



Letter of Editor-in-Chief What is the relationship between shift work and osteoporosis?

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This article discusses the impact of night shift work on osteoporosis, drawing on epidemiological evidence. Nowadays, night shift work is characterized as a common risk factor that contributes to a reduction in bone mineral density (BMD) content as well as an increase in bone fracture risk (1). Osteoporosis is defined by the National Institutes of Health (NIH) as "a skeletal disorder characterized by compromised bone strength, predisposing a person to an increased risk of fracture." BMD, a measure of bone strength, is assessed via dual-energy X-ray absorptiometry, with fractures most common in the hip, spine, and forearm. According to the International Osteoporosis Foundation, approximately 9 million low-energy fractures occur globally each year, affecting more than 200 million women, especially those over the age of 60 (1-2).

Studies indicate a higher fracture risk in economically developed countries, such as those in Europe and North America, where long-term healthcare and rehabilitation costs for individuals with osteoporosis are also substantial (2-3). Key risk factors for osteoporosis include age, gender, low physical activity, low body weight, smoking, excessive alcohol intake, estrogen deficiency, poor nutrition, vitamin D deficiency, certain diseases, and specific medications (3-4).

We collected all relevant articles regarding the impact of shift work on BMD through a comprehensive search in major databases, including Medline, ISI, Web of Science, Scopus, and Google Scholar, up to November 2024, without any restrictions on publication date or language. The search terms were "Shift work," "Night work," "Bone mineral density," "Osteoporosis," and "Trial." Several epidemiological studies have explored the link between night shift work and the risk of bone fractures. A cohort study of 38,062 postmenopausal nurses in the U.S. indicated that women who worked night shifts for more than 20 years had a 37% higher risk of hip and wrist fractures compared to those who had never worked night shifts (relative risk = 1.37, 95% confidence interval: 1.04-1.80) (5). Additionally, the results of a study conducted in Chile showed that postmenopausal nurses working night shifts had significantly lower BMD in the lumbar spine and femoral neck compared to their day-shift counterparts (6). Another study in South Korea involving 3,005 individuals aged 18 to 50 found that those working irregular shifts had lower total femur and lumbar spine BMD, with higher rates of osteopenia observed in shift workers (34.3%) compared to day workers (29.1%) (7). In the U.S., Santhanam et al. (2016) found that male shift workers had higher bone mineral content in the femoral neck than regular day workers; however, no significant difference was found in female participants (8).

Night shift work may reduce bone density through various biological pathways, including alterations in clock gene expression, decreased melatonin production, sleep disturbances, and possible vitamin D deficiency (9). Circadian rhythms regulated by clock genes influence various physiological

processes, including hormone secretion and immune system activity (9, 10). Research has shown that clock gene expression is disrupted in night workers, potentially impacting bone health. Melatonin, primarily produced at night, helps regulate bone metabolism by promoting osteoblast differentiation and inhibiting osteoclast activity (10, 11). Studies suggest that exposure to artificial light at night reduces melatonin secretion, potentially lowering bone density indirectly (9-11). Sleep deprivation, common among night shift workers, may also contribute to osteoporosis through its impact on the sympathetic nervous system and bone remodeling. An experimental study indicated that chronic sleep restriction reduced osteoblast activity, leading to lower BMD (11, 12). Other studies have found that insufficient sleep is associated with an increased body mass index, reduced glucose tolerance, and elevated inflammation, all of which can negatively affect bone health (12, 13).

In conclusion, the findings from current pieces of evidence support an association between night shift work and osteoporosis. Based on the available evidence, shift work could impact mineral bone density through various mechanisms, such as disruptions in normal hemostasis, endocrine hormone regulation, and immune system function, by alternating the BMD content. However, the current body of research is limited, and further studies are needed to clarify the link between night shift work and osteoporosis, as well as the underlying biological mechanisms.

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Conflict of interest

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Author's contribution

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