

Thousands of blood pressure and heart rate measurements at fixed clock hours may mislead

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Abstract

The diagnoses of summer or winter hypertension in one and the same person can depend upon the clock hour of measurement.

Subject and Methods

Over 76,000 half-hourly around-the-clock measurements of systolic (S), mean arterial (MA) and diastolic (D) blood pressure (BP) and heart rate (HR) of a cardiologist were carried out with few interruptions for over 15 years with an automatic ambulatory monitor (Colin Electronics, Komaki, Japan). Separate averages of 2 measurements for each hour of the day for most of 15 years (5479 days) constituted 24 separate series, each fitted with a 1-year cosine curve, Figure 1 top.

Results

The time of high values is in the summer for data collected between 6 and 7 a.m. and in the winter for data collected between 6 and 7 pm, Figure 1 bottom.

Discussion

Opposite diagnoses as a function of time of day alone were reported on a patient diagnosed as normotensive by one physician he saw in the morning and as hypertensive by another physician who saw him in the afternoon. When hospitalized at NIH

and measured around the clock for several weeks, the patient's blood pressure oscillated around a value which made him hypertensive at one clock-hour and normotensive at another [1]. Janeway had written that "... *it is essential* that a record of the pressure be made at frequent intervals *at some time previous* [to a visit to a physician], to establish the *normal level* and the *extent of the periodic variations* [2]". Whether large or small, rhythmic changes can lead to a summer [3, 4] and/or evening hypertension [5] because the measurements were consistently taken at one clock-hour rather than at another, an insufficient basis for deciding on a therapy for the long term [5, 6].

Conclusion

Generalizing for patients with "borderline hypertension", depending on the clock-hour of measurement, a set of diagnoses will differ as summer normotension vs. winter hypertension or vice versa, a mathematical necessity in cases with a circannual modulation of a circadian rhythm, as indeed documented by a clinical precedent.

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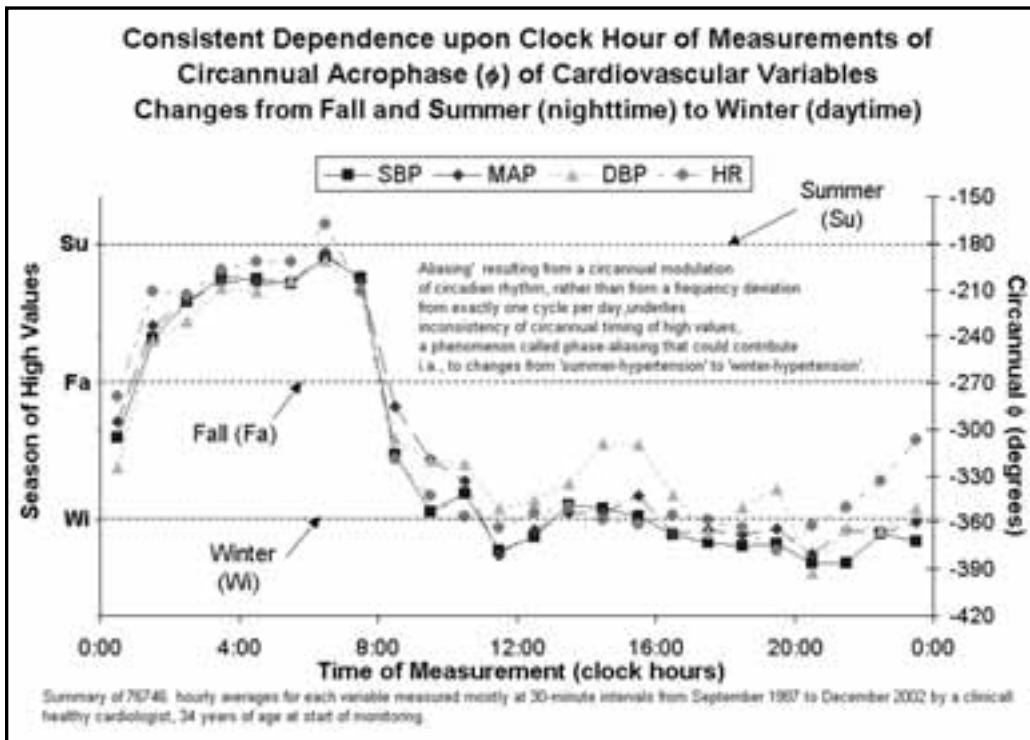


Figure 1. The fallacy of "controlling" any effects of rhythms by fixing the time of day of measurements. Opposite conclusions concerning hypertension will be drawn from long-term consistent spotchecks at a fixed clock-hour even when the time series cover 15 years of daily (this figure) or 26 years of mostly weekly morning values (3).

