The combined relationship between occupational physical activity and self-reported cardiorespiratory fitness with cardiovascular disease mortality: A Prospective Investigation in the Copenhagen City Heart Study

Andreas Holtermann\textsuperscript{a,b}, Jacob Louis Marott\textsuperscript{e}, Finn Gyntelberg\textsuperscript{d}, Karen Søgaard\textsuperscript{b}, Ole Steen Mortensen\textsuperscript{a,f}, Eva Prescott\textsuperscript{c,e}, Peter Schnohr\textsuperscript{c}

\textsuperscript{a}The National Research Centre for the Working Environment, Denmark; \textsuperscript{b}Institute of Sport Science and Clinical Biomechanics, University of Southern Denmark, Denmark; \textsuperscript{c}The Copenhagen City Heart Study, Frederiksberg Hospital, University of Copenhagen, Denmark; \textsuperscript{d}The Copenhagen Male Study, Epidemiological Research Unit, Dept. of Occupational and Environmental Medicine, Bispebjerg Hospital, University of Copenhagen, Denmark; \textsuperscript{e}Department of Cardiology, Bispebjerg Hospital, University of Copenhagen, Denmark; \textsuperscript{f}Department of Occupational Medicine, Køge University Hospital, Denmark

Introduction

A high occupational physical activity (OPA) in combination with low cardiorespiratory fitness may lead to excessive strain and higher risk of cardiovascular disease (CVD). Therefore, international recommendations favour a balanced relationship between the OPA and cardiorespiratory fitness for reducing overall risk of cardiovascular overstrain of workers. However, we are only aware of very few previous prospective studies investigating and supporting this international recommendation (Holtermann et al 2010; Clays et al 2014). Further investigations of the importance of the balance between OPA and cardiorespiratory fitness on the risk of CVD are needed. Therefore, we investigated the combined effects of OPA and self-reported cardiorespiratory fitness (SRCF) on cardiovascular and all-cause mortality in a prospective population study.

Method

2190 males and 2534 females from the Copenhagen City Heart Study without known CVD at study entry in 1991-94 were analyzed with multivariate Cox proportional hazards regression for the risk of CVD and all-cause mortality up to 2012 from combinations of self-reported OPA (i.e. low, moderate and high) and SRCF (i.e. lower, same and better as peers) at baseline. Stratified analyses on SRCF were also performed.

Results

During a median follow-up of 18.5 years, 257 individuals died from CVD and 852 from any cause. In the fully adjusted Cox model for classic CVD risk factors (i.e. gender, BMI, systolic blood pressure, blood pressure medication, cholesterol, smoking, alcohol consumption, diabetes and leisure time physical activity), income and self-rated health, a significant increased rate of CVD mortality was found among those reporting high OPA and lower SRCF (HR: 5.26, 95% CI: 2.12-13.04), compared to those reporting low OPA and better SRCF. Among those with lower SRCF, those reporting high OPA had a significantly higher rate of CVD mortality compared to those reporting low OPA (HR: 2.89, 95% CI: 1.26-6.64). Among those with same and
better SRCF respectively, those reporting high OPA did not have a significantly higher rate of CVD mortality compared to those reporting low OPA (HR: 1.30, 95% CI: 0.86-1.97; HR: 1.85, 95% CI: 0.76-4.52). Weaker and non-significant associations were found for all-cause mortality.

Discussion
The results support the classic notion that the combination of OPA and cardiorespiratory fitness is important for the risk of CVD mortality among workers. The finding of a multi-adjusted Hazard ratio of more than 5 for CVD mortality among workers with the combination of high OPA and lower SRCF compared to workers with low OPA and better SRCF highlights the significance of these factors for occupational health. Guidelines and occupational initiatives for promoting a healthy balance between OPA and cardiorespiratory fitness among workers are encouraged.

Reference