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THE INCIDENCE OF SUDDEN CARDIAC DEATH IN AUSTRIA

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Abstract

The aim of the study was to assess the time structure (chronome) of sudden cardiac death (SCD) in Austria. The daily incidence of SCD (ICD-10 I46.1) in Austria was obtained for the 4-year span from Jan 2002 to Dec 2005. Data were available separately for men and women. This data series was analyzed by linear-nonlinear rhythmometry. The major feature is the detection of a cis-half-year that is validated nonlinearly, the estimated period of the cis-half-year is 0.408 year (95% CI: 0.389, 0.426). It is concluded that the chronobiological analysis of sudden cardiac death in Austria showed the variability of total incidence with the period of a cis-half-year.

Key words

Sudden cardiac death, Chronobiology, Cis-half-year period

INTRODUCTION

The mapping of time structures, chronomes, constitutes an endeavor spawned by chronobiology: chronomics. The results of this mapping, chronomics, can be used to plan the system time of future studies and to interpret results in the context of a broader time horizon, e.g., in health care or basic science. This mapping is done all over the world and also in Brno, the birthplace of genetics. We draw a parallel between the mapping of the genome, genomics, spawned by genetics, and that of chronomics, an offshoot of chronobiology. Fiser et al. have greatly broadened the time horizon in archivization by showing a 50-year cycle in stroke incidence in the Czech Republic as in Minnesota (*1, 2*). The proper coding for medical chronomics, relating to natality, morbidity and mortality, is overdue and is an urgent governmental

task (*3*). Incidence of sudden cardiac death was studied using the chronobiology approach earlier. In Minnesota (*4–8*) and in Tokyo (*9*), a calendar year does not characterize sudden cardiac death as defined in the 10th classification of diseases (ICD-10, code I46.1), even though the importance of low winter temperatures continues to be emphasized (*10*). Instead, the two major components are a trans-year with a period of about 1.3 years corresponding to changes observed in solar wind speed (*11*) and a cis-half-year with a period of about 0.42 year corresponding to changes observed in solar flares (*12–14*). These components are also detected in other but not in all geographic locations with data available for analysis (*4, 5*). At some other sites, only a calendar year was detected with statistical significance and at yet other sites, both a calendar year and a trans-year were found (*4, 5*). To assess the time structure (chronome) of sudden cardiac death (SCD) in Austria for a comparison of the relative prominence of photic and non-photic components in this country and around it in the light of results obtained at several other geographical sites.

MATERIALS AND METHODS

The daily incidence of SCD (ICD-10 I46.1) in Austria was obtained for the 4-year span from Jan 2002 to Dec 2005 (15). Data were available separately for men and women from all 9 Austrian federal states (Burgenland, Kaernten, Niederoesterreich, Oberoesterreich, Salzburg, Steiermark, Tirol, Vorarlberg, and Wien). Also noted in the database was the age group at the time of death (21 5-year classes). Histograms were prepared to visualize the incidence of SCD at different sites or in different age groups, the latter separately for men and women. The Student t-test was used to compare the age at death between men and women. The data were reformatted to obtain the daily incidence of SCD, separately for men and for women, as well as overall. Monthly averages were computed for plotting, revealing the presence of a decreasing trend in both groups, *Fig. 1*.

The daily data were thus linearly detrended and pooled between men and women. This transformed data series was analyzed by linear-nonlinear rhythmometry (*16–18*). First, a least squares spectrum was computed in the frequency range of 1 cycle in 4 years to 1 cycle in about 3 days, with a particular focus in the low-frequency region of the spectrum, notably, trans-years, calendar year, and cis-half-year. At anticipated periods (1 year, 1.3 years, and 0.42 year), nonlinear analyses derived point and 95% confidence interval (CI) estimates for the period as well as for the MESOR, amplitude, and acrophase (*16–18*).

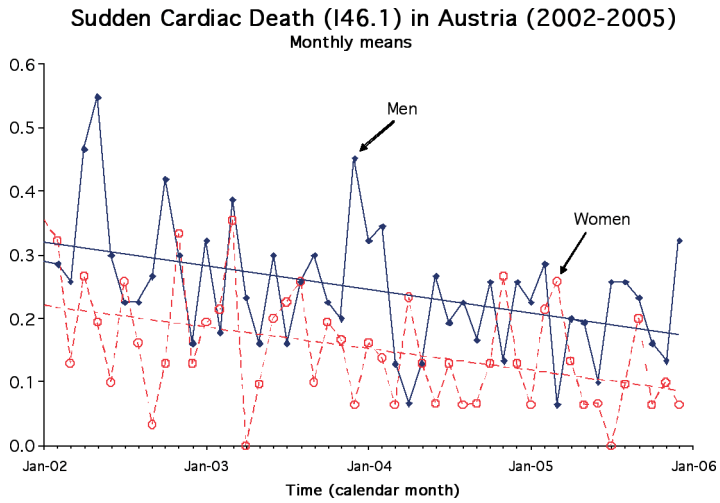

Fig. 1
Sudden cardiac death (ICD 10 146.1), presented as monthly means, in Austria from 2002 to 2005 years

RESULTS

The total incidence at any one site or in any one age group at death was insufficient for analysis. Data from men and women, showing similar spectral features when analyzed separately, were pooled after linear detrending. As anticipated, the age at death from SCD is older for women than for men ($P<0.001$). With data available for only 4 years, an assessment of any trans-year could not be obtained, as it may have been confounded in part by the decreasing trend. After detrending, the major feature is the detection of a cis-half-year that is validated nonlinearly, *Fig. 2.* The results differ only very slightly whether original daily totals between men and women ($N=1461$) are analyzed as such or with the added consideration of a linear trend in the nonlinear model, or whether pooled detrended data ($N=2922$) are considered. The estimated period of the cis-half-year is 0.408 year (95% CI: 0.389, 0.426), with the 95% CI of the amplitude not overlapping zero attesting to its statistical significance.

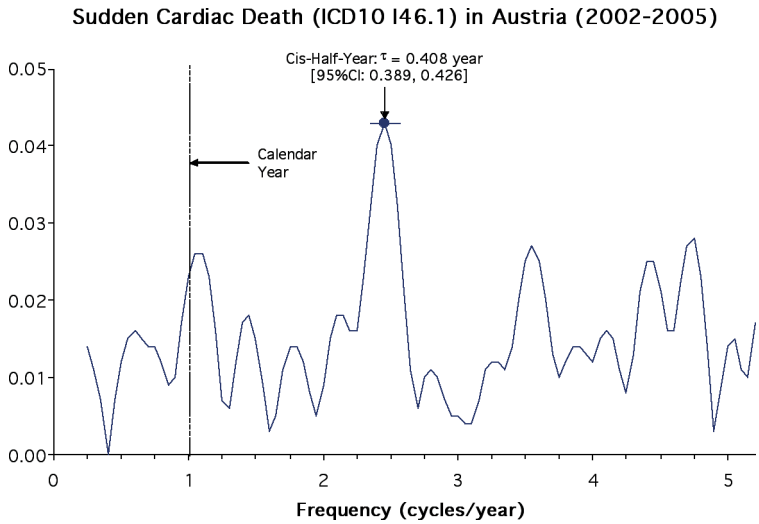

Fig. 2
Sudden cardiac death (ICD 10 I46.1): pooled data from men and women, after detrending

DISCUSSION

The results in Austria are in keeping with those obtained in Minnesota (*4-8*) and in Tokyo (*9*). A cis-half-year was also observed in nearby Hungary and somewhat remote Lithuania and for part of the time with available data in the Czech Republic (*3, 4*), *Fig. 3.*

Much longer records will be needed to attempt to determine whether in Austria, trans-years and/or a calendar year may also characterize the incidence of SCD (ICD-10 I46.1). In any event, the 4-year record sufficed to show the presence of the cis-half-year, a non-photic feature, in the absence of a calendar year. This result supports the proposition that non-photic signals such as magnetoperiodism may influence sudden cardiac death. It may do so via cardiac arrhythmia that has also been shown to present non-photic signatures in their chronomes (*7*). That magnetic disturbances may affect the incidence of SCD was suggested also by the fact that superposed epochs applied to pooled data from 9 different geographic locations indicate a decreased incidence of SCD on days of a magnetic storm (defined by a daily value of the planetary geomagnetic index Kp of 5 or higher) and by a negative correlation of SCD incidence with Kp (*7*). The extent to which such findings relate to sudden unexplained death syndrome (SUDS) and to a general extended view (*19*) remains to be examined.

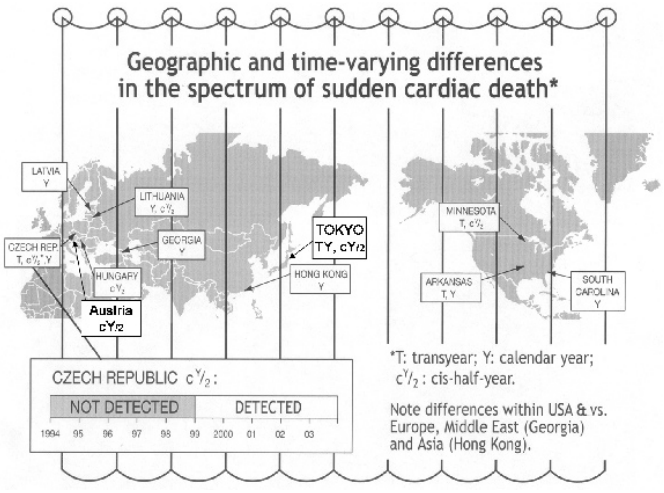

Fig. 3
Geographic spectrum of sudden cardiac death: the results in Austria, in Minnesota (1–5), in Tokyo (6), in nearby Hungary, and in the Czech Republic (1, 2).

A c k n o w l e d g e m e n t

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