

Measurements of sleep quality with low-cost sleep monitors: Effect of bedroom air quality and sleep quality

Pawel Wargocki*¹

¹ *International Centre for Indoor Environment and Energy*

Department of Civil Engineering, Technical University of Denmark

*Corresponding author: paw@byg.dtu.dk

ABSTRACT

More than 20 years of one's life is spent in the bedroom when sleeping. Sleep quality is essential for our health, well-being and next-day performance. However, there is very little information on how bedroom air quality affects the quality of sleep. One of the reason could be that the accurate measurements of the quality of sleep have been the domain of sleep research groups and sleep laboratories using polysomnography. In the recent years, however, many low-cost sleep monitors and actigraphs made their way into the market. They allow carrying out reasonably simple measurements of sleep quality at the large scale. But there are no accurate data on their performance and neither whether they can be used for research purposes. This project attempted to shed some light on these issues by comparing the performance of a few selected sleep monitors and by measuring the effects of bedroom air quality on sleep quality. To meet the latter objective, 30 persons were recruited to sleep in their bedrooms for two weeks under two different conditions: with the door to the bedroom opened and closed. Only people who sleep alone were selected. Bedrooms were not ventilated by mechanical systems and windows stayed closed during measurements. Recruited persons slept with the wearable monitor which registered their sleep quality from Monday to Friday, i.e., four nights on each week. Every morning they rated their sleep quality, air quality in the bedroom as well as made logical thinking tasks for 3 minutes that examined their cognitive performance. For that purpose, they used a specially developed App on the tablet. Temperature, relative humidity, and carbon dioxide concentration were continuously logged. Measured bedroom conditions were correlated against objectively and subjectively measured sleep quality to examine whether any relationship exists. To meet the former objective, several low-cost monitors were purchased, both wearable, standing on the night desk or placed on or under bedlinen. Six recruited persons slept for four nights, and their sleep quality was registered with some of those monitors as well as with the monitor used in the first experiment; their measurements were compared against each other to examine whether they differ in their performance.