Researchers use math to reduce jet lag

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Reducing jet lag is the aim of a new mathematical methodology and software program developed by researchers at Brigham and Women's Hospital and the University of Michigan.

A major cause of jet lag is the desynchronization of the body's internal clock and the local environment when a person travels across several time zones. Symptoms include trouble sleeping at night and trouble staying awake during the day.

The new methodology and software program helps users resynchronize their internal clock with the local time using light cues. The software program gives users exact times of the day when they should apply countermeasures such as bright light to intervene in the normal course of jet lag.

The findings are published in the June 19 issue of *PLoS Computational Biology*.

"This work shows how interventions can cut by half the number of days needed to adjust to a new time zone," said Daniel Forger, an assistant professor in the U-M Department of Mathematics and research assistant professor in the Center for Computational Medicine and Bioinformatics at the U-M Medical School. Forger is an author the paper.

Timed light exposure is a well known method for synching an individual's internal clock with the environment, and when used properly, this intervention can reset that clock to align with local time. This results in more efficient sleep, a decrease in fatigue, and an increase in cognitive performance. Poorly timed light exposure can prolong the re-synchronization process.

"Because the timing of proper light exposure is so important in synching the internal clock with local time, we have developed this mathematical computation that is able to automate the process of determining the timing of appropriate light cues," said Dennis Dean, a researcher in the Division of Sleep Medicine at BWH and the paper's lead author.

Using the computation, researchers simulated shifting sleep and wake schedules and the subsequent light interventions for realigning internal clocks with local times. They found that the mathematical computation resulted in quicker design of schedules and also predictions of substantial performance improvements.

"Using this computation in a prototyped software application allows a user to estimate background light level and the number of time zones traveled to determine the recommendation of when to expose a subject to bright light, such as the bright light sometimes used to treat Season Affective Disorder, to realign the internal body clock," Dean said.

Although this method is not yet available to the public, it has direct implications for designing jet lag, shift-work and scheduling for extreme environments, such as in space, undersea or the Polar Regions, he said.

This is a very practical way to combat jet lag, which can be a significant problem, Forger says.

"There are a lot of situations in which being alert and not falling asleep at the wrong time is critical. Imagine you're a military pilot, for example. You want to be at your optimal performance because mistakes can have huge consequences," Forger said.

The next phase of this research includes the addition of interventions such as naps, caffeine and melatonin to help the process of realigning the internal body clock while reducing decreased performance experienced during travel across time zones.

The paper is called, "Taking the lag out of jet lag through model-based schedule design." The research was funded by the National Space Biomedical Research Institute, the Air Force Office of Scientific Research, the National Air and Space Administration, and the National Institutes of Health.

Source: University of Michigan (news : web)