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Associations of active commuting and leisure-time physical activity with perceived cognitive function and work ability among Finnish employed adults: a population-based study

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Abstract

Background Regular active commuting – that is, walking or cycling to work – can improve cardiometabolic health and physical fitness among employed adults. This study aimed to examine whether regular active commuting is also associated with perceived cognitive function (memory function, learning ability, and concentration) and work ability. To explore potential differences across physical activity domains, these relationships were additionally assessed for leisure-time physical activity.

Methods This study was based on cross-sectional data from the nationally representative FinHealth 2017 Study. Employed participants were categorised based on their commuting and leisure-time physical activity behaviour as either active or passive commuters and as sedentary, recreationally active, or exercisers and athletes, respectively. Covariate-adjusted quasi-Poisson regression was used to estimate relative risks (RR) with 95% confidence intervals (CI). For active commuting, dose-response analyses were also performed.

Results Among Finnish employed adults ($N = 3525$; mean age 45 years; 51% female), active commuting was not associated with perceived memory function, concentration, or work ability. However, active commuters had a 17% lower risk of suboptimal perceived learning ability compared to passive commuters (RR 0.83, 95% CI 0.70–0.99). In dose-response analyses, the association was observed only for lower volumes of active commuting (< 15 min a day; RR 0.67, 95% CI 0.50–0.89). Regarding leisure-time physical activity, exercisers and athletes had a 52% lower risk of suboptimal memory function (RR 0.48, 95% CI 0.38–0.60), a 54% lower risk of suboptimal learning ability (RR 0.46, 95% CI 0.36–0.60), a 49% lower risk of suboptimal concentration (RR 0.51, 95% CI 0.39–0.67), and a 65% lower risk of suboptimal work ability (RR 0.35, 95% CI 0.26–0.47) compared to sedentary adults. Similar associations were observed for recreationally active adults.

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Conclusions Active commuting was associated with better perceived learning ability, suggesting that its benefits may extend to brain health. Leisure-time physical activity may have even greater potential for enhancing cognitive function and work ability among employed adults.

Keywords Active commuting, Leisure-time physical activity, Cognitive function, Work ability

Background

Demographic ageing in Europe decreases the number of working-aged adults, posing substantial social and economic challenges to the region [1, 2]. In Finland, for example, the proportion of the working-age population is estimated to decline from the current 62–57% by 2060 [3]. Consequently, Finns and other Europeans need to maintain good health and extend their working lives to reduce the burden of ageing on the healthcare and social security systems [4]. To ensure more healthy and productive years in the quickly changing working life, and beyond, there is an emerging need to find cost-effective solutions to promote cognitive health and work ability in the workforce.

Regular physical activity has been linked to improvements in brain structure (e.g., increased hippocampal volume) and function (e.g., enhanced executive functioning) as well as better late-life cognition among older adults [5, 6]. While the evidence on young and middle-aged adults is scarce [5, 7], recent study from the United Kingdom found that engaging in moderate-to-vigorous physical activity may enhance cognition also in midlife [8]. Research on work ability has mostly focused on workplace physical activity interventions, but their effectiveness remains unclear [9, 10]. Despite the potential of physical activity in enhancing cognitive function and work ability, more than a third of adults in the European Union are insufficiently physically active [11].

Promoting active commuting – that is, walking or cycling to work – has emerged as a key solution for increasing physical activity among the employed population [12]. Although active commuting has been associated with several health benefits, such as lower risk of obesity and type 2 diabetes [13], its potential in enhancing cognitive function among employed adults is – to the best of our knowledge – unexplored. As even very light- and light-intensity acute exercise can lead to short-term improvements in cognitive performance [5, 14], walking or cycling before work might enhance processing speed, cognitive flexibility, working memory, and attentional control also at the workplace.

Regarding work ability, active commuting has been linked with higher employee productivity among middle-aged Australians [15] and better work performance among Japanese male office workers [16]. Furthermore, a Finnish longitudinal study found that an increase in active commuting was associated with a modest improvement in work ability among public sector employees [17]. However, the study lacked control for employees' leisure-time physical activity behaviour, which has been associated with both active commuting and work ability elsewhere [18, 19]. Some studies also suggest that cycling to work may reduce sickness absences [20], but the evidence is mixed [21].

To address current evidence gaps, we aimed to examine the associations of active commuting with perceived cognitive function and work ability in a nationally representative cohort of Finnish employed adults. Additionally, we assessed the relationships between leisure-time physical activity and these outcomes to explore potential differences across physical activity domains.

Methods

Study design and participants

The FinHealth 2017 study [22], conducted by the Finnish Institute for Health and Welfare, is a large health and wellbeing survey study of the Finnish adult population. Comprehensive, nationally representative data were collected using self-administered questionnaires and health examination measurements in 2017. The data collection of the study was approved by the Coordinating Ethics Committee at the Hospital District of Helsinki and Uusimaa (37/13/03/00/2016).

Utilising one- and two-stage stratified random sampling, 10,305 adults (≥ 18-years-old) residing in Finland were invited to participate in the study. Of the invited, 10,247 were eligible to participate, and 7046 took part in at least one phase of the data collection (questionnaires or health examinations; 69% participation rate). We excluded participants who were unemployed or retired, worked from home, or were over 74 years old ($N = 3287$). To be able to perform complete-case analyses, we also removed those with missing data in exposure, outcome, or confounding variables ($N = 234$). Thus, the final analytical sample comprised 3525 adults. Notably, the number of participants aged 65–74 years in the analytical sample was low ($N = 109$), as the typical retirement age in Finland is 65.

Exposures

Active commuting was self-reported with response to the question: "On your way to work or school, how many minutes do you travel by walking, cycling, or using other active transportation modes? Add up the journeys to and from work or school". Based on the responses, we derived two commuting profiles: passive commuters ("I only use motorised vehicles for commuting") and active commuters ("less than 15 minutes", "15–29 minutes", "30–60 minutes", and "more than 60 minutes a day").

Leisure-time physical activity was self-reported with response to the question: "How much do you exercise and exert yourself physically in your leisure-time?". The question was a modification of the Saltin-Grimby Physical Activity Level Scale [23]. Initially, we derived four leisure-time physical activity profiles: sedentary ("I read, watch television, and do other activities involving minimal physical movement or exertion"), recreationally active ("I walk, cycle, and engage in other activities for several hours a week, such as fishing, hunting, or light home gardening"), exercisers ("I exercise for several hours a week, such as running, jogging, cross-country skiing, fitness training, swimming, ball games, or strenuous garden work"), and athletes ("I practice strenuous sports several times per week, including competitive sports such as running, orienteering, cross-country skiing, swimming, and ball games"). Subsequently, we merged the exercisers and athletes into one group due to a low number of athletes ($N = 93$).

Outcomes

Regarding perceived cognitive function, participants responded to the question: "How do you perceive your memory, learning ability, and concentration?". They were asked to evaluate their memory function ("My memory works…"), learning ability ("My ability to absorb new information and learn things works…"), and concentration ("I am usually able to concentrate on things…") using a five-point response scale: (1) very well, (2) well, (3) adequately, (4) poorly, or (5) very poorly. Aiming at consistency with work ability classifications (see below), we categorised "very well" and "well" responses as indicators of optimal cognitive function. Suboptimal cognitive function included "adequately", "poorly", and "very poorly" responses. The measure has previously been used in the Regional Health and Wellbeing Study and in the Health 2011 Survey [22].

Work ability was measured using the validated Work Ability Score: "Let's assume that your work ability would receive a score of 10 points at its best. What score would you give your current work ability?" [24]. The response format was a ten-point scale, ranging from 0 (completely unable to work) to 10 (all-time best). Guided by the work ability classifications [24], we categorised scores of 10 (excellent) and 8–9 (good) as optimal work ability, while scores of 6–7 (moderate) and 0–5 (poor) were categorised as suboptimal work ability.

Covariates

Based on data availability [22] and evidence on factors associated with physical activity behaviour [25], cognitive function [26], and work ability [24], we treated the following variables as potential confounders: age (categorised as "18-34-years-old", "35-54-years old", and "55-74-years old"), sex ("female" and "male"), education level ("primary education", "secondary education", and "higher education"), household income ("≤ 25 000 €", "25 001–45 000 €", "45 001–60 000 €", "60 001–80 000 €", and "> 80 000 € per year"), marital status ("unmarried, divorced or widowed" and "married, cohabiting or in a registered relationship"), children living at home (yes/no), smoking status ("non-smoker", "former smoker", and "smoker"), hazardous or problem drinking (yes/no; for more details, see the FinHealth 2017 Study methods report [22]), and occupational physical demands (categorised as "low" for desk-based jobs, "moderate" for jobs involving walking, some lifting, and stairs, and "high" for heavy physical work such as frequent lifting, digging, and shovelling).

In additional and sensitivity analyses, we also used body mass index ("normal weight or underweight" and "overweight or obese"), adequate sleep ("no, seldom or never, or cannot tell" and "yes, almost always" or "often"), history of chronic diseases (any of the following diseases: hypertension, heart failure, coronary heart disease, myocardial infarction, cerebrovascular disease, type 1 diabetes, type 2 diabetes, cancer, rheumatoid arthritis, chronic kidney disease, degenerative disc disease, asthma, chronic obstructive pulmonary disease, and sleep apnoea), and income satisfaction ("unsatisfied" and "satisfied") as they can both confound and mediate the studied associations.

All covariates were self-reported.

Statistical analyses

We examined the distribution of study population characteristics across active commuting, leisure-time physical activity, perceived cognitive function, and work ability groups. Chi-square test ($\chi2$) was used to test for differences across the groups.

Quasi-Poisson regression models were used to examine the cross-sectional associations of active commuting and leisure-time physical activity with perceived cognitive function and work ability. First, we controlled for age and sex, and then for education level, household income, marital status, children living at home, smoking status, and hazardous or problem drinking. Thirdly, in the main model, we additionally controlled for occupational physical demands and, depending on the exposure, either for leisure-time physical activity or active commuting. We also performed dose-response analyses using a four-level commuting variable, comprising passive commuting ($N = 1860$), < 15 min ($N = 463$), 15–29 min ($N = 656$), and ≥ 30 min of active commuting a day ($N = 546$). We combined the "30–60 minutes" and "more than 60 minutes a day" groups due to a low number of participants in the latter ($N = 168$).

In additional analyses, besides covariates in the main regression model, we controlled for body mass index, adequate sleep, and history of major chronic diseases in separate models. As a sensitivity analysis, we tested an alternative main regression model in which the household income variable was replaced with income satisfaction. Furthermore, we tested for interactions by age, sex, and income satisfaction in the main regression model. No statistically significant interactions emerged.

Passive commuters and sedentary adults were used as reference groups for all regression analyses on active commuting and leisure-time physical activity, respectively. Additionally, we used survey weights and the R package *survey* to account for non-participation (for more details, see the FinHealth 2017 Study methods report [22]). The absence of multicollinearity was confirmed with variance inflation factors. We performed all analyses using R (4.3.0) and RStudio (2023.09.0). Results from the quasi-Poisson regression analyses are presented as relative risks (RR) with 95% confidence intervals (CI).

Results

Descriptive characteristics

Of all 3525 participants (mean age 45 years; 51% female), 47% were categorised as active commuters and 53% as passive commuters. Active commuting was more prevalent among females than males, highly educated than less educated, unmarried than married, and non-smokers than smokers. Active commuters were also less likely to have children living at home, chronic diseases, overweight or obesity, and high occupational physical demands. Active commuting was also more common among exercisers and athletes and recreationally active adults than those with a sedentary lifestyle (Table 1). Additionally, participants with higher active commuting volumes were more likely to be older, female, from lower-income households, and in jobs with higher physical demands compared to those with lower active commuting volumes. However, no other major differences were observed among active commuters (Table S1).

Regarding leisure-time physical activity, 43% of participants were categorised as recreationally active, 35% as exercisers or athletes, and 22% as sedentary. Compared to the sedentary group, exercisers and athletes were more likely to be young adults, males, highly educated, from higher-income households, and to have lower body mass index and fewer chronic diseases. They also reported better health behaviours and lower levels of occupational physical demands. Recreationally active adults showed similar characteristics to exercisers and athletes, though the differences compared to the sedentary group were slightly less prominent (Table 2).

Nearly every fifth participant reported having suboptimal perceived cognitive function and work ability (17% for memory function; 17% for learning ability; 15% for concentration; 16% for work ability). Compared to those with optimal perceived cognitive function and work ability, these individuals were more likely to be older adults, males, less educated, and from lower-income households. Generally, they also reported more health problems, poorer health behaviours, and higher levels of occupational physical demands (Table S2 and Table S3).

Active commuting, perceived cognitive function, and work ability

Compared to passive commuters, we observed that active commuters had a 17% lower risk of suboptimal perceived learning ability after the multivariable adjustments in the main regression model (RR 0.83, 95% CI 0.70–0.99). In dose-response analyses, a statistically significant association emerged only for low volumes of active commuting (< 15 min a day; RR 0.67, 95% CI 0.50–0.89), while for higher volumes, the associations attenuated to null. Although similar trends were observed for memory function and concentration, these associations did not reach statistical significance. Active commuting, whether analysed as a binary or four-level variable, was also not associated work ability (Fig. 1).

Regarding Model 1 (adjusted only for age and sex), no associations were observed between active commuting and perceived concentration or work ability. For perceived memory function, controlling for socioeconomic status indicators and health behaviours attenuated most associations to null. No major changes were observed in the relative risks after adjusting for body mass index, adequate sleep, chronic diseases, and income satisfaction (Table S4).

Leisure-time physical activity, perceived cognitive function, and work ability

In the main regression model, leisure-time physical activity was associated with all outcomes (Fig. 2). Compared to the sedentary adults, exercisers and athletes had a 52% lower risk of suboptimal perceived memory function (RR 0.48, 95% CI 0.38–0.60), a 54% lower risk of suboptimal perceived learning ability (RR 0.46, 95% CI 0.36–0.60), a 49% lower risk of suboptimal perceived concentration (RR 0.51, 95% CI 0.39–0.67), and a 65% lower risk of suboptimal work ability (RR 0.35, 95% CI 0.26–0.47). Similarly, lower risks of suboptimal perceived cognitive function and work ability were observed for recreationally active adults (memory function RR 0.63, 95% CI 0.53–0.76; learning ability RR 0.66, 95% CI 0.56–0.79; concentration RR 0.69, 95% CI 0.56–0.84; work ability RR 0.73, 95% CI 0.62–0.87).

Table 1 Characteristics of the analytical sample by commuting profile

Characteristics	Passive commuters *N* (%)	Active commuters *N* (%)
Total number of participants	1860 (100.0)	1665 (100.0)
Sociodemographic		
Age		
18-34-years-old	387 (20.8)	484 (29.1)
35-54-years old	1034 (55.6)	729 (43.8)
55-74-years old	439 (23.6)	452 (27.1)
Sex		
Female	851 (45.8)	955 (57.4)
Male	1009 (54.2)	710 (42.6)
Education level		
Primary education	153 (8.2)	143 (8.6)
Secondary education	736 (39.6)	519 (31.2)
Higher education	971 (52.2)	1003 (60.2)
Household income		
≤ 25 000 €	152 (8.2)	339 (20.4)
25 001–45 000 €	441 (23.7)	439 (26.3)
45 001–60 000 €	382 (20.5)	256 (15.4)
60 001–80 000 €	450 (24.2)	292 (17.5)
> 80 000 €	435 (23.4)	339 (20.4)
Income satisfaction		
Unsatisfied	182 (9.8)	205 (12.3)
Satisfied	1677 (90.2)	1458 (87.7)
Marital status		
Unmarried, divorced, or widowed	378 (20.3)	531 (31.9)
Married or cohabiting	1482 (79.7)	1134 (68.1)
Children (living at home)		
No	1025 (55.1)	1136 (68.2)
Yes, at least one	835 (44.9)	529 (31.8)
Health status		
Body mass index		
Normal weight or underweight	706 (38.0)	795 (47.7)
Overweight or obese	1154 (62.0)	870 (52.3)
Chronic diseases		
No	863 (48.3)	847 (53.1)
Yes, at least one	925 (51.7)	749 (46.9)
Health behaviour		
Smoking status		
Non-smoker	973 (52.3)	1047 (62.9)
Former smoker	487 (26.2)	377 (22.6)
Smoker	400 (21.5)	241 (14.5)
Hazardous or problem drinking		
No	1336 (71.8)	1255 (75.4)
Yes	524 (28.2)	410 (24.6)
Adequate sleep		
No, seldom or never or cannot tell	470 (25.4)	408 (24.6)
Yes, almost always or often	1379 (74.6)	1250 (75.4)
Physical activity		
Occupational physical demands		
Low	692 (37.2)	811 (48.7)
Moderate	456 (24.5)	430 (25.8)
High	712 (38.3)	424 (25.5)
Leisure-time physical activity		

Table 1 (continued)

Characteristics	Passive commuters *N* (%)	Active commuters *N* (%)
Sedentary	433 (23.3)	356 (21.4)
Recreationally active	809 (43.5)	693 (41.6)
Exercisers and athletes	618 (33.2)	616 (37.0)

All variables globally significantly different between commuting groups at $p < 0.05$, except leisure-time physical activity ($p = 0.057$) and adequate sleep ($p = 0.579$)

Compared to Model 1, associations attenuated slightly, but remained significant, after adjusting for socioeconomic status indicators and health behaviours. Adjusting for body mass index, adequate sleep, chronic diseases, and income satisfaction did not affect the associations (Table S5).

While dichotomous outcome variables were used in the regression analyses, the distribution of the five-point cognitive function scores and four-point work ability classifications by commuting and leisure-time physical activity profiles are presented in Table S6 and Table S7.

Discussion

We examined the associations of active commuting and leisure-time physical activity with perceived cognitive function and work ability among Finnish employed adults. Active commuting, particularly at lower volumes (< 15 min a day), was associated with a lower risk of suboptimal perceived learning ability compared to passive commuting. Regarding leisure-time physical activity, engaging in both recreational physical activity and exercise or sports was associated with a lower risk of suboptimal perceived memory function, learning ability, concentration, and work ability compared to sedentary lifestyle.

While there is limited evidence for the association between physical activity and cognitive function among young and middle-aged adults [5, 7], our observations align with prior studies in older populations. For example, among older adults residing in the United States (mean age 70 years), regular leisure-time physical activity, but not active travel, was associated with better performance in processing speed, verbal fluency, and delayed recall compared to inactivity [27]. Similarly, a Finnish longitudinal study found that engaging in leisure-time physical activity during midlife was associated with a lower risk of dementia and Alzheimer's disease in later life (aged 65 to 79 years) [28]; however, among the same cohort, no risk reductions were observed for active commuting [29].

Some contradictory evidence exists from studies on adolescents. For example, in our previous work, active commuting to school – at any dose – was positively associated with perceived academic performance [30]. However, only 10 to 30 min of walking or cycling a day were associated with higher competency in academic skills, such as writing, reading, and mathematics [30]. Somewhat similarly, only lower volumes of daily active commuting were associated with a lower risk of suboptimal perceived learning ability in this study. Indeed, while there is no experimental evidence on active commuting and brain health per se, some evidence suggests that specifically shorter bouts of exercise can lead to acute improvements in executive functioning, while the acute benefits of longer bouts may be hindered by fatigue or dehydration [14]. In theory, short bouts of walking or cycling before work might benefit job performance during the workday, leading to better overall perceptions of cognitive function. Nevertheless, these associations are challenging to interpret, and we encourage future research to investigate whether there could be an optimal dose of active commuting for boosting cognitive performance at workplaces – and in schools – with more detailed data on the volume and intensity of active commuting (e.g., by comparing walking to cycling) and/or experimental study designs.

Several contextual factors can explain why leisure-time physical activity appears to be more beneficial for cognitive function than active commuting. For example, walking and cycling are motor skills that are typically developed at an early age and, consequently, make them unchallenging for most working-aged adults. In contrast, leisure-time physical activity, especially exercise and sports, often comprise more challenging, complex, and diverse movement patterns and cues, which require more advanced use of working memory, inhibitory control, and cognitive flexibility [31]. These components are hypothesised to be particularly important when aiming to improve executive function skills via physical activity [31, 32]. Furthermore, activities that reduce stress, provide enjoyment, enhance self-efficacy, and foster feelings of belonging may also benefit executive functions [31], which could explain our observations for recreational leisure-time physical activity as well.

Additionally, exercise and sports are typically more intense than active commuting. Therefore, various neurobiological mechanisms could also explain our observations. For example, higher exercise intensities have been shown to increase the levels of circulating brain-derived neurotrophic factor [33], angiogenic growth factors [34], and insulin-like growth factor-1 [35]. These growth factors promote the formation of new brain cells and blood

Table 2 Characteristics of the analytical sample by leisure-time physical activity profile

Characteristics	Sedentary *N* (%)	Recreationally active *N* (%)	Exercisers and athletes *N* (%)
Total number of participants	789 (100.0)	1502 (100.0)	1234 (100.0)
Sociodemographic			
Age			
18-34-years-old	187 (23.7)	264 (17.6)	420 (34.0)
35-54-years old	393 (49.8)	765 (50.9)	605 (49.0)
55-74-years old	209 (26.5)	473 (31.5)	209 (17.0)
Sex			
Female	409 (51.8)	820 (54.6)	577 (46.8)
Male	380 (48.2)	682 (45.4)	657 (53.2)
Education level			
Primary education	98 (12.4)	148 (9.9)	50 (4.1)
Secondary education	309 (39.2)	561 (37.3)	385 (31.2)
Higher education	382 (48.4)	793 (52.8)	799 (64.7)
Household income			
≤ 25 000 €	151 (19.1)	206 (13.7)	134 (10.9)
25 001–45 000 €	225 (28.5)	386 (25.7)	269 (21.8)
45 001–60 000 €	133 (16.9)	296 (19.7)	209 (16.9)
60 001–80 000 €	163 (20.7)	316 (21.0)	263 (21.3)
> 80 000 €	117 (14.8)	298 (19.9)	359 (29.1)
Income satisfaction			
Unsatisfied	130 (16.5)	152 (10.1)	105 (8.5)
Satisfied	657 (83.5)	1349 (89.9)	1129 (91.5)
Marital status			
Unmarried, divorced, or widowed	233 (29.5)	343 (22.8)	333 (27.0)
Married or cohabiting	556 (70.5)	1159 (77.2)	901 (73.0)
Children (living at home)			
No	501 (63.5)	946 (63.0)	714 (57.9)
Yes, at least one	288 (36.5)	556 (37.0)	520 (42.1)
Health status			
Body mass index			
Normal weight or underweight	254 (32.2)	628 (41.8)	619 (50.2)
Overweight or obese	535 (67.8)	874 (58.2)	615 (49.8)
Chronic diseases			
No	353 (46.2)	677 (47.2)	680 (57.3)
Yes, at least one	411 (53.8)	756 (52.8)	507 (42.7)
Health behaviour			
Smoking status			
Non-smoker	392 (49.7)	823 (54.8)	805 (65.2)
Former smoker	189 (23.9)	369 (24.6)	306 (24.8)
Smoker	208 (26.4)	310 (20.6)	123 (10.0)
Hazardous or problem drinking			
No	539 (68.3)	1132 (75.4)	920 (74.6)
Yes	250 (31.7)	370 (24.6)	314 (25.4)
Adequate sleep			
No, seldom or never or cannot tell	257 (32.7)	353 (23.6)	268 (21.8)
Yes, almost always or often	528 (67.3)	1141 (76.4)	960 (78.2)
Physical activity			
Occupational physical demands			
Low	327 (41.5)	573 (38.2)	603 (48.9)
Moderate	184 (23.3)	409 (27.2)	293 (23.7)
High	278 (35.2)	520 (34.6)	338 (27.4)
Active commuting			

Table 2 (continued)

Characteristics	Sedentary *N* (%)	Recreationally active *N* (%)	Exercisers and athletes *N* (%)
Passive commuters	433 (54.9)	809 (53.9)	618 (50.0)
Active commuters	356 (45.1)	693 (46.1)	616 (50.0)

All variables globally significantly different between leisure-time physical activity groups at $p < 0.05$, except active commuting ($p = 0.057$)

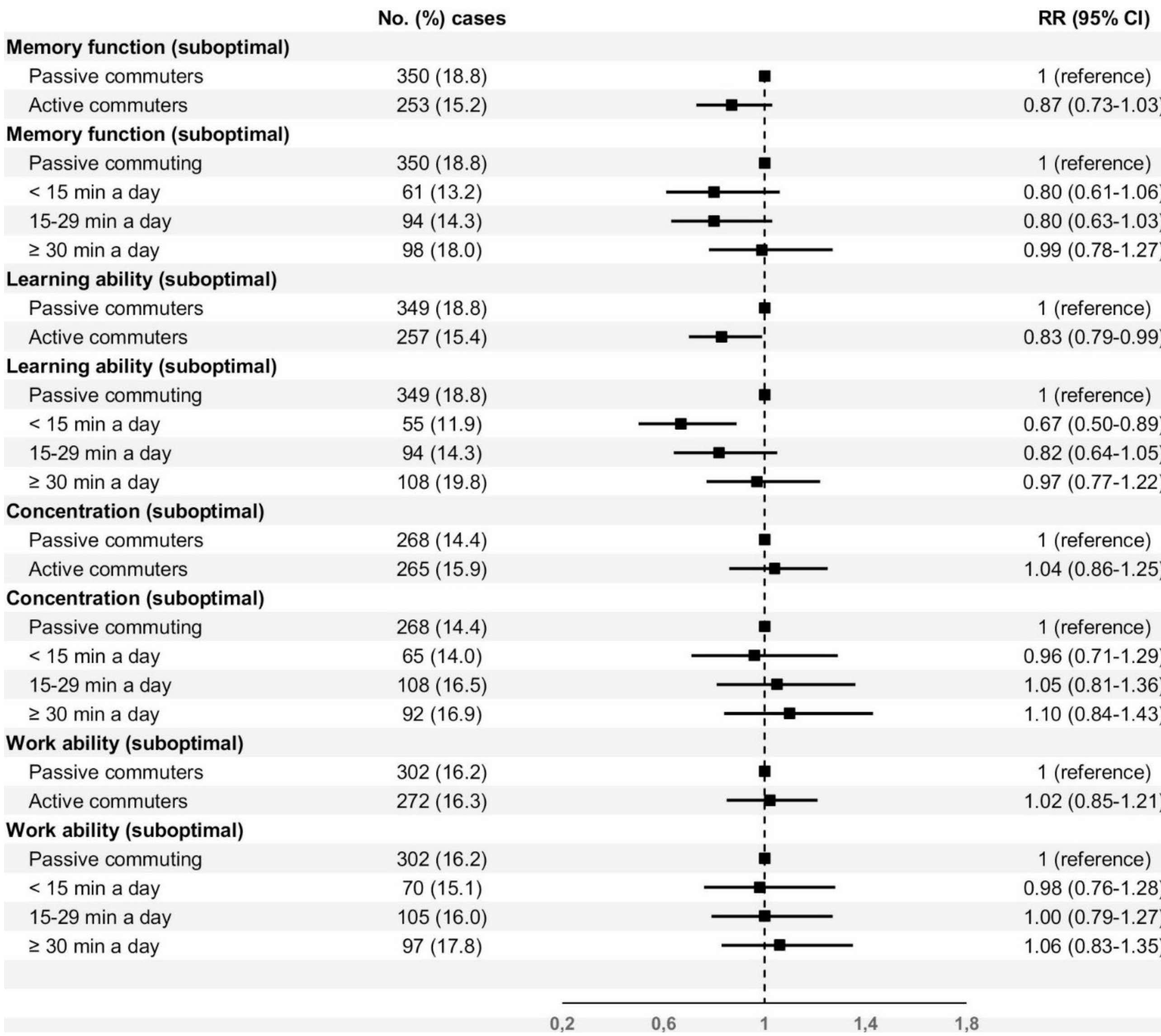

Fig. 1 Relative risks with 95% confidence intervals for perceived cognitive function and work ability outcomes by commuting profile and active commuting volume. Adjusted for age, sex, education level, household income, marital status, children (living at home), smoking status, hazardous or problem drinking, occupational physical demands, and leisure-time physical activity

vessels as well as neuroplasticity in various brain regions, including hippocampus, making them closely involved with memory and learning [36]. Moreover, particularly aerobic physical activity can increase cerebral blood flow and oxygen delivery to the brain, which can also improve cognitive function [31]. Nevertheless, we were not able to perform stratified analyses for walking and cycling, which prevents us from comparing active commuting modes of different intensities.

Although active commuting has been associated with several health benefits, including healthier body composition and higher physical fitness [13, 37], our observations suggest that walking or cycling to work alone may not be associated with work ability. This could imply that

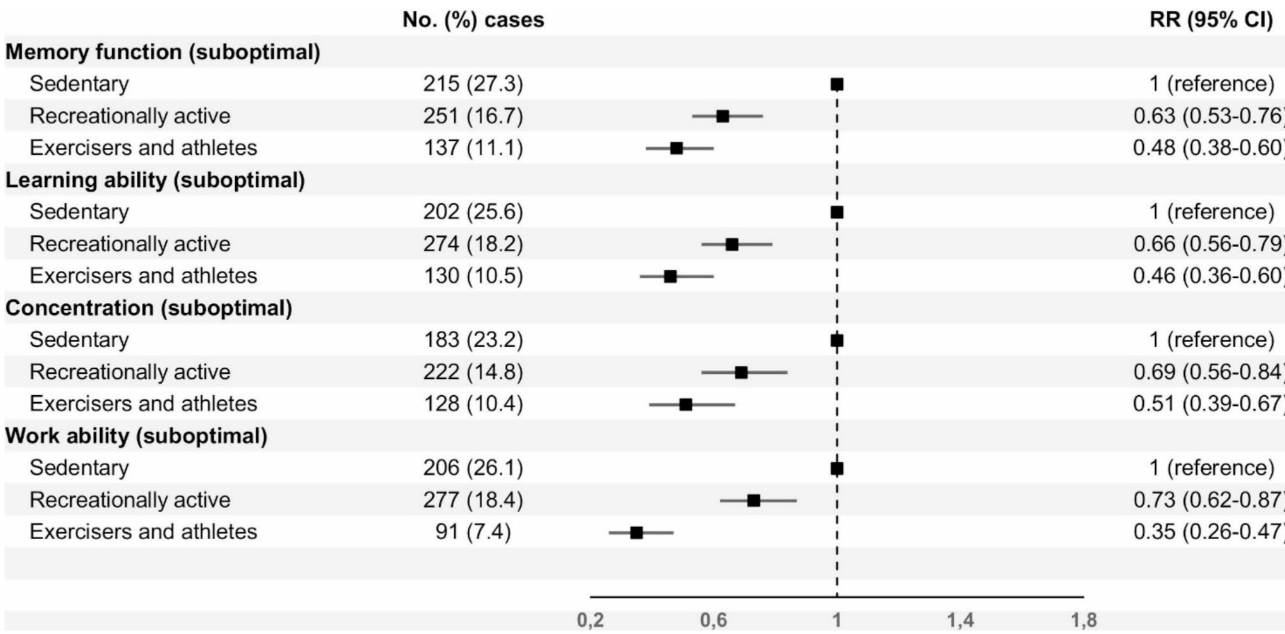

Fig. 2 Relative risks with 95% confidence intervals for perceived cognitive function and work ability outcomes by leisure-time physical activity profile. Adjusted for age, sex, education level, household income, marital status, children (living at home), smoking status, hazardous or problem drinking, occupational physical demands, and active commuting

other dimensions of work ability [24], including cognitive, mental, and social health, were considered at least as equally important as physical health when the work ability scores were self-evaluated. Regarding mental health, for example, regular leisure-time physical activity has been shown to be beneficial [38], but the evidence for active commuting is mixed [39].

Strengths of the study include a large, nationally representative cohort of Finnish employed adults, which enhances the generalisability of our observations to a broader Nordic working population. Furthermore, we were able to control for key covariates associated with physical activity behaviour, cognitive function, and work ability, which reduces the possibility of residual confounding bias.

Despite being successfully used in prior population studies [22], a key limitation of this study was the use of non-validated and self-reported measures of cognitive function. Although subjective cognitive evaluations can have some clinical utility, objective measures remain a gold-standard for assessing cognitive ability [40]. Active commuting measure was also non-validated and self-reported, but we believe that the risk of recall or misclassification bias was low due to a routine-like nature of commuting. Furthermore, compared to specific doses (e.g., time spent at different exercise intensities), we were interested in leisure-time physical activity profiles, which are arguably easier to report. Moreover, we were unable to control for additional employment-related factors, such as shift work and employment type, which may influence both physical activity behaviour and health. Finally, due to the cross-sectional design, we cannot draw conclusions about causality. Nevertheless, longitudinal and/or experimental studies support our observations – particularly for leisure-time physical activity [19, 31].

Conclusions

This study suggests that short bouts of walking or cycling to work may have potential to enhance learning ability among employed adults. However, engaging in leisure-time physical activity may be more beneficial in promoting broader cognitive function and work ability in the workforce. Further longitudinal and experimental research is needed to confirm and expand upon these findings.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22634-2.

Supplementary Material 1

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Author contributions
JJJ and TL conceived the study. JJJ analysed the data and wrote the first manuscript draft. JJ, AP, KAS, JE, JIH, EK, JL, SM, PS and TL contributed to the concept and design of the study, interpretation of the results, and manuscript revision. All authors approved the final version of the manuscript. JJJ is responsible for the overall content as guarantor.

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Data availability
The data of the FinHealth 2017 Study are available for research purposes in collaboration with the project organisation and through THL Biobank. In order to obtain access to the data, researchers must first submit a study proposal to the FinHealth 2017 or the THL Biobank Scientific Board. The forms to apply access to the data are available on the website of the FinHealth 2017 Study and the THL Biobank. The FinHealth 2017 website includes all the forms used during the fieldwork and the corresponding variables. Once access to the data is granted by the Scientific Board, a signed agreement is required, and all researchers must confirm to follow the THL data security rules.

Declarations

Ethics approval and consent to participate
The data collection of the FinHealth 2017 Study was approved by the Coordinating Ethics Committee at the Hospital District of Helsinki and Uusimaa (37/13/03/00/2016). Participants gave informed consent to participate in the FinHealth 2017 Study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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