

Psychosocial factors and health: the Finnish Public Sector study (FPS) – Kuntasektorin henkilöstön seuranta tutkimus

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1. Background

1.1 Psychosocial work environment

Several studies have demonstrated the association between job characteristics and various aspects of health (e.g., cardiovascular mortality and morbidity, sickness absence, mental health, self-rated health status) (Hemingway & Marmot 1999). Two leading models of work and health suggest that the combination of high demands and low job control and/or poor social support or an effort-reward imbalance represent psychosocial health risks at work (Karasek and Theorell 1990; Siegrist 1996; Kivimäki et al. 2002). Surveys by Statistics Finland show that in the beginning of 1990s a total of 300,000 Finnish employees worked under adverse psychosocial work conditions, as indicated by high demands and low job control. At the end of the decade, the corresponding number of employees was 570,000.

Other potential psychosocial risk factors have also been suggested. For example, poor organisational justice (Elovainio et al. 2002) and poor control over working times (Ala-Mursula et al. 2004), interfering a successful integration of work and private lives, have been associated with several health outcomes. Evidence from the Whitehall II study on reduced health risk after favourable change in organisational justice implies a promising area for health interventions at workplace (Kivimäki et al. 2005). Consequently, policy implications of prior studies have included strategies to change the work environment toward a direction in which job characteristics indicate lower health risk. However, evidence showing that a *change* in or *cumulated exposure* to job characteristics is really followed by a *change* in health is still sparse.

From the health point of view, work is not only a source of psychosocial stress, but it is central for adult life in many other ways. Besides being a principal prerequisite for continuous income opportunities, work role relates to recurrent options of belonging to some significant group. Working-age population spend a considerable part of their time in the work settings. Not surprisingly, workplace has been suggested to represent an important source of social capital (Kawachi 1999). Social capital can be defined as a community level resource referring to interpersonal trust, norms of reciprocity, mutual aid and other features of social structure that facilitate collective action for mutual benefit. Such social capital may take different forms in different settings. However, research on social capital in work settings is still sparse (Kawachi 1999, Liukkonen et al. 2004). Studies on changes in organisations would further improve opportunities to evaluate causality between social capital, health and well-being and, in addition, help workplaces to identify important targets to organisational development. Besides well-being, social capital is assumed to facilitate cooperation and coordination and should therefore be studied as a potential contributing factor to increased productivity.

1.1.1 Structural changes in organisations

The importance of a better understanding of the effects of psychosocial factors on health is further underlined as organisational changes, such as alterations in the national and global economy, international competition, the rapid pace of technological change, use of atypical employment, and personnel reductions, are increasingly common in modern work life with the advent of the global economy (Virtanen et al. 2003). Such changes have partially contributed to adverse changes in psychosocial work environment and health. Downsizing has been found to be associated with an increased risk of death from cardiovascular disease as well as heightened morbidity, as indicated by long-term sickness absence, musculoskeletal symptoms, poor self-rated

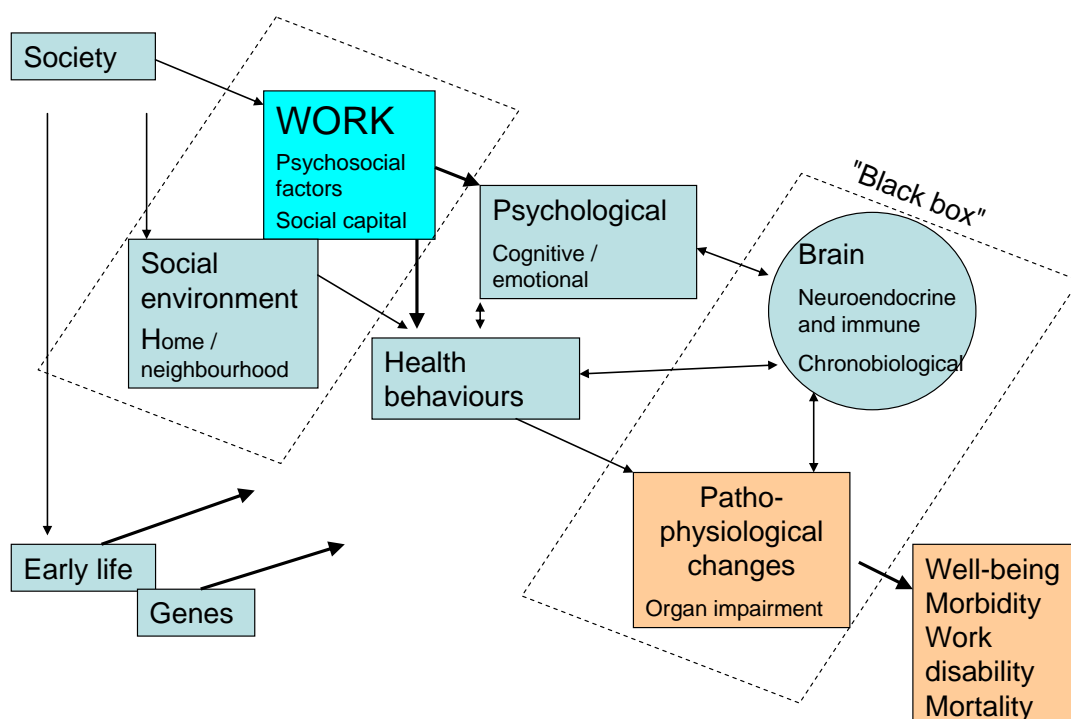
health and health complaints (Vahtera et al 2004). Increased morbidity is a risk factor for disability retirement, which is a great burden to the individual and extremely costly for society. A strong association found between downsizing and incidence of disability retirement among employees at a relatively young age link the problem of disability pensioning to common changes in modern work life (Vahtera et al 2005).

1.1.2 Environment and illness

The role of environment in producing chronic as well as acute illness merits attention as predictors of chronic illness (e.g. health behaviours, social factors such as social support, job control and fairness of treatment at work, and psychological factors such as hostility and depression) are nested within geographic, developmental, occupational, and social environments. Environmental characteristics may directly influence health and also influence individual characteristics or behaviours that pose risk to health (Taylor et al. 1997). However, the health effects of environments can not be explained only by individual-level factors. Rather, individual characteristics are nested within environments, with each level revealing information about the causes of health and illness that consideration of one level alone cannot provide.

1.2 Research framework: psychosocial pathways to illness

An important part of the research endeavour is to go further, and trace causation from social and psychosocial processes through behaviour and biology to disease. Previous research suggests different interrelated psychosocial pathways whereby environments may get "under the skin" of the individuals (Taylor et al. 1997). A simple model to guide our research of how psychosocial factors might get "under the skin" is illustrated in Figure 1 (see Stansfeld & Marmot 2002).



Modified from Stansfeld & Marmot 2002

Figure 1. Potential psychosocial pathways to illness.

The first route by which environments may have adverse health effect is by differentially exposing people to chronic or repetitive stress. Physiological systems within body fluctuate to meet demands from external forces. Over time, this load builds up as the physiological costs of chronic exposure to neural and neuroendocrine responses that result from repeated or chronic environmental challenges that an individual reacts to as stressful. In this way, the cascading relationships between environmental factors and genetic predispositions lead to large individual differences in susceptibility to stress and the development of illness over the life course (McEwen 1998).

The second route is via an impact on mental health or mental distress. Negative emotions, such as depression, anxiety and hostility, play a significant role in health risks, including all-cause mortality and coronary heart disease risk (Miller et al. 1996). These health effects, not explained by behavioural changes associating with mood disturbances, may result from the activation of both the sympathetic-adrenomedullary system and the hypothalamic-pituitary-adrenocortical axis. Environmental factors have been shown to reliably relate to sustained depression, anxiety, and anger. Thus, mental health constitutes an important pathway by which environments may exert their influence on health (Taylor et al. 1997).

The third route is health related behaviours. Health habits, such as smoking, high alcohol consumption, poor diet and sedentary life style, are important in the development of chronic diseases (Vahtera et al. 2002). Environments constitute the contexts in which health habits are learned, encouraged, and practiced (Kouvonen et al. 2004).

The fourth route considered in this study relates to access to and content of medical care which may be influenced by organisational measures (eg. use of medication, early rehabilitation).

2. Objectives

Based on the model illustrated in **Figure 1**, the objective of the study is to identify psychosocial risk factors among different groups of employees, trace causation from psychosocial work environment through psychological processes and behaviour to disease and estimate the extent to which organisational measures to improve psychosocial work environment are effective in disease prevention and health promotion. Repeated measurements over an extended time window enable examination of exposures affecting trajectories of health in individuals.

Specific aims of the study are to:

Examine the effect of change in and cumulative exposure to traditional and new psychosocial risk factors on mortality, morbidity, early retirement, prescriptions, use of health services, sickness absence and health, when the effects of non-psychosocial risk factors are taken into account.

Examine behavioural, biological, social and psychological mechanisms linking psychosocial factors and health. Although the relationship between psychosocial factors at work and biological diseases such as coronary heart disease is widely studied, the underlying mechanisms are not well understood.

To identify appropriate primary and secondary preventive measures (e.g., rehabilitation and other work disability prevention practices, organisational interventions).

To develop risk prediction models for psychosocial, health, and work disability risks.

3. The data

3.1 Study sample

The Finnish Public Sector Study (FPS), was established in 1997/1998 and is to be continued until 2030. The study, coordinated by the Finnish Institute of Occupational Health, is divided into two arms, the first focusing on employees working in towns (the 10-Town study, PI docent Jenni Ervasti) and the second on employees in hospitals (Work and health in Finnish hospital personnel, PI research prof. Mika Kivimäki). The participating organisations are in the 10-Town study: Helsinki, Espoo, Vantaa, Turku, Tampere, Oulu, Raisio, Nokia, Naantali, Virrat ja Valkeakoski; and in the Hospital personnel study: the hospital districts of Pirkanmaa, Kanta-Häme, and Vaasa; Forssan seudun hyvinvointikuntayhtymä; and Pietarsaaren sosiaali- ja terveystyövirasto. The Ethics committee of the Finnish Institute of Occupational Health has approved the study in 2006 and the Ethics committee of Helsinki Uusimaa Hospital District in 2011 and 2016.

3.1.1 The 'old' FPS cohort

The 'old' FPS cohort comprises all 260,240 employees with ≥ 1 day job contract in any year from 1991/1996 to 2005 in 10 towns and 5 hospital districts in Finland. Questionnaire surveys targeted to the 93,782 employees, who were at work in the years 1997/1998 (subcohort), 2000-2002 and/or 2004. Of them, 70,376 participants responded at least once (response rate 74%). In each survey, identifiable questionnaire data on psychosocial factors at work, individual factors, health and health behaviours have been gathered. All respondents have been followed up with repeated surveys in 2 to 4-year intervals regardless of whether they have still been employed by the organisations during the time of the follow-up survey. During 1997-2019, 57 358 participants had participated in >3 surveys and 38 862 >4 four surveys (mean 3.9, range 1-10).

3.1.2 The 'new' FPS cohort

The new FPS cohort represents a refreshment sample comprising 217 871 employees who had ≥ 1 day job contract in any year between 2006-2016 in the target organisations and who were not members of the old FPS cohort because they entered the service of the target organisations after the old cohort was closed. 85 717 of them have been employed in the target organisations during a survey and, therefore, have been eligible for participating to at least one survey. A total of 67 335 have responded at least once.

As in the old FPS, the new FPS cohort members have been informed that participation is voluntary. They have also been informed about follow-up surveys and linkages to employers' and national health registers. HUS Ethics committee approved the 'new' cohort in 2016 (HUS/1210/2016).

3.1.3 The extended cohort and register-linkage

The extended cohort combines both the 'old' and the 'new' FPS cohort members and, thereafter, comprise 478 111 public sector employees. They will be followed by surveys and from national health registers until 2030. These individuals have been linked to employers' registers on all work units, job contracts, absence from work (does not include sickness absence diagnoses) and

workplace characteristics up to 2019. For the ‘old’ cohort, the following data was retrieved from the Social Insurance Institution of Finland: granted special reimbursements for severe and chronic illnesses, annual number of prescriptions of medicines based on the ATC-DDD (Anatomical Therapeutic Chemical) classification, sickness absence longer than 9 days with diagnoses, and granted rehabilitation up to 2016. For the extended cohort, the following data from other national registers has been retrieved: from the Finnish Centre for Pensions data on pensions with related diagnoses, as well as earning history up to 2018; from the Finnish Institute for Health and Welfare data on hospital discharge register (time and diagnosis of hospitalisations), and data on time and diagnosis of cancer morbidity up to 2016; from the Statistics Finland data on occupation, education, and all-cause and cause-specific mortality up to 2018; from the Workers’ Compensation Center data on occupational accidents, injuries and illness; from the Population Register Centre data on living area and the GPS coordinates of the participants’ residential addresses up to 2011 (update in process).

3.2 Survey data

The baseline and follow-up surveys consist of repeated measurements of a comprehensive set of psychosocial, medical and behavioural variables using well-validated scales (see **Table 1**).

Psychosocial variables include job control, possibilities for participation, work time control, organisational justice, team climate, components of work-related social capital, job satisfaction, job demands, workload, effort-reward imbalance, job insecurity, discrimination, changes at work, paid work hours, social support, work-home interference, domestic responsibilities and work hours, adverse life events and their timing, violence, harassment and bullying at work, work engagement, and recovery from work.

Behavioural and biological risk factors include smoking, alcohol intake, leisure-time physical activity, and height and weight (body mass index).

Psychological factors include optimism and pessimism, sense of coherence, impulsiveness, hostility, anxiety, psychological distress, life satisfaction and early retirement attitudes.

Health outcomes include self-rated health status, work capacity, self-reported diseases, sleep duration and sleep disturbances.

3.3 Register data

3.3.1 Employers’ registers

Register data on all employees of their job contracts, work units, and work unit characteristics have been collected annually from the employers' records from 1990/2000 onwards. Data include the beginning and end of job contract, type of job contract, occupational title, working times, the beginning and end of absence from work. Based on work unit identification codes, we can calculate contextual (2-level) variables, such as size of work unit, the proportion of men/temporary employees/blue collar employees and independent aggregated work unit mean scores from the survey responses of employees in the work unit (and co-worker scores that are independent of the respondent’s score). The data also include information about the planning of shifts with TITANIA © (CGI) software programme and the changes made to improve working times to be healthier (“natural working time interventions”).

3.3.2 National health registers

The study has linked the existing data of the extended FPS cohort to the following data from national registers:

1. The Social Insurance Institution of Finland (Kela) data on the granted special reimbursements for severe and chronic illnesses (1980-2016), annual number of prescriptions of medicines based on the ATC-DDD (Anatomical Therapeutic Chemical) classification by the National Agency for Medicines (1994-2016), granted rehabilitation (1993-2016) and data on sickness absence and their diagnoses (1993-2016). These data are for the 'old' cohort only.
2. The Finnish Centre for Pensions data on individual work history, retirement dates, disability pension and related diagnoses (1994-2018).
3. The Finnish Institute for Health and Welfare data on the time and diagnosis of cancer morbidity (1980-2016), and data on hospitalisations from the hospital discharge register (1980-2016).
4. Statistics Finland data on overall and cause-specific mortality, education, occupation (1990-2018), grid database (2000-2015).
5. Workers' Compensation Center data on work-related accidents, injuries, and illness (1996-2018).
6. The Population Register Centre data on locations of residence, date of death, date of moving abroad, mother language (2000-2011, update on process).

The extended cohort will be followed until 31.12.2030. The data linkages are updated at about 5-year intervals.

Table 1. Phases of the FPS study

	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2010	2011-2019
N of employees with ≥ 1 day job contract Eligible population for the surveys		OLD COHORT 260,240 employees 93,782 employees	in 1991/96-2005	NEW COHORT 217,871 employees 85,717 employees	in 2006-2019
Mean age (range)	34.4 (18-63) in 1990	37.2 (18-68) in 1995	41.0 (18-73) in 2000	45.7 (18-78) in 2005	46,9 (17-77) in 2010
Total number of respondents		Respondents†: 1997: 16,948 (70%)	Respondents†: 2000: 48,598 (68%) 2004: 48,076 (66%)	Respondents†: 2006: 34,418 (69%) 2008: 52,891 (69%) 2010: 37,651 (69%)	Respondents: 2011: 13,883 (71%) 2012: 39,250 (69%) 2013: 12,963 (67%) 2014: 62,748 (69%) 2015: 12,952 (69%) 2016: 65,089 (72%) 2017: 9030 (74%) 2018: 64,066 (71%) 2019: 9018 (67%)
INDIVIDUAL LEVEL DATA					
Sociodemographic data					
Occupational grade	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Occupation (ISCO code), work career	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Education	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Type of job contract	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Work unit code	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Marital status‡	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Household size, number of children‡	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)
Location of residence ‡	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)
Type of the building ‡	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)
Labor market participation					
Employment history‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Unemployment‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Retirement‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Psychosocial work environment					
Work stress, organisational injustice	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Job insecurity	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Social capital, Social support	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Worktime control	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Working hours (paid, domestic, commuting)	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . . .	✓ ✓ ✓
Violent incidents at work and their timing	. . . . .	. . . . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Health behaviours					
Smoking status, smoking intensity	. . . . .	. . ✓ . .	✓ . . ✓ .	✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Alcohol intake (g/week)	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

Leisure-time physical activity	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Weight, height, BMI	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Optimism and pessimism (LOT-R)	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓
Life events and their timing	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .
Childhood adversities	. . . . .	. . . . .	. . . . .	. . . ✓ .	✓ ✓ ✓ ✓ ✓
Health	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .
Sleep duration, sleep disturbances	. . . . .	. . . . .	✓ . . ✓ .	✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Mental health (trait anxiety, GHQ-12)	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Self-rated health	. . . . .	. . ✓ . .	✓ . . ✓ .	. . . ✓ .	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Sickness absence (diagnoses) ‡ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Filed drug prescriptions (ATC, DDD) ‡ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Special reimbursement to medication ‡ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Rehabilitation (diagnoses) ‡ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Hospital admissions (diagnosis) ‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Cancer (site) ‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Cause-specific mortality ‡	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
CONTEXTUAL DATA					
Work unit characteristics					
mean size	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
absence rate, turnover rate	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
age structure	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
Neighbourhood characteristics (small area of 250*250 m ²)					
mean income, ‡	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)
unemployment rate ‡	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)
educational level, etc. ‡	. . . . .	. . . . .	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ (TO BE UPDATED)

†Questionnaires targeted to those cohort members who were at work during the survey (respondents who later left the organisations were targeted in the 2005 and 2009 surveys).

‡Update of register data for the years 1990-2016 in 2017 ; update of register data for the years 2017-2019 in 2020

4. Funding

The main funders have been the participating organisations (the cities of Helsinki, Espoo, Vantaa, Turku, Tampere, Oulu, Raisio, Nokia, Naantali, Virrat ja Valkeakoski; the hospital districts of Pirkanmaa, Kanta-Häme, Vaasa; Forssan seudun hyvinvointikuntayhtymä, and Pietarsaaren sosiaali- ja terveystyöryhmä) since 1997, the Academy of Finland since 2000, and the Finnish Institute of Occupational Health. Other funders have included the Finnish Work Environment Fund, Kela and KEVA.

Participating organizations pay for survey and feedback process 2.5-3 € per employee eligible for the survey. From the beginning of the study, organizational funding has totaled approximately 2,000,000 €, and the estimate for future organizational funding is 1,500,000 €. The Academy of Finland has granted nearly 3,000,000 € for FPS-based research projects. For future applications, our estimate is 1,500,000 € for the Academy of Finland. The Finnish Work Environment Fund has granted about 2,000,000 € for FPS-based research projects, and the estimate for future research grants is 1,500,000 €. The Finnish Institute of Occupational Health participates to own funding in research projects (30-50%), and in part, also covers survey and other data gathering costs. The funding for the entire lifespan of the project is thus estimated to 12,000,000 €. In 2020, we applied for Finnish Roadmap Infrastructure (FIRI) status from the Academy of Finland within a consortium led by the National Institute for Health and Welfare. This status would enable better resources for data sharing and new opportunities for research funding.

Recent, current, and ongoing research grants for the Finnish Public Sector Study include:

- 2020–2023 Ervasti J. Prevention of bullying and workplace violence in the public sector. Risk prediction and intervention. The Finnish Work Environment Fund, 165 000 €
- 2020-2023 Mattila-Holappa P, Juvonen-Posti P, Ervasti J, et al. Promotion of workability and mental health: evaluation of a work disability prevention intervention. The Finnish Work Environment Fund, 120 000 €
- 2020–2022 Leino-Arjas P, Kaila-Kangas L, Ervasti J et al. Trajectories of work-family conflict: associations to working conditions, workability, and sickness absence. The Finnish Work Environment Fund, 110 000 €
- 2020–2022 Ropponen A, Virtanen M, Kivimäki M. Utilizing digital data to improve working conditions in healthcare. Academy of Finland, 600 000 €
- 2019–2021 Kauppi, M et al. Teachers in changing world of schools and education. The Finnish Work Environment Fund, 120 000 €
- 2018–2020 Karhula K, Härmä M, Kivimäki M, et al. Mental wellbeing, sickness absence and occupational injuries in physicians working in shifts. The Finnish Work Environment Fund, 95 000 €
- 2018–2020 Ervasti J. Effectiveness of work ability promotion initiatives for partially disabled people in municipal workplaces. The Finnish Work Environment Fund, 120 000 €
- 2015–2020 Kivimäki M. et al. Psychosocial work environment and healthy ageing. NordForsk, 2 900 000 €
- 2017–2019 Oksanen T. Developing digital tools for strategic management of employee wellbeing. The Finnish Work Environment Fund, 120 000 €
- 2017–2018 Kauppi M. Social networks and extended working life. The Finnish Work Environment Fund, 100 000 €

- 2015–2018 Härmä M, Kivimäki M, Vahtera J, et al. Effects of working time models and interventions on occupational injuries, employee well-being and working careers. The Finnish Work Environment Fund, 220 000 €
- 2016–2017 Kivimäki M. Developing prediction algorithm for occupational health. The Finnish Work Environment Fund, 164 000 €
- 2013–2017 Virtanen M. Determinants of labour market participation and prognosis of common chronic diseases in working populations. A study of cohorts in Finland, UK, and France. Academy of Finland, 875 036 €
- 2014–2016 Vahtera J. Kivimäki M. Social ties and health. Academy of Finland, 199 000 €
- 2014–2016 Salo P. The mental health of social workers. The Finnish Work Environment Fund, 116 000 €
- 2013–2015 Kivimäki M. Long working hours and health. The Finnish Work Environment Fund, 200 000 €
- 2012–2014 Härmä M. Developing working hours in the public sector. The Finnish Work Environment Fund, 166 000 €
- 2010–2012 Virtanen M. Kouluympäristö opettajien terveyden, hyvinvoinnin ja työhön sitoutumisen ennustajana. Academy of Finland, 250 000 €

5. Ethical questions; data processes and privacy of personal information

FPS is based on employees' free and voluntary participation. It is observational and does not involve any experimentation on the volunteers. Participants are informed about the aims of the study, the confidentiality of the data, the follow-up, and the possible linkage of their survey responses to data on national health registers in the future. Withdrawal from participation is at the discretion of the participant. There is no penalty for withdrawing and the participant is not required to provide any reason.

5.1 Survey process

The survey questionnaires are sent to the participants' work e-mail addresses in a digital form by researchers at FIOH. Hard copies of the survey questionnaires are sent to participants who have difficulties in using their work e-mail during work hours (e.g. cleaners, bus drivers) or who have not responded to the digital survey. Hard copies are posted via mail using a trusted third party. This party keeps only names and addresses, and an individual pseudonymized code, and has no access to any other data. The survey questionnaires and information to the participants have been given in Finnish or Swedish. A small number of employees are not native Finnish or Swedish speakers. This mainly applies the city of Helsinki where 6% of employees' mother language is other than Finnish or Swedish. Therefore, starting from the 10-Town study survey in September 2016, the questionnaires and the information given to the participants, have also be available in English. Feedback from the survey results is given to the participating organizations at level of organization and work unit. As regards the latter, a minimum of 10 responders per work unit are needed to provide the results. Work units with 5-9 survey respondents receive a summary about their placing relative to other work units. Exact results are not reported to work units smaller than 10 respondents. Considering some sensitive issues (e.g. discrimination), at least 30 responders are needed to provide the results. These limits are strictly kept ensuring that no individual can be identified.

5.2 Register linkages

The survey data are linked to data from the employers' registers and various national health registers. Due to the large amount of data, and because only a part of the participants are targeted with surveys, the linkages have been done without participants' consent but with the permission of the institutions maintaining the registers. From 2020 onwards, we will ask for active consent to register linkage.

5.3 Data processing and privacy of personal information

The data will be stored in a safe location so that third parties are unable to access them. All data will remain confidential in the computers and servers of the Finnish Institute of Occupational Health. The computers and servers cannot be accessed from the outside. The data will be managed and analysed by FPS researchers who have signed a non-disclosure agreement. All personal information will be kept separate from the data ensuring that no individual can be identified. All analyses are conducted with anonymous data.

The data will be carefully archived according to FIOH rules and regulations of archiving and according to existing legislation and good research practice. Anonymised partial datasets can be shared by application for with *bona fide* researchers with an established scientific record and *bona fide* organisations. Data sharing involves also a written agreement of a research cooperation.

The following members of the study group at the Finnish Institute of Occupational Health: Jenni Ervasti (PI 10-Town study), Mika Kivimäki (PI Hospital personnel study), and statisticians Ville Aalto, Aki Koskinen, Jouko Remes, Jaana Pentti, and Solja Nyberg have access to the entire data. For all other investigators within FIOH, data are shared in pseudonymized form, from which all direct identifiers have been removed. For other researcher outside FIOH, survey data can be shared in anonymized form, so that no individual can be identified. Register data are not shared outside FIOH.

6. References

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