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Mild cognitive impairment and sedentary behavior: A multinational study

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ABSTRACT

Background: Sedentary behavior (SB) is associated with poor cognitive performance. However, the contribution of sedentary time to risk of mild cognitive impairment (MCI) remains unclear. This study assessed the association of SB with MCI in six low- and middle-income countries.

Methods: The Study on Global Ageing and Adult Health (SAGE) survey included 34,129 adults aged ≥50 years [mean (SD) age 62.1 (15.6) years; 51.7% females]. SB was self-reported and expressed as a categorical variable [< 8 or ≥8 h per day (high SB)]. The definition of MCI was based on the recommendations of the National Institute on Ageing-Alzheimer's Association. Multivariable logistic regression analysis was conducted to assess the association between SB and MCI.

Results: The overall prevalence (95%CI) of MCI and high SB (i.e., ≥8 h/day) were 15.3% (14.4%–16.3%) and 10.1% (9.0%–11.3%), respectively. After adjustment for potential confounders, being sedentary for ≥8 h/day was associated with a 1.56 (95%CI = 1.27–1.91) times higher odds for MCI. A one-hour increase in SB was associated with a 1.08 (95%CI = 1.05–1.11) times higher odds for MCI.

Conclusion: Our study results highlight the need to further explore a sedentary lifestyle as a potential risk factor for MCI or subsequent dementia. Longitudinal and intervention studies are warranted to confirm/refute the current findings.

1. Introduction

Dementia is one of the main causes of disability and dependency in the expanding older adult population worldwide (Wimo et al., 2017). Currently, it is estimated that approximately 50 million people worldwide are diagnosed with dementia, and this figure is projected to increase to 132 million by 2050 (Prince, 2015). The prevalence and incidence of dementia is increasing rapidly in low- and middle-income countries (LMICs), placing immense pressure on the social and economic systems in this part of the world (Wimo et al., 2017). Specifically, the proportion of those with dementia residing in LMICs are expected to increase from 58% in 2015 to 68% in 2050 (Alzheimer's Disease International, 2015).

The greatly increasing numbers of people with dementia in LMICs are attributed to the increase in life expectancy and the concurrent rise in other modifiable risk factors, such as unhealthy lifestyle behaviors

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(Ferri and Jacob, 2017; Prince et al., 2009). Since there is currently no treatment available to alter the clinical course of dementia significantly (Cummings, 2004; Kaduszkiewicz et al., 2005), identifying modifiable risk factors in the precursory stages of dementia is considered a priority to prevent or delay the onset of dementia (Livingston et al., 2017). Specifically, mild cognitive impairment (MCI) is considered to be a preclinical state of dementia (Albert et al., 2011) for which targeted interventions may be possible. Previously reported potentially modifiable risk factors for MCI include factors such as low physical activity levels, obesity, diabetes, and hypertension (Lara et al., 2016).

In the past decade, sedentary behavior has emerged as an important risk factor for various health outcomes in adult populations (Keadle et al., 2017). Sedentary behavior refers to any waking behavior characterized by an energy expenditure $\leq$1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture (Tremblay et al., 2017). It is associated with a range of deleterious outcomes such as diabetes, cancer, cardiovascular diseases, and premature mortality, largely independent of physical activity (Biswas et al., 2015; Powell et al., 2018). More recently, there has been growing interest in its relation with mental health. For example, recent meta-analyses have found a positive relationship between more time spent sedentary and depression (Zhai et al., 2015) and this was also independent from physical activity levels. While a systematic review (Falck et al., 2017a) showed that sedentary behavior is also associated with lower cognitive performance, none were specifically executed in MCI and therefore the attributable risk of sedentary time to MCI still remains unclear.

To the best of our knowledge, the only study on this topic to date found that Canadian community-dwelling people with MCI (n = 82) (at least 55 years old) spent a greater number of $\geq$30 min bouts/day sedentary per day than those without MCI (n = 69) (4.1 ± 1.8 versus 3.3 ± 1.7, p = 0.046) (Falck et al., 2017b). However, this study was conducted in a limited geographical area in a single high-income country and was of small sample size, limiting generalizability to other settings. Furthermore, it remains to be explored whether more time spent sedentary is associated with a higher risk for MCI. Given that there are no multinational, community-based, or nationally representative studies on the association between sedentary behavior and MCI, and that there are no studies on this topic from LMICs, we aimed to assess the association between time spent sedentary and MCI among adults aged $\geq$50 years in six LMICs using data from the WHO Global Ageing and Adult Health study (SAGE). We included the middle-aged (50 $\leq$ 65 years) in this analysis as intervening in mid-life has been reported to be important to prevent the later onset of dementia (Alzheimer's Disease International, 2014; Gottesman et al., 2017; Johansson et al., 2010; Kivipelto et al., 2006). Exploring the association between time spent sedentary and MCI in LMICs is of particular importance given the increasing rates of sedentary lifestyles (Christensen et al., 2009; Vancampfort et al., 2017a) and dementia and cognitive impairment in this part of the world (Prince et al., 2016). Next to this, there is a lack of knowledge regarding the risks associated with sedentary behavior in LMICs (Pengpid et al., 2015). Furthermore, the continuing dearth of studies from LMICs also highlights the gap between where research is conducted and where the largest public health impacts of sedentary behavior occur (Sallis et al., 2016).

2. Methods

2.1. The survey

Data from the SAGE were analyzed. These data are publically available through http://www.who.int/healthinfo/sage/en/. This survey was undertaken in China, Ghana, India, Mexico, Russia, and South Africa between 2007 and 2010. These countries broadly represent different geographical locations and levels of socio-economic and demographic transition. Based on the World Bank classification at the time of the survey, Ghana was the only low-income country, and China and India were lower middle-income countries although China became an upper middle-income country in 2010. The remaining countries were upper middle-income countries.

Details of the survey methodology have been published elsewhere (Kowal et al., 2012). In brief, in order to obtain nationally representative samples, a multistage clustered sampling design method was used. The sample consisted of adults aged $\geq$18 years with oversampling of those aged $\geq$50 years. Trained interviewers conducted face-to-face interviews using a standard questionnaire. Standard translation procedures were undertaken to ensure comparability between countries. If a respondent was unable to undertake the interview because of limited cognitive function, a separate questionnaire was administered to a proxy respondent. These individuals were however not included in the current study. The survey response rates were: China 93%; Ghana 81%; India 68%; Mexico 53%; Russia 83%; and South Africa 75%. Sampling weights were constructed to adjust for the population structure as reported by the United Nations Statistical Division. Ethical approval was obtained from the WHO Ethical Review Committee and local ethics research review boards. Written informed consent was obtained from all participants.

2.2. Mild cognitive impairment (MCI) (outcome)

MCI was ascertained based on the recommendations of the National Institute on Aging-Alzheimer's Association (Albert et al., 2011). We applied the identical algorithms used in previous publications using datasets including the SAGE with the same survey questions to identify MCI (Lara et al., 2017; Lara et al., 2016; Vancampfort et al., 2017b). Briefly, individuals fulfilling all of the following conditions were considered to have MCI:

(a) Concern about a change in cognition: Individuals who replied “bad” or “very bad” to the question “How would you best describe your memory at present?” and/or those who answered “worse” to the question “Compared to 12 months ago, would you say your memory is now better, the same or worse than it was then?”.
(b) Objective evidence of impairment in one or more cognitive domains: was based on a < -1 SD cut-off after adjustment for level of education, age, and country. Cognitive function was assessed through the following performance tests: word list immediate and delayed verbal recall from the Consortium to Establish a Registry for Alzheimer's Disease (Morris et al., 1989), which assessed learning and episodic memory; digit span forward and backwards from the Wechsler Adult Intelligence Scale (The Psychological Corporation, 2002), that evaluated attention and working memory; and the animal naming task (Morris et al., 1989), which assessed verbal fluency.
(c) Preservation of independence in functional abilities: was assessed by questions on self-reported difficulties with basic activities of daily living (ADL) in the past 30 days (Katz et al., 1963). Specific questions were: “How much difficulty did you have in getting dressed?” and “How much difficulty did you have with eating (including cutting up your food)?” The answer options were none, mild, moderate, severe, and extreme (cannot do). Those who answered either none, mild, or moderate to both of these questions were considered to have preservation of independence in functional activities. All other individuals were deleted from the analysis (935 individuals aged $\geq$50 years).
(d) No dementia: Individuals with a major cognitive impairment that precludes the possibility to undertake the survey were not included in the current study.

2.3. Sedentary behavior (exposure variable)

In order to assess sedentary behavior, participants were asked to state the total time they usually spent (expressed in minutes per day)