

ISTITUTO CLINICO  
HUMANITAS  
Istituto di Ricovero e Cura  
a Carattere Scientifico



Gruppo Italiano Multidisciplinare per lo Studio della Sincopa

# Sincopa e Cambiamenti Climatici

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*“Dichiaro di non aver legami di tipo economico o professionale con industrie o organizzazioni, per i quali può configurarsi un conflitto di interesse riguardante l’argomento discusso in questa presentazione.”*

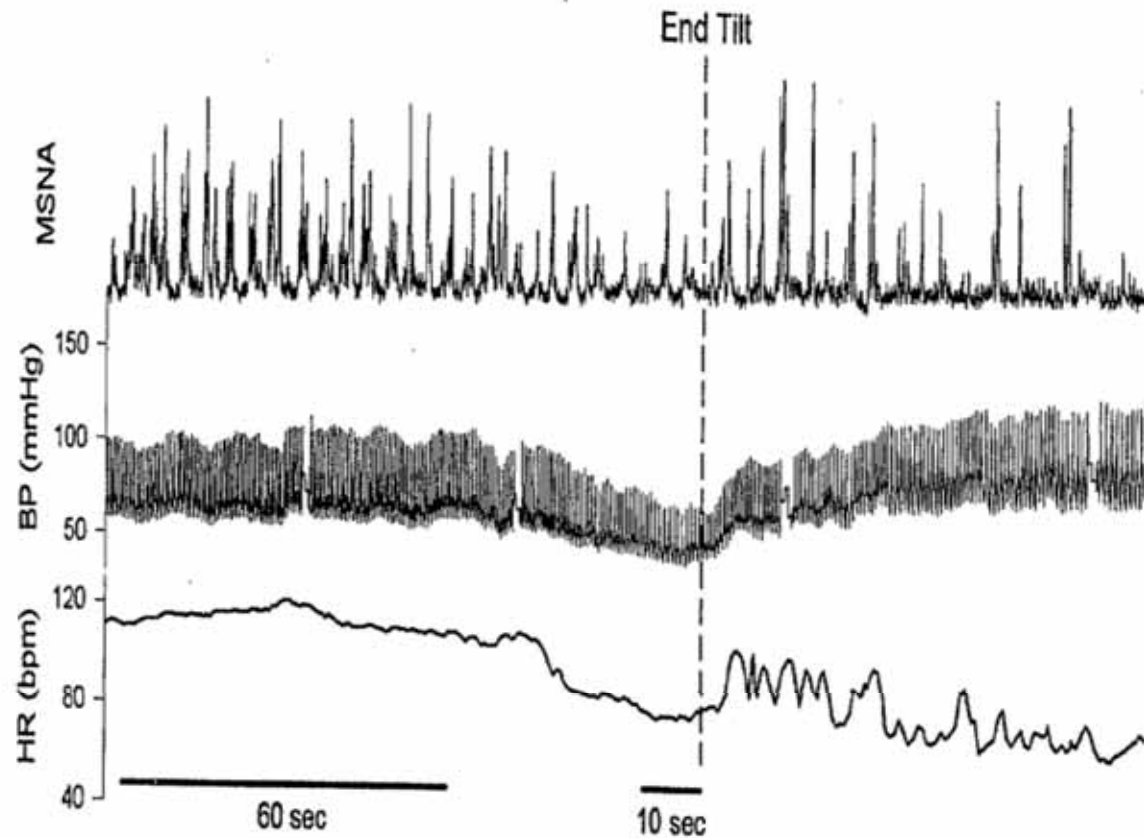
# Background

- Human pathophysiology suggests that heat exposure may facilitate syncope during standing

**Table 3** Thermal and hemodynamic variables prior to head-up tilt, during head-up tilt, and at pre-syncope

	Prior	Tilt	Pre-syncope	P
Internal temperature (°C)	37.9 ± 0.1	38.0 ± 0.1	37.9 ± 0.1	0.06
Mean skin temperature (°C)	37.8 ± 0.2	37.7 ± 0.2	37.7 ± 0.3	0.61
Sweat rate (mg/cm <sup>2</sup> /min)	0.49 ± 0.11	0.56 ± 0.10	0.62 ± 0.13	0.32
MAP (mmHg)	88 ± 1	92 ± 3	67 ± 5* <sup>#</sup>	<0.001
Heart rate (beats/min)	82 ± 6	113 ± 7*	92 ± 11 <sup>#</sup>	<0.001
Subject number	11	11	8	

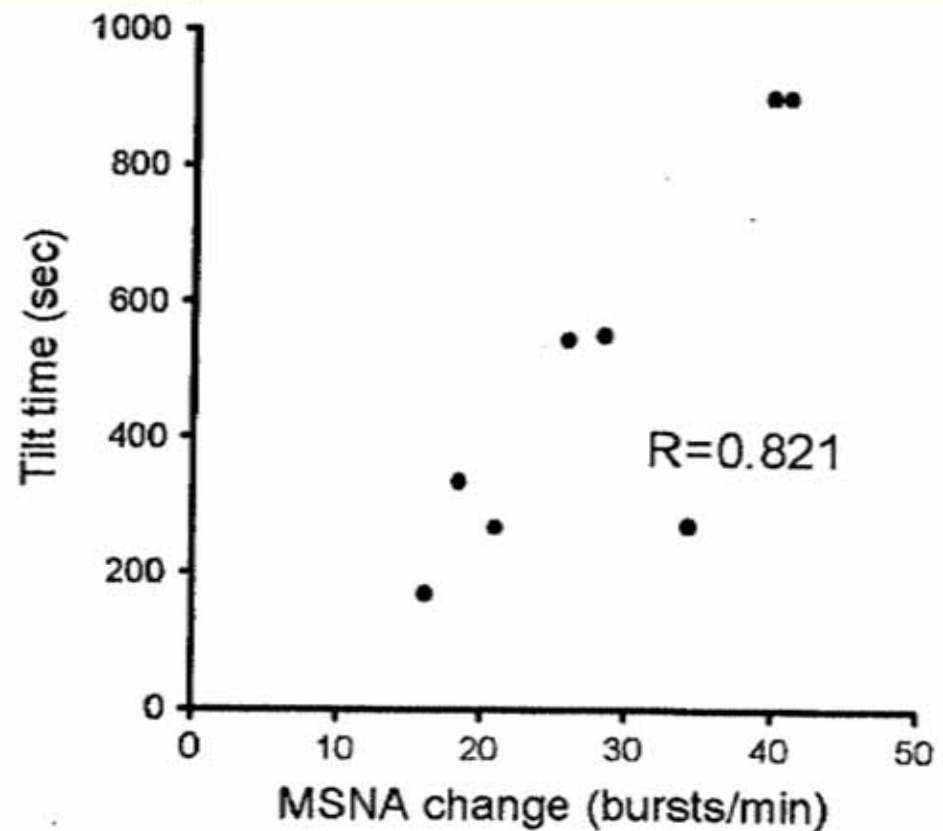
Prior: resting baseline while heat stressed but prior to head-up tilt. Tilt: the last minute of tilt for the non-fainters, or the 1-min period prior to the onset of any pre-syncopal symptoms. Pre-syncope: the last 10 s of data before the end of the tilt due to pre-syncopal symptoms. Given the transient nature of blood pressure, mean arterial blood pressure (MAP) for this dataset originate from the Finometer; however, pre-tilt (i.e., Prior) Finometer values were normalized to values obtained via auscultation of the brachial artery. The P values are from the main effect comparison of the one-way repeated measures ANOVA from the 8 subjects who experienced syncopal symptoms. \* Significantly different from Prior ( $P < 0.001$ ). <sup>#</sup> Significantly different from Tilt ( $P < 0.001$ )



**Fig. 1** Representative tracings of MSNA, blood pressure (BP) and heart rate (HR) during 60° head-up tilt while heat stressed from one subject. The tilt was ended because of pre-syncope symptoms (i.e., rapid reductions in arterial and pulse pressures along with

bradycardia). Notice the clear suppression in MSNA, HR and BP just prior to the end of tilt. Data indicated by the 60 s solid line are included in the “Tilt” averages, while data indicated by the 10 s line are included in the “Pre-syncope” averages, in Table 3

**Fig. 2** Correlation between the increase in MSNA burst rate (*left panel,  $P = 0.01$* ) and total activity (*right panel,  $P = 0.02$* ) due to head-up tilt and the tilt time. The increase in MSNA was calculated from the period just prior to tilt while heat stressed and the last minutes of the 15 min tilt test in the two non-fainters or the last minutes before any sign or symptom of ensuing syncope in subjects who did not complete the tilt test



# Background

- Human pathophysiology suggests that heat may facilitate syncope during standing
- Studies designed for public health surveillance, analyzing the changes in heat-related morbidity associated with seasonal high temperatures (or heat waves), inconsistently corroborate the hypothesis that high environmental temperatures may promote syncope.

## **Short and Long-Term Prognosis of Syncope, Risk Factors, and Role of Hospital Admission**

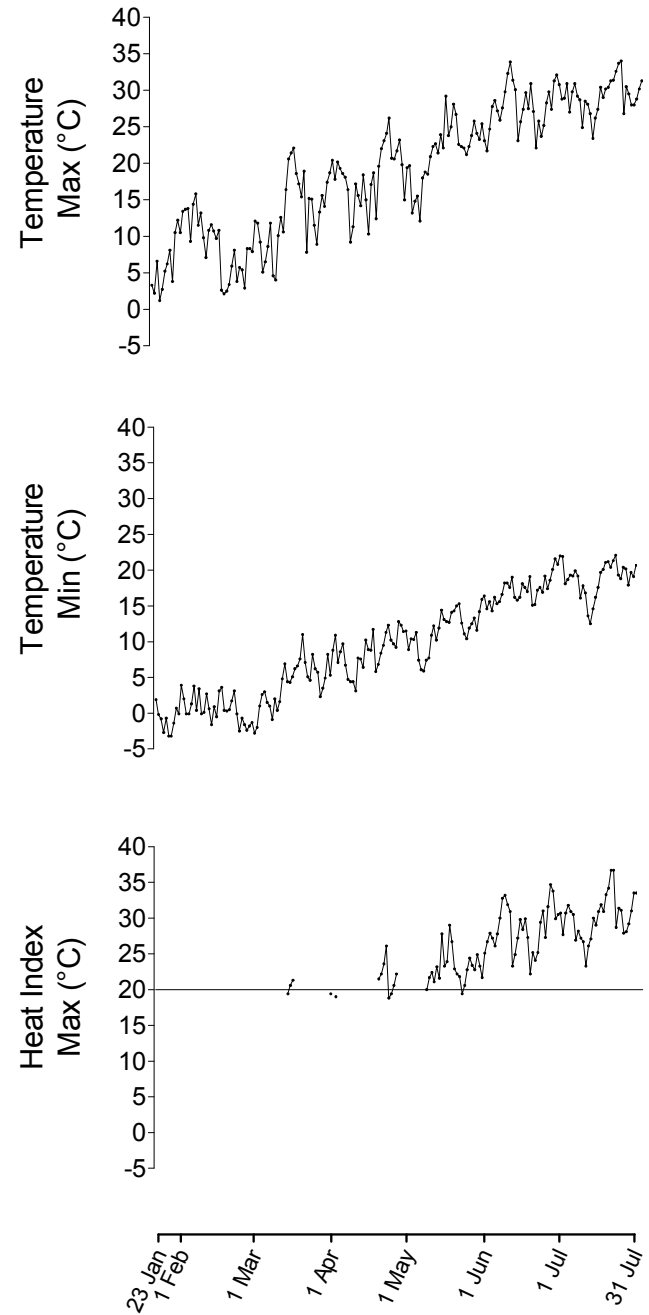
Results from the STePS (Short-Term Prognosis of Syncope) Study

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Marta Borella, MD,\* Andrea Galli, MD,\* Giulia Cantoni, MD,† Simonetta Dell'Orto, MD,‡  
Simonetta Dassi, MD,\* Nicola Filardo, MD,\* Pier Giorgio Duca, MD,¶ Nicola Montano, MD, PhD,\*  
and Raffaello Furlan, MD,\* on behalf of the STePS Investigators

*Milan, Italy*

- ED of 4 General Hospital of Milan area
- prospective
- 670 patients
- 6 months lasting enrollment  
(from January 23 to July 31)

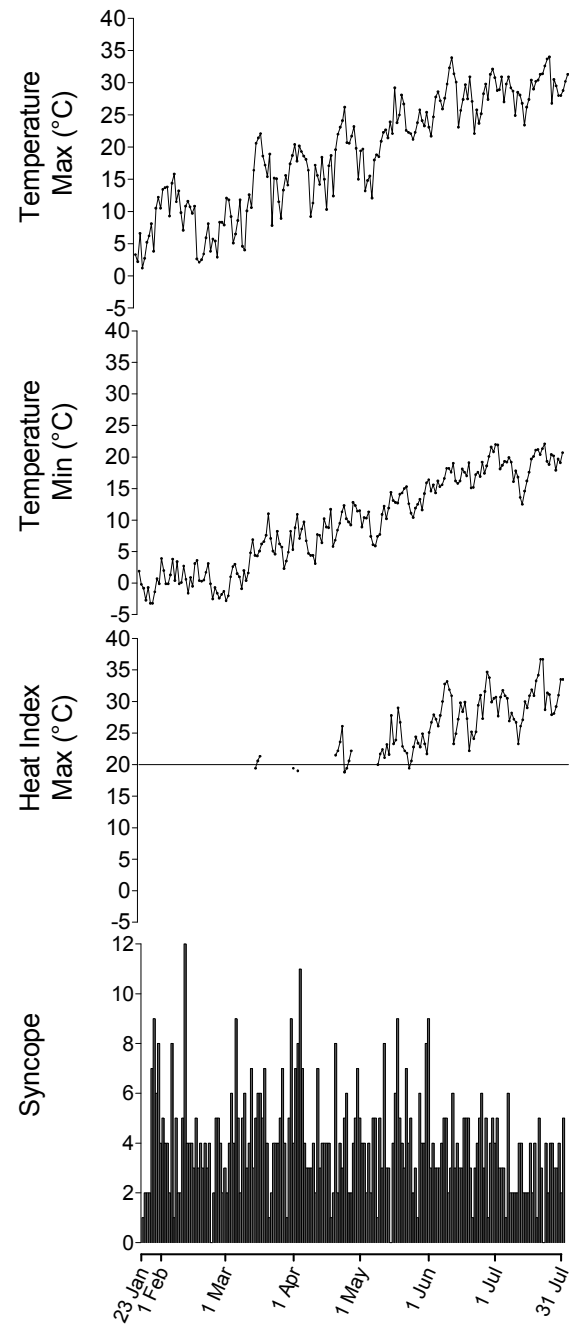
Weather indexes from  
Centro Metereologico Lombardo  
(Milan, Italy)

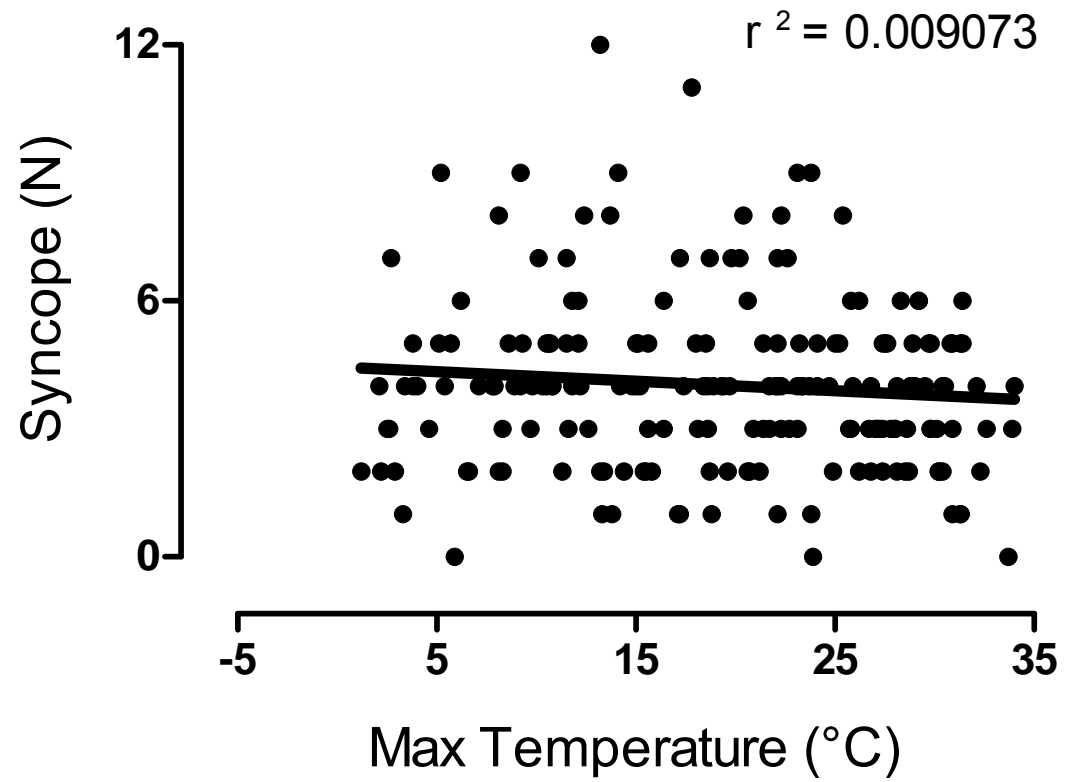


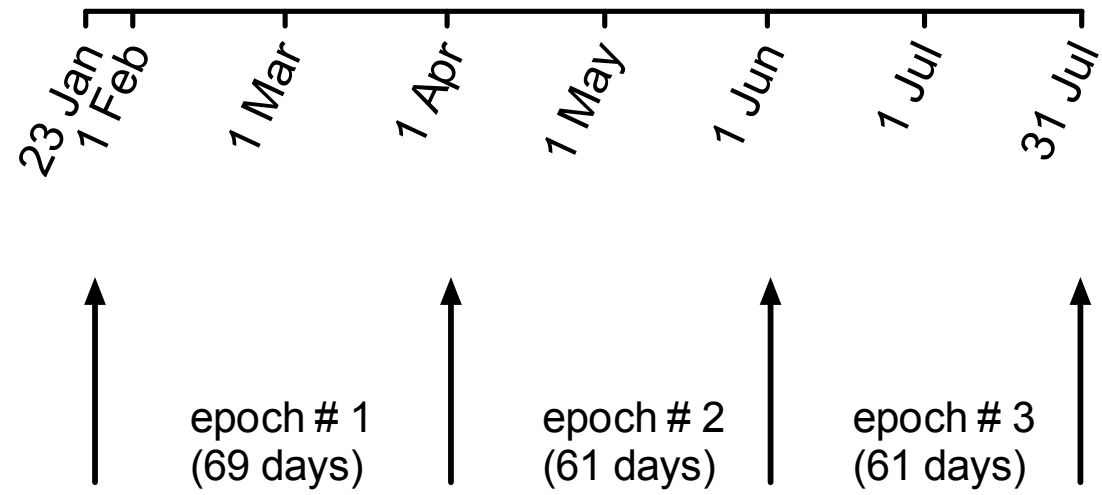


# AIMS

- To assess the relationship between the increase of maximal air temperature from January to July and the potential increase in the rate of ED visits for syncope







	EPOCH #1	EPOCH #2	EPOCH #3
	Jan-Feb-Mar (69 days)	Apr-May (61 days)	Jun-Jul (61 days)
Max Temperature, °C	10.0±5.1 (range 1.2 - 22.1)	20.0±4.4 # (range 9.2 – 29.2)	28.6±2.8 § (range 21.7 – 34.0)
Max Temperature Variability, °C	8.8±5.1	10.8±4.4	6.5±2.8 §
Total ED Admissions, n	34608	31289	31938
Syncope ED Admissions, n (%)	296 (8.6)	267 (8.5)	207 (6.5) *
Admitted Syncope, n (%)	104 (35.1)	98 (36.7)	71 (34.3)
Syncope aged >75 years, n (%)	82 (27.7)	75 (28.1)	55 (26.6)
Male			
Total Syncope, n (%)	133 (44.9)	111 (41.6)	95 (45.9)
Syncope aged >75 years, n (%)	34 (25.6)	23 (20.7)	23 (24.2)
Female			
Total Syncope, n (%)	163 (55.1)	156 (58.4)	112 (54.1)
Syncope aged >75 years, n (%)	48 (29.4)	52 (33.3)	32 (28.6)

# Summary

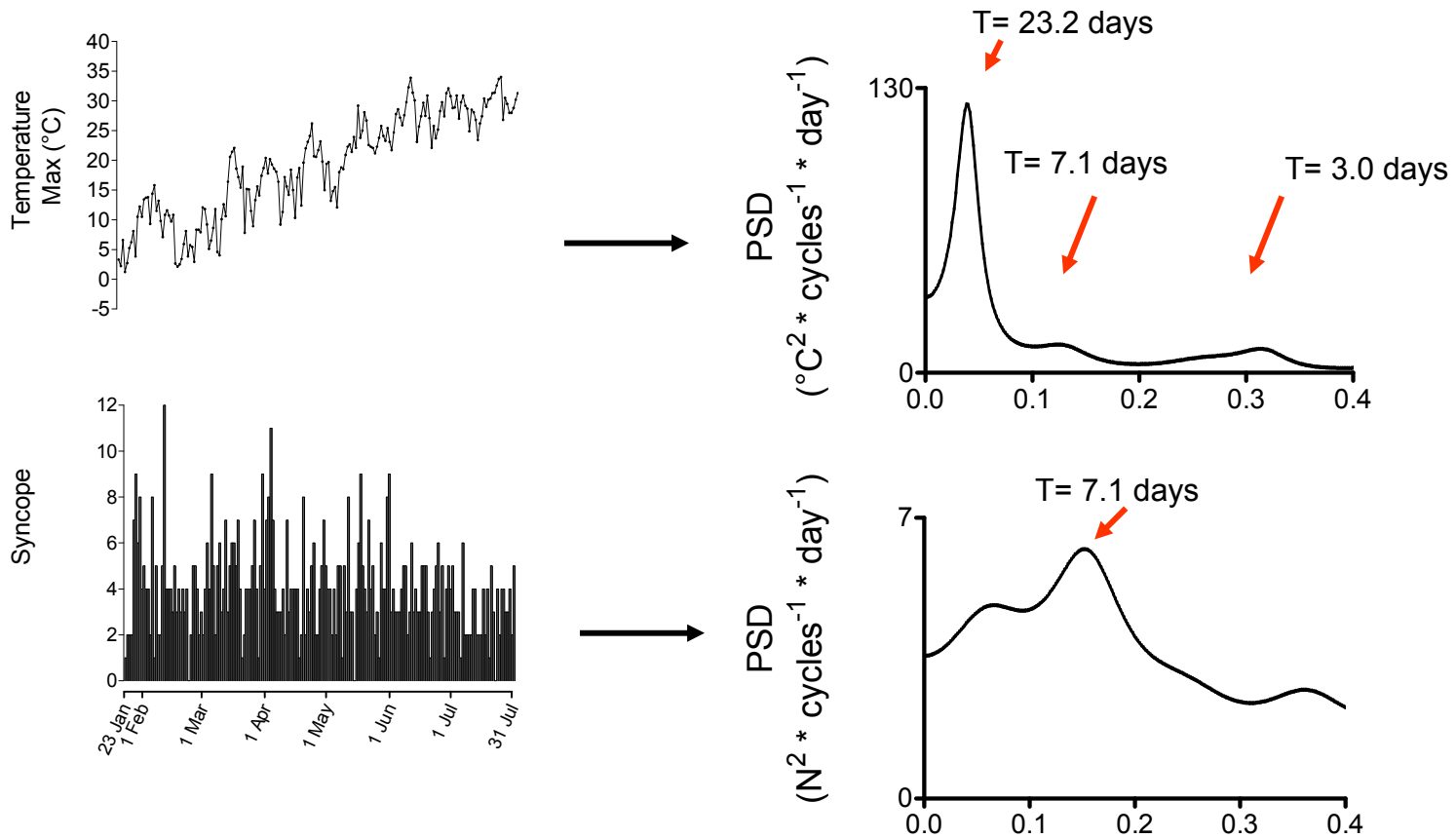
- No relationship between values of maximal temperature and the number of ED visits for syncope.
- June and July, characterized by the highest temperatures but the lowest *maximal temperature variability*, were associated with a lower rate of ED visits for syncope.

Is there any cross talking between temperature variability and the pattern of ED presentation for syncope?

Is there any hidden code between temperature oscillations and the pattern of ED presentation for syncope that might be uncovered by a frequency domain approach?

## AIM

- To address the relationship between maximal temperature variability and the pattern of ED visits for syncope

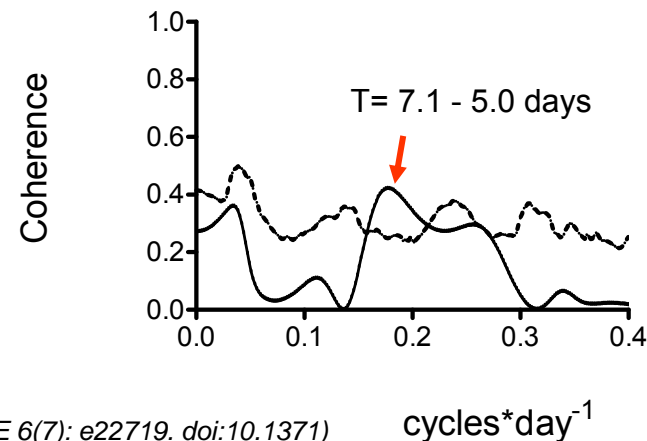


Daily maximal temperature values and number of syncope *sampled once per day* → series.

*Frequency domain analyses by autoregressive spectral methods*

*Surrogate data approach to assess the deterministic nature of the oscillations*

*Squared coherence function to assess their linear correlation*





# Summary

- Presence of similar and related oscillatory patterns in maximal temperature and ED presentation for syncope characterized by a  $\approx 7$ -day period.

# Conclusions

- No relationship between maximal temperature values and the number of ED visits for syncope.

(van Dijk et al, *Europace* 2007;9:823) and (Anderson and Reed, *Eur. J. Emerg. Med.* 2010;17:240 )

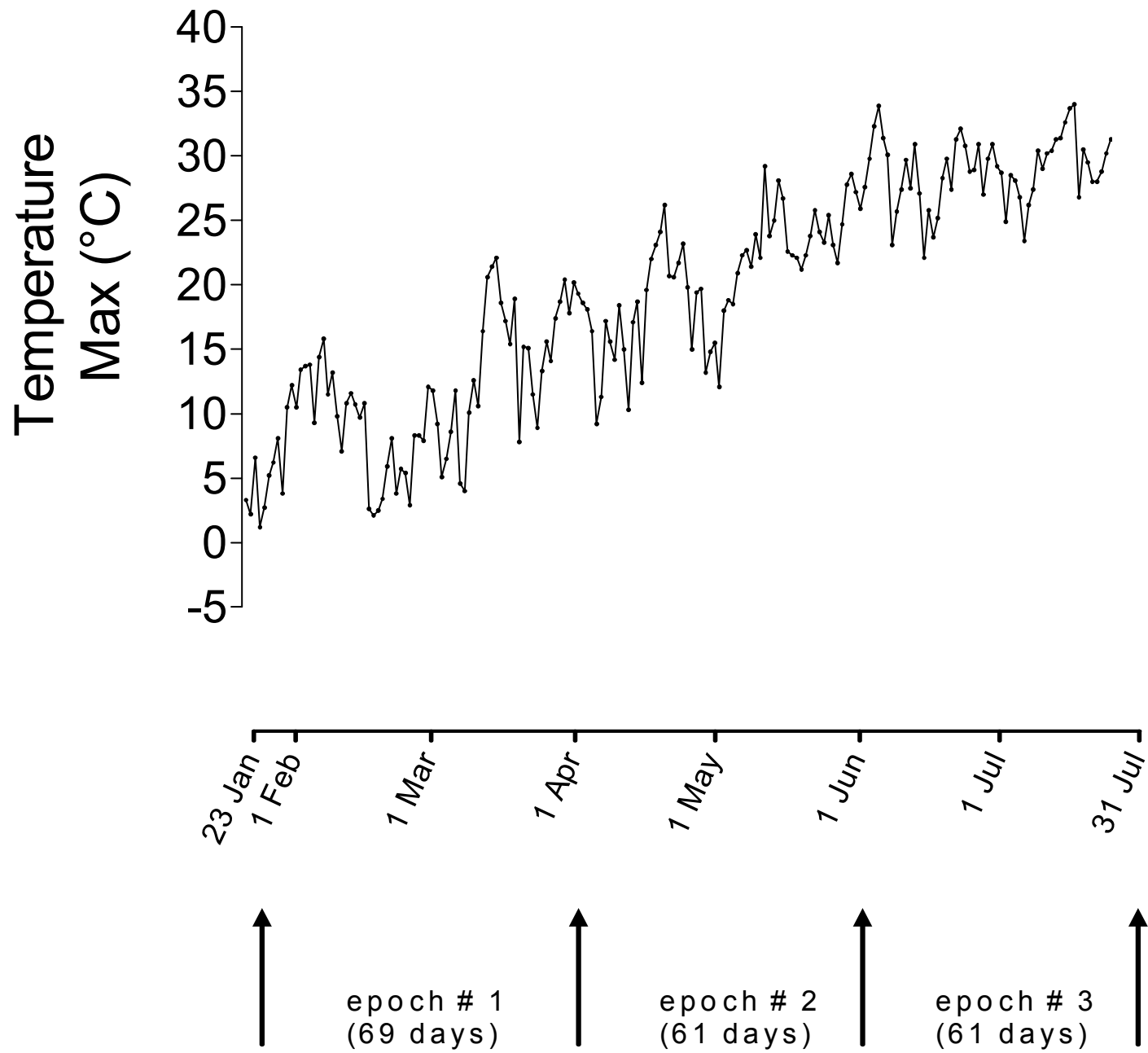
- June and July, characterized by the highest temperatures but the lowest *maximal temperature variability*, were associated with a lower rate of ED visits for syncope.

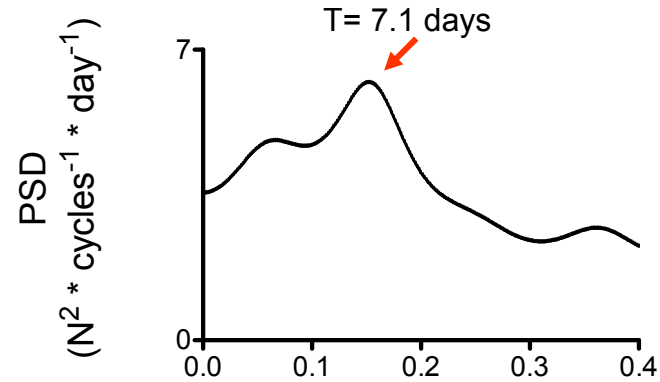
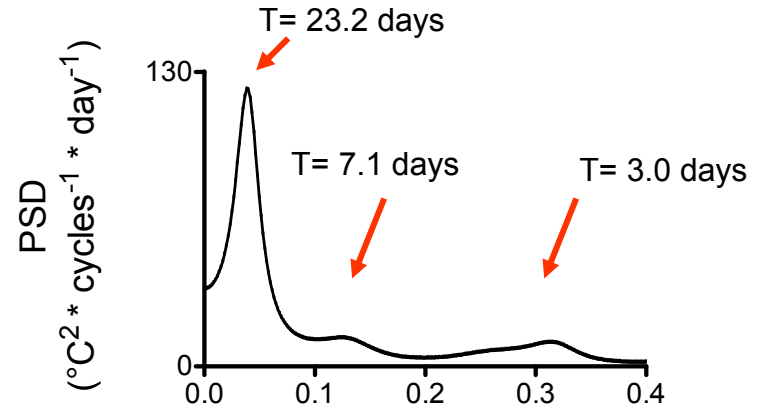
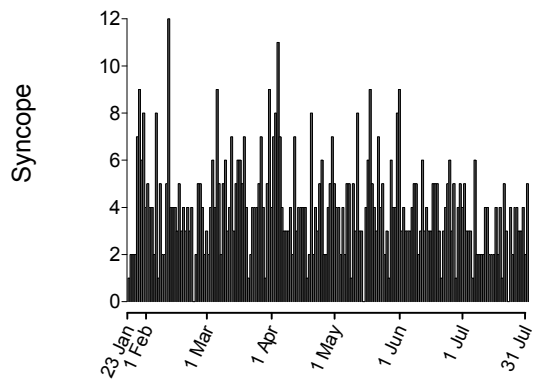
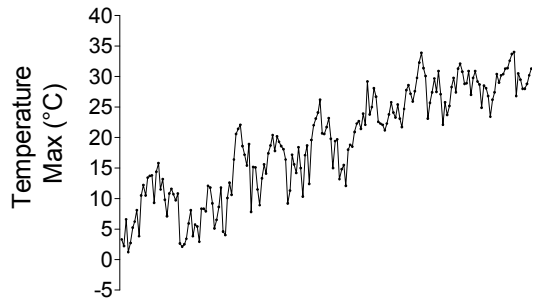
We hypothesize that a *reduced heat stress*, as it is the case when maximal temperature variability is lower, may play a role in lowering the rate of ED presentation for syncope.

- Temperature variability and the pattern of ED presentation for syncope seem “to talk” by means of a frequency domain code characterized by a  $\approx 7$ -day period.

This suggests a potential *influence of rhythmic changes in temperature (temperature variability) on the pattern of syncope ED presentation.*



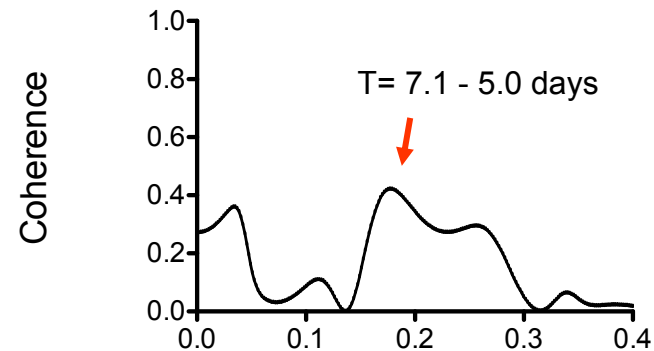


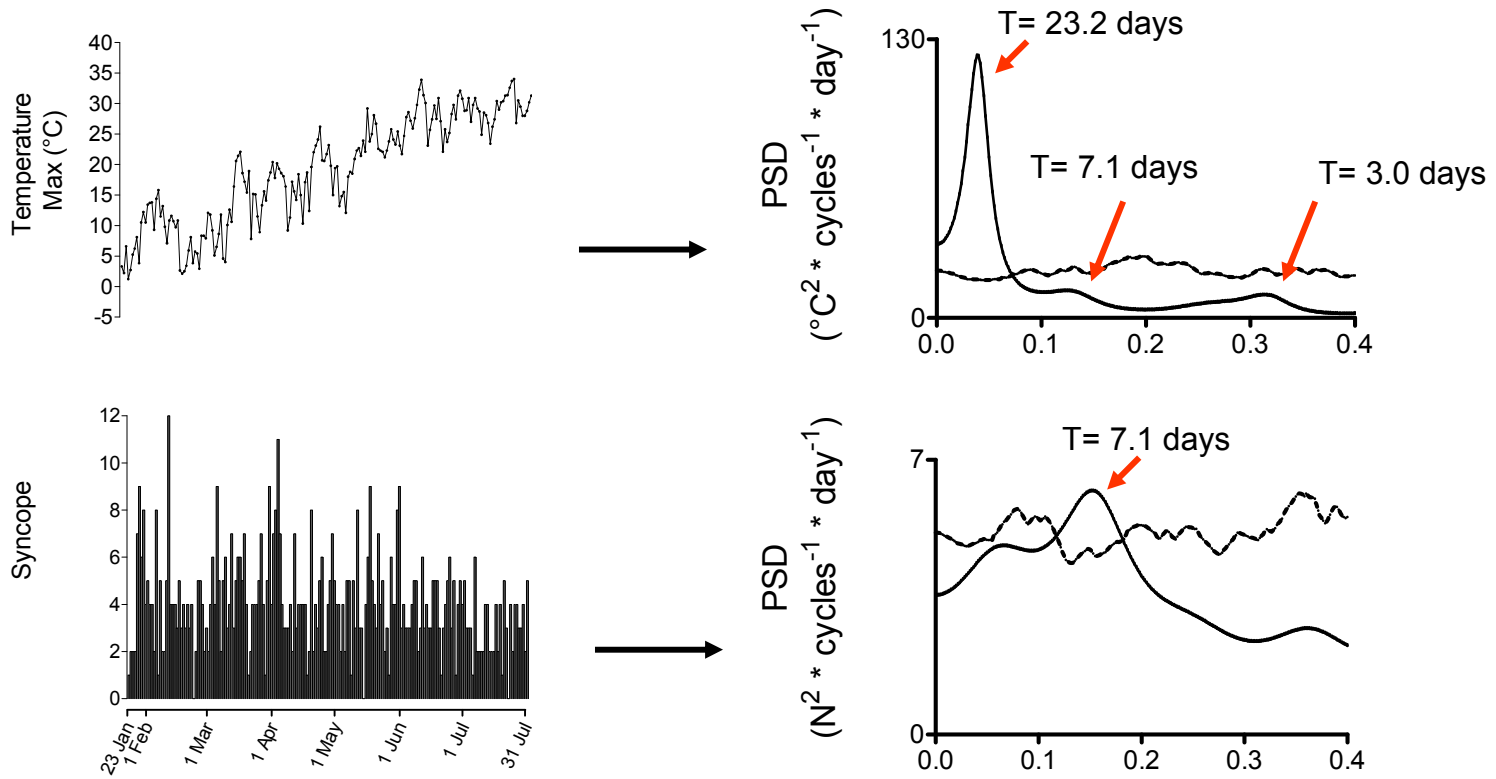


Daily maximal temperature values and number of syncopes *sampled once per day* → series.

*Frequency domain analyses by autoregressive spectral methods*

*Squared coherence function to assess their linear correlation*





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