

Increased Suicide Rate in the Middle-Aged and Its Association With Hours of Sunlight

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Objective: Aside from diminished daily functional capacity, individuals with depression are at greatly higher risk of suicide. Given that both endogenous depression severity and the incidence of suicide peak during the spring and summer months, it would seem that an environmental cue—one that generates alterations in brain neuronal activity that result in depressed affect or suicidal ideation—might be important.

Method: The authors examined the frequency of suicide and its relation to meteorological factors in the state of Victoria between January 1990 and April 1999.

Results: The incidence of suicide had its nadir in winter and zenith in the spring and summer and paralleled closely the number of bright sunlight hours. This pattern was particularly marked for violent suicide. During the decade, the suicide rate significantly increased among men between 21 and 60 years of age and women between 41 and 60.

Conclusions: The incidence of suicide in southeastern Australia displays a clear seasonal pattern, being positively linked with prevailing levels of sunlight. The rate of suicide increased in the latter half of the last decade.

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There are strong grounds for believing that subjects with depression are at greater risk of suicide (1). It follows that a higher prevalence of depression in the community would be mirrored by a concomitant elevation in the rate of suicide. Given that the severity of depression may peak in the spring (2), it would also seem that an environmental cue—one that generates altered central nervous system neuronal activity in predisposed individuals that results in depressed affect or suicidal ideation—might be important. If indeed meteorological factors have an impact on suicidal ideation, then it would be anticipated that not only would the seasonal variation in suicide be in some way explained by alterations in the weather but also that long-term alterations in meteorological parameters might influence rates of suicide. We examined the frequency of suicide and its relation to the weather in the state of Victoria between January 1990 and April 1999.

Method

The frequency of suicide in the community was derived from data obtained from the Research and Information Coordination Group of the Office of the State Coroner of Victoria and the Victorian Institute of Forensic Medicine. Data included date, time, method, and location of the incident as well as age and gender of the victim. Detailed meteorological data was obtained from the official database of the Australian Commonwealth Bureau of Meteorology (station number 87031, Laverton Royal Australian Air Force Base [latitude: 37° 51' 59" S, longitude: 144° 44' 45" E, elevation: 16 m] and station number 86071, Melbourne Regional Office [latitude: 37° 48' 26" S, longitude: 144° 58' 13" E, elevation: 34.7 m]). Maximum and minimum temperature, mean atmospheric pressure, total rainfall, and hours of bright sunlight were recorded daily. Bright sunlight hours were defined as the period of time during which the sun's intensity was sufficient to burn a trace on a standard chart when focused with a glass sphere (Campbell-Stokes recorder). As-

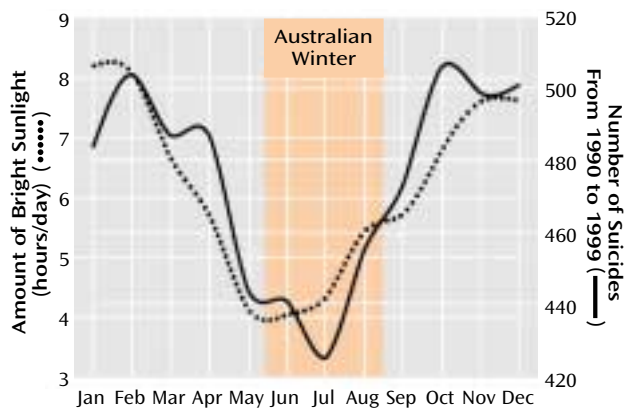
sociations between environmental factors and the number of suicides per month over the examination period were determined by using correlation and regression analyses. Seasonal decomposition was undertaken to identify the seasonally adjusted trends in suicide rates and environmental factors (SPSS Trends 6.1, SPSS, Chicago, 1994). This study conformed to the relevant guidelines of the National Health and Medical Research Council of Australia.

Results

Over the entire study period, there were 5,706 suicide incidents. Male victims outnumbered female victims 3.7:1 (the male-female suicide ratios by method were 2.4:1 for nonviolent suicides and 4.9:1 for violent suicides). The frequency of suicide displayed a clear seasonal pattern, with fewer incidents occurring during the winter months (Figure 1). This pattern was most prominent for violent suicide incidents (data not shown). While distinct and obvious annual fluctuations in temperature and rainfall were evident, only the average number of daily sunlight hours ($r=0.23$, $p<0.05$) and total sunlight hours per month ($r=0.24$, $p<0.05$) bore any association with the rate of suicide.

Examination of our data revealed a significant increase in the rate of suicide throughout the test period (annual trend=0.93, $p=0.002$). This increase was independent of climate and remained significant after we adjusted for season and variation in daily sunlight hours. In men, an increase in the rate of suicide was seen for those 21–40 years of age (from 30.4/100,000 in 1990–1992 to 35.3/100,000 in 1996–1999; trend=0.52, $p=0.002$) and those 41–60 years of age (from 22.8/100,000 in 1990–1992 to 26.3/100,000 in 1996–1999; trend=0.30, $p=0.02$). In women, the increase in the rate of suicide was confined to those 41–60 years of age (from 5.9/100,000 in 1990–1992 to 8.4/100,000 in 1996–

FIGURE 1. Association Between Suicide Frequency and Amount of Bright Sunlight in Victoria, Australia, 1990–1999^a



^a Monthly values encompass consecutive 3-month periods. For example, values for July were derived from the mean of values for June, July, and August, and values for August were derived from the mean of values for July, August, and September.

1999; trend=0.20, $p=0.008$). Thus, the only section of the community in which there was a significant increase in suicide for both men and women after we adjusted for season was among those 41–60 years of age. The annual seasonally adjusted trend for increase in monthly sunlight hours was 1.09 ($p<0.20$) and for daily sunlight hours 0.037 hours/day ($p<0.19$).

Discussion

In this study, we found that the incidence of suicide in the state of Victoria in southeastern Australia was at its lowest in winter and highest during the spring and summer and that it paralleled the daily hours of bright sunlight. Over the study period encompassing the past decade, there was a significant increase in the suicide rate among men 21–60 years of age and among women 41–60 years of age.

The observation that the incidence of suicide displayed an annual variation with, in the majority of instances, the peak occurring in spring, is in agreement with a number of studies undertaken in the Northern and Southern Hemispheres (3–7). We found a significant increase in the rate of suicide to be evident only in those subjects 21–40 and 41–60 years of age. This observation is not in accordance with data derived from England and Wales, where the suicide rate in men and women has recently been reported to have declined during the period 1990–1997 (8).

There exists a large body of evidence indicating that subjects with mental illness contribute disproportionately to the overall incidence of suicide (1) and that the occurrence and severity of some affective disorders, such as depression and mania, are more pronounced in the spring and summer period (2, 9, 10). Maes et al. (5) demonstrated a clear springtime peak in violent suicide and observed a positive correlation between the seasonality of depression severity

and the frequency of suicide (2). In line with this observation, Morken and Linaker (11) found the frequency of violence in Norway to be correlated with changes in day length and noted that the incidence of violent episodes increased with latitude. In their comprehensive examination of suicide across 28 countries, Chew and McCleary (6) concluded that the degree of seasonal variation in suicide is high in the temperate zones (between 30° and 60° north and south of the equator) and low in populations in the tropics. Whether latitude per se provides a reliable indicator of climatic variation is problematic—many places of similar latitude have markedly different climates. This is especially so for large countries such as Australia or the United States. Our observation of a strong association between suicide and sunlight hours and other reports documenting higher rates of suicide in springtime raise concerns about a possible link between suicide and bright light exposure. While there exists a small number of case reports documenting suicide attempt following bright light therapy (12), Lam and colleagues (13), in their retrospective examination of almost 200 case records, found that only 3% of seasonal affective disorder patients experienced a slight worsening of suicide scores following light therapy. Moreover, no patient attempted suicide or discontinued light therapy because of perceived elevated suicide risk (13).

We have demonstrated that the incidence of suicide in southeastern Australia displays a clear seasonal pattern, being positively linked with prevailing levels of sunlight. Moreover, the rate of suicide increased in the latter half of the last decade. While it is tempting to speculate on the importance of an environmental cue in predisposed individuals that results in depressed affect or suicidal ideation, it is clear that social issues such as possible reductions in the availability of mental health care and disintegration and loss of community (14) should be considered in parallel.

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