

Chronotype Impacts Melatonin Levels in Night Shift Workers

February 17, 2014

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In 2007, the International Agency for Research on Cancer classified shift work as a probable human carcinogen. This relationship between shift work and cancer may be mediated by circulating melatonin levels, which are decreased in night shift workers compared to day shift workers. A person's chronotype is their inherent preference for activity in either the morning or the evening, and has been associated with work performance, job satisfaction, and tolerance to shift work. To evaluate whether chronotype might play a role in the increased cancer risk seen in shift workers, Drs. Parveen Bhatti and Scott Davis in the Public Health Sciences Division evaluated the impact of chronotype on melatonin levels in shift workers. As recently reported in *Occupational and Environmental Medicine*, the authors found that morning-type individuals may be better protected from melatonin level changes due to shift work.

To evaluate melatonin levels in shift workers, the authors pooled data from two previous studies totaling 310 day shift and 354 night shift healthcare workers. Originally launched by senior author Davis, these studies "established an incredible resource with which we can now explore the biology that may underlie associations between shift work and cancer", said lead author Bhatti. In both studies, urine samples were collected throughout both work and sleep periods and assayed for 6-sulfatoxymelatonin, a urinary marker of circulating melatonin levels. Chronotype was determined by each participant's chronoscore on the Composite Scale of Morningness, a questionnaire that identifies whether participants tend to be morning-type, intermediate, or evening-type night shift workers. Bringing these two measures together was the key for this analysis. While "chronotype is known to influence one's psychosocial adaptability to shift work," said Bhatti, "it has received little attention in studies of shift work and cancer, especially studies of biomarkers of carcinogenesis, which melatonin seems to be."

As expected, circulating melatonin levels were lower in night shift workers compared to day shift workers. When evaluated by chronotype, however, the authors found that morning-type night shift workers were better able to maintain normal melatonin levels than evening-type night shift workers. These differences in the effect of chronotype were statistically significant in every instance

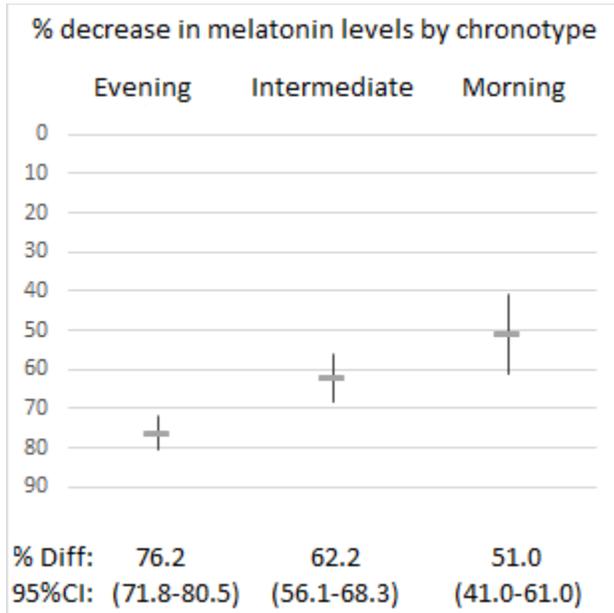
(P-interaction < 0.01). For example, morning-type night shift workers had 54% lower melatonin levels while working at night compared to day shift workers during night-time sleep, while evening-type night shift workers had 73% lower levels. When considering intermediate chronotypes, melatonin differences were consistently in between those of morning- and evening-types (see figure). Together, these results suggest that morning-type night shift workers may be better able to maintain a circadian pattern of melatonin production that is closer to normal levels (i.e. higher at night and lower during the day).

Since "one possible mechanism that could explain the association between shift work and cancer is that shift work disrupts the normal nocturnal rise in melatonin," said Davis, morning types may be better protected from the negative effects of shift work relative to evening types. Furthermore, said Bhatti, "there are other important mechanisms underlying the carcinogenicity of shift work, such as impacts on sleep quality and the immune system, that may be influenced by chronotype." This study demonstrates the benefit of considering the role of chronotype on the association between shift work and cancer, and the authors are looking forward to conducting future analyses. "Our goal is to launch new population-based studies to conduct in-depth analyses of these additional mechanisms," said Bhatti, "it is only through a comprehensive understanding of these mechanisms that we can begin to formulate interventions to protect susceptible populations from the negative effects of shift work." Ultimately, continues Davis, "it would then be possible to design and implement changes in shift work that would avoid such effects."

The authors invite anyone interested in learning more about this subject to attend the upcoming symposium, "Cancer and the circadian clock connection: a symposium on the current state of the science," which will be held May 19th at 1PM in the Pelton Auditorium.

Dana Mirick from PHS also contributed to this project.

[Bhatti P, Mirick DK, Davis S.](#) 2014. The impact of chronotype on melatonin levels among shift workers. *Occup Environ Med*. Published Online First: 2014 Jan 7. doi: 10.1136/oemed-2013-101730.



(Image provided by Dr. Jonathan Kocarnik)

Results from regression analyses of melatonin levels by chronotype, showing the decrease in circulating melatonin levels (6-sulfatoxymelatonin) in night shift workers during night work compared to day shift workers during night sleep, by chronotype.