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Study shows how night shift work can raise risk of diabetes, obesity

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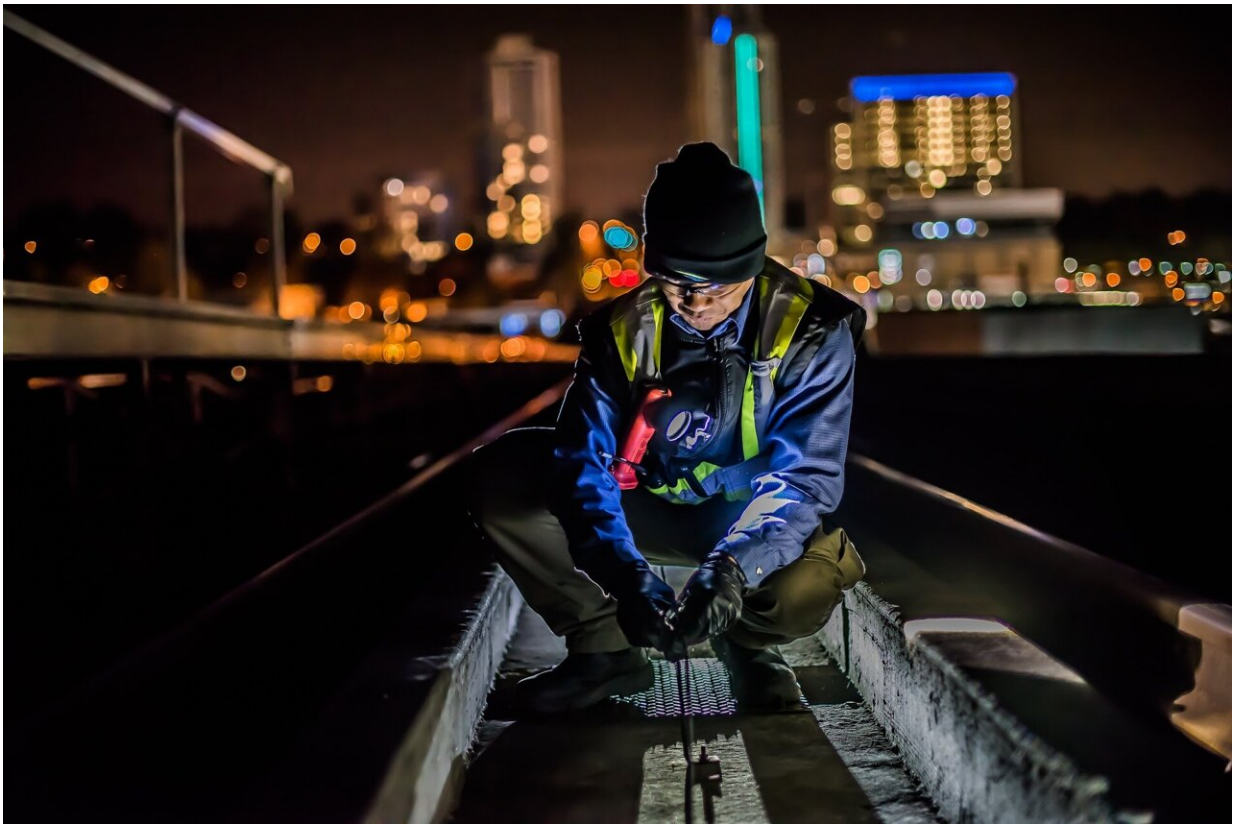

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Just a few days on a night shift schedule throws off protein rhythms related to blood glucose regulation, energy metabolism and inflammation, processes that can influence the development of chronic

metabolic conditions.

The finding, from a study led by scientists at Washington State University and the Pacific Northwest National Laboratory, provides new clues as to why night shift workers are more prone to diabetes, obesity and other metabolic disorders.

"There are processes tied to the master biological clock in our brain that are saying that day is day and night is night and other processes that follow rhythms set elsewhere in the body that say night is day and day is night," said senior study author Hans Van Dongen, a professor in the WSU Elson S. Floyd College of Medicine.

"When internal rhythms are dysregulated, you have this enduring stress in your system that we believe has long-term health consequences."

Though more research is needed, Van Dongen said the study shows that these disrupted rhythms can be seen in as little as three days, which suggests early intervention to prevent diabetes and obesity is possible. Such intervention could also help lower the risk of heart disease and stroke, which is elevated in night shift workers as well.

Published in the *Journal of Proteome Research*, the study involved a controlled laboratory experiment with volunteers who were put on simulated night or day shift schedules for three days. Following their last shift, participants were kept awake for 24 hours under constant conditions—lighting, temperature, posture and food intake—to measure their internal biological rhythms without interference from outside influences.

Blood samples drawn at regular intervals throughout the 24-hour period were analyzed to identify proteins present in blood-based immune system cells. Some proteins had rhythms closely tied to the master

biological clock, which keeps the body on a 24-hour rhythm. The master clock is resilient to altered shift schedules, so these protein rhythms didn't change much in response to the night shift schedule.

However, most other proteins had rhythms that changed substantially in night shift participants compared to the day shift participants.

Looking more closely at proteins involved in glucose regulation, the researchers observed a nearly complete reversal of glucose rhythms in night shift participants. They also found that processes involved in insulin production and sensitivity, which normally work together to keep glucose levels within a healthy range, were no longer synchronized in night shift participants.

The researchers said this effect could be caused by the regulation of insulin trying to undo the glucose changes triggered by the night shift schedule. They said this may be a healthy response in the moment, as altered glucose levels may damage cells and organs, but could be problematic in the long run.

"What we showed is that we can really see a difference in molecular patterns between volunteers with normal schedules and those with schedules that are misaligned with their biological clock," said Jason McDermott, a computational scientist with PNNL's Biological Sciences Division.

"The effects of this misalignment had not yet been characterized at this molecular level and in this controlled manner before."

The researchers' next step will be to study real-world workers to determine whether night shifts cause similar protein changes in long-term shift workers.

More information: Jason E. McDermott et al, Molecular-Level Dysregulation of Insulin Pathways and Inflammatory Processes in Peripheral Blood Mononuclear Cells by Circadian Misalignment, *Journal of Proteome Research* (2024). DOI: 10.1021/acs.jproteome.3c00418