

## COHORT PROFILE

# Cohort Profile: The Helsinki Health Study

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**Accepted** 20 February 2012

### Summary

The Helsinki Health Study cohort was set up to enable longitudinal studies on the social and work related determinants of health and well-being, making use of self-reported as well as objective register data. The target population is the staff of the City of Helsinki, Finland. Baseline data for the cohort were derived from questionnaire surveys conducted in 2000, 2001 and 2002 among employees reaching 40, 45, 50, 55 or 60 years of age in each year. The number of responders at baseline was 8960 (80% women, response rate 67%). Additional age-based health examination data were available. A follow up survey was conducted in 2007 yielding 7332 responders (response rate 83%). Measures of health include health behaviours, self-rated health, common mental disorders, functioning, pain, sleep problems, angina symptoms and major diseases. Social determinants include socio-demographics, socio-economic circumstances, working conditions, social support, and work-family interface. Further register linkages include sickness absence, hospital discharge, prescribed drugs, and retirement updated at the end of 2010. The cohort allows comparisons with the Whitehall II study, London, UK, and the Japanese Civil Servants Study from western Japan. The cohort data are available for collaborative research at Hjelt Institute, Department of Public Health, University of Helsinki, Finland.

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## Why was the cohort setup?

The Helsinki Health Study was set up in the late 1990s at the University of Helsinki, Finland, to enable focused studies on social- and work-related determinants of health and well-being. Researchers from the Departments of Public Health and Sociology looked for an opportunity to establish a cohort to be followed up over time, including reliable subjective and objective measurements of health, and allowing for more analytical studies than those based on repeated cross-sectional design. Although Finland has good register data sources and population-wide cross-sectional surveys, longitudinal cohort studies

with opportunities for prospective register linkages are few.

Following our collaboration with the Whitehall II study on London-based British civil servants<sup>1</sup> an occupational cohort was formed including employees of the municipality of the City of Helsinki, the capital of Finland and the largest single employer in the country with almost 40 000 employees. To be able to establish the study, ethical approval for the Helsinki Health Study protocol was received from the ethics committees of the health authorities of the City of Helsinki and the Department of Public Health, University of Helsinki. Permissions were obtained from the City of

Helsinki to collect survey data among the staff and to have access to the employer's retrospective and prospective personnel register data. Major funding has been received from the Academy of Finland and the Finnish Work Environment Fund. The study is based at the Hjelt Institute, Department of Public Health, University of Helsinki, Finland.

## What does it cover?

The principal scientific interest is in reliable and multi-faceted analysis of social- and work-related determinants of health over time. More specifically, the study includes five main emphases: (i) a comprehensive focus on domains of health and well-being, in particular on functioning, sickness absence and disability retirement due to main diagnostic causes, i.e. musculoskeletal and cardiovascular diseases and mental disorders; (ii) a comprehensive socio-economic focus including domains ranging from parental to own adult socio-economic circumstances as determinants of various indicators of health and well-being; (iii) a comprehensive focus on work environment including work arrangements, physical as well as psychosocial working conditions and work-family interface as determinants of employee health, functioning and well-being; (iv) a focus on analyses of health trajectories, in particular, among employees approaching the end of their work career and subsequent transition to retirement; and (v) a focus on social- and work-related determinants of health and well-being in comparable public sector cohorts from Finland, Britain and Japan.<sup>2</sup>

## Who is in the cohort?

The target population is the staff of the municipality of the City of Helsinki. The municipality is in charge of general local administration, health care, social welfare, education and culture, public transport and technical services. The staffs include hundreds of different occupations from manual workers to non-manual clericals, professionals and managers. Of all the employees, ~70% are women, as in the Finnish municipal sector in general. At baseline, 7% of men and 13% of women worked part-time reflecting the Finnish labour market where women work full-time more often than in many other countries.<sup>3</sup> Over 90% had permanent job contracts. All employees share the same personnel administration, registration and policies, as well as occupational health care. At baseline, the employees lived in Southern Finland in the Helsinki metropolitan area that has a population of about one million.

Baseline data for the cohort were derived from questionnaire surveys conducted in 2000, 2001 and 2002 among employees who reached 40, 45, 50, 55 or 60 years of age in each year (Figure 1). The total

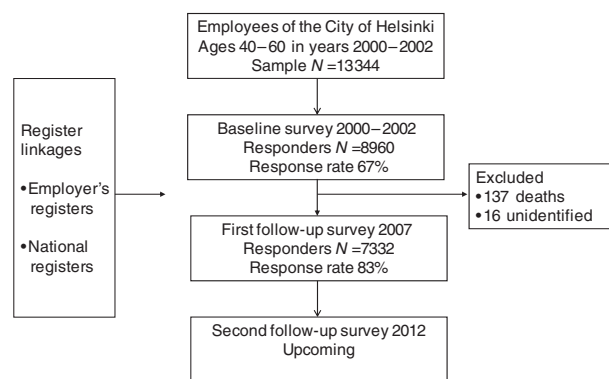


Figure 1 Helsinki Health Study cohort data collection

sample included 13 344 employees (78% women). Questionnaires were sent through the workplace internal mail system if possible, otherwise through ordinary mail. Missing addresses were followed up from the national Population Register Centre. Two reminders were sent, of which the latter included another copy of the questionnaire. The final number of responders at baseline amounted to 8960 (80% women, response rate 67%).<sup>4</sup>

Additional data were available for a subset of the cohort from routine health examinations made by qualified nurses as part of occupational health care. Employees reaching 40, 45, 50, 55 or 60 years of age in 2000, 2001 and 2002 were invited to these examinations ( $n=13\,923$ ). The invited largely covered the sample of the baseline questionnaire survey. However, the time period differed slightly from the survey and somewhat more temporary employees were included. Health examination data were available for 5943 employees who participated in the examinations and provided permission for the use of their data in the study. As participation in the health examinations and baseline surveys was not fully overlapping, data from both sources were available for 3815 participants.<sup>4</sup>

## How often have they been followed up?

The cohort is followed up using survey data, as well as linkages to internal registers of the employer and external registers from various national data sources providing longitudinal data on morbidity, mortality and socio-economic position. All data linkages are made at the individual level using the unique personal identification numbers assigned to each Finnish resident.

In autumn 2007, 5–7 years after the baseline surveys, a first follow-up questionnaire survey was conducted. Those who had died ( $n=137$ ) or could not be

identified due to missing information ( $n=16$ ) were excluded, yielding 8807 baseline participants to whom the follow-up questionnaires were sent. The contents of the questionnaire basically repeated those of the baseline survey, with most questions being identical in both surveys. The number of responders at follow-up was 7332 (82% women, response rate 83%). A second follow-up survey for the baseline responders using repeated measures is scheduled for Autumn 2012 (Figure 1).

Internal register linkages include the employer's personnel register data. These registers cover all employment contracts and sickness absence spells from 1990 onwards to 2010, with annual updates. The employer's internal register data can be linked for analyses with the survey data and health examination data for those consenting to internal linkage ( $n=6988$ , 78% of baseline responders). The internal register data can also be linked with external register data sources available for the cohort.

External linkages include national register data from the early 1990s onwards to 2010, with planned future updates. Register data from the Social Insurance Institute of Finland cover all purchases of prescribed reimbursed medication, granted entitlements to special reimbursements for medication used in the treatment of severe long-term diseases diagnosed by a specialist, as well as long sickness absence spells with medically confirmed diagnoses [International Statistical Classification of Diseases and Related Health Problems (ICD-10)]. Register data from the National Institute for Health and Welfare in Finland cover all hospital discharges and related diagnoses (ICD-10). Register data from the Finnish Centre for Pensions cover all retirement events based on disability, including diagnoses (ICD-10), and age-based retirement events. Causes of death from Statistics Finland will be applied for in the near future. The employer's internal and the national external register data sources can be linked for analyses to the baseline survey for those consenting to both internal and external linkage ( $n=6606$ , 74% of baseline responders). Additionally, data from the health examinations can be linked to the register data sources.

Full internal register data are available for all persons ever employed by the City of Helsinki from 1990 to 2010. The total number of employees during that period is about 140 000. For practically all these employees, external register data are also available. Internal and external register data from the various sources can be linked and analysed in any combination.

## What has been measured?

The data collection from survey, health examination and register sources is summarized in Table 1. The baseline and the first follow-up survey include a broad variety of health-related measures, such as

health behaviours [drinking, e.g. CAGE test for alcohol problems; smoking; physical activity, metabolic equivalent (MET); food habits], self-rated health, common mental disorders [General Health Questionnaire (GHQ-12)], health-related functioning [Short Form (SF-36)], pain (Von Korff), sleep problems (Jenkins), angina symptoms (Rose) and self-reported medically confirmed diseases. Measurements of social determinants of health cover socio-demographics, parental, childhood and adulthood socio-economic circumstances, work arrangements, psychosocial and physical working conditions, social relations and support and work-family interface.

In the health examinations in 2000–02, basic information was asked on health status, health behaviours and work-related factors including work ability [Work Ability Index (WAI)]. Biomarkers included among others, blood cholesterol, blood sugar, blood pressure, height and weight, body mass index (BMI), as well as waist and hip circumference, all measured by qualified occupational nurses.

The employer's internal personnel registers cover details of each employment contract and record each sickness absence spell including its length for all employees of the City of Helsinki. Absence due to accidents as well as other causes such as caring for a sick child can be distinguished.

The external register data from national sources on long-term sickness absence, purchases of prescribed reimbursed medication, as well as specially reimbursed medication, hospital discharge and disability retirement are available until the end of 2010 with plans for future updates, at least until 2015. These register data are available for practically all participants. Medically confirmed diagnoses are available from the external register sources except for medication for which the Anatomical Therapeutic Chemical (ATC) classification by the WHO is used.

## What are non-participation and attrition like?

The overall response rate to the baseline survey was 67% (women: 69%, men: 60%). The response rate tended to be lower for responders who were younger, in lower occupational classes and with longer sickness absence during the study year. However, these differences were relatively minor and not fully consistent. Further details are available in our non-response analyses.<sup>4,5</sup>

Attrition at baseline was examined comparing responders and non-responders by characteristics available from the internal registers of the employer. For both women and men, the proportion of non-responders was somewhat higher among those aged 55–60 years than their younger counterparts (Table 2). Manual men as well as both women and

**Table 1** Summary of survey and register data in Helsinki Health Study

	Baseline survey 2000–02 ( <i>N</i> = 8960)	Follow-up survey 2007 ( <i>N</i> = 7332)	Health examinations 2000–02 ( <i>N</i> = 5943)	Employer's registers 1990–2010	National registers 1990–2010
<b>Socio-demographics</b>					
Age, gender, living arrangements	x	x	x	x	x
<b>Socio-economic circumstances</b>					
Parental education	x				
Own education	x			x	x
Occupational class	x	x		x	
Income	x	x		x	
Housing tenure	x	x			
Wealth		x			
Economic difficulties	x	x			
Childhood adversities (economic, social, health)	x	x			
<b>Working conditions</b>					
Arrangements (shift work, overtime work, contract)	x	x		x	
Psychosocial (job strain, bullying, justice, work–family interface)	x	x	x		
Physical (workload, hazardous exposures, sedentary work)	x	x	x		
<b>Self-reported health</b>					
General	x	x			
Mental (GHQ-12)	x	x			
Functioning (SF-36)	x	x			
Musculoskeletal	x	x			
Pain (Von Korff)	x	x			
Angina symptoms (Rose)	x	x			
Major diseases	x	x	x		
Work ability (WAI)			x		
<b>Register-based health data</b>					
Sickness absence (ICD-10)				x	x
Hospital discharge (ICD-10)					x
Prescribed medication (ATC)					x
Special reimbursed medication					x
Mortality and causes of death					x
<b>Health behaviours/risk factors</b>					
Drinking (amount, binge, CAGE)	x	x	x		
Smoking (current, quitting)	x	x	x		
Physical activity (MET)	x	x	x		
Food habits	x	x			
Sleep (duration, problems)	x	x			
Height and weight (BMI)	x	x	x		
Waist and hip circumference			x		
Serum cholesterol	x	x	x		x
Blood pressure	x	x	x		x
Heart rate			x		
Retirement (old age, disability; ICD-10)	x	x			x

**Table 2** Percent distributions of Helsinki Health Study baseline survey (2000–02) responders and non-responders, and consenters and non-consenters to data linkage by background characteristics, women and men

	Women		Men		Women		Men	
	Responders (N = 7154)	Non-responders (N = 3189)	Responders (N = 1790)	Non-responders (N = 1211)	Consenters (N = 5185)	Non-consenters (N = 1969)	Consenters (N = 1420)	Non-consenters (N = 376)
<b>Age (years)</b>								
40	21	23	18	23	20	21	17	21
45	22	24	20	21	22	21	20	19
50	22	22	21	22	22	22	21	22
55	25	20	27	25	25	24	28	23
60	11	10	15	9	12	11	15	15
All	100	100	100	100	100	100	100	100
<b>Occupational class</b>								
Managers and professionals	27	25	43	33	29	22	44	37
Semi-professionals	18	16	19	16	19	16	20	16
Routine non-manual workers	42	45	10	9	41	46	10	13
Manual workers	12	15	28	43	11	15	26	35
All	100	100	100	100	100	100	100	100
<b>Sickness absence (days)</b>								
<4	54	49	67	61	57	52	68	65
4–14	21	21	15	21	21	23	15	15
≥15	25	30	18	19	22	25	17	20
All	100	100	100	100	100	100	100	100

men with sickness absence longer than 4 days were also overrepresented among the non-responders.

Similar comparisons were made between consenters and non-consenters to data linkage. Differences by age were relatively small (Table 3). Manual men and to some extent women and men with sickness absence >4 days were overrepresented among the non-consenters.

At baseline in 2000–02, the cohort participants were aged 40–60 years, and they all were employed by the City of Helsinki. Over the follow-up in 2007, 8% of the baseline survey participants had changed their employer and 20% left employment primarily due to retirement. By the end of 2010, 9% had retired due to disability and 20% due to old age.

The overall response rate to the follow-up survey was 83% (women: 85%, men: 78%). As at baseline, the response rate at follow-up tended to be lower for responders who were younger, in lower occupational classes and with poorer health (data not shown). These differences were not fully consistent and they were smaller than those at baseline. Even at its lowest, the follow-up response rate among men aged 68 years and manual men (68%) can be regarded as satisfactory.

Comparing responders and non-responders at follow-up by baseline characteristics shows that the responders were older than non-responders, and this

was somewhat more so among men than women (Table 3). Manual men, as well as women with less than good self-rated health and men with common mental disorders were to some extent overrepresented among non-responders. Men with high physical workload were also somewhat overrepresented among non-responders.

Comparisons between responders and non-responders at baseline and at follow-up, as well as consenters and non-consenters at baseline suggest some signs of attrition. This concerns mostly manual men who were overrepresented among non-responders and non-consenters. Attrition due to health and workload was less likely. We acknowledge that non-response and attrition are potential sources of bias and need to be considered in particular among manual men. Nevertheless, overall such bias is unlikely to substantially distort analyses of relative risks of health outcomes.

## What has been found? Key findings and publications

Analyses of the Helsinki Health Study cohort have provided a number of findings across the five main focuses of the study.

**Table 3** Percent distributions of Helsinki Health Study follow-up survey (2007) responders and non-responders by baseline survey characteristics (2000–02), women and men (%)

	Women		Men	
	Responders ( <i>N</i> = 5857)	Non-responders ( <i>N</i> = 1102)	Responders ( <i>N</i> = 1352)	Non-responders ( <i>N</i> = 389)
<b>Age (years)</b>				
40	20	27	16	26
45	21	26	18	24
50	22	20	20	24
55	25	19	29	20
60	12	8	17	6
All	100	100	100	100
<b>Occupational class</b>				
Managers and professionals	27	26	46	35
Semi-professionals	19	16	19	19
Routine non-manuals	42	45	10	10
Manual workers	12	14	25	36
All	100	100	100	100
<b>Self-rated health</b>				
Good	74	69	72	71
Less than good	26	32	28	29
All	100	100	100	100
<b>Common mental disorders (GHQ-12)</b>				
No	75	72	78	73
Yes	25	28	22	27
All	100	100	100	100
<b>Physical workload</b>				
Low	60	59	85	80
High	40	41	15	20
All	100	100	100	100
<b>Mental workload</b>				
Low	23	27	26	25
High	77	73	74	75
All	100	100	100	100

Firstly, a broad spectrum of outcomes is covered to enable a comprehensive picture of health and well-being among the target population. For example, there are consistent socio-economic differences in health outcomes across the subjective, functional and medical domains.<sup>3</sup>

Second, applying comprehensive analytic frameworks simultaneously including parental, childhood and adult socio-economic circumstances has confirmed that several indicators of socio-economic circumstances, independently of each other, are associated with various health-related outcomes.<sup>6–8</sup>

Economic difficulties,<sup>7,9,10</sup> as well as wealth,<sup>11</sup> over and above income and other conventional socio-economic indicators, have shown strong associations with health outcomes such as self-rated health, common mental disorders and physical functioning.

Third, examining a broad range of working conditions, the physical as well as psychosocial conditions have shown associations with self-reported general and mental health outcomes.<sup>12</sup> For sickness absence<sup>13</sup> and early retirement due to disability,<sup>14</sup> physical working conditions and job control have stood out. For chronic pain, psychosocial working conditions

have stood out.<sup>15</sup> However, for health behaviours<sup>16</sup> and psychotropic medication,<sup>17</sup> both physical and psychosocial working conditions have been largely unimportant.

Fourth, a number of studies on health trajectories utilizing the follow-up design and longitudinal register data linkages have been made. Over the 5–7 years' follow-up, socio-economic differences in physical health functioning (SF-36) have widened among both women and men.<sup>18</sup> Such widening is due to disproportionately faster decline in functioning among the lower classes. The key explanations include health behaviours among women and physical working conditions among men. In contrast, socio-economic differences in food habits have remained stable.<sup>19</sup> Further studies confirm that sleep problems,<sup>20</sup> chronic pain<sup>21</sup> and mental problems<sup>16</sup> are among the forces driving employees prematurely to retirement due to disability. Transition to mandatory retirement due to old age is likely to lead to healthier food habits<sup>22</sup> and increasing physical activity.<sup>23</sup>

Fifth, international comparisons with the British Whitehall II study and the Japanese Civil Servants Study reconfirm socio-economic differences in physical health functioning<sup>2,24</sup> as well as health behaviours, smoking in particular, in Finland and Britain.<sup>25</sup> Among Japanese women, socio-economic differences in health-related outcomes are inconsistent or non-existent. Comparative analyses also reconfirm weak associations between working conditions and health behaviours.<sup>26</sup>

## What are the main strengths and weaknesses?

The Helsinki Health Study cohort is large and versatile in terms of the measurement of health and social and work-related determinants. A major strength is the availability of reliable and complete retrospective and prospective register data on health outcomes linked with the survey-based data. Another strength is the large variety of health indicators and their determinants in the surveys. A limitation of the survey information is that it derives from self-reports, which are subject to potential reporting bias. The registers provide more objective data including medically confirmed diagnoses thus complementing self-reports of health and well-being.

The cohort is based on middle-aged municipal employees and is not representative of the Finnish general population, not even of the labour force at large. The spectrum of jobs however covers a large number of non-manual, as well as manual occupations. Nevertheless, this occupational cohort has little to say about non-employed people who tend to have poorer health than their employed counterparts.<sup>27</sup> Participation in the baseline survey was satisfactory and higher in the follow-up. Linking register data to

the survey data needed consent from the participants, which was given by 74%. Our non-response and attrition analyses suggest that the participants and consenters broadly represent the target population.

## Can I get hold of the data? Where can I find out more?

The Helsinki Health Study cohort offers wide opportunities for further longitudinal and comparative analyses across various domains of health and well-being in the social and work context. The data are kept at the Hjelt Institute, Department of Public Health, University of Helsinki, Finland. The team welcomes research proposals and initiatives. Collaboration is promoted and interested researchers and teams are encouraged to contact the Helsinki Health Study group, head Eero Lahelma (e-mail: eero.lahelma@helsinki.fi). Further information can be found at the study website ([www.hjelt.helsinki.fi](http://www.hjelt.helsinki.fi)).

## Collaboration

Collaboration with the Whitehall II study, UCL, London, UK, supported the setting up of the cohort and the baseline data collection. Collaboration with the Japanese Civil Servants Study, University of Toyama, Japan, which also has benefited from the Whitehall II study procedures, has enabled joint comparative studies between the three cohorts.<sup>23–25</sup> Collaboration with the City of Helsinki supported the baseline data collection and has provided data from the employer's registers. Substudies are carried out in broad collaboration with national and international partners from universities and research institutes.

## Funding

Funding for the Helsinki Health Study has been received from the Academy of Finland, and the Finnish Work Environment Fund.

## Acknowledgements

The authors would like to thank Olli Pietiläinen for his help in the statistical analyses for the paper. We acknowledge the City of Helsinki, its personnel administration and occupational health care, as well as all participating employees; the Whitehall II study; the Japanese Civil Servants Study; and the register data providers including the Finnish Centre for Pensions, the National Institute for Health and Welfare, and the Social Insurance Institution.

**Conflict of interest:** None declared.

## KEY MESSAGES

- Consistent differences in subjective, functional and medical domains of health across several socio-economic indicators, including less studied economic difficulties and wealth, have been confirmed.
- Work-related determinants of general and mental health, sickness absence and disability retirement include both physical and psychosocial working conditions.
- Socio-economic differences in physical health widened over the follow-up among both women and men due to disproportionately faster decline of health in the lower classes. Explanations include health behaviours as well as physical working conditions.
- Comparisons with British and Japanese employees reconfirm socio-economic differences in physical health and health behaviours in Finland and Britain but not among Japanese women.

## References

- Marmot M, Brunner E. Cohort Profile: the Whitehall II study. *Int J Epidemiol* 2005;**34**:251–56.
- Sekine M, Tatsuse T, Kagamimori S *et al.* Sex inequalities in physical and mental functioning of British, Finnish, and Japanese civil servants: role of job demand, control and work hours. *Soc Sci Med* 2011;**73**:595–603.
- Lahelma E, Martikainen P, Rahkonen O, Roos E, Saastamoinen P. Occupational class inequalities across key domains of health: results from the Helsinki Health Study. *Eur J Public Health* 2005;**15**:504–10.
- Laaksonen M, Aittomäki A, Lallukka T *et al.* Register-based study among employees showed small nonparticipation bias in health surveys and check-ups. *J Clin Epidemiol* 2008;**61**:900–06.
- Martikainen P, Laaksonen M, Piha K, Lallukka T. Does survey non-response bias the association between occupational social class and health. *Scand J Public Health* 2007;**35**:212–15.
- Laaksonen M, Sarlio-Lähteenkorva S, Lahelma E. Multiple dimensions of socioeconomic position and obesity among employees: the Helsinki Health Study. *Obes Res* 2004;**12**:1851–58.
- Laaksonen M, Rahkonen O, Martikainen P, Lahelma E. Socioeconomic position and self-rated health: the contribution of childhood socioeconomic circumstances, adult socioeconomic status, and material resources. *Am J Public Health* 2005;**95**:1403–09.
- Lahelma E, Martikainen P, Laaksonen M, Aittomäki A. Pathways between socioeconomic determinants of health. *J Epidemiol Community Health* 2004;**58**:327–32.
- Lahelma E, Laaksonen M, Martikainen P, Rahkonen O, Sarlio-Lähteenkorva S. Multiple measures of socioeconomic circumstances and common mental disorders. *Soc Sci Med* 2006;**63**:1383–99.
- Laaksonen E, Martikainen P, Head J, Rahkonen O, Marmot M, Lahelma E. Associations of multiple socio-economic circumstances with physical functioning among Finnish and British employees. *Eur J Public Health* 2009;**19**:34–45.
- Aittomäki A, Martikainen P, Lahelma E, Laaksonen M, Rahkonen O. The associations of household wealth and income with self-rated health—A study on economic advantage in middle-aged Finnish men and women. *Soc Sci Med* 2010;**71**:1018–26.
- Laaksonen M, Rahkonen O, Martikainen P, Lahelma E. Associations of working conditions with self-rated general health and mental health among municipal employees. *Int Arch Occup Environ Health* 2006;**79**:205–12.
- Laaksonen M, Pitkäniemi J, Rahkonen O, Lahelma E. Work arrangements, physical working conditions and psychosocial working conditions as risk factors for sickness absence. Bayesian analysis of prospective data. *Ann Epidemiol* 2010;**20**:332–38.
- Leinonen T, Pietiläinen O, Laaksonen M, Rahkonen O, Lahelma E, Martikainen P. Occupational social class and disability retirement among municipal employees—the contribution of working conditions and health behaviours. *Scand J Work Env Health* 2011;**37**:464–72.
- Saastamoinen P, Laaksonen M, Leino-Arjas P, Lahelma E. Psychosocial risk factors of pain among employees. *Eur J Pain* 2009;**13**:102–08.
- Lallukka T, Sarlio-Lähteenkorva S, Roos E, Laaksonen M, Rahkonen O, Lahelma E. Working conditions and health behaviours among employed women and men. The Helsinki Health Study. *Prev Med* 2004;**38**:48–56.
- Laaksonen M, Lallukka T, Lahelma E, Partonen T. Working conditions and psychotropic medication: a prospective cohort study. *Soc Psych Psych Epid* 2012;**47**:663–70.
- Pietiläinen O, Laaksonen M, Pitkäniemi J, Rahkonen O, Lahelma E. Changes of occupational class differences in physical functioning: a panel study among employees 2000–2007. *J Epidemiol Community Health* 2012;**66**:265–70.
- Seiluri T, Lahelma E, Rahkonen O, Lallukka T. Changes in socio-economic differences in food habits over time. *Public Health Nutr* 2011;**14**:1919–26.
- Lallukka T, Haaramo P, Lahelma E, Rahkonen O. Sleep problems and disability retirement: A register-based follow-up study. *Am J Epidemiol* 2011;**173**:871–81.
- Saastamoinen P, Laaksonen M, Kääriä S-M *et al.* Pain and disability retirement: a follow up study. *Pain* 2012;**153**:526–31.
- Helldán A, Lallukka T, Rahkonen O, Lahelma E. Changes in healthy food habits after transition to old age retirement. *Eur J Public Health* 2012;**22**:582–86.
- Lahti J, Laaksonen M, Lahelma E, Rahkonen O. Changes in leisure-time physical activity after transition to retirement: a follow-up study. *Int J Behav Nutr Phys Act* 2011;**8**:36.
- Martikainen P, Lahelma E, Marmot M, Sekine M, Nishi N, Kagamimori S. A comparison of socioeconomic differences in physical functioning and perceived health



- among male and female employees in Britain, Finland and Japan. *Soc Sci Med* 2004;**59**:1287–95.
- <sup>25</sup> Lahelma E, Lallukka T, Laaksonen M *et al*. Social class differences in health behaviours among employees from Britain, Finland and Japan: The influence of psychosocial factors. *Health Place* 2010;**16**:61–70.
- <sup>26</sup> Lallukka T, Laaksonen E, Martikainen P *et al*. Associations of job strain and working overtime with adverse health behaviors and obesity: Evidence from the Whitehall II Study, Helsinki Health Study and Japanese Civil Servants Study. *Soc Sci Med* 2008;**66**:1681–98.
- <sup>27</sup> Martikainen P, Valkonen T. Bias related to the exclusion of the economically inactive in studies on social class differences in mortality. *Int J Epidemiol* 1999;**28**:899–904.