

# SEASONAL VARIATION OF SUICIDE

## A brief review

C. CHRISTODOULOU\*, V. EFSTATHIOU\*\*, G. BOURAS\*\*, P. KORKOLIAKOU\*\*, L. LYKOURAS\*\*\*

### Summary

*Studies on suicide seasonality are significant, as they may assist in understanding the factors that contribute to suicidal behavior. Although some studies do not confirm the existence of seasonal variation, most of them, both from the Northern as well as the Southern hemisphere, indicate the existence of seasonal variation for suicides. The majority even converges to the fact that there is a peak of suicides during the Spring and early Summer. Seasonal variation of suicides seems to be mainly influenced by gender (male), older ages and violent methods of suicide. Apart from these parameters, there are additional ones that have been taken into consideration with a view to a more comprehensive understanding of the phenomenon of seasonality. Biological, cultural, socio-economic and bio-climatic factors are likely to be involved in the seasonal pattern for suicidal behavior. Studies on suicide seasonality are not only an important source of epidemiological data for suicides, but represent a global effort to clarify the parameters of self-destructive behavior with a view to prevention.*

**Key words:** suicides, seasonality, suicide methods

### Introduction

Suicide is an important cause of mortality in all countries. Assessing suicide risk is difficult, since suicide is a complex human behavior with multifactorial causation. Suicide is related to serious mental health disorders especially depression, bipolar depression, schizophrenia, alcohol addiction and personality disorders.[1]

Depression is, of all the psychiatric disorders, the most important predisposing factor for suicide. Patients with depression have a 30 times greater risk of suicide compared to general population.[2,3,4] Schizophrenia is also associated with high risk of suicide.5,6 Apart from psychopathology, there are, other parameters implicated, too. These are genetic, biological, socio-economic, and environmental events that interact and have an impact during the period of the final act.[7,8,9,10]

The seasonal variations of deaths by suicide offer a challenge in order to elucidate the parameters that could contribute to suicide and their prevention. Most studies on this issue conclude that deaths by suicide increase and peak during Spring and the beginning of Summer.[11,12,13,14,15,16] In Greece, June is the month with the highest suicide rates.[17] There are, however, studies which indicate absence of seasonality in suicides, during the year.[18,19,20]

Various parameters have been studied in order to unravel the underlying causes of seasonality. These include biological, cultural, sociological and socio-economic factors which may be involved in the seasonality of suicidal behavior.[21,22,23,24,25,26]

The aim of this paper is to review the studies referred to: a) the presence or absence of seasonal variation in suicides, b) the changes in seasonality over time, c) the role of age, sex and method of suicide regarding seasonality and d) the possible interpretations of the phenomenon of seasonal variation in suicides.

### Seasonal variation of suicide in Europe

A nationwide Greek study, covering the years 1959-1975, showed that men commit suicide more often than women, that the mortality figure is higher in rural than in urban areas and that there is a seasonal peak in June.[17] Another Greek study reports an increase of

\*Ass. Professor, University of Athens. 2nd Dept. of Psychiatry, "Attikon" Hospital

\*\*Psychologist, 2nd Dept. of Psychiatry, "Attikon Hospital"

\*\*\*MD, PhD, FICPM, Professor in Psychiatry, University of Athens. 2nd Dept. of Psychiatry, "Attikon Hospital"

the rate of male suicides during the Spring and Summer months, with a significant decrease in September, while regarding the overall suicide rate, it also indicates a second lower increase in October and November.[27]

A recent Greek study of violent suicide deaths, confirmed the existence of seasonal variation of suicides, with a peak at the end of May. In this study the existence of the statistically significant seasonal variation regarding the gender is attributed mainly to men.[28,29] Other studies, also indicate June, as the month when most suicides occur in Greece.[15,25]

In Italy, studies covering years 1969-1994, note a significant increase on suicidal behavior in Spring, especially during May, with a higher seasonal effect on men than women.[22,30] In a recent study, a total of almost 98000 suicides occurring in Italy from 1974 to 2003 were investigated for seasonal variation. Seasonality of suicides with a clear peak in Spring has been found. The increase is clearer until 1994 and then it appears reduced, probably as a result of the annual reduction in the number of suicides over the next years.[31]

In an earlier study, in the same country, for the period 1969-1981, a peak for men in May and two peaks for women: one in May and a subsidiary for October and November, were noted.[32] Another study from Italy (Cagliari) reports two annual peaks, irrespective of the victim's gender and age. One peak is for the month of February and a smaller one for July.[33]

Seasonal variation with a substantial increase for Spring, especially May, has been registered in France, Spain, and Portugal.[15,13] In addition, seasonal variation with a Spring peak, for both sexes, is registered in Slovenia, in a study covering years 1971-2002. Seasonality is stronger from 1987 to 1994 and decreases as the yearly rate of suicide declines, due to better psychiatric health care of the population after the war.[34]

The seasonal variation is evident in Eastern European countries, in spite of the fact that a weakening of the seasonal association has been reported in Hungary, during the 80s.[35,36,37] In Central Europe, in a study conducted in Switzerland, during the years 1969-1994 with 37518 suicides, a clear seasonal effect emerged, with an increase in suicides during the months of May and June and a decrease in December.[38] Nevertheless, another study from

Switzerland covering a 100 years period, showed a continuous weakening for the seasonality.[20,39]

Some studies, especially from the United Kingdom (UK), register an increase in suicides during Spring for both men and women and a second increase only for women during the months of Autumn.[40,41] In the same country, Yip et al. (2000)[19] re evaluate the seasonal variation of suicides in England and in Wales, during the years 1982 to 1996 and observe a decrease from 20.9% to 5.55%, which is attributed to a reduction of suicides of people who lost their partner or divorced. Researches from Northern European Countries (Finland, Lithuania and Greenland) studying large samples of suicides through extended time, have also established seasonality for Spring and the first Summer months with a subsequent reduction for Winter.[16,42,26] Rihmer et al. (1998)[43], find a reduction in the range of seasonality in suicides in the area of Sweden, which they attribute to an increased use of antidepressants. In a recent study in Denmark, where one of the best health monitoring systems exists, the overall seasonal variation appears to be reduced, but remains still significant in men who commit suicide and suffer from psychiatric illness. The researchers conclude that the seasonality in suicides carried out under severe mental illness is obvious, but varies between different time periods and by gender.[44]

### **Seasonal variation of suicide in the rest of th World**

In the United States of America, a study in California found no evidence for seasonality in Los Angeles and Sacramento, during the years 1968-1977.[45] On the other hand, in a study conducted in New Jersey, seasonal variation was found with a Spring and Summer peak for both sexes.[12] It seems that seasonality in the USA presents an increasing tendency during the period 1971-2000.[46]

Regarding seasonality in Japan, two peaks have been noted, a high in April and another lower peak in Autumn, in a study covering the period 1979-1999.[47] As for the seasonal variation in suicides in Hong Kong, it seems to be diminished.[48] Seasonal variation is noted in Taiwan with a peak during Spring, regardless of gender and age.[49]

In the countries Australia and New Zealand, during the years 1981-1993, in contrast with data from many other countries, no kind of seasonality was record-

ed.[18] In another Australian study, covering an almost 30 year span (1970-1999) an increase was noted regarding the seasonal variation of suicides with a peak in the late Spring (November in this country), attributed mainly to men.[50] Similarly, seasonality has been found in a study in South Africa, where suicides also increase during the Spring (months of September–October).[51]

Therefore, it seems that seasonality is observed with an increase in suicides for Spring and early Summer and an analogous decrease during Autumn and Winter months, that is a constant, if not a universal behavior that affects both the Northern as well as the Southern hemisphere.[13,15]

### **Factors affecting suicide seasonal variation**

In the study of suicide seasonality apart from the gender, crucial is the role of the age of the victim and the method of suicide. Studies show that suicides committed with mainly violent methods are characterized by seasonal variation with a Spring peak and a reduction in their rates in Autumn. In a recent study in Greece, seasonal variation is associated with suicides by self-shooting and by self-hanging, especially in individual's age of 45 and older.[28] On the contrary, suicides committed with non-violent means show no seasonal variation for both sexes, which is, however, remarkable in older ages.[14,52]

In Italy, only men with violent suicides have seasonality with a Spring peak.[53] Seasonality of suicide in a large number of cases was studied in Italy between 1969 and 1984 and it was noted that seasonal variation was significant for men, suicides were more frequent in urban areas, but seasonal distribution was greater in rural areas.[22]

A study in Belgium reconfirms that seasonal variation, with a peak during Spring and Summer, is associated with violent suicides, which become more frequent by increasing age and are more prominent in men. In younger individuals, there is an increase in March and April, while for the elderly, there is an increase in August.[54]

Furthermore, analyzing data of periods of more than 100 years from Switzerland, a continuous weakening of the seasonal variation has been observed. Despite this weakening, there is still a seasonal variation in violent suicides during Spring, especially in suicides by drown-

ing and hanging.[20] Similarly, in a study conducted in West Greenland, covering a 27 year span, which notes a significant seasonal variation with peak in June, violent methods are represented in 93% in all suicide cases.[42]

In a recent study from Lithuania, where the most common method of suicide is hanging, a strong seasonal variation with a peak in Summer is observed.[26] Suicide by hanging has a statistically significant increase in Spring for both sexes in a Finnish study with a large sample of suicides (1980-1995). In the same study, seasonality for Summer is noted especially for men who died by drowning, jumping, or poisonous gas inhalation. In women, there is an increase in Autumn, attributed to deaths by poisoning or drowning.[55] In another Finnish study, during the same period, despite a tendency for increased seasonality for the total number of suicides, violent suicides show a clear increase during the months of Spring and Summer.[56]

In a recent study conducted in Finland, seasonal variation of suicides by firearm was examined, comparing adolescents up to 18 years and adults. Seasonality with a significant increase during Autumn was reported concerning adolescents, whereas for adults during Spring.[57] Moreover, seasonality is recorded in suicides by violent methods in adolescents, in Norway.<sup>58</sup> Similar results are registered in a study conducted in Australia between 1970-1999, where the observed seasonal peak during Spring (September to November in Australia) is attributed to the use of violent methods and men.[50]

It appears that seasonal variation is a phenomenon which exists but varies from country to country or even within the same country, at times. Nevertheless, there are some studies in which seasonal variation is not supported.

### **Possible interpretations**

Durkheim concludes that "suicidal circles" are related with the intensity of other social "circular activities" i.e agricultural activities, where as the day is longer, the individual is under increasing social stress.[59]

The question about what is the mechanism by which the bioclimatic factors (as ambient temperature, sunlight duration, and precipitation) act, remains. Two interpretations seem more probable: it is either the seasonal cycle through the lengthening of days and physi-

ological changes, that they cause, or the intense seasonal changes, which intensify certain socio-psychological mechanisms. The answer is not simple, but it is probably a combination of both.[13] Some studies in both hemispheres incriminate socio-demographic factors, particularly for the increase of suicides during Spring.[51]

The influence of temperature and other bioclimatic factors in seasonal variation of suicides is controversial.[50,60,61] Some studies, however, establish seasonality with a Spring peak which they attribute to the temperature. Increased temperature might imply increased sunshine in these countries.[33,62,49] Exposure to sunshine is an interesting suggestion, because May and June have the longer days and as a consequence, more sunshine. It is assumed that sunlight triggers suicidality. This may be through hormones that are dependent to it and have a relation in emotional regulation, such as melatonin, cortisol, serotonin, and L tryptophan.[15] Furthermore, another study assumes that the triggering of suicidality by sunlight may be mediated through a mechanism with a specific lag and duration. The authors postulate that the sunshine acts as a natural antidepressant, that firstly improves the motivation and later improves the mood.[25]

Violent suicides have a significant positive correlation with exposure to the sun and increased temperature, and a significant negative correlation with humidity and rainfall. Non-violent suicide methods on the other hand, are negatively correlated with exposure to sunlight and increased temperature.[14] The increase of sunlight coincides with the seasonal variation in other studies as well.[42,16]

It is known that mental illnesses are an important variable in suicides.[1] Some mental disorders, especially those of the emotional type, have a seasonal variation, followed by pathological behaviors as violence and suicide.[63] A Canadian study of mentally ill men, concluded that the seasonal variation of suicide in patients manifests itself differently depending on their psychopathology. Indeed, it was reported that depressed suicides, without cluster B personality disorders, showed seasonality (Spring/Summer).[64] Some studies, however, did not establish seasonal variation of psychopathology and suicidal ideation during Spring.[65]

Apart from psychopathology, physical illnesses that present with seasonality such as atopic disease, has been suggested that might intensify the seasonal variation of suicide.[66] Moreover, serotonin is involved in the seasonal variation of suicide as well. Studies on the seasonality of emotional disorders that depend on serotonergic activity, indicate that sunlight possibly influences serotonergic activity in the central nervous system.[24,67] Acute and rapid changes in serotonin function caused by different factors (including antidepressant medication), are important in order to understand changes in suicidal behavior and to explain the robust seasonal peak of suicides in Spring.[68]

Finally, it has been proposed that the suicide seasonal variation is related with the seasonal variation of violent behavior since, as already mentioned, seasonal variation is stronger for violent suicides.[14,50]

Seasonal variation of suicides explanations is not necessarily unique. There might be associations between various parameters, as for instance weather conditions and biological rhythms.

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