Circadian misalignment helps explain higher risk for cardiovascular disease

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Shift workers frequently undergo circadian misalignment, disruption of

the "body clock," caused by inverted wake and sleep cycles. Although shift work, which requires workers to be awake when the brain's circadian clock is expecting sleep, is known to be a risk factor for hypertension, inflammation and cardiovascular disease, little is known about the specific impact of circadian misalignment on cardiovascular disease risk in humans.

New research from Brigham and Women's Hospital (BWH) published in the *Proceedings of the National Academy of Sciences* on February 8, 2016, may help explain why shift work increases the risk for cardiovascular disease. The study finds that short-term circadian misalignment, resulting from a rapid 12-hour inversion of the sleep/wake and fasting/feeding cycle that is typical in shift workers, leads to adverse cardiovascular and inflammatory consequences in healthy adults.

"We were able to determine, under highly controlled laboratory conditions, the independent impact of circadian misalignment on cardiovascular disease risk factors -blood pressure and inflammatory markers," said Frank A.J.L. Scheer, PhD, neuroscientist in the Division of Sleep and Circadian Disorders at BWH, and the senior author of the study. "Our findings provide evidence for circadian misalignment as an underlying mechanism to explain why shift work is a risk factor for elevated blood pressure, hypertension, inflammation and cardiovascular disease."

Researchers measured blood pressure and inflammatory markers, which are strongly predictive of cardiovascular disease risk, and compared circadian misalignment with circadian alignment in 14 healthy subjects during two eight-day stays in the BWH sleep laboratory. One stay included circadian misalignment, and the other maintained circadian alignment. Controlling for other contributing factors, such as work stressors, dietary habits, physical activity, as well as family, financial, genetic, health and social factors, researchers found that circadian

misalignment:

- Increased 24-hour systolic blood pressure (SBP) and diastolic blood pressure (DBP)
- Reduced blood pressure dipping, usually associated with sleep
- Decreased measures of autonomic nervous system activity (controlling bodily functions such as blood pressure)
- Increased inflammatory markers

During one of the eight-day periods, the participants maintained normal sleep patterns. During the other test period, the subjects maintained a normal sleep period for the first three nights and were then shifted by 12 hours to an 11 a.m. to 7 p.m. sleep period.

"Our study evaluated "short-term" circadian misalignment in healthy adults. The effect of circadian misalignments on cardiovascular function and inflammatory markers may be different in people with hypertension, and in shift workers," said Christopher J. Morris, PhD, associate physiologist in the Division of Sleep and Circadian Disorders at BWH, and first author of the paper. "Further research is needed to investigate countermeasures for the adverse cardiovascular effects of circadian misalignment, such as the timing of eating and exercise."

More information: Circadian misalignment increases cardiovascular disease risk factors in humans, *Proceedings of the National Academy of Sciences* , www.pnas.org/cgi/doi/10.1073/pnas.1516953113

Provided by Brigham and Women's Hospital

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