**Title**

Motivation and willingness to increase physical activity for dementia risk reduction: Cross-Sectional UK survey with people aged 50 and over.

**Authors and affiliations**

Deborah Oliveira[1,2*], Holly Knight[3], Katy A. Jones[2], Reuben Ogollah[4], Martin Orrell[2]

1. Universidade Federal de Sao Paulo (UNIFESP), School of Medicine, Department of Psychiatry, Brazil

2. University of Nottingham, School of Medicine, Institute of Mental Health, Division of Psychiatry & Applied Psychology, United Kingdom

3. University of Nottingham, School of Medicine, Division of Epidemiology and Public Health, United Kingdom

4. University of Nottingham, School of Medicine, Nottingham Clinical Trials Unit, United Kingdom

*** Corresponding author**

Deborah Oliveira, Universidade Federal de Sao Paulo (UNIFESP), School of Medicine, Department of Psychiatry. 241 Major Maragliano, 04017-030, Vila Mariana, São Paulo-SP, Brazil. Tel.: (+55)1134662170. Email: oliveiradc.phd@gmail.com.

**Abstract**

**Background:** Tackling modifiable risk factors such as physical inactivity currently represents the only way to reduce the increasing prevalence of dementia worldwide. **Aim:** This study investigated attitudes to increasing physical activity to reduce risk of dementia in people over 50. **Methods:** Attitudes to increasing physical activity to reduce risk of dementia were assessed in a national online survey promoted via online forums and public adverts. The Motivation to Change Behaviour for Dementia Risk Reduction (MOCHAD-10) scale examined motivation for lifestyle change. Multivariable logistic regression was used to identify the predictors of willingness and motivation to increase physical activity. **Results:** Data from 3,948 individuals showed most people were moderately/very physically active (80%). People more likely to be physically active had better health and education, were older, male, and had a partner. People willing to increase physical activity (73%) were more likely to be younger, non-White, underweight, had better health and lifestyles, and had experience caring for someone with dementia. People with higher levels of motivation to change lifestyle (MOCHAD-10 subscales) were more likely to be female, younger, in poorer physical/mental health, had lower perceived mental activity, and were a carer for someone with dementia. **Conclusion:** Men and those with better health were more physically active. Those who were more motivated to increase physical activity were not necessarily able to be physically active. Multisectoral public health strategies should seek to use the high motivation levels among this group to mitigate the barriers related to physical activity for dementia risk reduction.

**Keywords**

Physical activity; Dementia; Risk factors; Prevention; Behaviour change; Motivation

## Introduction

Around 28.8 million disability-adjusted life years can be attributed to dementia worldwide, of which 6.4 million could be linked to key modifiable risk factors (Nichols et al., 2019), including physical activity, diet (specifically sugar intake), and mental wellbeing (Steyaert et al., 2020; WHO, 2019). Tackling modifiable risk factors for dementia currently constitutes the only way to reduce its incidence (WHO, 2019). Even in those who already have some cognitive impairment, tackling modifiable risk factors might have positive effects on cognitive function (Chong et al., 2020; Horie et al., 2016). By doing so, the number of people with dementia could potentially halve by 2050 (Livingston et al., 2017). It is important to understand people's willingness and motivation to improve their lifestyle so that effective public health strategies can be put into place to reduce the number of people developing dementia (Baumgart et al., 2015).

Physical inactivity is one key modifiable risk factor for dementia (WHO, 2019). Increasing physical activity is low cost and can have direct and indirect benefits to people's overall physical and mental health (WHO, 2019). The World Health Organization guidelines for risk reduction of cognitive decline and dementia strongly recommends at least 150 minutes of moderate-intensity aerobic physical activity throughout the week to prevent dementia in cognitively healthy individuals, in light of moderate quality evidence (WHO, 2019). However, the link between physical inactivity as a risk factor for dementia is complex (Steyaert et al., 2020). The benefits to brain health appear to result from the direct positive effects that increased physical activity may have on brain structures, or indirectly, such as via the positive effects of physical exercise on other modifiable cardiovascular risk factors, including hypertension, insulin resistance and high cholesterol levels (WHO, 2019). Other biological systems, such as enhancement of immune system function, anti-inflammatory

properties, and increasing neurotrophic factors, also appear to play a mediating role between physical activity and risk for dementia (WHO, 2019).

Although there are clear benefits of physical activity in later life, there are also myriad intrapersonal (physical and mental health, individual preferences), interpersonal (personal motivation, level of guidance), physical environment (weather, neighbourhood, parking), and structural and organisational factors (cost of activities, flexibility of timetable, suitability of activities for fitness level) that will have an impact on how much one wishes to, or can exercise (Bethancourt et al., 2014, p.14). One such interpersonal factor, motivation, is central to numerous behaviour change theories (Michie et al., 2011; Thøgersen-Ntoumani & Ntoumanis, 2006) and interventions designed to improve physical activity uptake (Chemtob et al., 2019; Marcus et al., 1998; Schwarzer et al., 2011). An individual's motivation to engage in a behaviour may be guided by their needs, beliefs, and values and has been used to predict both uptake and maintenance of behaviour change (Knittle et al., 2018; Kwasnicka et al., 2016). In other chronic conditions, motivation is associated with healthy lifestyle change and adherence to treatment regimens (Fletcher et al., 2016; Kähkönen et al., 2015), even though not all people who are motivated may in fact be more engaged with physical activity.

For older adults specifically, both intrinsic and extrinsic motivation was found to contribute to physical activity levels (Dacey et al., 2008). In a group of older adults (median age = 77), Moschny et al. (2011) found the three most common barriers to physical activity were poor health, lack of company, and lack of interest. Poor health was the most frequent barrier for those aged 80 or over. The impact of external factors differed by gender, with lack of opportunity for sport or leisure, and lack of transport more likely to be cited by older women than men. Recent literature also suggests worry about dementia and one's perceived personal

risk of developing dementia may also contribute to prevention behaviours (Kessler et al., 2012). However, motivation to make lifestyle change as a means of preventing dementia is not well understood, with a paucity of literature exploring other internal or external factors that underpin this. Further consideration should be given to the individual characteristics or external factors that might impact motivation to make positive lifestyle changes (Kim et al., 2014). In particular, large studies have yet to explore the sociodemographic and other characteristics of older people who are less or more willing and motivated to engage with physical activity and other healthy activities. Knowing which particular groups are at higher risk for not engaging with physical activity can help inform dementia risk reduction interventions and may also help tackle other diseases which are preventable through increased physical activity.

Establishing effective interventions for dementia risk reduction is a public health priority (WHO, 2017, 2019), and understanding what might predict higher/lower willingness and motivation to increase physical activity in adults aged 50 and over is an important component of this (Oliveira, Bosco, et al., 2019; Oliveira et al., 2018). Physical inactivity is responsible for approximately one in six deaths and is estimated to cost the UK economy £7.4 billion annually, with around 1 in 3 (34%) of men and 1 in 2 (42%) of women not being active enough for good health (UK Government, 2019). Currently, there nearly 900,000 people living with dementia in the UK and 209,600 new cases each year (Wittemberg et al., 2019).

This study aimed to explore the levels of willingness and motivation to increase physical activity to potentially reduce the risk of dementia, as well as to identify the sociodemographic and health-related factors associated with these, among individuals aged 50 and over. Besides identifying the groups of people who are more or less motivated to change their lifestyle, this

study can also help understand personal motivators for and barriers to change among this population group which will help ensure that public health strategies are targeted.

## Materials and methods

### *Study design*

A cross-sectional online survey was conducted in the United Kingdom (UK) from September 2017 to February 2018. This study was reported in line with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (von Elm et al., 2014). Full details of the survey methods are published (Oliveira, Aubeeluck, et al., 2019).

### *Sample and recruitment*

Individuals aged 50 and over, without a dementia diagnosis (self-report), and who were living in any area of the UK were eligible to take part. Participants were recruited via social media, online and paper adverts, mailing lists, the Join Dementia Research network (an online platform through which people can take part in dementia-related research), and the UK National Institute for Health Research (NIHR) Portfolio. All potential participants were required to confirm that they met the study inclusion criteria and provided informed consent before completing the anonymous survey, therefore eligibility was based on self-report only. Participation took approximately 15 minutes. This study received ethical approval from East Midlands - Nottingham Research Ethics Committee (IRAS project ID 177280; REC reference 16/EM/0044).

### *Measures*

*Outcome variables*

*Willingness to increase physical activity:* Using 5-point Likert scales (1. not at all; 5. very much), participants were asked how much they would be willing to increase their physical activity levels if they were told that their risk of having dementia could be reduced. For analysis, this variable was dichotomised into: (1) those who were moderately or very active; and (2) those who had low physical activity levels or unsure. The dichotomisation cut-off was decided prior to data analysis and was aimed at identifying the groups with the highest and lowest levels of willing to increase physical activity.

*Motivation to change overall lifestyle:* The two-factor, 10-item 'Motivation to Change Behaviour for Dementia Risk Reduction Scale' (MOCHAD-10) (Oliveira, Aubeeluck, et al., 2019) was used to measure participants' motivation to change their overall lifestyle to potentially reduce their risk of having dementia. This brief, two factor questionnaire asks participants about cues to action for improving health behaviour using 5-point Likert scales (1. strongly disagree; 5. strongly agree), providing a mechanism for assessing both positive motivational cues, such as an individual's health beliefs, along with negative cues to action, such as perceptions of dementia severity. Negative and positive cues to action refer to internal or external stimulus to change behaviours, which can spike negative or positive emotional reactions (fear vs. encouragement, for example), both of which lead to higher motivation to change behaviour. This tool has shown strong internal consistency (Factor 1, 5 items: $\alpha = 0.809$; Factor 2, 5 items: $\alpha = 0.701$; Overall $\alpha = 0.785$) (Oliveira, Aubeeluck, et al., 2019). The scores for each sub-scale can range from 5 to 25 points; higher total scores indicate higher levels of positive or negative cues to action in each sub-scale (meaning higher motivation to change lifestyle). For analysis, the two sub-scales were treated as continuous outcomes.

*Predictor variables*

*Sociodemographic information and their final categorisation:* We collected information on gender (female/ male/ other), age (years), highest qualification (school degree), relationship status (with a partner/ without a partner), whether the person had/did not have children (yes/ no), their ethnic group, whether they knew or had known someone living with dementia (yes/ no), as well as whether they had cared or were caring for someone living with dementia (yes/ no).

*Self-reported health status and wellbeing:* Participants were asked about current health issues and lifestyle, such as current alcohol consumption (yes/no) or smoking (yes/no), diabetes (medically diagnosed), hypertension (medically diagnosed), hypercholesterolemia (medically diagnosed), hearing impairment (medically diagnosed), and frequent experience of fatigue. Using 5-point Likert scales, participants were also asked to self-report their quality of sleep, level of social and mental activity, and how often they felt stressed or depressed (e.g. how often do you sleep well – from 1. always to 5. never).

*Physical activity:* Using 5-point Likert scales, participants were asked how physically active they considered themselves to be (1. not active at all; 5. very active) and how many hours of exercise they did per week during a typical week (1. <1 hour per week; 5. >6 hours a week). Those who engaged in at least 60 minutes of physical activity a week, were then asked how often their physical activity was moderate or vigorous, such as walking fast, playing football, running, swimming, gymnastics (1. very often; 5. never).

*Weight/height and diet:* Self-reported weight and height were collected to calculate BMI ($kg/m^2$). For descriptive purposes, BMI values were categorized as follows: BMI <18.5 = underweight; 18.5 to <25 = regular weight; 25.0 to <30 = overweight; ≥30=obese (NHS, 2019). Participants were asked how 'healthy' they perceived their diet to be (5-point Likert scale) and how many portions of fruit/vegetables they normally consumed per day (1 portion=a handful) during a typical week. We have replaced the term 'normal weight' with

'regular' as to avoid labelling those who fall under other categories as having a somewhat 'abnormal' body shape, and risking being potentially discriminatory towards people who are classed as obese (Rubino et al., 2020).

### *Data analysis*

For the binary 'willingness to increase physical activity' outcome, logistic regression model was fitted to examine the association between potential predictors and the outcome. The univariable association between each potential predictor and outcome variable was examined; only those with p-values <0.25 were included as candidate predictors in the initial multivariable model (considering that the more traditional level of 0.05 may fail to identify important control variables, while any predictor with a p-value >0.25 in the unadjusted analysis is unlikely to contribute anything to a multivariable model including other predictors). Potential predictors were tested for the presence of multicollinearity. If multicollinearity was identified, one of the correlated predictors was removed from the multivariable model. Manual backward elimination procedure was used to remove variables from the multivariable model until only variables with a p-value <0.05 were retained in the final model. The total number of variables considered in the initial multivariable logistic model complied with the rule of at least 10 events per predictor parameter to avoid overfitting (Peduzzi et al., 1996). Odds ratios are presented with 95% confidence intervals (CI). The same procedure was repeated for the continuous outcomes (two MOCHAD-10 sub-scales) using linear regression. We did not have any missing data because participants were required to respond to all the questions, therefore we performed complete case analysis. The analyses were conducted in Stata® 15.

## Results

***Characteristics of the sample***

A total of 3,948 individuals [mean (SD) age 62.3 (7.9); 73% female] completed the survey (Table 1). Most participants had a partner (73.1%), had graduate or post-graduate education (58.2%), reported having good or excellent health (90.8%), consumed alcohol at least once a month on a typical month (89.3%), were non-smokers (96.5%), and had no diseases or health conditions (50.7%). About half of participants felt low or depressed never or almost none of the time (51.6%) and felt stressed sometimes (57.6%). Majority were quite or very socially active (76.1%) or mentally active (90.6%), and slept well always or most nights (52.9%)

*<Insert Table 1 here>*

***Sample characteristics by level of physical activity***

Around 78% considered themselves moderately or very active. Of those who exercised, 9.4% did so less than one hours per week, 34% did between 1 and 3 hours per week, and 52% did 4 or more hour per week. In addition, 75% did moderate or vigorous activities sometimes or very often, and 25% did moderate or vigorous activities almost never or never. People who were moderately active or very active were significantly more likely to be men, highly educated, in good or excellent self-rated health, who consumed alcohol at least once a month, non-smoker, with no existing diseases, who felt low or stressed never or almost none of the time (all $p<0.001$) (Table 1). More individuals with a partner were moderately active or very active compared to those without a partner ($p<0.05$). More people who were socially active were moderately or very physically active compared to those not socially active or with low social activities ($p<0.001$), with a similar pattern found for mental activity ($p=0.007$). More people who slept well always or most nights were moderately to very active compared to those who slept well some night or never/almost never ($p<0.001$). Individuals who were

moderately active exercised more hours per week and more often did moderate to vigorous activities, compared to those who exercised less hours per week or who did moderate or vigorous activities less often (both $p<0.001$),.

***Predictors of willingness to become more physically active***

Over 70% of the respondents were quite a bit or very willing to become more physically active if they were told that this could reduce their risk of having dementia. After adjusting for the other variables in the model (Table 2), the odds of being willing to increase physical activity was 2.10 higher in those with good or excellent self-rated health (95% CI: 1.62, 2.73), 3.10 higher in those who were underweight (95% CI: 1.20, 8.08) compared to those of regular weight, 1.28 higher in those who were or had been a family carer for someone with dementia (95% CI: 1.08, 1.52), 1.94 higher in those who reported they were already were moderately or very active (95% CI:1.60, 2.35), and 1.47 higher in those who reported they were very or quite socially active (95% CI: 1.22, 1.76). An inverse relationship was observed between willingness to increase physical activity and age whereby willingness decreased by 3% with each year of increasing age (0.97; 95% CI: 0.96, 0.98). The odds were also lower in those who were classified as 'overweight' (0.66; 95% CI: 0.55, 0.79) or 'obese' (0.53; 95% CI: 0.42, 0.67) and in those who were from a White ethnic background (0.49; 95% CI: 0.27, 0.89).

*<Insert Table 2 here>*

***Predictors of motivation to change lifestyle for dementia risk reduction (MOCHAD-10)***

The mean levels of motivation to change lifestyle were above the middle range for both positive (*M*=17.0; *SD*=3.1) and negative cues to action (*M*=16.4; *SD*=3.2). After adjusting for the other variables in the model (Table 3), the mean 'positive cues to action' score (subscale 1) was 0.27 higher in women compared to men (95% CI 0.04, 0.51). For every year of age,

the mean positive cues to action score decreased by 0.03 (95% CI: -0.04, -0.01). Compared to those who had regular weight, the mean positive cues to action score were 0.45 (95% CI: 0.22, 0.67) and 0.98 (95% CI: 0.68, 1.27) higher for those who were classified as being overweight and obese, respectively. White individuals had 0.76 (95% CI: -1.39, -0.12) lower mean positive cues to action scores than those who were from a non-White background. Similarly, those who were or had been family carers of people with dementia, those who had ≥2 diseases or conditions, and those who felt stressed always or most of the time had 0.60 (95% CI: 0.37, 0.80), 0.53 (95% CI: 0.28, 0.77), and 0.80 (95% CI: 0.43, 1.16) higher mean positive cues to action scores than their counterparts, respectively. On the other hand, those who smoked and those who rated themselves as very or quite mentally active had 0.66 (95% CI: -1.21, -0.12) and 0.61 (95% CI: -0.95, -0.27) lower mean positive cues to action scores than their counterparts, respectively.

*<Insert Table 3 here>*

Regarding the negative cues to action (subscale 2), women had 1.07 (95% CI: 0.83, 1.31) higher mean score for negative cues to action than men. Similarly, those with a partner, those who were or had been a family carer for someone with dementia and those with ≥2 diseases or conditions had 0.27 (95% CI: 0.03, 0.51), 0.65 (95% CI: 0.43, 0.90), and 0.36 (95% CI: 0.11, 0.60) higher mean scores for negative cues to action than their counterparts, respectively. People who felt low or depressed and those who felt stressed always or most of the time also had higher mean scores (1.07; 95% CI: 0.50, 1.64 and 0.98; 95% CI: 0.56, 1.40, respectively). Conversely, the mean scores for negative cues to action decreased 0.03 at every year of age (95% CI: -0.04, -0.01). Those who were highly educated and those who were professional carers for someone with dementia had 0.27 (95% CI: -0.48, -0.06) and 0.12 (95% CI: -0.59, -

0.34) lower mean scores for negative cues to action than their counterparts, respectively. Similarly, those who ate ≥5 portions of fruits/vegetables per day, those who slept well always or most nights, and those who were very or quite mentally active had 0.58 (95% CI: -0.81, -0.21), 0.66 (95% CI: -0.99, -0.32) and 0.54 (95% CI: -0.89, -0.19) lower mean scores for negative cues to action than their counterparts, respectively. Higher levels of willingness to increase levels of physical activity predicted higher levels of overall motivation levels in MOCHAD-10 sub-scales 1 (1.67; 95% CI: 1.44, 1.90) and 2 (0.91; 95% CI: 0.68, 1.14).

**Discussion**

This is the first study to investigate willingness to increase levels of physical activity and overall motivation levels to improve overall lifestyle in order to potentially reduce risk of dementia in people aged 50 and over in the UK. Overall, we were able to identify three key patterns: 1) those who were already significantly more physically active (men, older age, with better overall health status, highly educated), 2) those who were more willing to increase physical activity (younger age, with a positive perception of health and lifestyle, with experience as carers for someone with dementia), and 3) those with higher motivation to improve their overall lifestyle (women, younger age, poorer perceived physical and mental health, with experience as carers for someone with dementia).

Our findings indicate that individuals who perceive themselves as being ‘healthy’ tend to be more physically active and more willing to increase their physical activity to reduce their risk of dementia. It is likely that those already engaging in ‘healthy’ levels of physical activity exhibited greater self-efficacy and were consequently more *willing* to increase their activity levels if needed and had greater knowledge and accessibility to do this. Though less physically active, individuals with perceptions of poorer health were more *motivated* to

engage in lifestyle change to prevent dementia. It might be that those who perceived themselves to be in good health did not feel that additional lifestyle changes were warranted to reduce their risk of dementia. On the other hand, individuals with poorer perceived health may have felt that general lifestyle changes were more readily attainable, in contrast to increasing levels of physical activity, specifically.

Increasing age was significantly associated with decreased willingness to increase physical activity, despite older adults reporting greater levels of current physical activity. Older age is often accompanied by an increased prevalence of physical comorbidities that might preclude engagement in lifestyle change, in particular physical activity (Lovell et al., 2010). Older adults with impaired mobility often report poorer health and fear of negative outcomes as barriers to physical activity (Rasinaho et al., 2007). Moschny et al. (2011) found lower engagement in physical activity in people aged 80 and over, which was linked to decreasing health. It is therefore possible that older adults do not feel comfortable or able to increase their physical activity level to prevent dementia. It should be examined if this is due to practical and structural barriers such as lack of access to age-appropriate activities.

We also found a negative association between age and willingness to increase physical activity and motivation to change lifestyle across both positive and negative cues to action. This suggests that whilst older adults report higher current levels of physical activity, their willingness and motivation to reduce dementia risk might become less intrinsically relevant over time. Studies show that knowledge about cognitive disorders is limited among older adults who often show doubt about the possibility of dementia prevention (Rosenberg et al., 2020). Limited knowledge about the causes of dementia and the relationship between

lifestyle, physical activity, and dementia risk may contribute to reduced motivation to make lifestyle changes in older adults.

Whilst men reported being more physically active, women demonstrated greater willingness to increase their physical activity. Women demonstrate significantly lower levels of physical activity than men, falling substantially below the recommended weekly targets (Guthold et al., 2018). The discrepancy between women's willingness and ability to be active might be explained by social and financial barriers to engaging in physical activity (Tinker et al., 2017; Kowal & Fortier, 2007a; Nies et al., 1998). In Germany, for example, having access to a car was an important factor, with women being less likely to have a driving licence in later life than men (Moschny et al., 2011). Women may also have more caring responsibilities, and therefore less time to exercise, than men (Kowal & Fortier, 2007b).

Women also reported higher scores in both positive and negative cues to action than their male counterparts, suggesting higher overall motivation to improve lifestyle. This finding, along with greater willingness to be active, corroborates previous research in which women were more likely to report intentions to and engagement in lifestyle change to promote improved brain health (Smith et al., 2015). This may in part relate to greater reported knowledge of health behaviours that reduce the risk of dementia in women (Smith et al., 2014), but also suggests greater receptivity to general health risk information. Gender differences in health information behaviour have been previously identified, with women demonstrating greater interest in and actively seeking out health-related information more frequently than men (Ek, 2015).

We found no differences in levels of physical activity in people with personal or professional experience with dementia compared to their counterparts. However, people with current or past experiences as carers for people living with dementia were significantly more willing to increase physical activity and more motivated to improve their overall lifestyle. Having higher levels of education and professional experience with dementia were, on the other hand, related to lower levels of negative cues to action. Studies show that loss or fear-based cues may be more effective at prompting health behaviour change in individuals who are highly knowledgeable about a subject or behaviour (Rothman et al., 2006; Wansink & Pope, 2015). However, our findings suggest that professional experience with dementia may in fact impair the positive effects that fear-based motivation can have on lifestyle change.

***Strengths and limitations***

The large sample size provided a broad snapshot of middle aged and older adults across the UK, particularly for women, who were well represented within the sample. However, the sample itself was self-selected using convenience sampling from an online platform. The sample was predominantly White, well educated, with low rates of smoking, and with relatively high levels of physical activity and perceived health. Therefore, this sample may have been particularly health conscious compared to the general population. Previous studies have demonstrated variability in dementia risk by ethnicity, whilst those with lower educational attainment demonstrate higher risk of dementia (Pham et al., 2018; Sharp & Gatz, 2011). Thus, the findings may not extend to ethnically diverse groups or those with lower education levels. Further, due to the lack of diversity in our sample, we may have not included specific factors that may influence willingness to partake in physical activity in different ethnic groups such as culture-specific exercise, and cost of classes (Belza et al., 2004).

We have measured and reported weight in this paper, but we have been particularly careful in our reporting and interpretations of any findings about obesity. This is because people living at lower socioeconomic conditions tend to be more exposed to sedentarism and unhealthy diets, and those classified as obese commonly face social stigma and discrimination, which can cause physical and psychological harm, and may lead to poor-quality healthcare (Rubino et al., 2020). Hence, being able to have a 'healthy' lifestyle of regular physical movement and nourishing food is not an individual factor only, nor is it an option for many; it is rather a complex societal issue (Bosco et al., 2020). Though we included BMI in our analysis, this measure can be highly inadequate and unreliable as a diagnostic criterion for obesity (Rubino et al., 2020).

Use of an online survey allowed for large scale data collection, however those without access to the internet or with limited health literacy were likely not included in our sample. Future research should attempt to recruit a sample that reflects the diverse experiences of the general population. Additionally, the study relied on self-report tools, which are often hampered by response bias. Some tools were not standardised which has implications for validity and reliability. It is hoped that anonymization of the survey encouraged candid responding and reduced self-report bias. Further, the MOCHAD-10 has previously been validated for use a community sample (Oliveira, Aubeeluck, et al., 2019), bolstering support for the validity and reliability of the motivation to change lifestyle findings.

***Implications***

Our findings have implications for clinical practice and dementia prevention research. Physical inactivity and weight management are complex and multifactorial issues involving

both internal and external factors. People living with poorer health status who we found to be less willing and motivated to increase physical activity are also likely to be living with complex social issues, such as discrimination and poverty, and therefore public health decision-making is far from straight forward (World Health Organization, 2013). However, there is growing evidence that little increases in physical activity can have wide benefits to both physical and mental health. In addition, we showed that people with were overweight or living with obesity responded more favourably to positive cues and may benefit from small targets to increase physical activity.

Physical activity is often unlikely to be the priority of socially disadvantaged groups who are affected by a variety of life challenges. However, for many of these individuals low levels of physical activity can add to the list of disadvantages (World Health Organization, 2013). The literature shows that even though physical activity promotion among socially disadvantaged groups is not much different from what would be with any other population group, targeting and implementation measures are likely to be different and specifically more intense support measures are needed (e.g., project time duration, funding, and capacity-building needs). It is suggested a combination of strategies should be used, going beyond simply giving information (e.g. establishment of local activity groups, involvement of local members of the community as key partners of physical activity engagement projects) (World Health Organization, 2013). Public health measures should therefore aim to remove potential obstacles that may arise in relation to personal characteristics or geographical or residential location, for example, to foster motivation to engage in physical activity, particularly in low-active groups (World Health Organization, 2013).

Moreover, brief interventions can elicit short-term change in physical activity levels, however evidence for long-term maintenance of increased physical activity levels, particularly in older adults, is limited (Sansano-Nadal et al., 2019). Novel approaches to intervention design are therefore required to promote sustained behaviour change in populations at risk of developing dementia. This study demonstrated that specific predictors, including age, gender, current activity level, and previous experience with dementia all contributed to willingness to increase physical activity and motivation to change lifestyle to prevent dementia. Given that motivation to make lifestyle changes is linked to improved outcomes in other chronic conditions (Kähkönen et al., 2015; Shigaki et al., 2010), tailoring referral strategies and physical activity programmes or research to meet the unique needs of these specific populations might bolster participation in and the long-term efficacy of these programmes.

Consideration should also be given to the unique needs of older adults, many of whom might struggle to increase physical activity levels due to mobility restrictions. In their systematic review of the motivators and barriers to physical activity in older adults, Baert and colleagues (2011) suggest that physical activity could be promoted through discussion of the health benefits associated with being active, along with addressing individuals' fears, preferences, level of social support, and constraints in their physical environment. Lifestyle programmes aiming to reduce dementia risk should target improvements in disease specific knowledge and address age specific needs.

In summary, our findings suggest not only that motivation to change is complex, but also in some cases the groups who are both more willing and more motivated to change their lifestyle to reduce risk of dementia are also the groups who are less at risk and less in need of further lifestyle change. This has implications for personalised medicine, health education, and public

health more broadly. For example, should prevention strategies target those at highest risk and most in need even though they may be less likely to make changes? Or should the strategies be applied at a general population level to try and reduce population risk? We believe further research needs to be conducted to further establish personal motivators for change in highest risk groups.

## Conclusion

We found that most people aged 50 and over report to be moderately or very active. Those who were significantly more physically active were male, of older age, with better overall health status, and were highly educated. However, those who were more motivated to increase physical activity – women, those of younger age, those with experience as a carer for a person with dementia, and those with poorer perceived physical and mental health – were not necessarily able to be physically active, which could be due to time constraints or poor physical wellbeing, for example. Multisectoral public health strategies should seek to use the high motivation levels among this group to mitigate the barriers related to physical activity as means to enable the inclusion of physical activity into their routines. This study had limitations related to the cross-sectional design and sampling and we recommend that future studies are conducted using longitudinal designs and activity trackers which can be more reliable and could be compared with self-reported information. Studies should also include social determinants of healthy lifestyles to ensure that public health messages and action can be better tailored to people who are less motivated to improve physical activity due to social issues.

## References

Baert, V., Gorus, E., Mets, T., Geerts, C., & Bautmans, I. (2011). Motivators and barriers for physical activity in the oldest old: A systematic review. *Ageing Research Reviews*, *10*(4), 464–474. https://doi.org/10.1016/j.arr.2011.04.001

Baumgart, M., Snyder, H. M., Carrillo, M. C., Fazio, S., Kim, H., & Johns, H. (2015). Summary of the evidence on modifiable risk factors for cognitive decline and dementia: A population-based perspective. *Alzheimer's & Dementia*, *11*(6), 718–726. https://doi.org/10.1016/j.jalz.2015.05.016

Belza, B., Walwick, J., Shiu-Thornton, S., Schwartz, S., Taylor, M., & LoGerfo, J. (2004). Older adult perspectives on physical activity and exercise: Voices from multiple cultures. *Preventing Chronic Disease*, *1*(4), A09.

Bethancourt, H. J., Rosenberg, D. E., Beatty, T., & Arterburn, D. E. (2014). Barriers to and Facilitators of Physical Activity Program Use Among Older Adults. *Clinical Medicine & Research*, *12*(1–2), 10–20. https://doi.org/10.3121/cmr.2013.1171

Bosco, A., Jones, K. A., Di Lorito, C., Stephan, B. C. M., Orrell, M., & Oliveira, D. (2020). Changing lifestyle for dementia risk reduction: Inductive content analysis of a national UK survey. *PLOS ONE*, *15*(5), e0233039. https://doi.org/10.1371/journal.pone.0233039

Chemtob, K., Rocchi, M., Arbour-Nicitopoulos, K., Kairy, D., Fillion, B., & Sweet, S. N. (2019). Using tele-health to enhance motivation, leisure time physical activity, and quality of life in adults with spinal cord injury: A self-determination theory-based pilot randomized control trial. *Psychology of Sport and Exercise*, *43*, 243–252. https://doi.org/10.1016/j.psychsport.2019.03.008

Chong, T. W. H., Curran, E., Ellis, K. A., Southam, J., You, E., Cox, K. L., Hill, K. D., Pond, D., Dow, B., Anstey, K. J., Hosking, D., Cyarto, E., & Lautenschlager, N. T. (2020). Physical activity for older Australians with mild cognitive impairment or subjective

cognitive decline – A narrative review to support guideline development. *Journal of Science and Medicine in Sport*, S1440244019314938. https://doi.org/10.1016/j.jsams.2020.03.003

Dacey, M., Baltzell, A., & Zaichkowsky, L. (2008). Older adults' intrinsic and extrinsic motivation toward physical activity. *American Journal of Health Behavior*, *32*(6), 570–582. https://doi.org/10.5555/ajhb.2008.32.6.570

Ek, S. (2015). Gender differences in health information behaviour: A Finnish population-based survey. *Health Promotion International*, *30*(3), 736–745. https://doi.org/10.1093/heapro/dat063

Fletcher, B. R., Hinton, L., Hartmann-Boyce, J., Roberts, N. W., Bobrovitz, N., & McManus, R. J. (2016). Self-monitoring blood pressure in hypertension, patient and provider perspectives: A systematic review and thematic synthesis. *Patient Education and Counseling*, *99*(2), 210–219. https://doi.org/10.1016/j.pec.2015.08.026

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. *The Lancet Global Health*, *6*(10), e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7

Horie, N. C., Serrao, V. T., Simon, S. S., Gascon, M. R. P., dos Santos, A. X., Zambone, M. A., del Bigio de Freitas, M. M., Cunha-Neto, E., Marques, E. L., Halpern, A., de Melo, M. E., Mancini, M. C., & Cercato, C. (2016). Cognitive Effects of Intentional Weight Loss in Elderly Obese Individuals With Mild Cognitive Impairment. *The Journal of Clinical Endocrinology & Metabolism*, *101*(3), 1104–1112. https://doi.org/10.1210/jc.2015-2315

Kähkönen, O., Kankkunen, P., Saaranen, T., Miettinen, H., Kyngäs, H., & Lamidi, M.-L. (2015). Motivation is a crucial factor for adherence to a healthy lifestyle among people

with coronary heart disease after percutaneous coronary intervention. *Journal of Advanced Nursing*, *71*(10), 2364–2373. https://doi.org/10.1111/jan.12708

Kessler, E.-M., Bowen, C. E., Baer, M., Froelich, L., & Wahl, H.-W. (2012). Dementia worry: A psychological examination of an unexplored phenomenon. *European Journal of Ageing*, *9*(4), 275–284. https://doi.org/10.1007/s10433-012-0242-8

Kim, S., Sargent-Cox, K., Cherbuin, N., & Anstey, K. J. (2014). Development of the Motivation to Change Lifestyle and Health Behaviours for Dementia Risk Reduction Scale. *Dementia and Geriatric Cognitive Disorders Extra*, *4*(2), 172–183. https://doi.org/10.1159/000362228

Knittle, K., Nurmi, J., Crutzen, R., Hankonen, N., Beattie, M., & Dombrowski, S. U. (2018). How can interventions increase motivation for physical activity? A systematic review and meta-analysis. *Health Psychology Review*, *12*(3), 211–230. https://doi.org/10.1080/17437199.2018.1435299

Kowal, J., & Fortier, M. S. (2007a). Physical activity behavior change in middle-aged and older women: The role of barriers and of environmental characteristics. *Journal of Behavioral Medicine*, *30*(3), 233–242. https://doi.org/10.1007/s10865-007-9102-y

Kowal, J., & Fortier, M. S. (2007b). Physical Activity Behavior Change in Middle-aged and Older Women: The Role of Barriers and of Environmental Characteristics. *Journal of Behavioral Medicine*, *30*(3), 233–242. https://doi.org/10.1007/s10865-007-9102-y

Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behaviour change: A systematic review of behaviour theories. *Health Psychology Review*, *10*(3), 277–296. https://doi.org/10.1080/17437199.2016.1151372

Livingston, G., Sommerlad, A., Orgeta, V., Costafreda, S. G., Huntley, J., Ames, D., Ballard, C., Banerjee, S., Burns, A., Cohen-Mansfield, J., Cooper, C., Fox, N., Gitlin, L. N.,

Howard, R., Kales, H. C., Larson, E. B., Ritchie, K., Rockwood, K., Sampson, E. L., … Mukadam, N. (2017). Dementia prevention, intervention, and care. *The Lancet*, *390*(10113), 2673–2734. https://doi.org/10.1016/S0140-6736(17)31363-6

Lovell, G. P., El Ansari, W., & Parker, J. K. (2010). Perceived exercise benefits and barriers of non-exercising female university students in the United Kingdom. *International Journal of Environmental Research and Public Health*, *7*(3), 784–798. https://doi.org/10.3390/ijerph7030784

Marcus, B. H., Bock, B. C., Pinto, B. M., Forsyth, L. A. H., Roberts, M. B., & Traficante, R. M. (1998). Efficacy of an individualized, motivationally-tailored physical activity intervention. *Annals of Behavioral Medicine*, *20*(3), 174–180. https://doi.org/10.1007/BF02884958

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 42. https://doi.org/10.1186/1748-5908-6-42

Moschny, A., Platen, P., Klaaßen-Mielke, R., Trampisch, U., & Hinrichs, T. (2011). Barriers to physical activity in older adults in Germany: A cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 121. https://doi.org/10.1186/1479-5868-8-121

NHS. (2019). *What is the body mass index (BMI)?* [Government]. https://www.nhs.uk/common-health-questions/lifestyle/what-is-the-body-mass-index-bmi/

Nichols, E., Szoeke, C. E. I., Vollset, S. E., Abbasi, N., Abd-Allah, F., Abdela, J., Aichour, M. T. E., Akinyemi, R. O., Alahdab, F., Asgedom, S. W., Awasthi, A., Barker-Collo, S. L., Baune, B. T., Béjot, Y., Belachew, A. B., Bennett, D. A., Biadgo, B., Bijani, A., Bin Sayeed, M. S., … Murray, C. J. L. (2019). Global, regional, and national burden

of Alzheimer's disease and other dementias, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, *18*(1), 88–106. https://doi.org/10.1016/S1474-4422(18)30403-4

Nies, M. A., Vollman, M., & Cook, T. (1998). Facilitators, barriers, and strategies for exercise in European American women in the community. *Public Health Nursing (Boston, Mass.)*, *15*(4), 263–272. https://doi.org/10.1111/j.1525-1446.1998.tb00349.x

Oliveira, D., Aubeeluck, A., Stupple, E., Kim, S., & Orrell, M. (2019). Factor and reliability analysis of a brief scale to measure motivation to change lifestyle for dementia risk reduction in the UK: the MOCHAD-10. *Health and Quality of Life Outcomes*, *17*(1), 75–75. PubMed. https://doi.org/10.1186/s12955-019-1143-8

Oliveira, D., Bosco, A., & di Lorito, C. (2019). Is poor health literacy a risk factor for dementia in older adults? Systematic literature review of prospective cohort studies. *Maturitas*, *124*, 8–14. https://doi.org/10.1016/j.maturitas.2019.03.010

Oliveira, D. C., Vass, C., & Aubeeluck, A. (2018). The development and validation of the Dementia Quality of Life Scale for Older Family Carers (DQoL-OC). *Aging & Mental Health*, *22*(5), 709–716. https://doi.org/10.1080/13607863.2017.1293004

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, *49*(12), 1373–1379. https://doi.org/10.1016/S0895-4356(96)00236-3

Pham, T. M., Petersen, I., Walters, K., Raine, R., Manthorpe, J., Mukadam, N., & Cooper, C. (2018). Trends in dementia diagnosis rates in UK ethnic groups: Analysis of UK primary care data. *Clinical Epidemiology*, *10*, 949–960. https://doi.org/10.2147/CLEP.S152647

Rasinaho, M., Hirvensalo, M., Leinonen, R., Lintunen, T., & Rantanen, T. (2007). Motives for and barriers to physical activity among older adults with mobility limitations. *Journal of Aging and Physical Activity*, *15*(1), 90–102. https://doi.org/10.1123/japa.15.1.90

Rosenberg, A., Coley, N., Soulier, A., Kulmala, J., Soininen, H., Andrieu, S., Kivipelto, M., Barbera, M., Kivipelto, M., Sindi, S., Solomon, A., Andrieu, S., Coley, N., Soininen, H., Rosenberg, A., Richard, E., van Middelaar, T., Hartmann, T., Brayne, C., … for the MIND-AD and HATICE groups. (2020). Experiences of dementia and attitude towards prevention: A qualitative study among older adults participating in a prevention trial. *BMC Geriatrics*, *20*(1), 99. https://doi.org/10.1186/s12877-020-1493-4

Rothman, A., Bartels, R., Wlaschin, J., & Salovey, P. (2006). The Strategic Use of Gain- and Loss-Framed Messages to Promote Healthy Behavior: How Theory Can Inform Practice. *Journal of Communication*, *56*, S202–S220. https://doi.org/10.1111/j.1460-2466.2006.00290.x

Rubino, F., Puhl, R. M., Cummings, D. E., Eckel, R. H., Ryan, D. H., Mechanick, J. I., Nadglowski, J., Ramos Salas, X., Schauer, P. R., Twenefour, D., Apovian, C. M., Aronne, L. J., Batterham, R. L., Berthoud, H.-R., Boza, C., Busetto, L., Dicker, D., De Groot, M., Eisenberg, D., … Dixon, J. B. (2020). Joint international consensus statement for ending stigma of obesity. *Nature Medicine*, *26*(4), 485–497. https://doi.org/10.1038/s41591-020-0803-x

Sansano-Nadal, O., Giné-Garriga, M., Brach, J. S., Wert, D. M., Jerez-Roig, J., Guerra-Balic, M., Oviedo, G., Fortuño, J., Gómara-Toldrà, N., Soto-Bagaria, L., Pérez, L. M., Inzitari, M., Solà, I., Martin-Borràs, C., & Roqué, M. (2019). Exercise-Based Interventions to Enhance Long-Term Sustainability of Physical Activity in Older

Adults: A Systematic Review and Meta-Analysis of Randomized Clinical Trials. *International Journal of Environmental Research and Public Health*, *16*(14). https://doi.org/10.3390/ijerph16142527

Schwarzer, R., Lippke, S., & Luszczynska, A. (2011). Mechanisms of health behavior change in persons with chronic illness or disability: The Health Action Process Approach (HAPA). *Rehabilitation Psychology*, *56*(3), 161–170. https://doi.org/10.1037/a0024509

Sharp, E. S., & Gatz, M. (2011). The Relationship between Education and Dementia An Updated Systematic Review. *Alzheimer Disease and Associated Disorders*, *25*(4), 289–304. https://doi.org/10.1097/WAD.0b013e318211c83c

Shigaki, C., Kruse, R. L., Mehr, D., Sheldon, K. M., Bin Ge, null, Moore, C., & Lemaster, J. (2010). Motivation and diabetes self-management. *Chronic Illness*, *6*(3), 202–214. https://doi.org/10.1177/1742395310375630

Smith, B. J., Ali, S., & Quach, H. (2014). Public knowledge and beliefs about dementia risk reduction: A national survey of Australians. *BMC Public Health*, *14*, 661. https://doi.org/10.1186/1471-2458-14-661

Smith, B. J., Ali, S., & Quach, H. (2015). The motivation and actions of Australians concerning brain health and dementia risk reduction. *Health Promotion Journal of Australia*, *26*(2), 115–121. https://doi.org/10.1071/HE14111

Steyaert, J., Deckers, K., Smits, C., Fox, C., Thyrian, R., Jeon, Y.-H., Vernooij-Dassen, M., Köhler, S., & on behalf of the Interdem taskforce on prevention of dementia. (2020). Putting primary prevention of dementia on everybody's agenda. *Aging & Mental Health*, 1–5. https://doi.org/10.1080/13607863.2020.1783514

Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-

evaluations. *Journal of Sports Sciences*, *24*(4), 393–404. https://doi.org/10.1080/02640410500131670

Tinker, A., Molloy, L., Monks, I., Pennells, L., Russell, E., & Haines, E. (2017). The benefits and barriers of exercise for the physical health of older women. *Journal of Aging and Clinical Research*, *6*, 73–79. https://doi.org/10.14283/jarcp.2017.6

UK Government. (2019). Physical activity: Applying All Our Health [Government]. *Guidance*. https://www.gov.uk/government/publications/physical-activity-applying-all-our-health/physical-activity-applying-all-our-health

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotzsche, P. C., & Vandenbroucke, J. P. (2014). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for reporting observational studies. *International Journal of Surgery (London, England)*, *12*(12), 1495–1499. https://doi.org/10.1016/j.ijsu.2014.07.013

Wansink, B., & Pope, L. (2015). When do gain-framed health messages work better than fear appeals? *Nutrition Reviews*, *73*(1), 4–11. https://doi.org/10.1093/nutrit/nuu010

Wittemberg, R., Hu, B., arraza-Araiza, L., & Rehill, A. (2019). *Projections of older people with dementia and costs of dementia care in the United Kingdom, 2019–2040* (CPEC Working Paper No. 5). Care Policy and Evaluation Centre, London School of Economics and Political Science. https://www.alzheimers.org.uk/sites/default/files/2019-11/cpec_report_november_2019.pdf

World Health Organization. (2013). *Physical activity promotion in socially disadvantaged groups: Principles for action*. The Regional Office for Europe. https://www.euro.who.int/__data/assets/pdf_file/0006/193092/PHAN-brochure_ENG.pdf

World Health Organization. (2017). *The Global action plan on the public health response to dementia 2017-2025*. https://apps.who.int/iris/bitstream/handle/10665/259615/9789241513487-eng.pdf?sequence=1

World Health Organization. (2019). *Risk reduction of cognitive decline and dementia*. https://apps.who.int/iris/bitstream/handle/10665/312180/9789241550543-eng.pdf?ua=1

**Table 1. Sample characteristics by level of physical activity (*n*=3,948)**

| Variables | n (%) | Moderately or very active (n=3,071; 77.9%) n (%) | Low physical activity levels or unsure (n=869; 22.1%) n (%) | p-value* |
|---|---|---|---|---|
| **Age (years): mean (SD)** | 62.3 (7.9) | 62.5 (7.9) | 61.4 (8.0) | <0.001 |
| **Gender** | | | | <0.001 |
| Male | 1,060 (26.9) | 887 (83.7) | 173 (16.3) | |
| Female | 2,880 (73.1) | 2,184 (75.8) | 696 (24.2) | |
| **Relationship status** | | | | 0.003 |
| Doesn't have a partner | 1,015 (25.7) | 757 (74.6) | 258 (25.4) | |
| Has a partner | 2,933 (74.3) | 2,319 (79.1) | 614 (20.9) | |
| **Highest qualification** | | | | <0.001 |
| Non-graduate | 1,651 (41.8) | 1,241 (75.2) | 410 (24.8) | |
| Graduate or post-graduate | 2,297 (58.2) | 1,835 (79.9) | 462 (20.1) | |
| **General health** | | | | <0.001 |
| Fair or poor | 363 (9.2) | 142 (39.1) | 221 (60.9) | |
| Good or excellent | 3,585 (90.8) | 2,934 (81.8) | 651 (18.2) | |
| **Consumes alcohol in a typical month** | | | | <0.001 |
| No | 421 (10.7) | 281 (66.8) | 140 (33.2) | |
| Yes | 3,527 (89.3) | 2,795 (79.3) | 732 (20.7 | |
| **Smoker** | | | | <0.001 |
| No | 3,809 (96.5) | 2,987 (78.4) | 822 (21.6) | |
| Yes | 89 (64.0) | 89 (64.0) | 50 (36.0) | |
| **Diseases or other health conditions** | | | | <0.001 |
| None | 2,000 (50.7) | 1,679 (83.9) | 321 (16.1) | |
| 1 | 821 (20.8) | 656 (79.9) | 165 (20.1) | |
| ≥2 | 1,127 (28.6) | 741 (65.8) | 386 (34.2) | |
| **Feel low or depressed** | | | | <0.001 |
| Never or almost none of the time | 2,037 (51.6) | 1,723 (84.6) | 314 (15.4) | |
| Sometimes | 1,736 (43.9) | 1,275 (73.4) | 461 (26.6) | |

| | | | | |
|---|---|---|---|---|
| Always or most of the time | 175 (4.4) | 78 (44.6) | 97 (55.4) | |
| **Feel stressed** | | | | <0.001 |
| Never or almost none of the time | 1,244 (31.5) | 1,032 (83.0) | 212 (17.0) | |
| Sometimes | 2,275 (57.6) | 1,780 (78.2) | 495 (21.8) | |
| Always or most of the time | 429 (10.9) | 264 (61.5) | 165 (38.5) | |
| **Social activity** | | | | <0.001 |
| Not socially active or low social activity | 944 (23.9) | 640 (67.8) | 304 (32.2) | |
| Very/quite socially active | 3,004 (76.1) | 2,436 (81.1) | 568 (18.9) | |
| **Mental activity** | | | | 0.007 |
| Not mentally active low mental activity | 369 (9.3) | 267 (72.4) | 102 (27.6) | |
| Very/quite mentally active | 3,579 (90.6) | 2,809 (78.5) | 770 (21.5) | |
| **Sleep well** | | | | <0.001 |
| Almost never or never | 486 (12.3) | 307 (63.2) | 179 (36.8) | |
| Some nights | 1,373 (34.8) | 1,053 (76.7) | 320 (23.3) | |
| Always or most of the nights | 2,089 (52.9) | 1,716 (82.1) | 373 (17.8) | |
| **Hours per week of physical activity** | | | | <0.001 |
| No physical activity | 172 (4.4) | 28 (16.3) | 144 (83.7) | |
| <1 hour per week | 371 (9.4) | 69 (18.6) | 302 (81.4) | |
| 1-3 hours per week | 1,344 (34.0) | 984 (73.2) | 360 (26.8) | |
| 4+ hours per week | 2,061 (52.2) | 1,995 (96.8) | 66 (3.2) | |
| **Moderate or vigorous physical activity** | | | | <0.001 |
| Very often | 913 (24.2) | 898 (98.4) | 15 (1.6) | |
| Sometimes | 1,914 (50.7) | 1,693 (88.5) | 220 (11.5) | |
| Never\Almost never\Not sure | 950 (25.7) | 457 (48.1) | 493 (51.9) | |

SD=Standard Deviation; Physical activity: moderately or very active vs. not active: cell entries for categorical variables are the row percentages.
*p-value based on Chi-squared test for categorical variables or 2-sample t-test for continuous variables.

**Table 2. Characteristics of individuals who would be willing to become more physically active to potentially reduce the risk of dementia and the univariable and multivariable association between each characteristic and the willingness to become more physically active (*n*=3,948)**

| | **Not at all/A little bit/Not sure (n=1,081; 27.4%)** n (%) | **Quite a bit/ Very much (n=2,867; 72.6%)** n (%) | **Unadjusted (Univariable)** OR (95% CI)[*] | **Adjusted (Multivariable)** OR (95% CI)[†] |
|---|---|---|---|---|
| **Gender** | | | | |
| Male [‡] | 317 (29.9) | 743 (70.1) | | |
| Female | 756 (26.3) | 2,124 (73.8) | 1.20 (1.06, 1.40) | - |
| **Age (years): mean (SD)** | 63.3 (8.1) | 61.9 (7.8) | 0.98 (0.97, 0.99) | 0.97 (0.96, 0.98) |
| **Relationship status** | | | | |
| Doesn't have a partner[‡] | 313 (30.8) | 702 (69.2) | | |
| Has a partner | 764 (26.1) | 2,169 (74.0) | 1.27 (1.08, 1.48) | - |
| **Highest qualification** | | | | |
| Non-graduate[‡] | 467 (28.3) | 1,184 (71.7) | | |
| Graduate or post-graduate | 610 (26.6) | 1,687 (73.4) | 1.09 (0.95, 1.26) | - |
| **General health** | | | | |
| Fair or poor[‡] | 180 (49.6) | 183 (50.4) | | |
| Good or excellent | 897 (25.0) | 2,688 (75.0) | 2.95 (2.37, 3.67) | 2.10 (1.62, 2.73) |
| **Body Mass Index** | | | | |
| Underweight (<18.5) | 6 (10.5) | 51 (89.5) | 2.23 (0.95, 5.23) | 3.10 (1.20, 8.08) |
| Regular weight (18.5-24.9) [‡] | 384 (20.8) | 1,464 (79.2) | | |
| Overweight (25-29.9) | 422 (30.8) | 948 (69.2) | 0.59 (0.50, 0.69) | 0.66 (0.55, 0.79) |
| Obese (30+) | 259 (39.4) | 398 (60.6) | 0.40 (0.33, 0.49) | 0.53 (0.42, 0.67) |
| **Currently employed** | | | | |
| No[‡] | 586 (29.5) | 1,404 (70.6) | | |
| Yes | 491 (25.1) | 1,467 (74.9) | 1.25 (1.08, 1.43) | - |
| **Ethnic group** | | | | |
| Non-White[‡] | 19 (17.6) | 89 (82.4) | | |
| White | 1,058 (27.6) | 2,782 (72.5) | 0.56 (0.34, 0.93) | 0.49 (0.27, 0.89) |
| **Has children** | | | | |

| | | | | |
|---|---|---|---|---|
| No‡ | 269 (27.3) | 716 (72.7) | | |
| Yes | 804 (27.2) | 2,153 (72.8) | 1.00 (0.86, 1.18) | - |
| **Consumes alcohol in a typical month** | | | | |
| No‡ | 117 (27.8) | 304 (72.2) | | |
| Yes | 960 (27.2) | 2,567 (72.7) | 1.03 (0.82, 1.29) | - |
| **Knew or know someone with dementia** | | | | |
| No‡ | 155 (30.8) | 348 (69.2) | | |
| Yes | 922 (26.8) | 2,523 (73.2) | 1.22 (0.99, 1.49) | - |
| **Cared or care for someone with dementia** | | | | |
| No‡ | 416 (28.8) | 1,029 (71.2) | | |
| Yes (family/informal carer) | 381 (24.7) | 1,161 (75.3) | 1.23 (1.05, 1.45) | 1.28 (1.08, 1.52) |
| Yes (professional carer) | 72 (26.8) | 197 (73.2) | 1.11 (0.83, 1.48) | 1.08 (0.79, 1.48) |
| Yes (professional & family carer) | 53 (28.0) | 136 (72.0) | 1.04 (0.74, 1.45) | 1.03 (0.72, 1.48) |
| **Diseases or conditions** | | | | |
| None‡ | 477 (23.9) | 1,523 (76.2) | | |
| 1 | 204 (24.9) | 617 (75.2) | 0.95 (0.78, 1.14) | - |
| ≥2 | 396 (35.1) | 731 (64.9) | 0.57 (0.49, 0.67) | - |
| **Smoker** | | | | |
| No‡ | 1,026 (26.9) | 2,783 (73.1) | | |
| Yes | 51 (36.7) | 88 (63.3) | 0.64 (0.45, 0.90) | - |
| **Physical activity** | | | | |
| Not active‡ | 372 (42.7) | 500 (57.3) | | |
| Moderately or very active | 707 (22.9) | 2,371 (77.1) | 2.50 (2.14, 2.93) | 1.94 (1.60, 2.35) |
| **Portions of fruits/vegetables consumed/day** | | | | |
| 0-2‡ | 238 (33.1) | 482 (66.9) | | |
| 3-4 | 464 (27.2) | 1,240 (72.8) | 1.32 (1.09, 1.59) | - |

| | | | | |
|---|---|---|---|---|
| ≥5 | 375 (24.6) | 1,149 (75.4) | 1.51 (1.25, 1.84) | - |
| **Sleep well** | | | | |
| Almost never or never‡ | 169 (34.8) | 317 (65.2) | | |
| Some nights | 388 (28.3) | 985 (71.7) | 1.35 (1.09, 1.69) | - |
| Always or most nights | 520 (24.9) | 1,569 (75.1) | 1.61 (1.30, 1.99) | - |
| **Feel low or depressed** | | | | |
| Never or almost none of the time‡ | 513 (25.2) | 1,524 (74.8) | | |
| Sometimes | 495 (28.5) | 1,241 (71.5) | 0.84 (0.73, 0.98) | - |
| Always or most of the time | 69 (39.4) | 106 (60.6) | 0.52 (0.38, 0.71) | - |
| **Feel stressed** | | | | |
| Never or almost none of the time‡ | 327 (26.3) | 917 (73.7) | | |
| Sometimes | 618 (27.2) | 1,657 (72.8) | 0.96 (0.82, 1.12) | - |
| Always or most of the time | 132 (30.8) | 297 (69.2) | 0.80 (0.63, 1.02) | - |
| **Social activity** | | | | |
| Not socially active‡ | 336 (35.6) | 608 (64.4) | | |
| Very or quite socially active | 741 (24.7) | 2,263 (75.3) | 1.69 (1.44, 1.97) | 1.47 (1.22, 1.76) |
| **Mental activity** | | | | |
| Not mentally active‡ | 98 (26.6) | 271 (73.4) | | - |
| Very or quite mentally active | 979 (27.4) | 2,600 (72.7) | 0.96 (0.75, 1.22) | - |

* Univariable association between each variable and willingness to increase physical activity; †Adjusted for all the other variables in the final model.
‡Reference category

**Table 3. Predictors of motivation to change lifestyle for dementia risk reduction measured by two sub-scales as part of the MOCHAD-10 scale (*n*=3,948)**

| Variables | Subscale 1: Positive cues to action | | Subscale 2: Negative cues to action | |
|---|---|---|---|---|
| | Unadjusted (Univariable) Regression coefficient (95% CI)* | Adjusted (Multivariable) Regression coefficient (95% CI) † | Unadjusted (Univariable)* Regression coefficient (95% CI)* | Adjusted (Multivariable) Regression coefficient (95% CI) † |
| **Gender** | | | | |
| Male | | | | |
| Female | 0.51 (0.29, 0.73) | 0.27 (0.04 0.51) | 1.38 (1.16, 1.60) | 1.07 (0.83, 1.31) |
| **Age (years)** | -0.05 (-0.06, -00.4) | -0.03 (-0.04, -0.01) | -0.05 (-0.06, -0.04) | -0.03 (-0.04, -0.01) |
| **Relationship status** | | | | |
| Doesn't have a partner | | | | |
| Has a partner | 0.27 (0.05, 0.49) | - | 0.16 (-0.07, 0.39) | 0.27 (0.03, 0.51) |
| **Highest qualification** | | | | |
| Non-graduate | | | | |
| Graduate or post-graduate | -0.30 (-0.50, -0.11) | - | -0.47 (-0.68, -0.27) | -0.27 (-0.48, -0.06) |
| **General health** | | | | |
| Fair or poor | | | | |
| Good or excellent | -0.26 (-0.59, 0.07) | - | -0.57 (-0.92, -0.23) | - |
| **Body Mass Index** | | | | |
| Underweight (<18.5) | 0.00 (-0.81, 0.81) | -0.35 (-0.97, 0.70) | -1.01 (-1.85, -0.17) | - |
| Regular weight (18.5-24.9) | | | | |
| Overweight (25-29.9) | 0.30 (0.08, 0.51) | 0.45 (0.22, 0.67) | -1.02 -1.87, -0.18) | - |
| Obese (30+) | 0.92 (0.65, 1.19) | 0.98 (0.68, 1.27) | -0.63 (-1.49, 0.24) | - |
| **Currently employed** | | | | |
| No | | | | |
| Yes | 0.33 (0.14, 0.53) | - | 0.15 (-0.05, 0.34) | - |
| **Ethnic group** | | | | |
| Non-White | | | | |
| White | -0.84 (-1.43, -0.26) | -0.76 (-1.39, -0.12) | 0.32 (-0.29, 0.93) | - |

| | | | | |
|---|---|---|---|---|
| **Has children** | | | | |
| No | | | | |
| Yes | 0.14 (-0.08, 0.36) | - | 0.02 (-0.21, 0.25) | - |
| **Consumes alcohol in a typical month** | | | | |
| No | | | | |
| Yes | -0.33 (-0.64, -0.02) | - | -0.22 (-0.54, 0.11) | - |
| **Knew or know someone with dementia** | | | | |
| No | | | | |
| Yes | 0.62 (0.34, 0.91) | - | 0.79 (0.50, 1.09) | - |
| **Cared or care for someone with dementia** | | | | |
| No | | | | |
| Yes (family/informal carer) | 0.82 (0.59, 1.04) | 0.60 (0.37, 0.80) | 1.09 (0.86, 1.32) | 0.65 (0.43, 0.90) |
| Yes (professional carer) | 0.18 (-0.23, 0.58) | -0.22 (-0.62, 0.20) | -0.52 (-0.93, -0.10) | -1.08 (-1.48, -0.68) |
| Yes (professional & family carer) | 0.64 (0.17, 1.11) | 0.20 (-0.25, 0.66) | 0.49 (0.01, 0.98) | -0.12 (-0.59, 0.34) |
| **Diseases or conditions** | | | | |
| None | | | | |
| 1 | 0.19 (-0.06, 0.44) | 0.24 (-0.01, 0.50) | -0.14 (-0.40, 0.12) | -0.06 (-0.33, 0.20) |
| ≥2 | 0.34 (0.12, 0.56) | 0.53 (0.28, 0.77) | 0.28 (0.04, 0.51) | 0.36 (0.11, 0.60) |
| **Smoker** | | | | |
| No | | | | |
| Yes | -0.47 (-0.99, 0.05) | -0.66 (-1.21, -0.12) | 0.21 (-0.33, 0.76) | - |
| **Physical activity** | | | | |
| Not active | | | | |
| Moderately or very active | -0.38 (-0.61, -0.15) | - | -0.44 (-0.69, -0.20) | - |
| **Portions of fruit/vegetables per day** | | | | |
| 0-2 | | | | |
| 3-4 | -0.17 (-0.44, 0.09) | - | -0.25 (-0.53, 0.03) | -0.21 (-0.46, 0.13) |
| ≥5 | -0.34 (-0.61, -0.07) | - | -0.59 (-0.88, -0.31) | -0.58 (-0.81, -0.21) |
| **Sleep well** | | | | |
| Almost never or never | | | | |

| | | | | |
|---|---|---|---|---|
| Some nights | -0.27 (-0.59, 0.05) | - | -0.30 (-0.63, 0.03) | -0.11 (-0.45, 0.23) |
| Always or most nights | -0.66 (-0.97, -0.36) | - | -1.27 (-1.58, -0.95) | -0.66 (-0.99, -0.32) |
| **Feel low or depressed** | | | | |
| Never or almost none of the time | | | | |
| Sometimes | 0.47 (0.28, 0.67) | - | 1.12 (0.92, 1.33) | 0.54 (0.31, 0.78) |
| Always or most of the time | 0.57 (0.09, 1.04) | - | 2.04 (1.55, 2.52) | 1.07 (0.50, 1.64) |
| **Feel stressed** | | | | |
| Never or almost none of the time | | | | |
| Sometimes | 0.58 (0.37, 0.79) | 0.47 (0.24, 0.70) | 1.01 (0.80, 1.23) | 0.51 (0.26, 0.75) |
| Always or most of the time | 1.04 (0.71, 1.38) | 0.80 (0.43, 1.16) | 2.16 (1.82, 2.51) | 0.98 (0.56, 1.40) |
| **Social activity** | | | | |
| Not socially active | | | | |
| Very or quite socially active | 0.02 (-0.20, 0.25) | - | -0.17 (-0.40, 0.06) | - |
| **Mental activity** | | | | |
| Not mentally active | | | | |
| Very or quite mentally active | -0.78 (-1.11, -0.45) | -0.61 (-0.95, -0.27) | -1.12 (-1.46, -0.78) | -0.54 (-0.89, -0.19) |
| **Willingness to increase physical activity** | | | | |
| Not at all/A little bit/Not sure | | | | |
| Quite a bit/Very much | 1.59 (1.38, 1.80) | 1.67 (1.44, 1.90) | 0.83 (0.61, 1.06) | 0.91 (0.68, 1.14) |

* Univariable association between each variable and cues to action; † Adjusted for all the other variables in the final model.