


LITERATURE REVIEW

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Screen Time and the Risk of Dementia in Older Adults: Impact, Mechanisms, and Preventive Solutions

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ABSTRACT

Excessive screen time has become a major health issue, particularly in the digital age. The term cognitive overload describes a condition in which the brain is required to process an excessive amount of information, which may result from excessive screen time. This condition may adversely affect the development of motor functions, problem-solving abilities, visuospatial skills, learning processes, cognitive functioning, short- and long-term memory, as well as emotional and behavioral functioning. Older adults, as a group vulnerable to cognitive impairments, face significant risks from uncontrolled screen time. Studies indicate that sedentary screen-based activities, such as watching television, can increase the risk of dementia, while active cognitive activities like using a computer may offer protective effects for brain health. The term *digital dementia* refers to impaired cognitive functioning associated with excessive use of digital technology. Therefore, digital detox may be necessary to reduce the potential adverse effects of excessive screen time. Digital detox can be implemented by limiting the use of a particular type of digital technology or by reducing screen time at least one day per week. This article reviews recent scientific literature to explore the relationship between screen time and the risk of dementia among older adults.

Keywords: Cognitive overload, dementia, digital detox, older adults, screen time.

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INTRODUCTION

Dementia is a neurodegenerative disorder characterized by a decline in cognitive function, memory, and thinking ability that affect daily activities. According to WHO data from 2015, dementia affected 50 million people worldwide. The number of people with dementia is projected to increase to 82 million by 2030 and 152 million by 2050.[1] The exponential increase in dementia prevalence is associated with advancing age and the aging of the global population. Risk factors for dementia include age, genetics, and lifestyle, with screen-use duration increasingly receiving attention.

Screen time refers to the amount of time spent using electronic devices such as televisions, computers, and smartphones.[2] Several studies have shown that the type and duration of screen time can affect brain function differently.[2] Passive sedentary screen time, such as simply sitting and watching television, may increase the risk of dementia, whereas screen time involving computer use can stimulate cognitive function and reduce the risk of dementia.[3]

Harvey, *et al*., showed that approximately 53% of older adults reported have a screen time for more than 4 hours per day, 15% of older adults watched television for more than 4 hours per day and 54% watched television for around 3 hours per day, whereas fewer than 10% of older adults used computers for over 1.6 hours per day. Approximately 60% of older adults spend more than 4 hours per day sitting. Objective measurements have shown that 67% of the population in sedentary behavior for more than 8.5 hours during their waking day. Computer use increased over time as people became more familiar with computer technology.[4]

The study conducted by Yuan, *et al*., demonstrated an association between screen time and the risk of dementia in older adults. The risk of dementia increased with longer durations of television viewing. Watching television for 2–3 hours per day was associated with a higher risk of all-cause dementia with hazard ratio (HR) = 1.09 and $p < 0.05$. Furthermore, watching television for ≥ 4 hours per day was associated with a substantially higher risk of all-cause dementia with HR = 1.29 and $p < 0.001$.[5]

Although previous studies have examined associations between screen time and specific health outcomes, the available evidence remains limited in several aspects. Previous research has predominantly focused on television viewing duration, while other forms of digital media use, such as computer and other screen-based activities, have received comparatively less attention. Associations between screen time and cognitive function may vary depending on the type of digital activity. In addition, the underlying mechanisms and the potential cognitive consequences of excessive digital media use have not been comprehensively synthesized. Therefore, a comprehensive review is needed to integrate the available evidence and provide a better understanding

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of the cognitive, psychological, and behavioral consequences of excessive digital media use. This article aims to review the latest scientific evidence on the effects of screen time on dementia risk among older adults, explain the mechanisms underlying these effects, and provide recommendations for interventions that may help prevent or slow the progression of dementia among older adults.

MAIN REVIEW

Relationship Between Screen Time and Dementia Risk

Excessive screen time, such as spending more than 2–3 hours per day using electronic media, may affect brain development both structurally and functionally and increase the risk of cognitive, emotional, and behavioral problems, thereby increasing the risk of dementia among older adults.[6] Wu, *et al*., found that the associations between screen time and disease outcomes varied according to the type and duration of screen-based activities. Based on the experiment among 473,184 participants from the UK Biobank, computer use for 0.5–1 hour per day was associated with a 32% lower hazard of dementia compared with no computer use (as a reference: 1.00) (HR = 0.68, 95% CI: 0.64–0.72). Similarly, computer use for 2–3 hours per day and ≥ 4 hours per day was associated with a 24% (HR = 0.76, 95% CI: 0.70–0.82) and 23% (HR = 0.77, 95% CI: 0.68–0.88) lower hazard of dementia, respectively. In contrast, watching television for ≥ 4 hours per day was associated with a 28% higher hazard of dementia compared with watching television for 0–1 hour per day (HR = 1.28, 95% CI: 1.17–1.39).[7] These findings indicate that the type and duration of screen time play important roles in determining its effects on brain health.[7]

Da Ronch, *et al*., reported consistent findings, showing that longer television viewing was associated with lower scores on the Mini-Mental State Examination (MMSE), a tool used to assess cognitive function. The study highlighted a significant association between passive sedentary activity and cognitive impairment among older adults in three European countries.[8] Fancourt and Steptoe also found that watching television for more than 3.5 hours per day was associated with a decline in verbal memory after six years, although the effect was not significant for semantic fluency.[9] Excessive use of digital technology can impair cognitive function in ways observed in dementia.[10]

Biological Mechanisms

The term "digital dementia" was introduced by neuroscientist Manfred Spitzer to refer to cognitive impairment resulting from excessive use of digital technology. This condition may cause cognitive impairments involving memory, attention, communication ability, and decision-making.[3] Neuroimaging studies have shown that individuals who spend excessive amounts of time on the internet experience changes in brain structure and function, particularly in the prefrontal cortex (PFC) and anterior cingulate cortex (ACC). These brain regions are responsible for cognitive functions such as decision-making, impulse control, and emotion regulation. Internet addiction may reduce gray matter density in several brain areas, including the dorsolateral prefrontal cortex (DLPFC) and rostral ACC. The DLPFC is involved in executive functions such as decision-making, whereas the ACC regulates and processes emotions.[11]

Passive sedentary activities such as watching television are associated with decreased hippocampal volume and increased white matter hyperintensity (WMH), a marker of brain damage.[9] Conversely, moderate computer use is negatively associated with WMH volume and positively associated with hippocampal volume.[9] These findings indicate that different types of screen time can affect brain structure differently. Although the underlying biological mechanisms are not yet fully understood, several scientific explanations may clarify the relationship between screen-time type and increased dementia risk.[7]

1. Compared with watching television, computer use involves more muscle activity, thereby burning more energy than simply sitting and watching television.
2. Computer use can stimulate cognitive function.
3. Computers use enables social interaction (online communication) with family and friends, providing social support among older adults.

Exposure to light from screens, particularly in the evening, may suppress melatonin secretion and disrupt circadian rhythms, thereby affecting sleep quality and duration. Cognitive overload refers to the increased mental demand associated with processing large amounts of information, which may occur during excessive or highly demanding digital-media use. Excessive screen exposure may affect motor development, problem-solving ability, spatial ability, and learning processes. Cognitive impairment may also involve short and long-term memory problems and difficulty concentrating. In addition, emotional and behavioral changes such as stress, anxiety, mood changes, and depressive symptoms may affect cognitive health. These effects may reduce work performance, characterized by decreased productivity and increased errors. Collectively, these factors may contribute to cognitive difficulties associated with excessive digital technology use.[12] The following figure explains some impacts of excessive use of digital media **(Figure 1).**[12]

Screen Time and Sleep Quality

Jiang, *et al*., in a study conducted in China, showed that sleep duration and sleep latency were associated with cognitive function. Participants who slept 6 to < 8 hours per day and had a sleep latency of 16–30 minutes had a lower risk of cognitive impairment.[13] Xu, *et al*., found that insufficient sleep (< 4 hours per day) or excessive sleep (> 12.5 hours per day) may increase the risk of cognitive impairment.[14] Another study conducted in one of the provinces in China reported that 6.89% of the total participants engaged in excessive screen time, while 13.45% engaged in screen time before bedtime. Excessive screen time was associated with socioeconomic factors and was more commonly observed among men.[15]

Rasmussen, *et al*., showed that good sleep quality is important because during sleep the body clears substances that are no longer needed, including amyloid β, which is removed through the glymphatic pathway. The glymphatic pathway is active during sleep. Disruption of this pathway may increase the risk of Alzheimer's disease dementia.[16] Poor sleep quality may also affect the balance of neurotransmitters in the brain.[17] Screen





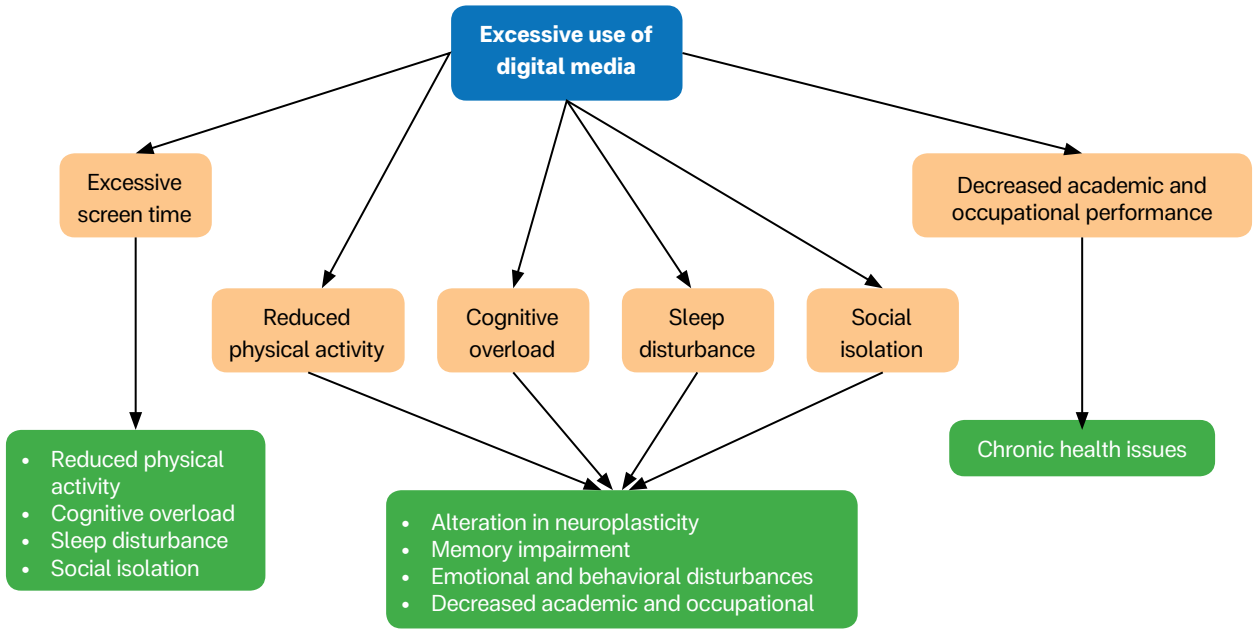


Figure 1. Mechanism of digital dementia.[9]

time during the 1–2 hours before bedtime can inhibit melatonin production, affecting the circadian rhythm and disrupting sleep quality.[18] Therefore, screen time among older adults should be monitored to help ensure good sleep quality.

Intervention Strategies

Montag and Diefenbach proposed a design-based approach to create digital environments that better support mental and cognitive health. This includes developing applications that promote cognitive exercises, meditation, and physical activity. In addition, family education about the effects of screen time is important to help older adults manage their technology-use patterns.[19]

Shanmugasundaram and Tamilarasu explained that several solutions can effectively limit excessive use of digital technology. These include setting screen-time limits and engaging in activities that stimulate brain function, such as reading, physical exercise, socializing with family and friends, and playing puzzles or other memory-training games to help maintain cognitive function.[10]

Physical Activity and Screen Time

Physical activity can help reduce the negative effects of screen time. Replacing passive sedentary time with light-to-moderate physical activity can significantly reduce dementia risk, although this cannot completely eliminate the harmful effects of passive screen time, such as watching television.[3] For example, isotemporal substitution analysis according to Wu, *et al*., showed that replacing 30 minutes of television viewing with light physical activity could reduce dementia risk by up to 20%.[7] This demonstrates the importance of physical activity as a measure to mitigate the risk of cognitive decline.[7]

Zhao, *et al*., found that older adults who previously had sedentary lifestyles and subsequently engaged in physical activity for more than 12 weeks showed significant improvements in cognitive function. Physical activity lasting more than 12 weeks was shown to improve cognitive function significantly compared with shorter-duration interventions. Factors such as baseline cognitive status, duration and type of physical activity, and geographic location may influence the degree of cognitive impairment among sedentary older adults. Physical activity not only increases blood flow to the brain and improves cardiovascular function but also plays a role in metabolic processes. Aerobic exercise has been shown to be more effective than multicomponent exercise in improving cognitive function among older adults.[20] The following five mechanisms explain why physical activity is important for preventing the progression of dementia **(Table 1).**[21]

Physical activity increases the production of several biomolecules in the brain, skeletal muscles, and liver that can enhance hippocampal plasticity and cognitive function. Physical activity can increase the production of BDNF (brain-derived neurotrophic factor), IGF-1 (insulin-like growth factor-1), and VEGF (vascular endothelial growth factor) in the brain, increases the release of GPLD-1

Table 1. Relationship between physical activity and dementia progression.[21]

Mechanism	Description
Vascular	Physical activity increases blood perfusion to the brain.
Neurochemical	Physical activity increases endorphins and serotonin in the brain, thereby improving cognitive function.
Cognitive reserve	Physical activity can increase synaptogenesis and neurogenesis.
Stress	Physical activity reduces stress and makes more positive mood.
Functional	Physical activity improves memory and spatial function.





(glycosylphosphatidylinositol-specific phospholipase D1), β-hydroxybutyrate and lactate metabolites in the liver, and increases the release of irisin and cathepsin B in skeletal muscle, which support cognitive function through processes such as neurogenesis, angiogenesis, and/or synaptic plasticity.[22]

Social and Educational Implications

Education is a protective factor against the negative effects of screen time. Older adults with higher levels of education tend to engage in active cognitive activities, such as reading or using computers for educational purposes, which may increase their cognitive reserve. Digital detox is needed to reduce the effects of excessive screen time so that individuals can reconnect with their surroundings and avoid social isolation.[23] Digital detox aims to achieve a balance between technology use and real-life activities, thereby reducing dependence on technology. This may help improve cognitive function. Depending on individual needs, digital detox can be carried out by limiting the use of one type of technology or screen time for seven days or at least once a week.[12]

In addition, education contributes to digital literacy, enabling older adults to use technology productively. Good digital literacy can help older adults to access relevant health information and use technology to support their well-being.

The Influence of the Digital Environment on Social Interaction

A study involving the online Dementia Talking Point forum in the United Kingdom found that digital technology can provide a platform for people with dementia to share their stories, symptoms, and ways of adapting to dementia. Emotional support and information sharing can beparticularly valuable for those who live far from family or alone, because online forums provide broad access that enables people with dementia to maintain social interaction.[24]

Wilson, *et al*., showed that most older adults prefer face-to-face communication to digital communication, with digital communication viewed as a supplement when face-to-face communication is not possible. Face-to-face communication provides a more complete physical, psychological, and social experience and may also reduce the risk of miscommunication. Studies show that face-to-face social interaction has a greater impact on cognitive function than digital communication alone. Therefore, it is important to encourage older adults to remain engaged in their local communities while also using technology as a supportive tool.[25]

Preventive Solutions

The findings discussed in this review suggest that preventive solutions for dementia in older adults should not focus solely on reducing overall screen time but should also consider the type, purpose, and context of screen-based activities. Evidence has shown that passive television viewing may be associated with an increased risk of dementia, whereas cognitively engaging computer use may have different cognitive implications.[5,7] Therefore, a more balanced approach to digital engagement may be preferable to a general recommendation to avoid screen use.

Several complementary strategies may be considered. First, replacing prolonged sedentary screen time with light physical activity may help reduce dementia risk. Physical activity has been linked to cognitive health through potential biological mechanisms.[7,20,22] Second, maintaining adequate sleep and reducing screen exposure before bedtime may help support sleep quality and circadian regulation, which are relevant to brain health.[16] Third, older adults may benefit from purposeful digital activities that promote cognitive stimulation and social engagement. Digital communication may help maintain social connections, particularly when it complements rather than replaces face-to-face interactions.[24,25]

CONCLUSION

The association between screen time and dementia risk among older adults varies by activity type. Prolonged television viewing is associated with an increased risk of dementia, whereas active computer use may be associated with better cognitive health. Potential mechanisms include changes in brain structure and function, cognitive overload, and sleep disturbances, although these mechanisms require further investigation. Preventive strategies include limiting prolonged sedentary screen time, increasing physical activity, maintaining adequate sleep, and engaging in cognitive and face-to-face social activities. Interventions such as digital detox, which aims to reduce dependence on technology have significant potential to reduce the negative effects of screen time on brain health. Digital literacy and balanced technology use may also help older adults use digital media more productively and support cognitive health

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Author Contributions

Margareth Hildaria contributed to conceptualization, writing – original draft. Frisca Erika contributed to supervision, writing – review and editing.

Conflict of Interest

The authors declare no conflicts of interest.

Declaration on the Use of Artificial Intelligence (AI)

The authors affirm that the manuscript was prepared without generative AI or automated text tools, and that all content was developed solely by the authors.

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