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Mild cognitive impairment and physical activity in the general population: Findings from six low- and middle-income countries

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A R T I C L E I N F O

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A B S T R A C T

Introduction: Despite the beneficial effects of physical activity (PA) for people with mild cognitive impairment (MCI) on cognition and the acknowledgement that MCI is a critical period for intervening to prevent dementia, little is known about the actual PA levels in people with MCI. This study investigates the relationship between MCI and compliance with PA recommendations.
Methods: Cross-sectional data from the World Health Organization's Study on Global Ageing and Adult Health (China, Ghana, India, Mexico, Russia, South Africa) (n = 32,715; mean age = 62.1 ± SD 15.6 years; 51.7% female) were analyzed. MCI was ascertained based on the National Institute on Aging-Alzheimer's Association recommendations. PA level was assessed by the Global Physical Activity Questionnaire. Participants were grouped into those who do and do not meet the 150 min of moderate-to-vigorous PA/week recommendation. Associations between PA and MCI were examined using multivariable logistic regressions.
Results: The overall prevalence [95%CI] of MCI and low PA were 15.3% [14.4%–16.3%] and 22.4% [21.1%–23.7%] respectively. In the model adjusted for sociodemographic factors, MCI was associated with a 1.28 [1.11–1.48] times higher odds for low PA in the overall sample. This association was driven by the particularly strong association observed in individuals aged ≥65 years (odds ratio = 1.65 [1.34–2.03]). Further adjustment for behavioral and health-related factors made very little difference to the estimates obtained in the model adjusted only for sociodemographic factors.
Conclusions: MCI was associated with an increased odds of not meeting the recommended PA levels. If replicated in longitudinal studies, these findings will offer new targets and strategies for prevention and treatment programs in people at risk for MCI and dementia.

1. Introduction

In 2015, almost 50 million people worldwide were diagnosed with dementia, with this figure projected to increase to 75 million by 2030 and to 132 million by 2050, largely driven by population aging (Prince, 2015). Among people with dementia, the proportion of those residing in low- and middle-income countries (LMICs) are expected to increase from 58% in 2015 to 68% in 2050 (Alzheimer's Disease International, 2015).

Dementia is one of the major causes of disability and dependency in the aging population. Its social and economic impact is significant (Wimo et al., 2017). Furthermore, there is currently no treatment available to cure dementia or to alter its clinical course significantly (Cummings, 2004; Kaduszkiewicz et al., 2005). Thus, identifying

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modifiable risk factors of the precursory stage of dementia to establish interventions to prevent or delay the onset of dementia should be a priority. Specifically, mild cognitive impairment (MCI) is considered to be a preclinical state of dementia (Albert et al., 2011a) for which targeted interventions may be possible. It has been demonstrated that the population attributable risk of low physical activity (PA) for dementia is 21.0% [95% confidence interval (CI) = 5.8–36.6], 20.3% [5.6–35.6], and 21.8% [6.1–37.7] in the USA, Europe and UK respectively (Norton et al., 2014). In a recent Lancet Series on PA, progress and challenges, it was argued that regular PA could prevent almost 300,000 cases of dementia per year, worldwide, if everyone were to comply with the PA recommendation of 150 min of moderate-to-vigorous PA per week (Sallis et al., 2016). Indeed, an evolving body of literature documents significant benefits of long-term, regular PA on cognition while it also reduces dementia risk in people with MCI (Ahlskog et al., 2011; Barber et al., 2011; Blondell et al., 2014; Cammisuli et al., 2017; Gallaway et al., 2017; Lautenschlager et al., 2010; Sofi et al., 2011).

Despite the beneficial effects of PA on cognition, little is known about the actual PA levels in people with MCI compared to people without MCI. For example, in the only study to date, Japanese people aged 75 or older with MCI (diagnosed with a Clinical Dementia Rating of 0.5) ($n = 295$) were significantly less physically active than healthy controls ($n = 221$) [8.70 versus 9.74 metabolic equivalents (METs) × h/day, $P < 0.05$] (Kobayashi et al., 2016). The degree to which people with MCI comply with the international PA recommendations compared with people without MCI also remains unknown.

Also the lack of studies from LMICs specifically focusing on the MCI and PA relationship is an important omission given that the individual, economic and societal burden of dementia is increasing particularly in these countries (Alzheimer's Disease International, 2015). Next to this, there is an upward trend in physical inactivity and non-communicable diseases in this part of the world (Christensen et al., 2009), both risk factors for developing dementia (Beydoun et al., 2008; Covell et al., 2015). Third, compared to high-income countries, different socio-economic, cultural, and environmental factors may influence the MCI–PA relationship differently in LMICs.

Given the current gaps within the literature (a lack of multi-national studies on PA and MCI and the absence of studies specifically on this topic from LMICs), we set out to investigate the relationship between MCI and compliance with PA recommendations using data from six LMICs which participated in the Study on Global Ageing and Adult Health (SAGE) survey (Kowal et al., 2012).

2. Methods

2.1. Procedure

Cross-sectional data from the SAGE survey were analyzed. The survey was undertaken in China, Ghana, India, Mexico, Russia, and South Africa between 2007 and 2010. Based on the World Bank classification at the time of the survey, all countries were LMICs. Details of the survey methodology are provided elsewhere (Kowal et al., 2012). Briefly, in order to obtain nationally representative samples, a multistage clustered sampling design method was used. The sample consisted of adults aged ≥ 18 years with oversampling of those aged ≥ 50 years. The current analysis was restricted to individuals aged ≥ 50 years due to the age-related nature of MCI. Trained interviewers conducted face-to-face interviews using a standard questionnaire. Standard translation procedures for the questionnaires were undertaken to ensure between-country comparability. Individuals with a level of cognitive impairment severe enough to preclude the possibility to undertake the survey were not included in the analysis. The survey response rate ranged from 51% (Mexico) to 93% (China). 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. Physical activity (outcome)

The Global Physical Activity Questionnaire (Bull et al., 2009) was used to assess levels of PA. The total amount of moderate-to-vigorous PA in a typical week was calculated based on self-report. Those scoring ≥ 150 min of moderate-to-vigorous intensity PA were classified as meeting the recommended guidelines (coded = 0), and those scoring < 150 min (low PA) were classified as not meeting the recommended guidelines (coded = 1) (World Health Organization, 2010).

2.3. Mild cognitive impairment (MCI) (exposure)

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

(a) <u>Concern about a change in cognition</u>: 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?" were considered to have this condition.
(b) <u>Objective evidence of impairment in one or more cognitive domains</u>: 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) <u>Preservation of independence in functional abilities</u>: 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)?". If the individual reported that ADL was intact or minimally impaired based on both questions, their ADL was considered to be preserved.
(d) <u>No dementia</u>: individuals with a level of cognitive impairment severe enough to preclude the possibility to undertake the survey were not included in the analysis.

2.4. Control variables

The selection of control variables was based on past literature (Etgen et al., 2010). The sociodemographic variables included age, sex, highest level of education achieved (≤ primary, secondary, ≥ tertiary), wealth, and setting (urban or rural). Wealth quintiles were created based on country-specific income.

Other variables included current smoking (Yes or No), alcohol consumption in the past 30 days (Yes or No), obesity (see below for assessment), number of chronic physical conditions, depression, anxiety, sleep/energy, pain/discomfort, and perceived stress. A stadiometer and a routinely calibrated electronic weighting scale were used to measure height and weight respectively. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.