September–February) exceeded the number of months in which they felt worst during

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