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Up in the Air, Stressing Out

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Jet lag is the perennial unwelcome companion of the air traveler, an experience that can make one's mind feel like it was left back at the airport. That powerful disorientation has made jet lag a topic of interest for scientists, who have looked at changes to a person's brain chemistry and physiology after lengthy, intercontinental trips. But unless you're a serious jetsetter, most of your flights only cross a time zone or two or three, enough to produce a milder form of jet lag's mind-scramble. Few studies have looked at physiological changes after these more routine flights, until an almost accidental opportunity to do so occurred to a team of researchers studying an unusual subject pool: hundreds of sets of twin brothers.

The Vietnam Era Twin Registry is a pool of military veterans that have been tested in a multitude of studies examining genetic and environmental factors for everything from pathological gambling to cardiovascular disease. In one such study, designed to study different parameters associated with aging, the subjects flew to medical centers in



Boston or San Diego for a full day of medical and psychiatric tests. Several scientific papers were published from those results, including one by a team including the University of Chicago Assistant Professor of Psychiatry and Behavioral Neuroscience Kristen Jacobson, Ph.D. (left) on the heritability of levels of cortisol, sometimes called the "stress hormone."

But the researchers in that study realized that there could be an important influence on their data: jet lag. Long-distance flights have previously been shown to throw off a person's natural cortisol rhythms, the ebb and flow of the hormone normally

experienced during a given day. So the researchers in the Vietnam Era study had their participants spit in a vial several times at home, then repeat their spitting during their Boston or San Diego visits. Those salivary samples - used to measure cortisol levels - allowed researchers to look for changes in the hormone before and after air travel for people who are less than frequent fliers.

“A person traveling 5 days a week or repeatedly traveling to Hong Kong on business is not representative of the general population,” Jacobson said. “But we all know how it feels when you’re going to California versus going to DC from Chicago and struggling with waking up. This paper links what we all think to be true about jet-lag with an existing body of research that had shown effects under fairly extreme circumstances and said yeah, this is in fact what’s going on, there are changes in the body even with short-term travel.”

The results of that analysis were published earlier this month in the journal *Health Psychology* by a 13-author team topped by Leah Doane, formerly a postdoctoral researcher in Dr. Jacobson’s laboratory.

“Previous studies looked at select samples of people - small sample sizes of athletes or pilots, people who travel chronically or across very far distances,” said Doane, now an assistant research professor at the Northwestern University Institute for Policy Research. “But we know cortisol is reactive to a lot of different things and it hadn’t been looked at before for shorter distances that people travel across all the time in the U.S. for work or for pleasure. Understanding how the body’s physiology is reacting to this travel is interesting.”

The researchers did find detectable changes to that physiology in their sample, with cortisol rhythms affected even after flights that only crossed one time zone. Curiously, eastbound flights produced larger cortisol perturbations than westbound flights, a phenomenon that had previously been shown by studies of longer trips. Despite eastbound flights being half as long on average as westbound flights in the subject pool, the effect size of that eastward travel was twice as large.

What could cause this east/west gap remains something of a mystery, Doane and Jacobson said. One might expect that being forced to wake up earlier the day after travel to a easterly time zone could throw off a person’s cortisol, but statistically controlling for wake time and hours of sleep did not remove the effect. The disconnect between a person’s circadian rhythm and the new time zone they find themselves in could change cortisol dynamics by some still-unrecognized mechanism, the authors suggested, or the mere experience of air travel could be a significant stressor (as anyone who’s ever flown out of O’Hare can attest).

That missing mechanism will require further study to tease out, as would more detailed assessment of how the cortisol changes observed in this study would translate to behavior. While the changes are less severe than those seen after intercontinental

flights, Doane wondered whether repeated, short flights - attention business travelers - might lead to more drastic and potentially damaging hormonal changes.

“Short term changes like we are seeing here are pretty adaptive,” Doane said. “In and of themselves they aren’t bad, but they could cause harm when they are repeated a lot over time. With chronic activation of the stress system, you start to see maladaptive health outcomes: anything from cardiovascular risk to morbidity and mortality in cancer patients.”

There’s a thought as uncomfortable as a seat in coach, but don’t worry, George Clooney - it’s a hypothesis that will require further study.

See: Doane, L., Kremen, W., Eaves, L., Eisen, S., Hauger, R., Hellhammer, D., Levine, S., Lupien, S., Lyons, M., Mendoza, S., Prom-Wormley, E., Xian, H., York, T., Franz, C., & Jacobson, K. (2010). Associations between jet lag and cortisol diurnal rhythms after domestic travel. *Health Psychology, 29* (2), 117-123.

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