Dragan Hrnčić, University of Belgrade – Faculty of Medicine, Belgrade (Serbia)
dragan.hrncic@med.bg.ac.rs
https://orcid.org/0000-0003-0806-444X
UDK: 551.583:159.963.2 **DOI: 10.5937/POPENVIROS25053H**

Climate Change – Related Sleep Alterations: An Impact for Society and Global Heath

Sleep is a vital physiological process essential for physical well-being, cognitive capacities, immunity system, as well as mental health. Sleep duration and quality alterations have been increasingly recognized as significant risk factors of a number of chronic non-communicable diseases. With the intensification of climate change, environmental factors such as rising nighttime temperatures and extreme weather events have emerged as substantial disruptors of sleep health, impacting population well-being and health equity. Recent clinical and basic studies have established a clear link between elevated ambient temperatures and poor sleep quality. A comprehensive analysis involving over 47,000 individuals across 68 countries revealed that warmer nighttime temperatures are associated with reduced sleep duration, increased sleep fragmentation, and delayed sleep onset. Specifically, on nights exceeding 30°C, individuals experienced an average sleep loss of approximately 14 minutes. Vulnerable populations, including elderly, women, and residents in low-income or highly urbanized areas, are disproportionately affected by these sleep disturbances. Unfortunately, rigorously conducted studies suggest minimal evidence of adaptation to these changes over time. To assess long-term risks and potential adaptive strategies, we applied qualitative foresight planning using the Three Horizons Framework and scenario development based on Shared Socioeconomic Pathways (SSPs). We relied on pre-developed four future scenarios for the year 2050, integrating projections of global warming trajectories (RCP4.5–RCP8.5), taking into account variables such as urbanization, technological adaptation, and public health responses and counteract it to sleep health using llm. Theoretical outcomes from this scenario analysis suggest divergent sleep health trajectories: "High-Adaptation, Green Infrastructure" (SSP1-RCP4.5): Sleep quality disruption could be ameliorated in this scenario since it foresees a future in which proactive measures, including widespread access to cooling technologies, improved building designs, and heat-resilient urban planning. "Fragmented Response, High Emissions" (SSP3-RCP8.5): In contrast, this scenario predicts chronic sleep quality impairment contributing to elevated risks of cardiovascular and metabolic diseases, cognitive decline, and mental health disorders. These findings underscore the imperative to integrate sleep health considerations into climate resilience planning. It could be concluded that public health strategies must address both physiological vulnerabilities and environmental determinants of sleep, fostering adaptive capacities in the face of a warming world.

Keywords: Sleep, climate changes, temperature, heatwaves, prediction