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Cohort Profile

Cohort Profile: The Well-being in HospitAL Employees (WHALE) study

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Why was the cohort set up?

Most health care systems face a challenge to balance efficiency and quality under the pressure of limited resources and budget cuts. Consequently, hospital employees may face stressful working conditions, which may increase the risk of health problems as well as poor co-operation between staff. Combined, these may increase the risk of inefficiency, poor quality of care or even malpractice.^{1,2} The Well-being in Hospital Employees (WHALE) study is an ongoing prospective, observational cohort on work environment among all health care employees within the Capital Region of Denmark. The data are collected to continuously monitor the well-being of employees, in order to develop targets for potential intervention.

The term 'psychosocial work environment' denotes the interplay of a range of psychological and social factors that affect the employees' well-being. The concept of job strain was introduced with the job demand-control model,³ describing job stress from the balance between high job demands and low control. Self-reported job strain has been associated with an elevated risk of a number of adverse health outcomes such as cardiovascular disease,^{4–6} type 2 diabetes,⁷ affective disorders⁸ and mortality.⁹ Another

aspect of psychosocial work environment is reflected in the multidimensional concept of organizational justice.¹⁰ Here, it is argued that a poor psychosocial work environment arises from the perception of injustice at work. In addition, other stressors such as negative interpersonal relations in the workplace have received increasing research interest, and empirical evidence indicates that bullying is strongly associated with subsequent depression and elevated risk for cardiovascular disease.¹¹

The psychosocial work environment also encompasses positive elements with potential beneficial effects on job performance and individual health in occupational settings. Social capital has been defined as features of a social structure which facilitate the action of individuals within the structure.¹² Key elements within an occupational setting include norms and trust between co-workers, which facilitate coordination and co-operation.¹³ Over the past decades, social capital in occupational settings has received increasing attention, as the concept differs from other factors of the psychosocial work environment mentioned above, by being a positive resource and by being a characteristic of the workplace rather than an individual perception of the work environment. In periods of high demand, high social capital may buffer employees' stress levels, and the transmission of informal social norms may lead to healthier lifestyles.¹² A recent prospective study on social capital in relation to long-term sickness absence found a decreased risk among higher occupational grade workers with high vs low social capital.¹⁴ In addition, several publications based on the Finnish Public Sector study have linked workplace social capital to health outcomes such as depression,^{15,16} hypertension,¹⁷ healthy lifestyle^{18,19} and mortality.²⁰

In a hospital setting, the concept of social capital is particularly relevant as the work environment, the efficiency, and the quality of care highly depend on co-operation across professions. However, the literature on social capital in hospital settings is sparse. A recent cross-sectional study among Japanese health care professionals found a positive association between unit-level social capital and work engagement as an indicator of well-being.²¹ In addition, a Swedish prospective study found that an increase in social capital among health care professionals was related to higher levels of engagement and job satisfaction.²² Other previous studies related social capital to quality of care, productivity, patient satisfaction and employee satisfaction and well-being.^{2,23-31} A recent large crosssectional study found that nurses in better work environments (as measured by managerial support for nursing, nurse participation in hospital affairs, and doctor-nurse relations) reported higher care quality and better patient safety. Also, patients in hospitals with better work environments rated the hospital more highly.¹ Thus, several international studies suggest that challenges with regard to efficiency, quality of care and well-being of employees within the health care sector could in part be met by strengthening the social capital.

The majority of the above-mentioned studies are crosssectional in design and thus not designed to address effects of social capital by separating cause and effect in time. Given the collective dimension of social capital, neither

individual nor ecological approaches in isolation will capture the essence of the concept. Therefore it has been argued that a multi-level approach to the analysis of health effects of social capital is more appropriate, taking into account the organizational levels in which the individual responses are embedded.^{32,33} The data collected for the WHALE study are a unique source to prospectively relate social capital and other aspects of the psychosocial work environment to various outcomes, through linkage with registers on sickness absence, health outcomes, prescription of medicine, socioeconomic outcomes and questionnaire data on patient satisfaction. In addition, the structure of the database provides detailed information on organizational levels for every individual, which allows for the determination of effects of dimensions of the work environment at different aggregate organizational levels. This may help to address common methods bias which is an important source of bias in the majority of studies in the field.³⁴

Who is in the cohort?

The cohort includes employees at hospitals within the Danish Capital Region at the time of the questionnaire assessments in 2011 and 2014. All 35894 ordinary employees who were actively working by 1 October 2010 throughout 12 January 2011 were invited to participate in the survey. Data were collected in the period 12 January to 9 February 2011. Employees with a work e-mail address filled out a web-based questionnaire, and paper versions were handed out among remaining employees. A response rate of 81% was obtained in the 2011 survey. Following the same procedures, 37720 employees were invited for a second survey in March 2014 (response rate 84%). In 2014, the organizations included nine hospitals and institutions involved with handicaps, psychiatry, pharmacy, emergency care, and central administration (Figure 1). Information on sex, institution, department, work unit and professional group was obtained from the payment system.



Figure 1. Overview of the organizational structure of the Danish Capital Region in 2014.

The 2011 sample included 29 004 employees with any information on the psychosocial work environment, including 28 785 employees with information on social capital. After exclusion of 26 persons who had responded twice (due to being affiliated with two departments), the total sample comprised 28 759 persons. Likewise, the 2014 sample included a total of 31 823 employees including 30 434 with information on social capital (excluding 11 duplicates). In total, 21 969 of the respondents in 2011 were employed in 2014. Of these, 19 572 responded to the 2014 survey.

The mean age of employees was 45 years [standard deviation (SD) = 11] and women constituted 78% and 79% in 2011 and 2014, respectively. Nurses were the largest staff group, constituting 31% in 2011 and 34% in 2014, whereas medical doctors represented 12% of the respondents in both years. Administrative personnel comprised 21% and 19% in 2011 and 2014, respectively. In both years, 64% were employed full-time and 92% and 93%, respectively, were appointed on standard terms in 2011 and 2014. The percentage of employees with a seniority of 10 or more years varied from 36% in 2011 to 38% in 2014.

Socio-demographic information on non-respondents was retrieved from the regional administration system. enabling comparisons with participants in either of the waves and with those participating in both waves (Table 1). The sex distribution was somewhat skewed between participants and non-respondents, in that a higher proportion of men was observed among non-respondents. Also, non-respondents were slightly younger than participants in both waves, with the exception of employees who were eligible but declined to participate in any of the surveys. Most notably, medical doctors and dentists were over-represented among non-respondents in both the 2011 and 2014 survey. Thus, these data suggest that study participants represent a somewhat selected group, primarily with respect to profession.

How often have they been followed up?

Figure 2 illustrates the collection of questionnaire information, the data linkages and the sample sizes at each of the two waves already collected. An additional wave is planned for 2017. The questionnaire responses from 2011 and 2014 have been linked to individual-level data on sickness absence from the payment system, which were collected on a monthly basis according to number of hours absent due to: general sickness absence, work injuries and absence in relation to sick children or chronic illnesses. In addition, the data linkage included information on standard working hours for each individual, seniority and length of employment. The data cover the period from January 2009 to June 2016.

 Table 1. Socio-demographic characteristics of participants vs non-respondents in 2011 or 2014, respectively, and participants in both waves versus only one and neither of the waves

| | 2011 | | | 2014 | | 2011 and 2014 | | |
|---------------------------|--------------|-----------------|--------------|-----------------|---------------------------|----------------------|----------------------|--|
| | Participants | Non-respondents | Participants | Non-respondents | Participants ^a | Only 1 wave | None | |
| N (%) | 28759 (81) | 6908 (19) | 30434 (84) | 5934 (16) | 19589 (75) | 5252 (20) | 1347 (5) | |
| Sex | | | | | | | | |
| Women, % | 78 | 73 | 79 | 72 | 78 | 74 | 64 | |
| Men, % | 22 | 27 | 21 | 28 | 22 | 26 | 36 | |
| Age | | | | | | | | |
| Mean (SD) | 45 (11) | 43 (12) | 45 (11) | 44 (12) | 45 (10) ^b | 43 (11) ^b | 45 (11) ^b | |
| Staff group, % | | | | | | | | |
| Medical doctors/dentists | 12 | 20 | 12 | 23 | 11 | 17 | 26 | |
| Nurses | 31 | 32 | 33 | 31 | 32 | 35 | 28 | |
| SHS helpers | 9 | 11 | 7 | 8 | 8 | 10 | 11 | |
| Biomedical lab technician | 5 | 4 | 6 | 4 | 6 | 4 | 3 | |
| Midwives | 1 | 2 | 1 | 2 | 1 | 2 | 3 | |
| Medical secretary | 7 | 6 | 8 | 5 | 8 | 7 | 5 | |
| Other health staff | 6 | 3 | 6 | 2 | 6 | 3 | 2 | |
| Social and pedagogical | 4 | 2 | 4 | 3 | 4 | 3 | 2 | |
| Other administrative | 14 | 6 | 12 | 9 | 14 | 7 | 4 | |
| Service-related | 11 | 13 | 11 | 13 | 16 | 12 | 10 | |

^aAmong all employees eligible to participate in both 2011 and 2014.

^bAge in 2011.



Figure 2. Illustration of the collection of questionnaire information, the data linkages and the sample sizes at each of the two completed waves.

The database is also linked to a database on patient perceptions of hospital admissions and outpatient treatments in the region. Every year a survey on treatment satisfaction among patients in each hospital department is carried out. A random sample of all treated patients during a specified inclusion period (12 weeks from August to October for admitted patients and 6 weeks from the end of August to the beginning of October for outpatients) are invited to participate. The sample consists of 400 patients per department per area of specialization. In departments with less than 400 treated patients during the inclusion period, all patients are invited. Patients both admitted and treated in outpatient care are only invited once.³⁵

In addition to linkage with the above-mentioned data sources, it is possible to link the survey data to various registers. Through the unique personal identification number, information on vital status, cause-specific mortality, hospital admissions and discharge diagnoses, prescription of medicine and emigration can be obtained.³⁶ Information on organizational changes (merging and division of work units, change in management, relocations, cuts in staff and financial down-sizing) in the period 2009–13 was also collected.³⁷

What has been measured?

The survey included a broad range of questions concerning the overall well-being of employees in which psychological and physical work environment are key elements (Box 1). The 2011 survey included a total of 46 questions on the psychosocial work environment. Of these, 29 questions were derived from the second version of the Copenhagen Psychosocial Questionnaire (COPSOQII).^{38,39} The remaining questions were formulated by the human resources (HR) department, the management and employee representatives. The 2014 wave included 40 questions on the psychosocial work environment, of which 37 were also included in 2011. A complete list of items is provided in the Appendix (available as Supplementary data at *IJE* online). The dimensions of the physical work environment included in 2011 and 2014 were identical and covered by 26 items in the two waves.

Social capital

The data on social capital were collected by eight items covering elements of trust, justice and collaboration (Figure 3). These items reflect both horizontal (relations across employees at the same hierarchy level) as well as vertical components (i.e. relations that span hierarchies). The responses were re-computed into percentages and the social capital score was given by the percentage mean. Participants who responded to at least four of the eight items were included in the present analyses. Person mean imputation was performed for missing values by assigning the mean of the remaining responses to each individual. If the person responded to less than four of the eight items, the social capital score was computed as missing.¹⁴ We assessed social capital at the individual level (by applying each individual assessment) and aggregated the mean social capital score within each department. Department-

| | 2011 | 2014 | | 2011 | 2014 | |
|--|------|------|--|------|------|--|
| Socio-demographic | | | Psycho-social work environment | | | |
| | | | Social capital | | | |
| Age | V | V | Trust regarding management | V | V | |
| Sex | V | V | Justice | V | V | |
| Profession | V | V | Collaboration | V | V | |
| Institution/hospital | V | V | Work demands | | | |
| Department | V | V | Emotional | V | | |
| Unit | V | V | Quantitative | V | V | |
| The physical work environment | | | | | | |
| Ergonomics | | | Stress and vitality | | | |
| Lifts, movements | V | V | Work-family imbalance | V | V | |
| Potential for correct movement | V | V | Perceived stress | V | V | |
| (variation, monotony) | | | Perceived burn-out | V | | |
| Indoor climate and noise | | | Organization and content | | | |
| Temperature, air, cleaning | V | V | Decision authority | V | V | |
| Noise | V | V | Influence on work schedule | V | V | |
| | | | Skill discretion | V | V | |
| Safety/transmission risks | | | Management and collaboration | | | |
| Chemical agents exposure | V | V | Quality of leadership | V | V | |
| Biological agents exposure | V | V | Recognition | V | V | |
| Medicine exposures | V | V | Social support | V | V | |
| Skin affections | V | V | Role clarity | V | | |
| Necessary safety precautions | V | V | Respect for differences | V | V | |
| | | | Predictability | V | V | |
| Work-related accidents | | | Job satisfaction | | | |
| Sufficient focus on accidents | V | V | Work environment | V | V | |
| Specific conditions of importance | | | Use of abilitites | V | V | |
| for the risk of accidents | V | V | Future prospects | V | V | |
| Usage of precautionary equipment | V | V | Job as a whole | V | V | |
| Sickness absence | | | Offensive behaviours | | | |
| Related to work environment | V | V | Sexual harassment | V | V | |
| Specific environmental causes of | | | Threats and violence | V | V | |
| absence | V | V | Bullying | V | V | |
| Pregnancy | | | Professional quality | | | |
| Degree of necessary work-environmental precautions | V | V | Explicit criteria for professional quality | V | V | |
| | | | Satisfaction with quality of work | V | V | |
| | | | Pride in work | V | V | |

| Box 1 | listina | of individual | level measures | in the WHALF | - database |
|-------|---------|---------------|----------------|--------------|------------|

level social capital was regarded missing if based on data from less than 50% of the eligible employees.

Other dimensions of the psychosocial work environment

The psychosocial work environment was measured according to dimensions of work demands (quantitative, emotional as well as work pace), organization and content (influence, possibilities for development/skill discretion), perceived stress and burn-out, work-family imbalance, management and collaboration (predictability, recognition, role clarity, social support and quality of leadership) and job satisfaction as well as exposure to sexual harassment, violence and bullying (Box 1; and Appendix).

Physical work environment

The physical work environment concerns ergonomics, indoor climate, noise, exposure to chemical or biological agents (e.g. transmission risk) and work-related accidents (Box 1).

What has it found? Key findings and publications

The overall mean level of social capital did only change marginally between the two surveys [67.4 (SD = 14.9) in2011 and 68.3 (SD = 15.2) in 2014]. The Cronbach's alpha coefficient of the social capital scale was 0.83 for the 2011 survey and 0.85 for the 2014 survey.⁴⁰ In both waves, the social capital mean was on average evaluated slightly

ITEMS COVERING TRUST AND JUSTICE

To what degree ...:

- ... can you trust the information that comes from the management?
- ... does the management trust the employees to do their work well?
- ... are conflicts resolved in a fair way? ... is the work distributed fairly?
- ... is your staff group respected by other staff groups in the workplace?

Response categories:

A 7 point scale ranging from 1="Never/hardly ever" to 7="To a very high degree"

ITEMS COVERING COLLABORATION

| To what degree: |
|---|
| are you and your colleagues good at coming up with suggestions for improving work procedures? |
| do you and your colleagues take responsibility for a nice atmosphere and tone of communication? |
| do you get help and support from your colleagues when needed? |

Response categories:

A 5 point scale ranging from 1="Not at all" to 5="To a very high degree"

Figure 3. The eight items covering the social capital elements of trust, justice and collaboration.

higher among women compared with men, but it did not vary noticeably according to age (Table 2). The highest level of social capital was observed among medical doctors and dentists. In both waves, social capital scores were observed among Social and Health Service (SHS) helpers, medical secretaries and service-related staff. In 2014, biomedical laboratory technician and midwives also scored below average. The social capital level did not vary considerably between full-time vs part-time employees. Employees on standard terms had a social capital score considerably lower than the remaining employment groups; especially persons who were appointed on fixed terms (job activation, trainees, paid by the hour etc.) reported high levels of social capital. However, these types of employment constituted a very small proportion of the total number of employees. With regard to the seniority of employees, staff with less than 4 years of employment had

| | Table 2. | Individually | / measured socia | al capital accord | ing to socio-der | nographic charac | teristics of the | cohort in 2011 | and 2014 |
|--|----------|--------------|------------------|-------------------|------------------|------------------|------------------|----------------|----------|
|--|----------|--------------|------------------|-------------------|------------------|------------------|------------------|----------------|----------|

| | 2011 | | | 2014 |
|------------------------------|-------|--------------------------|-------|--------------------------|
| | N | Social capital mean (SD) | N | Social capital mean (SD) |
| Sex | | | | |
| Women | 22437 | 68 (14) | 24043 | 69 (15) |
| Men | 6322 | 66 (16) | 6391 | 67 (16) |
| Age | | | | |
| < 40 years | 9905 | 68 (15) | 10577 | 69 (15) |
| 40-51 years | 9832 | 67 (15) | 9995 | 68 (15) |
| 52+ years | 9022 | 67 (15) | 9862 | 68 (15) |
| Staff group | | | | |
| Medical doctors and dentists | 3429 | 70 (15) | 3776 | 71 (14) |
| Nurses | 8903 | 68 (14) | 10156 | 69 (14) |
| SHS helpers | 2585 | 65 (15) | 2167 | 65 (15) |
| Biomedical lab technician | 1508 | 67 (14) | 1705 | 65 (15) |
| Midwives | 308 | 68 (13) | 447 | 66 (14) |
| Medical secretary | 2133 | 65 (15) | 2285 | 66 (15) |
| Other health staff | 1664 | 68 (14) | 1792 | 69 (14) |
| Social and pedagogical | 1173 | 68 (15) | 1187 | 68 (16) |
| Other administrative | 3960 | 69 (15) | 3560 | 70 (15) |
| Service-related | 3033 | 63 (17) | 3205 | 65 (17) |
| Monthly work hours | | | | |
| Part time | 10406 | 67 (14) | 10977 | 68 (15) |
| Full time | 18154 | 68 (15) | 19457 | 69 (15) |
| Type of employment | | | | |
| Standard terms | 26318 | 67 (15) | 28388 | 68 (15) |
| Paid on an hourly basis | 26 | 73 (17) | 31 | 76 (15) |
| Tenured | 1274 | 69 (15) | 973 | 70 (16) |
| Paid through funding | 845 | 72 (15) | 949 | 73 (14) |
| Trainee | 35 | 73 (14) | 63 | 73 (16) |
| Job activation | 54 | 76 (12) | 21 | 77 (16) |
| Seniority | | | | |
| < 48 months | 10454 | 68 (15) | 8980 | 70 (15) |
| 48-119 months | 7793 | 67 (15) | 9938 | 67 (15) |
| 120+ months | 10311 | 67 (15) | 11516 | 68 (15) |

higher levels of social capital compared with staff who had been employed for 4 years or more in 2014.

The intraclass correlations for social capital within departments were 0.11 in 2011 and 0.13 in 2014. In both waves, department-level social capital was higher among departments with fewer employees compared with larger departments and also in departments with (on average) younger compared with older employees (Table 3). Likewise, departments with fewer senior staff had higher social capital compared with departments with higher seniority. The department-level score did not vary according to sex distribution in 2011, but in 2014 departments with a larger share of women had a higher social capital compared with departments with fewer women. In 2014, the department mean social capital was slightly higher in departments with a larger share of full-time employees. The social capital means for type of department did not show any obvious patterns.

Previous findings

The cohort was assembled recently for research purposes, and thus previous findings are sparse. However, the 2011 survey was used for a study examining the impact of organizational changes on psychosocial work environment and voluntary non-disability early retirement in senior employees (aged 60–64 years). This study found that senior employees who had experienced organizational change, in terms of change in management or reorganization of work units in the 2-year period preceding follow-up, were more likely to retire early than those who had not experienced such changes. Also, early withdrawal from the labour market was related to poor psychosocial work environment measured in the 2011 survey. For instance, low scores on factors such as organizational justice, quality of management and social capital were associated with a higher rate of early retirement.³⁷

What are the main strengths and weaknesses?

A major strength of the database is the relatively large sample size, and the two rounds of questionnaire measurements separated in time allow for analyses of effects of changes over time for various dimensions of the psychosocial work environment. As mentioned previously, the structure of the database makes it possible to determine dimensions of the psychosocial work environment on different aggregate organizational levels. Compared with a measure solely based on perceptions of the work environment as measured individually, the aggregate level may better reflect the theoretical concept of social capital. The

| Table 3. | Department-level s | ocial capital | according to socio | -demographic cha | racteristics of th | e cohort in : | 2011 and 2014 |
|----------|--------------------|---------------|--------------------|------------------|--------------------|---------------|---------------|
|----------|--------------------|---------------|--------------------|------------------|--------------------|---------------|---------------|

| | 2011 | | | 2014 | |
|-----------------------------|------|--------------------------|-----|--------------------------|--|
| | N | Social capital mean (SD) | N | Social capital mean (SD) | |
| Department size | | | | | |
| Small ($N < 20$) | 80 | 71 (9) | 115 | 75 (10) | |
| Medium $(N = 20 - 99)$ | 169 | 68 (6) | 107 | 71 (7) | |
| Large $(N = 100 +)$ | 120 | 67 (4) | 138 | 68 (5) | |
| Sex distribution, % females | | | | | |
| < 70% | 104 | 68 (8) | 110 | 70 (8) | |
| 70-84% | 145 | 69 (5) | 133 | 70 (6) | |
| 85+ % | 120 | 68 (5) | 117 | 72 (9) | |
| Department mean age | | | | | |
| < 40 years | 27 | 73 (6) | 80 | 74 (8) | |
| 40–44 years | 155 | 68 (5) | 138 | 70 (7) | |
| 45+ years | 184 | 67 (7) | 142 | 70 (8) | |
| Full-time employees, % | | | | | |
| < 65 | 168 | 68 (5) | 181 | 70 (7) | |
| 65+ | 201 | 68 (7) | 179 | 72 (9) | |
| Average seniority | | | | | |
| < 84 months | 66 | 70 (7) | 99 | 75 (7) | |
| 84–131 months | 191 | 69 (5) | 170 | 70 (7) | |
| 132+ months | 112 | 67 (7) | 91 | 70 (9) | |
| Department type | | | | | |
| Patients | 199 | 69 (8) | 243 | 71 (7) | |
| Non-patients | 137 | 70 (9) | 117 | 72 (9) | |

possibility of linking the database to a wide range of other registers enables analyses of the effects of social capital and psychosocial work environment on various outcome measures such as sickness absence, specific health outcomes, socioeconomic outcomes and mortality at the individual level as well as, for instance, patient perceptions on an aggregate level. Also, when addressing questions of associations between variables collected in the same questionnaire, problems of common method bias may arise in that employees who report low levels of social capital may also tend to report low on specific outcomes of interest. This creates a non-causal association between the two parameters.³⁴ Such bias is avoided by merging the cohort with other data resources. The possibility of aggregating the individual answers to the questionnaire at the department level, and thus assigning the average value of the exposure of interest to all employees in that unit, also reduces the common method bias. Another strength is the multiplicity of professional groups represented in the data. The sparse literature on social capital in health care systems suffers from under-representation of specific staff groups. The majority of previous studies have focused on either physician or nurse social capital.^{2,23-31} Yet other occupational groups such as administrative staff, social and health service helpers and service-related personnel, who constitute a large proportion of all hospital employees, may be just as important in terms of efficiency and quality of care.⁴¹ Also, as mentioned previously, the productivity and quality of care in a health care unit are highly dependent on cooperation between staff groups, so a focus confined to a specific profession seems inadequate.

The included items on social capital were derived from the validated COPSOQII.14 The questionnaire included elements of trust, justice and collaboration and as described previously, reflecting both horizontal and vertical components, which are considered key in the measurement of workplace social capital.³³ The theoretically appropriate level at which social capital is measured has been much debated in the past decades.³² It has been argued that neither individual nor contextual measurements suffice; given the collective dimension of social capital (i.e. beyond social networks and support), the individual approach in isolation would only yield effects of perceptions of social capital, whereas a strictly ecological approach does not eliminate the residual compositional confounding by individual characteristics.^{33,42} Therefore, it has been argued that the analysis of health effects of social capital calls for a multi-level methodological framework in which the individual responses and their outcomes are nested within a workplace unit.^{32,33} The nature of the data collected for the WHALE study enables analyses of this type.

Weaknesses

First of all, the cohort measurements of work environment and well-being were self-reported secondary data that were not initially collected for research purposes. Thus, the measurements inherently suffer from some degree of misclassifi-However, in a prospective design, cation. the misclassification of exposures will be independent of the outcome measurements. In addition, the secondary nature of the data, being elaborated and collected within the HR setting of the region, entails some important weaknesses in that important aspects of the psychosocial work environment were omitted. Specifically, within each domain of the psychosocial work environment examined, a lower number of items were generally applied compared with the number of items within the same domain in the COPSOQII. However, regarding this as an issue of missing data, multiple imputation procedures may be applied to give an impression of the presumed loss of information. Such validation procedures are currently being implemented into the database.⁴³ Further, the database does include several dimensions of the psychosocial and physical work environment and the possibility of linkage between several registers, but information on lifestyle factors has not yet been collected.

The participation rates were high in both surveys, but the analysis comparing participants with non-respondents showed variances according to sex, age and profession. Most notably, medical doctors and dentists were underrepresented among respondents. These details must be taken into account by carefully considering a link between exposures and outcomes of interest in future studies. The possibilities of addressing longitudinal changes in exposure are challenged by a high rate of turnover of staff and changes in the organization (splitting or merging of departments) over time. However, the period between the two surveys, i.e. from 2011 to 2014, was relatively stable with regard to re-organizations.

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

Anonymized data are available to other investigators through collaborative agreements. Please contact Dr Naja Hulvej Rod [nahuro@sund.ku.dk].

Supplementary Data

Supplementary data are available at IJE online.

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Profile in a nutshell

- The WHALE study involves an ongoing prospective, observational cohort to collect data on physical and psychosocial work environment embedded within the Capital Region of Denmark.
- The baseline data were collected in 2011 among all employees in the region ($N=35\,894$) and a response rate of 81% was obtained. A follow-up questionnaire was distributed among all employees in 2014 ($N=37\,720$) with a response rate of 84%. Another wave will be conducted in 2017.
- The dataset comprises a broad range of questions concerning the overall well-being of employees, in which psychosocial and physical work environment are key elements. The 2011 survey included a total of 44 questions on the psychosocial work environment and 26 on the physical work environment. Analyses of various outcomes are possible through linkage with a database on patient satisfaction as well as register data on sickness absence, physical and mental health outcomes, socioeconomic outcomes and prescription of medicine.
- The structure of the database makes it possible to determine dimensions of the work environment on different aggregate organizational levels. Also, multiple professional groups are represented in the data.
- Any researcher interested in collaborating with the WHALE study should contact Dr Naja Hulvej Rod [nahuro@sund.ku.dk].

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References

- 1. Aiken LH, Sermeus W, Van den Heede K *et al.* Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ* 2012;344:e1717.
- 2. McHugh MD, Rochman MF, Sloane DM *et al.* Better nurse staffing and nurse work environments associated with increased survival of in-hospital cardiac arrest patients. *Med Care* 2016;**54**:74–80.
- 3. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q* 1979;24:285–308.
- Kivimäki M, Nyberg ST, Batty GD *et al.* Job strain as a risk factor for coronary heart disease: a collaborative metaanalysis of individual participant data. *Lancet* 2012;380: 1491–97.

- Mäntyniemi A, Oksanen T, Salo P et al. Job strain and the risk of disability pension due to musculoskeletal disorders, depression or coronary heart disease: a prospective cohort study of 69,842 employees. Occup Environ Med 2012;69:574–81.
- 6. Nyberg ST, Fransson EI, Heikkilä K *et al.* Job strain and cardiovascular disease risk factors: meta-analysis of individualparticipant data from 47,000 men and women. *PLoS One* 2013;8:e67323.
- Nyberg ST, Fransson EI, Heikkilä K *et al.* Job strain as a risk factor for type 2 diabetes: a pooled analysis of 124,808 men and women. *Diabetes Care* 2014;37:2268–75.
- Wieclaw J, Agerbo E, Mortensen PB, Burr H, Tuchsen F, Bonde JP. Psychosocial working conditions and the risk of depression and anxiety disorders in the Danish workforce. *BMC Public Health* 2008;8:280.
- Nilsen C, Andel R, Fritzell J, Kåreholt I. Work-related stress in midlife and all-cause mortality: can sense of coherence modify this association? *Eur J Public Health* 2016;26:1055–61.
- Colquitt JA, Conlon DE, Wesson MJ, Porter CO, Ng KY. Justice at the millennium: a meta-analytic review of 25 years of organizational justice research. J Appl Psychol 2001;86:425–45.
- Kivimäki M, Virtanen M, Vartia M, Elovainio M, Vahtera J, Keltikangas-Järvinen L. Workplace bullying and the risk of cardiovascular disease and depression. Occup Environ Med 2003;60:779–83.
- Kawachi I, Takao S, Subramanian SV. Global Perspectives on Social Capital and Health. New York, NY: Springer New York, 2013.
- 13. Putnam RD. Bowling alone: america's declining social capital. J Democr 1995;6:65–78.
- Rugulies R, Hasle P, Pejtersen JH, Aust B, Bjorner JB. Workplace social capital and risk of long-term sickness absence. Are associations modified by occupational grade? *Eur J Public Health* 2016;26:328–33.
- 15. Oksanen T, Kouvonen A, Vahtera J, Virtanen M, Kivimäki M. Prospective study of workplace social capital and depression: are vertical and horizontal components equally important? *J Epidemiol Community Health* 2010;64:684–89.
- Lofors J, Sundquist K. Low-linking social capital as a predictor of mental disorders: a cohort study of 4.5 million Swedes. Soc Sci Med 2007;64:21–34.
- 17. Oksanen T, Kawachi I, Jokela M *et al.* Workplace social capital and risk of chronic and severe hypertension: a cohort study. *J Hypertens* 2012;30:1129–36.
- Väänänen A, Kouvonen A, Kivimäki M *et al.* Workplace social capital and co-occurrence of lifestyle risk factors: the Finnish Public Sector Study. Occup Environ Med 2009;66:432–37.
- Kouvonen A, Oksanen T, Vahtera J *et al*. Work-place social capital and smoking cessation: the Finnish Public Sector Study. *Addiction* 2008;103:1857–65.
- Oksanen T, Kivimäki M, Kawachi I *et al.* Workplace social capital and all-cause mortality: a prospective cohort study of 28,043 public-sector employees in Finland. *Am J Public Health* 2011;101:1742–48.
- 21. Fujita S, Kawakami N, Ando E *et al.* The association of workplace social capital with work engagement of employees in health care settings: a multilevel cross-sectional analysis. *J Occup Environ Med* 2016;58:265–71.

- 22. Strömgren M, Eriksson A, Bergman D, Dellve L. Social capital among health care professionals: A prospective study of its importance for job satisfaction, work engagement and engagement in clinical improvements. *Int J Nurs Stud* 2016;53:116–25.
- Kowalski C, Driller E, Ernstmann N *et al.* Associations between emotional exhaustion, social capital, workload, and latitude in decision-making among professionals working with people with disabilities. *Res Dev Disabil* 2010;31:470–79.
- 24. Kowalski C, Ommen O, Driller E *et al*. Burnout in nurses the relationship between social capital in hospitals and emotional exhaustion. *J Clin Nurs* 2010;**19**:1654–63.
- 25. Ommen O, Driller E, Köhler T *et al.* The relationship between social capital in hospitals and physician job satisfaction. *BMC Health Serv Res* 2009;**9**:81–89.
- 26. Van Bogaert P, Kowalski C, Weeks SM, Van Heusden D, Clarke SP. The relationship between nurse practice environment, nurse work characteristics, burnout and job outcome and quality of nursing care: a cross-sectional survey. *Int J Nurs Stud* 2013;50:1667–77.
- Susanne Lehner B, Kowalski C, Wirtz M et al. [Work engagement of hospital physicians: do social capital and personal traits matter?]. Psychother Psychosom Med Psychol 2013;63:122–28.
- Sheingold BH, Sheingold SH. Using a social capital framework to enhance measurement of the nursing work environment. *J Nurs Manag* 2013;21:790–801.
- 29. Ernstmann N, Ommen O, Driller E *et al*. Social capital and risk management in nursing. *J Nurs Care Qual* 2009;24:340–47.
- Sutinen R, Kivim M, Elovainio M, Virtanen M, Sutinen R. Organizational fairness and psychological distress in hospital physicians. *Scand J Public Health* 2002;30:209–15.
- Driller E, Ommen O, Kowalski C, Ernstmann N, Pfaff H. The relationship between social capital in hospitals and emotional exhaustion in clinicians: a study in four German hospitals. *Int J Soc Psychiatry* 2011;57:604–09.
- Kawachi I, Kim D, Coutts A, Subramanian SV. Commentary: Reconciling the three accounts of social capital. *Int J Epidemiol* 2004;33:682–90.
- 33. Oksanen T, Suzuki E, Takao S, Vahtera J, Kivimäki M. Work place social capital and health. In: Kawachi I, Takao S,

Subramanian SV (eds). *Global Perspectives on Social Capital and Health*. New York, NY: Springer New York, 2013.

- Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J Appl Psychol 2003;88:879–903.
- 35. Enheden for Brugerundersøgelser: Baggrund og metode for den Landsdaekkende Undersøgelse af Patientoplevelser. [Center for Patient Experience and Evaluation: Background and methods for the National Study of Patient Experience]. The Capital Region, Copenhagen: 2011.
- Pedersen CB, Gøtzsche H, Møller JØ, Mortensen PB. The Danish Civil Registration System. A cohort of eight million persons. *Dan Med Bull* 2006;53:441–49.
- Breinegaard N, Jensen JH, Bonde J. Organizational change, psychosocial work environment, and non-disability old-age retirement: a prospective study among senior public employees. *Scand J Work Environ Health* 2017, Feb 6. doi: 10.5271/sjweh.3624. [Epub ahead of print.]
- Pejtersen JH, Kristensen TS, Borg V, Bjorner JB. The second version of the Copenhagen Psychosocial Questionnaire. *Scand J Public Health* 2010;38:8–24.
- Bue Bjorner J, Pejtersen JH. Evaluating construct validity of the second version of the Copenhagen Psychosocial Questionnaire through analysis of differential item functioning and differential item effect. *Scand J Public Health* 2010;38:90–105.
- 40. Yu CH. An introduction to computing and interpreting Cronbach Coefficient Alpha in SAS. In: Proceedings of the Twenty-Sixth Annual SAS Users Group International Conference, 22–25 April 2001. Long Beach, CA: SAS Institute, 2001.
- 41. Shantz A, Alfes K, Arevshatian L. HRM in health care: the role of work engagement. *Pers Rev* 2016;45:274–95.
- 42. Subramanian S, Lochner KA, Kawachi I. Neighborhood differences in social capital: a compositional artifact or a contextual construct? *Health Place* 2003;9:33–44.
- Sterne JAC, White IR, Carlin JB *et al.* Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ* 2009;338:b2393.