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Circadian sleep–wake rhythm of older adults with intellectual disabilities

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ABSTRACT

The circadian sleep–wake rhythm changes with aging, resulting in a more fragmented sleep–wake pattern. In individuals with intellectual disabilities (ID), brain structures regulating the sleep–wake rhythm might be affected. The aims of this study were to compare the sleep–wake rhythm of older adults with ID to that of older adults in the general population, and to investigate which factors are associated with the sleep–wake rhythm in older adults with ID.

This study is part of the 'Healthy Aging and Intellectual Disabilities' study (HA-ID). We applied actigraphy in 551 persons with ID and 58 persons in the general population, aged 50 years and over. Outcome measures were stability (interdaily stability), fragmentation (intradaily variability) and amplitude (relative amplitude) of the sleep–wake rhythm.

Compared to older adults in the general population, the sleep–wake rhythm of older adults with ID was significantly less stable ($p = 0.03$), more fragmented ($p < 0.001$) and had a lower relative amplitude ($p < 0.001$). Multivariate regression analysis revealed that higher age, dementia, depression, visual impairment, severe hearing impairment, epilepsy and spasticity are independently associated with a more disturbed sleep–wake rhythm in this group. The sleep–wake rhythm is more stable in females and those living at a setting for more intensive care. Higher physical activity levels are strongly associated with both a less fragmented ($p < 0.001$) and a more stable ($p < 0.001$) sleep–wake rhythm. Higher age, dementia and depression are also associated with the sleep–wake rhythm in the general population. Neurological and sensory impairments that were associated with the sleep–wake rhythm in older adults with ID, are frequent known conditions in the ID population. Further research should focus on which factors specifically influence the sleep–wake rhythm in older adults with ID, and on the effects of more physical daytime activity on the sleep–wake rhythm in this population.

1. Introduction

The sleep–wake rhythm is a biological rhythm with duration of around 24 h (Sack et al., 2007). This circadian sleep–wake rhythm is controlled by the 'circadian pacemaker', a small group of cells located in the hypothalamus, called the suprachiasmatic nucleus (SCN) (Dijk & Lockley, 2002). Because the normal intrinsic circadian rhythm duration is slightly longer than 24 h (Czeisler et al., 1999), precise synchronization to a 24-h day mainly depends on exposure to environmental

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time signals, the so-called 'Zeitgebers', of which light is the most important one. A disrupted sleep–wake rhythm can lead to diminished quality of life, performance and health (Dijk & Lockley, 2002).

The SCN degenerates in the process of aging (Hofman & Swaab, 1994). As a result, older adults wake up earlier than younger adults, and their sleep becomes often more fragmented (van Someren, 2000). In patients with Alzheimer's disease, alterations of the sleep–wake rhythm might also be explained by decreased SCN function (Mirmiran et al., 1992). Besides SCN function, environmental factors and physical activity can affect the sleep–wake rhythm in older adults as well. van Someren, Lijzenga, Mirmiran, and Swaab (1997) observed that three months of fitness training led to a less fragmented rhythm in 10 healthy older men (van Someren et al., 1997). Meadows et al. (2010) studied the influence of residential status on the sleep–wake rhythm in 122 non-demented care-home residents and 52 community-dwelling poor sleepers. They observed that the care home residents had a more fragmented sleep–wake pattern than community-dwelling older adults, which could have been caused by ambient noise and light at night (Meadows et al., 2010). In older adults in the general population, depression is also associated with sleep–wake rhythm disturbances (Germain & Kupfer, 2008).

Because individuals with ID have some form of brain dysfunction, the circadian pacemaker in the SCN or pathways involved in the sleep–wake rhythm might be affected as well, besides the process of aging. Additionally, people with ID often live in groups with other clients, which might disturb the sleep–wake rhythm. As a result, the circadian sleep–wake rhythm in older adults with ID might be more affected than the sleep–wake rhythm of older adults in the general population.

To our knowledge, no studies have been published on the circadian sleep–wake rhythm of older adults with intellectual disability (ID). Therefore, the aims of this study were to compare the sleep–wake rhythm of this population with that of older adults in the general population, and to investigate factors related to the circadian sleep–wake rhythm in older adults with intellectual disabilities.

2. Methods

2.1. Study design and participants

2.1.1. Older adults with intellectual disabilities

This study was part of the large cross-sectional study 'Healthy Aging and Intellectual Disabilities' (HA-ID) in 1050 clients aged 50 years and over, who receive support or care from three intellectual disability (ID) care provider services in the Netherlands. Details about design, recruitment and diagnostic methods have been presented elsewhere (Hilgenkamp et al., 2011). Ethical approval was provided by the Medical Ethical Committee of the Erasmus Medical Center (MEC 2008-234) and by the ethical committees of the participating care provider services. Written informed consent was obtained from all participants or their legal representatives. The study adheres to the Declaration of Helsinki for research involving human subjects.

2.1.2. Comparison group

The comparison group consisted of community-dwelling adults aged 50 years and over in the general population, who were family members, friends or colleagues of the researchers. Informed consent was obtained from all participants. Exclusion criteria were immobility of the arms, shift work or a flight over more than two time zones within one week before or during measurement, as well as known circadian rhythm disorders or neurodegenerative disorders.

2.2. Materials

2.2.1. Participant characteristics

For the older adults with ID, general information on age, gender and residential status was collected through the care providers. Residential status was categorized as central setting (care), community-based setting (support) and living independently with ambulatory support. Level of ID was obtained from behavioral therapists' and psychologists' records (borderline, mild, moderate, severe or profound). Information on physical or mental co-morbidities (autism, dementia, epilepsy, visual impairment, hearing impairment, spasticity, Down syndrome) and medication use (anti-epileptics, benzodiazepines, antidepressants and antipsychotics) was acquired from medical and behavioral therapists' records. Depression symptoms were assessed using self-report (Inventory of Depressive Symptomatology Self Report, IDS-SR) and informant-report (Dutch informant-report Signalizing Depression List for people with Intellectual Disabilities, SDL-ID) screening instruments. Severe depression symptoms were defined as a score above the cut-off of at least one of these screening instruments (Hermans, Beekman, & Evenhuis, 2012). Information on dementia was available in both the medical and behavioral therapist record. Because dementia is difficult to diagnose in older adults with ID, only cases with consensus between the medical and behavioral therapist record (diagnosis in both records, one suspicion and one diagnosis, or both suspicion) were used for further analysis.

For the comparison group, general information on age, gender and exclusion criteria was obtained using a short questionnaire.

2.2.2. Sleep–wake rhythm assessment

The circadian sleep–wake rhythm (from here called 'sleep–wake rhythm') was assessed using actigraphy. Actigraphy is a valid method to measure the circadian rhythm (Ancoli-Israel et al., 2003; Morgenthaler et al., 2007; Pollak, Tryon, Nagaraja,