

Active commuting and cardiovascular risk among healthcare workers

Correspondence to: Anawat Wisetborisut, Department of Family Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand; Email:

anawat.w@cmu.ac.th, Tel: +66 53 945 462, Fax: +66 53 289 306

Chawin Lerssrimongkol, MD¹, Anawat Wisetborisut, MD¹, Chaisiri Angkurawaranon, MD¹, Wichuda Jiraporncharoen, MD¹, Kin Bong Hubert Lam, PhD²

¹Department of Family Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

²Nuffield Department of Population Health, University of Oxford, Oxford, UK

Abstract

Background: Although the benefit of physical activity on cardiovascular health has been well demonstrated, being physically active can be difficult for healthcare workers. Active commuting such as walking or cycling may be a good way to promote physical activity.

Aims: To investigate the relationship between active commuting and cardiovascular disease (CVD) risk factors in healthcare workers.

Methods: A cross-sectional study of healthcare workers conducted in Chiang Mai University Hospital, Thailand. Information on demographics and lifestyle, including active commuting, was obtained from questionnaires. Results were analysed with multiple logistic regression, adjusting for other physical activity and possible confounders.

Results: Among 3204 participants fewer than half engaged in active commuting. After adjustment for possible confounders, low active commuting was associated with increased risk of hypertension (adjusted OR (aOR) 1.3, 95% CI: 1.1-1.7). High active commuting was associated with central obesity (aOR 1.4, 95% CI: 1.0-1.8). Compared to non-active commuters, younger active commuters (aged under 40) had reduced prevalence of hypertension (aOR 0.4, 95% CI: 0.2-1.0), while older active commuters (aged 40 or over) demonstrated increased hypertension (aOR 1.6, 95% CI: 1.1-2.3) and central obesity (aOR 1.5, 95% CI: 1.1-2.1).

Conclusions: We found conflicting evidence on the relationship between active commuting and cardiovascular risk factors. Reverse causation may explain the association between active commuting and hypertension and central obesity and should be investigated further.

Keywords: Active commuting, cardiovascular risk factor, healthcare worker

INTRODUCTION

Physical inactivity and sedentary lifestyle are important risk factors for cardiovascular disease (CVD), and are commonly seen in healthcare workers (1). Although regular physical activity could have beneficial effects on CVD prevention only a minority of this population may achieve sufficient levels of physical activity (2).

Active commuting, such as walking or cycling to work, can be an appealing form of physical activity and provides a feasible means to integrate physical activity in an increasing sedentary lifestyle (3). However, evidence for the effects of active commuting on CVD has not been consistent (4, 5). We therefore investigated the association between active commuting and CVD risk factors in a large sample of Thai healthcare workers.

METHODS

The cross-sectional Chiang Mai University (CMU) Health Worker Study was conducted in Chiang Mai, Thailand in 2013. The rationale and details of the study have been published elsewhere (6). Briefly, all healthcare workers at the Chiang Mai University Hospital were invited to participate in a health check up programme. Each enrolled participant completed an online questionnaire on demographics and a structured interview on personal and family medical history and lifestyle conducted by trained staff. Blood pressure (BP), height, weight, and waist circumference were measured by trained nurses. Blood samples were drawn for fasting blood sugar (FBS), triglycerides, and high- and low-density lipoprotein-cholesterol (HDL-C and LDL-C).

Participants were considered as active commuters if they answered yes to the question “Do you walk or use a bicycle as mode of transport to get to and from places (e.g. to work, to the market) for at least 10 minutes continuously?” We multiplied the

duration and frequency of the reported active commute, and categorised the result into three levels: non-active, low (1-149 minutes/week), and high (≥ 150 minutes/week) commuting (7). We collected information on leisure-time and occupational physical activity, and categorised overall physical activity into inactive, moderately active, and highly active levels (8).

Cardiovascular risk factors in the study included overweight (BMI ≥ 25 - <30 kg/m²), obesity (BMI ≥ 30 kg/m²), central obesity (waist circumference ≥ 90 cm in men and ≥ 80 cm in women), hypertension (either BP $\geq 140/90$ mmHg, or a history of taking anti-hypertensive medication), impaired fasting glucose (levels ≥ 100 to <126 mg/dL), diabetes (fasting glucose ≥ 126 mg/dL or a history of taking anti-diabetic medication/insulin), high LDL-C (≥ 160 mg/dL), low HDL-C (<40 mg/dL in men and <50 mg/dL in women) and elevated triglycerides (≥ 150 mg/dL).

The association between active commuting and CVD risk factors was assessed using χ^2 tests and logistic regression models, adjusting for age, sex, educational level, marital status, income, occupation, smoking, alcohol consumption, physical activity level and BMI (for all outcomes other than obesity). To examine the possibility of reverse causation we performed stratified analysis by age group (cut-off at median 40 years) and tested for an interaction between age and active commuting, since older individuals with CVD risk factors might change lifestyle because of their diagnoses. All analyses were performed with STATA version 12 (StataCorp LP, College Station, TX, USA). The study was approved by the Ethics Committee of the Faculty of Medicine, CMU.

RESULTS

There were 5364 workers eligible for the study; of these 3204 (60%) participated. There were 728 men and 2476 women. Overall, 1382 (43%) reported active commuting. Among respondents the most common CVD risk factors were low HDL-C (25%), hypertension (24%), and elevated triglycerides (22%). The prevalence of diabetes and obesity was low, at only 2.3% and 6.5%, respectively. Table 1 shows the characteristics of participants stratified by level of active commuting.

TABLE 1 HERE

Adjusting for other possible confounders, only hypertension and central obesity showed a positive association with active commuting (OR 1.37, 95% CI 1.08-1.73, and 1.35, 95% CI 1.03-1.77, respectively). There was a significant association with hypertension in high-level active commuters aged 40 or over (OR 1.62, 95% CI 1.13-2.33) but a markedly reduced risk for those under 40 (OR 0.40, 95% CI 0.16-0.99) (p for interaction = 0.055) (Table2).

TABLE 2 HERE

DISCUSSION

Nearly half of the healthcare workers who responded in our sample reported engaging in daily active commuting. While active commuters were more likely to meet recommendations for physical activity, they exhibited increases in obesity and hypertension.

Our findings are in contrast to previous reports that show active commuting is associated with lower risk of CVD (4), but corroborate results from a large population-based study in China (5). Chiang Mai is undergoing economic development, with emphasis placed on building highways and infrastructure, while neglecting the needs

of pedestrians and cyclists. Benefits from active commuting on CVD risk factors might possibly be negated or outweighed by increased respiratory pollutant exposure (9). Also it may be possible that healthcare workers who are at risk of CVD may switch to a healthier lifestyle, which could include active commuting. Our results indicate that there may be differential effects of active commuting on hypertension by age. Such interaction has not been reported previously. While this could be a chance finding, it warrants further investigation.

The strengths of this study include use of a large sample in the same workplace. Results are less likely to be confounded by disparities in deprivation, occupational exposure, and health. Nonetheless, there are several limitations. Temporality could not be ascertained with the cross-sectional design. We could not differentiate between walking and cycling, which have been reported to differ in their health benefits (10), and we are unable to account for speed and distance travelled. Active commuting may be only part of a healthy lifestyle “package”, which may include healthy diet, and such unmeasured factors might further weaken the association between active commuting and CVD risks.

In conclusion, we found conflicting evidence on the association between active commuting and CVD risk factors. We still recommend active commuting to all healthcare workers, as their physical activity level is generally low. The apparent relationship between active commuting and adverse CVD risk factors needs further investigation, especially with the use of a longitudinal design in order to address properly the issue of temporal association and possible reverse causality.

Key Points

- Active commuting appeared to reduce the risk of hypertension among young healthcare workers.
- The benefits of active commuting on cardiovascular health, especially in low to middle income countries, and in older workers, are unclear.
- Despite the lack of evidence to support active commuting in all age groups, we still recommend active commuting as a way to improve the low level of physical activity in healthcare workers.

Acknowledgements

The authors thank the Faculty of Medicine of Chiang Mai University and the Research Institute for Health Sciences of Chiang Mai University for their support; the Health Promotion Unit and all members of the research team involved with data collection and data entry; and all the healthcare workers who participated in our study.

Funding

This work was supported by the Faculty of Medicine Research Fund of Chiang Mai University (SOR TOR 6393(8).3 BOR JOR/2981).

Conflicts of interest

None declared.

REFERENCES

1. Nahm ES, Warren J, Zhu S, An M, Brown J. Nurses' self-care behaviors related to weight and stress. *Nurs Outlook*. 2012;**60**:e23-31.
2. Trinh OT, Nguyen ND, Dibley MJ, Phongsavan P, Bauman AE. The prevalence and correlates of physical inactivity among adults in Ho Chi Minh City. *BMC Public Health*. 2008;**8**:204.
3. Woodcock J, Edwards P, Tonne C, Armstrong BG, Ashiru O, Banister D, et al. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet*. 2009;**374**:1930-1943.
4. Hamer M, Chida Y. Active commuting and cardiovascular risk: a meta-analytic review. *Prev Med*. 2008;**46**:9-13.
5. Lu SR, Su J, Xiang QY, Zhang FY, Wu M. Active transport and health outcomes: findings from a population study in Jiangsu, China. *J Environ Public Health*. 2013;**2013**:624194.
6. Angkurawaranon C, Wisetborisut A, Jiraporncharoen W, Likhitsathian S, Uaphanthasath R, Gomutbutra P, et al. Chiang Mai University Health Worker Study aiming toward a better understanding of noncommunicable disease development in Thailand: methods and description of study population. *Clin Epidemiol*. 2014;**6**:277-286.
7. Furie GL, Desai MM. Active transportation and cardiovascular disease risk factors in U.S. adults. *Am J Prev Med*. 2012;**43**:621-628.

8. Aekplakorn W, Porapakam Y, Taneepanichkul S, Pukchareon H, Satheannoppakao W, Thaikla K. The Fourth National Health Examination Survey, 2008-2009,. Nontaburi: The graphico system co, Ltd; 2010.
9. Brook RD, Rajagopalan S, Pope CA, 3rd, Brook JR, Bhatnagar A, Diez-Roux AV, et al. Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation*. 2010;**121**:2331-2378.
10. Hoevenaar-Blom MP, Wendel-Vos GC, Spijkerman AM, Kromhout D, Verschuren WM. Cycling and sports, but not walking, are associated with 10-year cardiovascular disease incidence: the MORGEN Study. *Eur J Cardiovasc Prev Rehabil*. 2011;**18**:41-47.

Table 1: Characteristics of survey participants according to levels of active commuting.

Data presented as n (%) unless otherwise specified.

Characteristics	Non-active commuting	Active commuting		P values
n	1822	Low (1-<150 min/week)	High (≥150 min/week)	
		1036	346	
Sex				<0.001
Female	1402 (77)	846 (82)	228 (66)	
Male	420 (23)	190 (18)	118 (34)	
Age (years)				<0.001
Mean, SD	39.7, 10.6	40.4, 10.9	42.6, 10.6	
Income (bahts)				NS
< 10,000	193 (11)	123 (12)	49 (14)	
10,001-30,000	785 (43)	427 (41)	154 (45)	
30,001-50,000	413 (23)	236 (23)	64 (18)	
> 50,000	431 (23)	250 (24)	79 (23)	
Occupation				<0.001
Physician/dentist	41 (2)	28 (3)	7 (2)	
Pharmacist	19 (1)	19 (2)	5 (1)	
Nurse	712 (39)	432 (42)	92 (27)	
Nurse aide	283 (16)	167 (16)	64 (18)	
Other health professionals	60 (3)	29 (3)	16 (5)	
Supporting officer	248 (14)	124 (12)	27 (8)	
Worker**	459 (25)	237 (23)	135 (39)	
Smoking				NS
Non-smoker	1706 (94)	994 (96)	312 (90)	
Current smoker	116 (6)	42 (4)	34 (10)	
Health risk due to alcohol consumption				NS
Low	1617 (89)	951 (92)	288 (83)	
Moderate	187 (10)	81 (8)	53 (15)	
High	18 (1)	4 (1)	5 (2)	
Physical activity level*				<0.001
Low	853 (47)	395 (38)	108 (31)	
Moderate	701 (38)	485 (47)	149 (43)	
High	268 (15)	156 (15)	89 (26)	
BMI (kg/m ²)				
Mean, SD	23.3, 4.1	23.3 (4.1)	24.2 (4.0)	<0.001
Cardiovascular risk				
Obesity	108 (5.9)	70 (6.7)	31 (9.0)	<0.01
Hypertension	275 (15.1)	197 (19.0)	88 (25.4)	<0.001
Central obesity	370 (20.3)	216 (20.8)	100 (28.9)	<0.001
Diabetes	39 (2.1)	22 (2.1)	12 (3.5)	<0.05
High LDL-C	338 (18.6)	200 (19.3)	80 (23.1)	NS
Low HDL-C	324 (17.8)	193 (18.6)	61 (17.6)	NS
Elevated triglycerides	279 (15.3)	161 (15.5)	66 (19.1)	NS

* Physical activity level was calculated excluding MET from commuting

** Workers are contracted employees whose job is physical manual work e.g.

transporting patients, delivering medical supplies etc.

Table 2: Adjusted odds ratios for association between level of active commuting and cardiovascular disease risk factors,

Cardiovascular risk factors	Non-active commuting	Low Active commuting (1-<150 min/week)	High active commuting (≥150 min/week)
Obesity*			
Total	Ref	1.24 (0.90-1.70)	1.44 (0.94-2.21)
Age < 40 years	Ref	1.09 (0.69-1.72)	1.52 (0.80-2.88)
Age ≥ 40 years	Ref	1.49 (0.95-2.35)	1.52 (0.83-2.79)
Central obesity*			
Total	Ref	1.03 (0.85-1.26)	1.35 (1.03-1.77)
Age < 40 years	Ref	1.06 (0.78-1.45)	1.17 (0.73-1.90)
Age ≥ 40 years	Ref	1.02 (0.78-1.32)	1.49 (1.06-2.09)
Hypertension			
Total	Ref	1.37 (1.08-1.73)	1.25 (0.91-1.73) [§]
Age < 40 years	Ref	1.38 (0.87-2.19)	0.40 (0.16-0.99)
Age ≥ 40 years	Ref	1.37 (1.04-1.80)	1.62 (1.13-2.33) [¶]
Impaired fasting glucose			
Total	Ref	1.02 (0.79-1.31)	1.02 (0.72-1.44)
Age < 40 years	Ref	1.21 (0.79-1.86)	0.99 (0.51-1.92)
Age ≥ 40 years	Ref	0.88 (0.64-1.21)	1.03 (0.68-1.56)
Diabetes			
Total	Ref	1.03 (0.59-1.79)	1.02 (0.51-2.04)
Age < 40 years	Ref	0.30 (0.06-1.45)	0.55 (0.10-3.19)
Age ≥ 40 years	Ref	1.40 (0.75-2.61)	1.09 (0.49-2.40)
High LDL-C			
Total	Ref	1.07 (0.88-1.31)	1.14 (0.85-1.52)
Age < 40 years	Ref	0.97 (0.70-1.34)	1.16 (0.70-1.94)
Age ≥ 40 years	Ref	1.13 (0.87-1.47)	1.19 (0.84-1.71)
Low HDL-C			
Total	Ref	1.05 (0.85-1.29)	0.94 (0.68-1.29)
Age < 40 years	Ref	1.08 (0.79-1.48)	0.80 (0.46-1.41)
Age ≥ 40 years	Ref	1.05 (0.79-1.39)	1.07 (0.72-1.59)
Elevated triglycerides			
Total	Ref	1.16 (0.91-1.47)	0.87 (0.62-1.22)
Age < 40 years	Ref	1.00 (0.68-1.47)	0.83 (0.45-1.53)
Age ≥ 40 years	Ref	1.29 (0.95-1.77)	0.89 (0.58-1.35)

Data presented as odds ratio (95% confidence interval). Odds ratio were adjusted for age, sex, marital status, educational level, income, occupation, smoking, health risk due to alcohol consumption, physical activity level and BMI.

* BMI was not adjusted for

§ P-value for trend <0.05

¶ P-value for trend <0.001