Chapter 10
Optimize Healthcare Workflows:
Sleeping Disorders Diagnosis and Challenges Using Digital Twins

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ABSTRACT

Sleeping disorders are a common medical condition affecting individuals of all ages. These disorders can manifest in various ways. One of the most common sleeping disorders among adults, insomnia, affects roughly 33-50% of the adult population and is characterized by difficulties getting to sleep and staying asleep. Insomnia is not only a standalone disorder but also a contributing risk factor for other health issues, including diabetes, obesity, asthma, chronic pain syndrome, depression, anxiety disorders, and cardiovascular illnesses. Moreover, sleeplessness is frequently linked to other mental health conditions like anxiety, depression, and post-traumatic stress disorder. In addition to the physical and mental health implications, insomnia also leads to impairments in daytime functioning and can greatly reduce an individual's quality of life.

1. INTRODUCTION

Sleeping disorders are a common health issue affecting millions worldwide; presenting a significant public health concern (Chang, 2023). The advent of digital twin technology offers a promising avenue for optimizing healthcare workflows in the diagnosis and management of sleeping disorders. By creating a virtual replica of a patient's physiology and behavior, healthcare providers can gain invaluable insights into the intricacies of sleep patterns and disturbances. This innovative approach has the potential to revolutionize the way sleeping disorders are diagnosed and treated, leading to more personalized and effective interventions (Fjell, 2023). However, the implementation of digital twins in healthcare is not

without its challenges, including privacy of data concerns, ethical issues and the requirement for certain training and infrastructure (Yang, 2023). This research aims to explore the current state of digital twin technology in the context of sleeping disorders, highlighting its benefits and addressing the obstacles that must be overcome for successful integration into clinical practice (Yin, 2023).

1.1 Types of Sleeping Disorders

A common category of illnesses known as sleep disturbances can have detrimental effects on a person's general health and well-being (Yin, 2023). Numerous disorders fall under this category, such as respiratory issues, irregular movements during sleep, circadian rhythm abnormalities, insomnia, hypersomnia, parasomnia, and other miscellaneous disorders (Naguib, 2023). A sleep problem called insomnia is characterized by trouble getting to sleep or remaining asleep (Wang, 2023). On the other side, increased daytime sleepiness and extended sleep durations are characteristics of hypersomnia. The term "parasomnia" describes aberrant sleep-related actions or experiences, such sleepwalking or night terrors (Rahman, 2023). Disorders affecting the circadian rhythm cause abnormalities in the body's normal sleep-wake cycle, which can make it difficult to go asleep or wake up at the right times (Mahmoud, 2022).

Disorders such periodic limb movement disorder and restless leg syndrome are included in abnormal movements that occur while you sleep. Sleep apnea and other respiratory problems cause abnormal breathing patterns when a person is asleep. Nightmares, nocturnal enuresis (bedwetting), and eating disorders associated with sleep are examples of other non-specific sleep disorders (Thiedke, 2001). A common category of illnesses known as sleep disturbances can have detrimental effects on a person's general health and wellbeing. They can interfere with the immune system, cause major psychological and mental issues, and throw off the regular cycle of sleep and wakefulness. To enhance general health and quality of life, it is critical to obtain an accurate diagnosis and treatment for sleep problems (Morokuma, 2023). Figure 1 shows Sleep disorder types.

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