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Predictors of quality of life and work ability among Finnish municipal employees: a cross-sectional study

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PREDICTORS OF QUALITY OF LIFE AND WORK ABILITY AMONG FINNISH MUNICIPAL EMPLOYEES: A CROSS-SECTIONAL STUDY

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1

ABSTRACT

Objectives: Quality of life (QoL) and work ability are elementary parts in defining the well-being of

an employed person. The aim of this study was to demonstrate the predictors of QoL and self-

reported work ability among public sector employees, while taking into account several confounding

factors, including sleep quality, occupational stress and psychosocial risk factors.

Methods: A cross-sectional study was conducted in Finland among 710 employees (89% women,

mean age 49 [SD = 10] years) from ten municipal work units in 2015. Information about the

participants was collected by physical examination, self-administered questionnaire and from

medical history. QoL was assessed with the EUROHIS-QOL 8-item index and work ability with the

Work Ability Score (WAS).

Results: The EUROHIS-QOL mean score among all participants was 4.07 (95% CI 4.03–4.11). QoL was

positively associated with good sleep quality, cohabiting, university-level education, and lower BMI,

and negatively associated with occupational stress, depression and/or anxiety and disease burden.

Work ability was reported good or excellent by 80% of the participants and the WAS mean score

among all participants was 8.31 (95% CI 8.21–8.41). Work ability was positively associated with good

sleep quality, younger age, lower BMI and university-level education, and negatively associated with

occupational stress and disease burden.

Conclusions: Occupational stress and self-reported sleep quality were powerful predictors of both

QoL and work ability among Finnish public sector employees. These findings highlight the need for

screening and handling of work stress and sleep problems in occupational and primary health care.

KEYWORDS

Quality of life, Work ability, Occupational health, Sleep quality, Occupational stress

2

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Several aspects affecting the employees' quality of life and work ability could be taken into account.

- The participants completed all questionnaires at home before the examination was performed.

- Any causality cannot be determined due to the cross-sectional nature of the study.

- The initial response rate in the first part of the study in 2014 was only 32.5% and 84.9% of them attended this follow-up study in 2015.

INTRODUCTION

Quality of life (QoL) and other subjectively assessed metrics have in recent years become important outcomes evaluated in studies concerning diseases, therapies or care. Several assessment tools have been developed to measure well-being from the patient's point of view, and those tools have proven to be reliable in defining significant outcomes.[1–4] In our previous study, self-reported sleep quality was observed to be an even more powerful predictor of QoL than ideal cardiovascular health metrics among public sector employees.[5] Furthermore, the association between poor sleep quality and impaired QoL has been demonstrated among patients with sleep disorders and other medical conditions [6–9], and self-reported sleep quality has been shown to predict QoL in higher education students.[10] Poor sleep has also been associated with poorer work ability [11], and sleep problems have been linked to an increased rate of sickness absence.[12] Further, QoL seems to be closely related to work ability [13,14], but few studies have evaluated QoL and self-reported work ability simultaneously among apparently healthy, working-age individuals.

Based on our previous study, we focused in the present work first on self-reported sleep quality and its role in characterizing our study population. The aim of this study was to demonstrate the

3

predictors of QoL and self-reported work ability in a non-clinical sample of public sector employees, while taking into account several confounding factors, including psychosocial risk factors and occupational stress. We wanted to use short, subjective and user-friendly tools for the assessment of sleep quality, QoL, and work ability. We hypothesized that self-reported sleep quality would be a significant predictor of both QoL and work ability in this population of apparently healthy, active work force.

PARTICIPANTS AND METHODS

Participants

This cross-sectional study was part of the PORTAAT (PORi To Aid Against Threats) study conducted among employees of the city of Pori (83,497 inhabitants in 2014) in South-Western Finland in 2014 and 2015. The participating work units were selected by the chief of the Welfare Unit of Pori. Invitations to participate and information of the study were sent to employees via e-mail by the managers of the selected ten work units (total number of employees 2,570). The employees willing to participate contacted the study contact person at their work unit, who then sent their contact information to the study nurse. There were no exclusion criteria. A total of 836 employees (104 males, 732 females) participated in the study in 2014 and 710 of them (79 males, 631 females) attended the follow-up visit in 2015. The initial response rate in the first part of the study in 2014 was 32.5%, and 84.9% of these respondents attended the follow-up study in 2015. In the present work, we used the data from the year 2015 because complete information about psychosocial risk factors was available only from that year. The gender distribution of the study participants corresponds to the standard gender distribution of the employees of Pori. The participants' occupations included librarians, museum employees, janitors, IT workers, social workers, nurses, physicians, administrative officials, and general office staff.

4

Quality of life

QoL was assessed with the EUROHIS-QOL 8-item index.[15] This is a shortened version of the WHOQOL-Bref scale, a widely used instrument for the assessment of generic QoL.[16,17] The domains in both questionnaires are the general, physical, psychological, social and environmental aspects of QoL. The EUROHIS-QOL instrument has been validated in several European countries.[2] The participants of the present study answered the questions at home before the study visits. Every question was scored from 1 to 5 (1 for very poor and 5 for very good). All scores were then added together and divided by 8 (the sum of the questions) to obtain the EUROHIS-QOL mean score.[2]

Work-related measures

Work ability was assessed with the question "What is your current work ability compared to your lifetime best?". This is the first item of the widely used Work Ability Index (WAI) [3], referred to as the Work Ability Score (WAS). It has a 0–10 response scale, where 0 stands for "completely unable to work" and 10 stands for "work ability at its best". Work ability was considered poor for scores of 0–5, moderate for scores of 6–7, good for scores of 8–9, and excellent for a score of 10 points, based on the same values that have been used in the WAI.[18] Work-related stress was evaluated with Bergen Burnout Indicator 15 (BBI-15).[19] The BBI-15 measures three dimensions of burnout: exhaustion, cynicism, and reduced professional efficacy. Responses are rated on a 6-point Likert-type scale (1 = totally disagree, 6 = totally agree). In this work, we used the total score from all three dimensions, which can vary from 15 to 90, with higher scores indicating more severe burnout symptoms. Burnout symptoms are in this indicator classified as severe, moderate, mild, and no burnout, with specific threshold values according to gender and age.[19] We assessed burnout as a binary variable where all scores from mild to severe burnout were set to indicate the presence of burnout symptoms.

5

Sleep-related measures

Self-reported sleep quality was assessed with the question "During the past month, how would you rate your sleep quality overall?" (very good, good, poor, or very poor). This is the subjective sleep quality question used in the Pittsburgh Sleep Quality Index (PSQI).[4] In the analyses, the two lowest classes of sleep quality were combined and set to indicate poor sleep quality. Sleep duration was assessed with the question "During the past month, how many hours of sleep did you normally get at night?". The participants were asked to answer the question in a free field, and sleep duration was handled as a continuous variable in the analyses.

Psychosocial measures

Depressive symptoms were assessed with the Major Depression Inventory (MDI) questionnaire.[20] This inventory can be used as a diagnostic tool for major depression (according to DSM IV diagnostic criteria) as well as an assessment tool for severity of depressive symptoms.[20,21] To assess severity of depressive symptoms, a total score of 0–20 is considered as no symptoms, 21–25 as mild symptoms, 26–30 as moderate symptoms, and 31–50 as severe depressive symptoms. In this work, the diagnostic tool was used to determine whether a person had depression or not. Anxiety was assessed with the General Anxiety Disorder 7-item Scale (GAD-7).[22] In the GAD-7, a total score of 0–4 is considered as no anxiety, 5–9 as mild anxiety, 10–14 as moderate anxiety, and 15–21 as severe anxiety. A total score of 10 was used as a cut-off point when a binary variable for anxiety was used in our analyses. This cut-off is recommended by the developers of the GAD-7 questionnaire.[22]

Other measures

Smoking status was assessed by a questionnaire. Non-smoking was defined as having never smoked or having quit smoking >12 months ago. Height and weight were measured by a study nurse with subjects in standing position without shoes and outer garments. Weight was measured to the

6

nearest 0.1 kg with calibrated scales and height to the nearest 0.5 cm with a wall-mounted

stadiometer. BMI was calculated as weight (kg) divided by the square of height (m²). Information

concerning diseases diagnosed by a physician, medication used regularly, marital status (cohabiting

or not), working times (3-shift work or not) and education level (vocational school, college-level

education, or university-level education) was gathered using self-administered questionnaires and

medical records. Alcohol consumption was assessed using the 3-item Alcohol Use Disorders

Identification Test (AUDIT-C) [23] with a cut-off of 5 points for harmful alcohol use in women and 6

points in men.[24,25] Disease burden was defined as having at least one chronic disease diagnosed

by a physician.

Statistical analysis

Continuous variables are presented with means and standard deviations (SD) together with 95%

confidence intervals (CI). Categorical variables are summarized with counts and percentages (%).

Association between sleep quality and background variables was evaluated using a chi-square test or

a one-way analysis of variance (ANOVA).

Association between QoL / work ability and background variables including sleep quality were

examined first one by one (univariate approach), with one-way analysis of variance or with linear

regression. A multivariable model was then built up, and age, gender and all factors with significant

association with QoL and / or work ability in the univariate approach were entered into the model.

The method used was linear model and assumptions were checked using studentized residuals.

All statistical tests were performed as 2-sided, with a significance level set at 0.05. The analyses were

performed using an SAS System version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA).

Patient and public involvement

Information events about the PORTAAT Study with guidance for the management of physical and

psychosocial well-being were arranged for the employees of the selected work units. All participants

7

were given personalized lifestyle counselling at the study visits. The chief of the Welfare Unit of Pori

has been informed regularly about the published study results. The participants of this study were

not involved in the design or development of the study.

RESULTS

The study cohort consisted of 710 employees with a mean age of 49 years (SD 10, range 20 – 68),

89% of whom were female.

Characteristics of the participants and sleep quality

Table 1 displays the basic characteristics of the participants, classified according to their sleep

quality. Sleep quality was reported very good by 14.5%, good by 62.1%, poor by 21.2%, and very

poor by 2.1% of the participants. Poor and very poor sleep quality were combined and set to indicate

poor sleep quality in the analyses. Self-reported sleep quality was negatively associated with disease

burden, prevalence of depression and severity of depressive symptoms, anxiety, and work stress,

and positively associated with QoL and work ability. Better sleep quality was associated with longer

sleep duration (p<0.0001). There were only five participants with a previously diagnosed obstructive

sleep apnoea and three with restless legs syndrome. During the past month, 14.8% of the

participants had used sleep medication at least occasionally. The use of sleep medication was more

common in women (15.1% in women vs. 12.6% in men, p=0.038).

Only 9 (1.3%) of the participants were diagnosed as depressive according to the MDI diagnostic tool.

All of them were also classified as anxious (GAD-7 score > 10). These two psychosocial risk factors

were combined for multivariable analyses.

8

Table 1

Characteristics of the participants according to self-reported sleep quality

	Total	Sleep quality			p-value
		Very good (n=103)	Good (n=441)	Poor (n=166)	
Age mean, years (SD)	49.0 (9.7)	47.5 (10.6)	49.1 (9.7)	49.8 (9.2)	0.072
Gender, n (%)					0.10
Female	631 (88.9)	85 (13.5)	397 (62.9)	149 (23.6)	
Male	79 (11.1)	18 (22.8)	44 (55.7)	17 (21.5)	
Education, n (%)					0.36
Vocational school	21 (3)	4 (19.1)	14 (66.7)	3 (14.3)	
College-level	361 (51.6)	53 (14.7)	232 (64.3)	76 (21.1)	
University-level	318 (45.4)	45 (14.2)	188 (59.1)	85 (26.7)	
Co-habiting, n (%)					0.64
Yes	575 (81.2)	83 (14.4)	353 (61.4)	139 (24.2)	
No	133 (18.8)	20 (15.0)	86 (64.7)	27 (20.3)	
3-shift work, n (%)					0.41
Yes	76 (10.9)	15 (19.7)	44 (57.9)	17 (23.4)	
No	620 (89.1)	87 (14.0)	386 (57.9)	147 (23.7)	
Smoking, n (%)					0.45
Yes	64 (9.0)	9 (14.1)	44 (68.8)	11 (17.2)	
No	645 (91.0)	94 (14.6)	396 (61.4)	155 (24.0)	
Harmful alcohol consumption, n (%)					0.55
Yes	101 (14.2)	18 (17.8)	59 (58.4)	24 (23.8)	
No	609 (85.8)	85 (14.0)	382 (62.7)	142 (23.3)	
Body mass index mean (95% CI)	26.8 (26.42 -27.13)	26.4 (25.50 - 27.25)	27.0 (26.54 - 27.46)	26.5 (25.72 - 27.24)	0.92
Disease burden[a], n (%)					0.0016
Yes	468 (65.9)	55 (11.8)	289 (61.8)	124 (26.5)	
No	242 (34.1)	48 (19.8)	152 (62.8)	42 (17.4)	

9

Depression (MDI), n (%)					0.016
Yes	9 (1.3)	0 (0.0)	3 (33.3)	6 (66.7)	
No	701 (98.7)	103 (14.7)	438 (62.5)	160 (22.8)	
MDI mean score (95% CI)	5.0 (4.57-5.43)	2.4 (1.75 - 2.97)	4.1 (3.59 - 4.51)	9.2 (8.09 - 10.27)	<0.0001
Level of anxiety (GAD-7), n (%)					<0.0001
No anxiety	534 (75.2)	92 (17.2)	343 (64.2)	99 (18.5)	
Mild anxiety	143 (20.1)	10 (7.0)	85 (59.4)	48 (33.6)	
Moderate anxiety	26 (3.7)	1 (3.9)	10 (38.5)	15 (57.7)	
Severe anxiety	7 (1.0)	0 (0.0)	3 (42.9)	4 (57.1)	
BBI15 mean total score (95% CI)	31.6 (30.82-32.41)	28.3 (26.43-30.23)	31.0 (30.05- 31.99)	35.4 (33.60-37.20)	<0.0001
Occupational stress (BBI15), n (%)					<0.0001
No stress	592 (89.4)	97 (16.4)	374 (63.2)	121 (20.4)	
Stress	70 (10.6)	3 (4.3)	38 (54.3)	29 (41.4)	
Sleep duration mean (95% CI)	7.00 (6.93 - 7.07)	7.50 (7.35 - 7.66)	7.17 (7.09 - 7.24)	6.23 (6.09 - 6.38)	<0.0001
EUROHIS mean score (95% CI)	4.07 (4.03 - 4.11)	4.38 (4.30 - 4.45)	4.09 (4.05 - 4.14)	3.83 (3.75 - 3.91)	<0.0001
WAS mean score (95% CI)	8.31 (8.21-8.41)	8.99 (8.78 - 9.20)	8.34 (8.22 - 8.46)	7.80 (7.55 - 8.04)	<0.0001
Level of work ability (WAS), n (%)					<0.0001
Poor	27 (3.8)	1 (3.7)	12 (44.4)	14 (51.9)	
Moderate	114 (16.1)	3 (2.6)	69 (60.5)	42 (36.8)	
Good	459 (64.9)	61 (13.3)	298 (64.9)	100 (21.8)	
Excellent	107 (15.1)	37 (34.6)	60 (56.1)	10 (9.4)	

ª At least one chronic disease diagnosed by a physician, BBI15 = Bergen Burnout Indicator 15, CI = Confidence Interval, EUROHIS = EUROHIS-QOL 8-item index, GAD-7= General Anxiety Disorder 7-item Scale, MDI = Major Depression Inventory, SD = Standard deviation, WAS = Work Ability Score

10

Quality of life

As seen in Table 2, the EUROHIS-QOL mean score among all participants was 4.07 (SD 0.51) with no

significant difference between genders (p=0.94). In the univariate approach, QoL was positively

associated with good sleep quality, university-level education, co-habiting, lower BMI and younger

age, and negatively associated with occupational stress, depression, anxiety and disease burden.

In the multiway analysis of co-variance, QoL was positively associated with good sleep quality, co-

habiting, university-level education and lower BMI, and negatively associated with occupational

stress, depression and/or anxiety and disease burden (Table 2).

11

Table 2

Predictors of quality of life in a univariate approach and in a multivariable model. EUROHIS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	EUROHIS total mean / slope	95% Confidence Interval	p-value	EUROHIS total model based mean / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.0040	(-0.0079, -0.00008)	0.046	-0.00028	-0.0042 - 0.0036	0.02	1	0.89
Gender			0.94			0.00	1	0.99
Female	4.07	4.03 - 4.11		3.54	3.38 - 3.70			
Male	4.07	3.96 - 4.18		3.54	3.36 - 3.72			
Education			0.036			4.17	2	0.016
Vocational school	3.83	3.61 - 4.05		3.37	3.11 - 3.62			
College-level	4.05	4.00 - 4.11		3.59	3.44 - 3.74			
University-level	4.11	4.05 - 4.16		3.66	3.51 - 3.81			
Co-habiting			0.011			5.72	1	0.017
Yes	4.09	4.05 - 4.13		3.59	3.43 - 3.75			
No	3.97	3.88 - 4.06		3.48	3.31 - 3.66			
Smoking			0.39					
Yes	4.02	3.89 - 4.14						
No	4.08	4.38 - 4.12						
Harmful alcohol consumption			0.33					
Yes	4.12	4.02 -4.22						
No	4.06	4.02 - 4.11						
Body mass index	-0.020	(-0.028, -0.012)	<0.0001	-0.018	(-0.025, -0.011)	23.91	1	<0.0001
Disease burden[a]			<0.0001			13.35	1	0.0003
Yes	3.99	3.95 - 4.04		3.47	3.31 - 3.63			
No	4.22	4.16 - 4.29		3.61	3.44 - 3.77			
Depression[b]			<0.0001					
Yes	3.07	2.74 - 3.39						

12

	Mean	CI	p-value	Mean	CI	χ²	DF	p-value
No	4.08	4.05 - 4.12						
Level of anxiety[c]			<0.0001					
No	4.19	4.16 - 4.23						
Mild	3.75	3.67 - 3.82						
Moderate	3.47	3.29 - 3.64						
Severe	3.66	3.32 - 4.00						
Depression and/or anxiety[bd]						13.92	2	<0.0001
No depression/ No anxiety				3.89	3.77 - 4.08			
Only anxiety				3.59	3.36 - 3.34			
Depression and anxiety				3.14	2.81 - 3.44			
Occupational stress[e]			<0.0001			39.30	1	<0.0001
Yes	3.63	3.51 - 3.74		3.35	3.18 - 3.59			
No	4.13	4.09 - 4.17		3.72	3.56 - 3.87			
3-shift work			0.089			0.55	1	0.46
Yes	4.16	4.02 - 4.10		3.56	3.37 - 3.74			
No	4.06	4.05 - 4.28		3.52	3.36 - 3.67			
Self-reported sleep quality			<0.0001			22.02	2	<0.0001
Very good	4.38	4.30 - 4.45		3.74	3.56 - 3.92			
Good	4.05	4.05 - 4.14		3.53	3.36 - 3.69			
Poor	3.83	3.75 - 3.91		3.34	3.18 - 3.51			

[a] At least one chronic disease diagnosed by a physician, [b] Defined by Major Depression Inventory (MDI) diagnostic tool (DSM IV), [c] General Anxiety Disorder 7-item Scale (GAD-7), [d] General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, [e] Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI = Confidence Interval, DF = Degrees of freedom, EUROHIS = EUROHIS-QOL 8-item index

13

Work ability

Work ability was reported excellent by 15.2%, good by 64.9%, moderate by 16.1% and poor by 3.8% of the participants. The WAS mean score among all participants was 8.31 (SD 1.37), and the median was 9.0 (Q1:8.0, Q3:9.0). There was no difference in work ability between genders (p=0.11). In the univariate approach, work ability was positively associated with good sleep quality, younger age, lower BMI, university-level education, female gender, and 3-shift work, and negatively associated with disease burden, depression, anxiety and occupational stress.

In the multiway analysis of co-variance, work ability was positively associated with good sleep quality, younger age, lower BMI, and university-level education, and negatively associated with occupational stress and disease burden (Table 3).

14

Table 3

Predictors of work ability in a univariate approach and in a multivariable model. WAS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	WAS estimate / slope	95% Confidence Interval	p-value	WAS model based estimate / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.019	(-0.029, -0.0090)	0.0002	-0.012	(-0.022, -0.0018)	5.34	1	0.021
Gender			0.027			3.36	1	0.067
Female	8.35	8.24 - 8.46		7.83	7.43 - 8.23			
Male	7.99	7.68 - 8.29		7.56	7.09 - 8.03			
Education			0.0079			4.74	2	0.0091
Vocational school	7.90	7.30 - 8.50		7.42	6.76 - 8.07			
College-level	8.18	8.04 - 8.32		7.70	7.32 - 8.09			
University-level	8.48	8.33 - 8.63		7.80	7.58 - 8.37			
Co-habiting			0.91			0.04	1	0.85
Yes	8.31	8.20 - 8.42		7.69	7.27 - 8.10			
No	8.30	8.06 - 8.53		7.71	7.26 - 8.18			
Smoking			0.19					
Yes	8.10	7.76 - 8.44						
No	8.33	8.23 - 8.44						
Harmful alcohol consumption			0.35					
Yes	8.43	8.18 - 8.40						
No	8.30	8.16 - 8.70						
Body mass index	-0.036	(-0.057, - 0.016)	0.0006	-0.023	(-0.042, -0.0041)	5.71	1	0.017
Disease burden[a]			<0.0001			12.23	1	0.0005
Yes	8.07	7.95 - 8.20		7.52	7.11 - 7.95			
No	8.77	8.60 - 8.93		7.87	7.44 - 8.30			
Depression[b]			0.0083					
Yes	7.11	6.22 - 8.01						

15

	Mean	95% CI	p-value	Mean	95% CI	χ²	DF	p-value
No	8.33	8.23 - 8.43						
Level of anxiety[c]			<0.0001					
No	8.55	8.44 - 8.66						
Mild	7.59	7.38 - 7.81						
Moderate	7.44	6.95 - 7.94						
Severe	8.00	7.03 - 8.97						
Depression and/or anxiety[bd]						1.73	2	0.17
No depression / No anxiety				8.02	7.72 - 8.20			
Only anxiety				7.67	7.07 - 8.20			
Depression and anxiety				7.41	6.57 - 8.24			
Occupational stress[e]			<0.0001			29.80	1	<0.0001
Yes	7.47	7.18 - 7.76		7.28	6.82 - 7.74			
No	8.47	8.37 - 8.57		8.12	7.70 - 8.55			
3-shift work			0.0040			3.75	1	0.053
Yes	8.74	8.43 - 9.05		7.84	7.36 - 8.33			
No	8.26	8.15 - 8.36		7.55	7.16 - 7.95			
Self-reported sleep quality			<0.0001			14.44	2	<0.0001
Very good	9.00	8.73 - 9.25		8.13	7.66 - 8.60			
Good	8.34	8.22 - 8.47		7.68	7.25 - 8.10			
Poor	7.80	7.59 - 8.00		7.29	6.86 - 7.72			

[a] At least one chronic disease diagnosed by a physician, [b] Defined by Major Depression Inventory (MDI) diagnostic to (DSM IV), [c] General Anxiety Disorder 7-item Scale (GAD-7), [d] General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, [e] Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI= Confidence Interval, DF = Degrees of freedom, WAS = Work Ability Score

16

DISCUSSION

In this study, we managed to show that occupational stress, self-reported sleep quality, and disease burden were powerful predictors of both QoL and work ability in public sector employees. In addition, QoL was strongly associated with BMI and depression and / or anxiety. To our knowledge, few studies have evaluated QoL and work ability simultaneously among apparently healthy, working-age individuals, with information about a wide range of factors potentially influencing these two variables. However, although both QoL and work ability were assessed, we could not enter them in the same model because these factors are so closely related.

Occupational stress was identified as the strongest predictor of both QoL and work ability in this study. It is well known, that job strain is an important factor affecting employees' health and well-being.[26–28] Occupational stress is known to be associated, for example, with poor sleep quality [29], lower work ability [30] and mental health problems.[31] Furthermore, work stress was found to be associated with elevated mortality rates in patients with cardiometabolic disease in a large multicohort study.[32] Work stress has also been found to have a negative association with QoL in several studies.[26,27] The interesting finding in our study was that the association of occupational stress with QoL and WAS was strong, regardless of the fact that our study population had low rates of occupational stress. Only 10.6% of the participants in our study had at least mild occupational stress symptoms, and severe symptoms were very rare. It is thus possible that even low levels of occupational stress can have an important influence on a person's work ability and QoL. These results highlight the need for screening and handling of work stress among municipal employees.

As we hypothesized, self-reported sleep quality was also a powerful predictor of both QoL and work ability in this study. A negative association between poor sleep quality and QoL has previously been demonstrated among patients with sleep disorders and other medical conditions [6–9], and studies on shift workers have shown a clear association between sleep quality and QoL.[33,34] Furthermore, in a previous work on higher education students, Marques et al. showed that self-reported sleep

17

quality remained a significant predictor of most aspects of QoL, regardless of the presence of

psychopathological symptoms, such as depression.[10] Sleep problems have in previous literature

also been linked to poorer work ability and an increased rate of sickness absence.[11,12] In addition,

Ng et al. have shown a positive association between good sleep quality and work ability among Hong

Kong construction workers.[35] However, in this study we managed to show that self-reported sleep

quality is a significant predictor of both QoL and work ability among apparently healthy employees

not restricted to a specific occupation and working mainly in regular morning shifts. The associations

remained significant also in the multivariable models, where many potential confounding factors

could be taken into account.

Disease burden, higher BMI and lower educational level were negatively associated with both QoL

and work ability in this study, as well as in previous literature. Chronic diseases are known to have a

negative association with QoL [2] and with work ability.[36,37] Lower BMI has been linked to better

QoL [38] and to better work ability [39,40], and higher education has been positively associated with

QoL [41] and with work ability.[42] In our study, as well as in previous literature, older age was

associated with poorer work ability [39,43], but no significant association was found between age

and QoL. This finding is consistent with the Finnish reference values for the EUROHIS-QOL 8-item

index.[44] Furthermore, cohabiting had a significant positive association with QoL in our study, as

has previously been observed in a population based study in Sweden.[45] Cohabiting has previously

been linked to better health and work ability, for example, in an unemployed population [46], but in

our setting, where only active work force was studied, there was no significant association between

cohabiting and work ability.

An interesting finding in our study was that depression and / or anxiety was a strong predictor of

QoL but did not have a significant association with work ability in the multivariable model.

Depression and anxiety are known to have a negative impact on QoL [47–49], but depression also

affects a person's ability to work.[37,50] However, depression often leads to sickness absence, which

18

means that these people are not in the active work force. In our study, the prevalence of depression

and anxiety was low, and most of the cases were relatively mild. Only 9 (1.3%) of the participants

met the diagnostic criteria for major depression and 33 (4.6%) of the participants where categorized

as moderately or severely anxious. It is known that not all depressive patients consider themselves

unable to work.[50] These patients may benefit from the schedule and routine of work life and do

not want to seek sick leave, while depression still affects their QoL. In the Finnish Current Care

Guidelines for depression, sick leave is not recommended in mild depression and the need for sick

leave in moderate depression should be evaluated individually.[51] According to these

recommendations, those depressive patients whose work ability is not affected should remain in the

active work force. Furthermore, as the prevalence of depression and anxiety in our study population

was low, the generalizability of these results can be questioned.

In this study, 3-shift work was not significantly associated either with QoL or with work ability in the

multivariable models. In the univariate approach, the work ability of the 3-shift workers was better

(p=0.0040), but no significant difference was seen in QoL. Somewhat surprisingly, 3-shift work did

not seem to have any adverse effects on the participants' well-being in our study. There was no

difference in sleep quality or occupational stress compared to the regular morning shift workers.

Almost all 3-shift workers in our study were women working as nurses or social workers. Their mean

age was 45.6 years, which is 3.5 years younger than the mean age of the whole study population. In

addition to the younger age, one possible explanation for their well-being is that they may have

voluntarily chosen to work in shifts and feel that it is a suitable way of working for them. Those shift

workers who have had health problems or difficulties with sleep due to shift work may have changed

to day work.[52] Another unexpected result in this work was that harmful alcohol consumption did

not have adverse effects on sleep quality, QoL or work ability. However, even though there were 101

(14.2%) participants that fulfilled the definition of "harmful drinking" in the AUDIT-C, heavy drinking

was very rare in this predominantly female, active work force population. We assume that these

19

people may consume alcohol mainly during weekends, which diminishes the effects on everyday life and work.

We acknowledge some limitations of the study. We cannot determine the causality of the found associations because of the cross-sectional nature of the study. A possible healthy worker effect [53] can be present because only subjects in the active work force were studied. In addition, the initial response rate in the first part of the study in 2014 was only 32.5% (and 84.9% of them attended this follow-up study in 2015). It is known that response rates in e-mail surveys tend to be lower than in mail surveys [54], but it can nevertheless cause selection bias. It is possible that the healthiest part of the work force is also the most willing to attend voluntary health surveys, which may result in the possibility that our results reflect the situation in the mainly healthy section of the work force. The information about alcohol consumption was collected by self-assessment, which may be influenced by social desirability. In addition, we unfortunately do not have data of possible menopausal symptoms, which may have affected our results in women.

The strengths of our study are that we could take into account several aspects affecting the employees' QoL and work ability. All questionnaires were completed by the participants at home before the examination was performed. In this study, the approaches to sleep quality, QoL and work ability were all subjective, which emphasizes the importance of personal experience in evaluating these factors. We assessed self-reported sleep quality and work ability with single questions. This approach was chosen over longer questionnaires because a single question could also be used at a normal physician's appointment in primary or occupational health care for the evaluation of these factors. The self-reported sleep quality question we used was from the Pittsburgh Sleep Quality Index (PSQI), and it has previously been shown to be closely related with QoL.[10] With this question we showed a clear association of sleep quality with QoL and with work ability. However, it would be interesting to further assess this connection in a similar population with a more detailed questionnaire to determine whether the different components of sleep have different impacts on

20

QoL and work ability. The WAS score we used for the evaluation of work ability has been shown to have a strong association with the Work Ability Index and is reliable in evaluating work ability.[55] WAS has also been shown to predict disability pension and long-term sickness absence according to a Finnish register-based study.[56] The associations of self-reported sleep quality with both QoL and with work ability were clear and in line with previous literature even when studied with these simple tools.

CONCLUSIONS

In this paper we showed that occupational stress and self-reported sleep quality are powerful predictors of both QoL and work ability among Finnish public sector employees. According to our results, even a low level of occupational stress has a significant negative association with QoL and work ability. In addition, we found that even in this apparently healthy population one in four employees suffers from poor sleep quality. These findings highlight the need for screening and handling work stress and sleep problems in occupational and primary health care.

CONTRIBUTORS

EB, EL, SM, PR and PK contributed to the conception or design of the work, and to the acquisition, analysis or interpretation of data for the work. EB and PK drafted the manuscript. All authors critically revised the manuscript, gave final approval, and agreed to be accountable for all aspects of work ensuring integrity and accuracy.

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FUNDING

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DECLARATION OF COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the

ethical standards of the institutional and/or national research committee and with the 1964 Helsinki

Declaration and its later amendments or comparable ethical standards. The study protocol and

consent forms were reviewed and approved by the Ethics Committee of the Hospital District of

Southwest Finland (ETMK 43/180/2013).

INFORMED CONSENT

Written informed consent was obtained from all individual participants included in the study.

AVAILABILITY OF DATA

The datasets used and/or analysed during the current study are available from the corresponding

author on request.

REFERENCES

1   Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community

     studies. *J Health Soc Behav* 1997;**38**:21–37.http://www.ncbi.nlm.nih.gov/pubmed/9097506

     (accessed 3 Sep 2019).

2   Schmidt S, Mühlan H, Power M. The EUROHIS-QOL 8-item index: Psychometric results of a

     cross-cultural field study. *Eur J Public Health* 2006;**16**:420–8. doi:10.1093/eurpub/cki155

3   Ilmarinen J. The Work Ability Index (WAI). *Occup Med (Chic Ill)* 2006;**57**:160–160.

     doi:10.1093/occmed/kqm008

4   Buysse DJ, Reynolds CF, Monk TH, *et al.* The Pittsburgh sleep quality index: A new instrument

22

for psychiatric practice and research. *Psychiatry Res* Published Online First: 1989. doi:10.1016/0165-1781(89)90047-4

5   Bergman E, Löyttyniemi E, Rautava P, *et al.* Ideal cardiovascular health and quality of life among Finnish municipal employees. *Prev Med Reports* 2019;**15**:100922. doi:10.1016/j.pmedr.2019.100922

6   LeBlanc M, Beaulieu-Bonneau S, Mérette C, *et al.* Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res* 2007;**63**:157–66. doi:10.1016/j.jpsychores.2007.03.004

7   Reimer MA, Flemons WW. Quality of life in sleep disorders. *Sleep Med Rev* 2003;**7**:335–49. doi:10.1053/smrv.2001.0220

8   Liu L, Fiorentino L, Rissling M, *et al.* Decreased Health-Related Quality of Life in Women With Breast Cancer Is Associated With Poor Sleep. *Behav Sleep Med* 2013;**11**:189–206. doi:10.1080/15402002.2012.660589

9   Liu J-C, Hung H-L, Shyu Y-K, *et al.* The Impact of Sleep Quality and Daytime Sleepiness on Global Quality of Life in Community-Dwelling Patients With Heart Failure. *J Cardiovasc Nurs* 2011;**24**:99–105. doi:10.1097/JCN.0b013e3181ed7d12

10   Marques DR, Meia-Via AMS, da Silva CF, *et al.* Associations between sleep quality and domains of quality of life in a non-clinical sample: results from higher education students. *Sleep Heal* 2017;**3**:348–56. doi:10.1016/j.sleh.2017.07.004

11   Lian Y, Xiao J, Liu Y, *et al.* Associations between insomnia, sleep duration and poor work ability. *J Psychosom Res* 2015;**78**:45–51. doi:10.1016/j.jpsychores.2014.09.009

12   Lallukka T, Kaikkonen R, Härkänen T, *et al.* Sleep and Sickness Absence: A Nationally Representative Register-Based Follow-Up Study. *Sleep* 2014;**37**:1413–25.

23

doi:10.5665/sleep.3986

13 Chiu MC, Wang MJJ, Lu CW, *et al.* Evaluating work ability and quality of life for clinical nurses in Taiwan. *Nurs Outlook* 2007;**55**:318–26. doi:10.1016/j.outlook.2007.07.002

14 Sörensen LE, Pekkonen MM, Männikkö KH, *et al.* Associations between work ability, health-related quality of life, physical activity and fitness among middle-aged men. *Appl Ergon* 2008;**39**:786–91. doi:10.1016/j.apergo.2007.11.001

15 Power M. Development of A Common Instrument for Quality of Life. *EUROHIS Dev Common Instruments Heal Surv* 2003;**57**:145–59.http://www.euro.who.int/en/publications/abstracts/eurohis-developing-common-instruments-for-health-surveys

16 WHOQOL Group. the World Health Organization Quality of Life Assessment (Whoqol): Development and General Psychometric Properties* the Whoqol Group{. *Soc Sci Med* 1998;**46**:1569–85. doi:10.1016/S0277-9536(98)00009-4

17 THE WHOQOL GROUP. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychol Med* 1998;**28**:551–8. doi:10.5.12

18 Gould R, Ilmarinen J, Jarvisalo J, *et al. Dimensions of Work Ability*. 2008. doi:10.1108/02656710210415668

19 Näätänen P, Aro A, Mathiesen SB, *et al. Bergen Burnout Indicator 15*. Helsinki: : Edita 2003.

20 Bech P, Rasmussen NA, Olsen LR, *et al.* The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *J Affect Disord* 2001;**66**:159–64. doi:10.1016/S0165-0327(00)00309-8

21 Bech P, Timmerby N, Martiny K, *et al.* Psychometric evaluation of the Major Depression Inventory (MDI) as depression severity scale using the LEAD (Longitudinal Expert

24

Assessment of All Data) as index of validity. *BMC Psychiatry* 2015;:1–7. doi:10.1186/s12888-015-0529-3

22   Spitzer RL, Kroenke K, Williams JBW, *et al.* A Brief Measure for Assessing Generalized Anxiety Disorder. 2006;**166**:1092–7.

23   Bush K, Kivlahan DR, McDonell MB, *et al.* The AUDIT alcohol consumption questions (AUDIT-C). *Arch Interal Med* 1998;**158**:1789–95. doi:10.1097/00000374-199811000-00034

24   Aalto M, Tuunanen M, Sillanaukee P, *et al.* Effectiveness of structured questionnaires for screening heavy drinking in middle-aged women. *Alcohol Clin Exp Res* 2006;**30**:1884–8. doi:10.1111/j.1530-0277.2006.00233.x

25   Tuunanen M, Aalto M, Seppä K. Binge drinking and its detection among middle-aged men using AUDIT, AUDIT-C and AUDIT-3. *Drug Alcohol Rev* 2007;**26**:295–9. doi:10.1080/09595230701247756

26   Sarafis P, Rousaki E, Tsounis A, *et al.* The impact of occupational stress on nurses' caring behaviors and their health related quality of life. *BMC Nurs* 2016;**15**:1–9. doi:10.1186/s12912-016-0178-y

27   Yang X, Ge C, Hu B, *et al.* Relationship between quality of life and occupational stress among teachers. *Public Health* 2009;**123**:750–5. doi:10.1016/j.puhe.2009.09.018

28   Lerner DJ, Levine S, Malspeis S, *et al.* Job strain and health-related quality of life in a national sample. *Am J Public Health* 1994;**84**:1580–5. doi:10.2105/AJPH.84.10.1580

29   Knudsen HK, Ducharme LJ, Roman PM. Job stress and poor sleep quality: Data from an American sample of full-time workers. *Soc Sci Med* 2007;**64**:1997–2007. doi:10.1016/j.socscimed.2007.02.020

30   Yong M, Nasterlack M, Pluto R-P, *et al.* Occupational stress perception and its potential

25

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impact on work ability. *Work* Published Online First: 2013. doi:10.3233/WOR-121556

31   Chen W-Q, Wong T-W, Yu T-S. Review Article: Influence of occupational stress on mental

health among Chinese off-shore oil workers. *Scand J Soc Med* 2009;**37**:766–73.

doi:10.1177/1403494809341097

32   Kivimäki M, Pentti J, Ferrie JE, *et al.* Work stress and risk of death in men and women with

and without cardiometabolic disease: a multicohort study. *Lancet Diabetes Endocrinol*

2018;:7–9. doi:10.1016/S2213-8587(18)30140-2

33   Palhares V de C, Corrente JE, Matsubara BB. Association between sleep quality and quality of

life in nursing professionals working rotating shifts. *Rev Saude Publica* 2014;**48**:594–601.

doi:10.1590/S0034-8910.2014048004939

34   Nena E, Katsaouni M, Steiropoulos P, *et al.* Effect of Shift Work on Sleep , Health , and Quality

of Life of Health-care Workers. *Indian J Occup Env Med* 2018;**22**:29–34.

doi:10.4103/ijoem.IJOEM

35   Ng JYK, Chan AHS. The work ability of Hong Kong construction workers in relation to

individual and work-related factors. *Int J Environ Res Public Health* 2018;**15**.

doi:10.3390/ijerph15050990

36   Jędryka-Góral A, Bownik I, Michalak JM, *et al.* Work Ability in Ageing Workers Suffering From

Chronic Diseases. *Int J Occup Saf Ergon* 2015;**12**:17–30.

doi:10.1080/10803548.2006.11076665

37   Leino-Arjas P, Kaila-Kangas L, Heliövaara M, *et al.* The Relation of Co-occurring

Musculoskeletal Pain and Depressive Symptoms With Work Ability. *J Occup Environ Med*

2013;**55**:1281–5. doi:10.1097/jom.0b013e3182a4ffc4

38   Kroes M, Osei-Assibey G, Baker-Searle R, *et al.* Impact of weight change on quality of life in

26

adults with overweight/obesity in the United States: a systematic review. *Curr Med Res Opin* 2015;**32**:485–508. doi:10.1185/03007995.2015.1128403

39   Bridger RS, Bennett AI. Age and BMI interact to determine work ability in seafarers. *Occup Med (Chic Ill)* 2011;**61**:157–62. doi:10.1093/occmed/kqr003

40   Andersen LL, Izquierdo M, Sundstrup E. Overweight and obesity are progressively associated with lower work ability in the general working population: cross-sectional study among 10,000 adults. *Int Arch Occup Environ Health* 2017;**90**:779–87. doi:10.1007/s00420-017-1240-0

41   Mielck A, Reitmeir P, Vogelmann M, *et al.* Impact of educational level on health-related quality of life (HRQL): results from Germany based on the EuroQol 5D (EQ-5D). *Eur J Public Health* 2011;**23**:45–50. doi:10.1093/eurpub/ckr206

42   Martimo KP, Varonen H, Husman K, *et al.* Factors associated with self-assessed work ability. *Occup Med (Chic Ill)* 2007;**57**:380–2. doi:10.1093/occmed/kqm028

43   Pohjonen T. Perceived work ability of home care workers in relation to individual and work-related factors in different age groups. *Occup Med (Chic Ill)* 2001;**51**:209–17. doi:10.1093/occmed/51.3.209

44   Koskinen S, Lundqvist A, Ristiluoma N. *Terveys, toimintakyky ja hyvinvointi Suomessa 2011*. 2012. http://www.julkari.fi/bitstream/handle/10024/90832/Rap068_2012_netti.pdf?sequence=1

45   Helena Michelson, Christina Bolund,. Health-related Quality of Life Measured by the EORTC QLQ-C30: Reference Values From a Large Sample of the Swedish Population. *Acta Oncol (Madr)* 2002;**39**:477–84. doi:10.1080/028418600750013384

46   Hult M, Pietilä AM, Koponen P, *et al.* Association between good work ability and health

27

behaviours among unemployed: A cross-sectional survey. *Appl Nurs Res* 2018;**43**:86–92. doi:10.1016/j.apnr.2018.07.008

47   Saarni SI, Suvisaari J, Sintonen H, *et al.* Impact of psychiatric disorders on health-related quality of life: General population survey. *Br J Psychiatry* 2007;**190**:326–32. doi:10.1192/bjp.bp.106.025106

48   Palacin C, Martinez-Alonso M, Codony M, *et al.* Use of mental health services in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatr Scand* 2004;**109**:47–54. doi:10.1111/j.1600-0047.2004.00330.x

49   Da Rocha NS, Power MJ, Bushnell DM, *et al.* The EUROHIS-QOL 8-item index: Comparative psychometric properties to its parent WHOQOL-BREF. *Value Heal* 2012;**15**:449–57. doi:10.1016/j.jval.2011.11.035

50   Elinson L, Houck P, Marcus SC, *et al.* Depression and the Ability to Work. *Psychiatr Serv* 2003;**55**:29–34. doi:10.1176/appi.ps.55.1.29

51   Isometsä E, Kinnunen E, Kivekäs T, *et al.* Depression. Current Care Guidelines. Working group set up by the Finnish Medical Society Duodecim and the Finnish Psychiatric Association. Finnish Curr. Care Guidel. 2016.www.kaypahoito.fi (accessed 5 Sep 2019).

52   Linton SJ, Kecklund G, Franklin KA, *et al.* The effect of the work environment on future sleep disturbances: A systematic review. *Sleep Med Rev* 2015;**23**:10–9. doi:10.1016/j.smrv.2014.10.010

53   Li C, Sung E. A review of the healthy worker effect in occupational epidemiology. *Occup Med (Chic Ill)* 1999;**49**:225–9.

54   Shih T, Fan X. Comparing response rates in e-mail and paper surveys : A meta-analysis. *Educ Res Rev* 2009;**4**:26–40. doi:10.1016/j.edurev.2008.01.003

28

55   Fassi M El, Bocquet V, Majery N, *et al.* Work ability assessment in a worker population :

      comparison and determinants of Work Ability Index and Work Ability score. *BMC Public

      Health* 2013;**13**:1–10.

56   Kinnunen U, Nätti J. Work ability score and future work ability as predictors of register-based

      disability pension and long-term sickness absence: A three-year follow-up study. *Scand J

      Public Health* 2018;**46**:321–30. doi:10.1177/1403494817745190

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Factors associated with quality of life and work ability among Finnish municipal employees: a cross-sectional study

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FACTORS ASSOCIATED WITH QUALITY OF LIFE AND WORK ABILITY AMONG FINNISH MUNICIPAL

EMPLOYEES: A CROSS-SECTIONAL STUDY

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1

ABSTRACT

Objectives: Quality of life (QoL) and work ability are elementary parts in defining the well-being of an employed person. The aim of this study was to demonstrate factors associated with QoL and self-reported work ability among public sector employees, while taking into account several confounding factors, including sleep quality, occupational stress and psychological symptoms.

Methods: A cross-sectional study was conducted in Finland among 710 employees (89% women, mean age 49 [SD = 10] years) from ten municipal work units in 2015. Information about the participants was collected by physical examination, self-administered questionnaire and from medical history. QoL was assessed with the EUROHIS-QOL 8-item index and work ability with the Work Ability Score (WAS).

Results: The EUROHIS-QOL mean score among all participants was 4.07 (95% CI 4.03–4.11). QoL was positively associated with good sleep quality, cohabiting, university-level education, and lower BMI, and negatively associated with occupational stress, depression and/or anxiety and disease burden. Work ability was reported good or excellent by 80% of the participants and the WAS mean score among all participants was 8.31 (95% CI 8.21–8.41). Work ability was positively associated with good sleep quality, younger age, lower BMI and university-level education, and negatively associated with occupational stress and disease burden.

Conclusions: Occupational stress and self-reported sleep quality were strongly associated with both QoL and work ability among Finnish public sector employees. These findings highlight the need for screening and handling of work stress and sleep problems in occupational and primary health care.

KEYWORDS

Quality of life, Work ability, Occupational health, Sleep quality, Occupational stress

2

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Several aspects associated with the employees' quality of life and work ability could be taken into account.

- The participants completed all questionnaires at home before the examination was performed.

- Psychological symptoms were assessed with well-validated instruments.

- Any causality cannot be determined due to the cross-sectional nature of the study.

- The response rate of the study was moderate at most, which is a common limitation in e-mail surveys.

INTRODUCTION

Quality of life (QoL) and work ability are elementary outcomes in defining the well-being of an employed person. Both of these can be affected by numerous conditions, including physical and mental health [1,2], occupational stress [3,4], sleep quality [5,6] , psychosocial risk factors and environmental aspects. [7] Many of these can be measured reliably by evaluating the persons' perceptions about the condition with self-reported assessment tools. [1,8–13] In our previous study, especially self-reported sleep quality was strongly associated with QoL among public sector employees. [14]

QoL and work ability have been studied also previously in currently employed populations, but most of the studies have concentrated on a specific occupational group or employees suffering from a certain medical condition. [2,15,16] To our knowledge, there is a gap of information about factors associated with QoL and work ability, studied simultaneously among apparently healthy public sector employees. Public sector is a large employer sector in the Scandinavian countries, and it

3

would be important to recognize the factors associated with well-being of the employees in

municipal work places.

The aim of this study was to demonstrate factors associated with QoL and self-reported work ability

among public sector employees, while taking into account several confounding factors, including

psychological symptoms, sleep quality and occupational stress. We wanted to use short, subjective

and user-friendly tools for the assessment of QoL, work ability and sleep quality. These instruments

could easily be used for screening also in occupational and primary healthcare.

PARTICIPANTS AND METHODS

Participants

This cross-sectional study was part of the PORTAAT (PORi To Aid Against Threats) study conducted

among employees of the city of Pori (83,497 inhabitants in 2014) in South-Western Finland in 2014

and 2015. The participating work units were selected by the chief of the Welfare Unit of Pori.

Invitations to participate and information of the study were sent to employees via e-mail by the

managers of the selected ten work units (total number of employees 2,570). The employees willing

to participate contacted the study contact person at their work unit, who then sent their contact

information to the study nurse. There were no exclusion criteria. A total of 836 employees (104

males, 732 females) participated in the study in 2014. The response rate in 2014 was 32.5%.

Complete information about data collection from that year has been described earlier. [17] All the

initial respondents were invited to the second part of the study in 2015, and 710 of them (79 males,

631 females) attended. In the present work, all the information is from the year 2015, and this data

was chosen, because complete information about psychosocial risk factors was available only from

that year. The gender distribution of the study participants corresponds to the standard gender

distribution of the employees of Pori. The participants' occupations included librarians, museum

4

employees, janitors, IT workers, social workers, nurses, physicians, administrative officials, and

general office staff. The involved employment sectors, reported according to the number of

employees participating in the study in 2015 were Health and Welfare (275 employees), Social Work

(198), Technical Services (143), Education and Culture (62) and Administration (32).

Quality of life

QoL was assessed with the EUROHIS-QOL 8-item index.[18] This is a shortened version of the

WHOQOL-Bref scale, a widely used instrument for the assessment of generic QoL.[7,19] The domains

in both questionnaires are the general, physical, psychological, social and environmental aspects of

QoL. The EUROHIS-QOL instrument has been validated in several European countries.[1] The

participants of the present study answered the questions at home before the study visits. Every

question was scored from 1 to 5 (1 for very poor and 5 for very good). All scores were then added

together and divided by 8 (the sum of the questions) to obtain the EUROHIS-QOL mean score.[1]

Work-related measures

Work ability was assessed with the question "What is your current work ability compared to your

lifetime best?". This is the first item of the widely used Work Ability Index (WAI) [9], referred to as

the Work Ability Score (WAS). It has a 0–10 response scale, where 0 stands for "completely unable to

work" and 10 stands for "work ability at its best". Work ability was considered poor for scores of 0–

5, moderate for scores of 6–7, good for scores of 8–9, and excellent for a score of 10 points, based

on the same values that have been used in the WAI.[20] Work-related stress was evaluated with

Bergen Burnout Indicator 15 (BBI-15).[13] The BBI-15 measures three dimensions of burnout:

exhaustion, cynicism, and reduced professional efficacy. Responses are rated on a 6-point Likert-

type scale (1 = totally disagree, 6 = totally agree). In this work, we used the total score from all three

dimensions, which can vary from 15 to 90, with higher scores indicating more severe burnout

symptoms. Burnout symptoms are in this indicator classified as severe, moderate, mild, and no

burnout, with specific threshold values according to gender and age.[13] We assessed burnout as a

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binary variable where all scores from mild to severe burnout were set to indicate the presence of

burnout symptoms.

Sleep-related measures

Self-reported sleep quality was assessed with the question "During the past month, how would you

rate your sleep quality overall?" (very good, good, poor, or very poor). In the analyses, the two

lowest classes of sleep quality were combined and set to indicate poor sleep quality. Sleep duration

was assessed with the question "During the past month, how many hours of sleep did you normally

get at night?". The participants were asked to answer the question in a free field, and sleep duration

was handled as a continuous variable in the analyses. Both of these questions are items from the

well-validated Pittsburgh Sleep Quality Index (PSQI)[10], which has good internal consistency (α =

0.83) and test–retest reliability (r = 0.82; over an average of 19 days). [21,22]

Psychological symptoms

Depressive symptoms were assessed with the Major Depression Inventory (MDI) questionnaire.[23]

This inventory can be used as a diagnostic tool for major depression (according to DSM IV diagnostic

criteria) as well as an assessment tool for severity of depressive symptoms.[11,23] To assess severity

of depressive symptoms, a total score of 0–20 is considered as no symptoms, 21–25 as mild

symptoms, 26–30 as moderate symptoms, and 31–50 as severe depressive symptoms. In this work,

the diagnostic tool was used to determine whether a person had depression or not. Anxiety was

assessed with the General Anxiety Disorder 7-item Scale (GAD-7).[12] In the GAD-7, a total score of

0–4 is considered as no anxiety, 5–9 as mild anxiety, 10–14 as moderate anxiety, and 15–21 as

severe anxiety. A total score of 10 was used as a cut-off point when a binary variable for anxiety was

used in our analyses. This cut-off is recommended by the developers of the GAD-7

questionnaire.[12] The participants with severe depressive or anxious symptoms were referred to

the occupational health care for further follow-up.

6

Other measures

Smoking status was assessed by a questionnaire. Non-smoking was defined as having never smoked

or having quit smoking >12 months ago. Height and weight were measured by a study nurse with

subjects in standing position without shoes and outer garments. Weight was measured to the

nearest 0.1 kg with calibrated scales and height to the nearest 0.5 cm with a wall-mounted

stadiometer. BMI was calculated as weight (kg) divided by the square of height (m²). Information

concerning diseases diagnosed by a physician, medication used regularly, marital status (cohabiting

or not), working times (3-shift work or not) and education level (vocational school, college-level

education, or university-level education) was gathered using self-administered questionnaires and

medical records. Alcohol consumption was assessed using the 3-item Alcohol Use Disorders

Identification Test (AUDIT-C) [24] with a cut-off of 5 points for harmful alcohol use in women and 6

points in men.[25,26] Disease burden was defined as having at least one chronic disease diagnosed

by a physician.

Statistical analysis

Continuous variables are presented with means and standard deviations (SD) together with 95%

confidence intervals (CI). Categorical variables are summarized with counts and percentages (%).

Association between sleep quality and background variables was evaluated using a chi-square test or

a one-way analysis of variance (ANOVA).

Association between QoL / work ability and background variables including sleep quality were

examined first one by one (univariate approach), with one-way analysis of variance or with linear

regression. A multivariable model was then built up, and age, gender and all factors with significant

association with QoL and / or work ability in the univariate approach were entered into the model.

The method used was linear model and assumptions were checked using studentized residuals.

7

All statistical tests were performed as 2-sided, with a significance level set at 0.05. The analyses were

performed using an SAS System version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA).

Patient and public involvement

Information events about the PORTAAT Study with guidance for the management of physical and

psychosocial well-being were arranged for the employees of the selected work units. All participants

were given personalized lifestyle counselling at the study visits. The chief of the Welfare Unit of Pori

has been informed regularly about the published study results. The participants of this study were

not involved in the design or development of the study.

RESULTS

The study cohort consisted of 710 employees with a mean age of 49 years (SD 10, range 20 – 68),

89% of whom were female.

Characteristics of the participants

Table 1 displays the basic characteristics of all the participants, also classified according to their sleep

quality. Sleep quality was reported very good by 14.5%, good by 62.1%, poor by 21.2%, and very

poor by 2.1% of the participants. Poor and very poor sleep quality were combined and set to indicate

poor sleep quality in the analyses. Self-reported sleep quality was negatively associated with disease

burden, prevalence of depression and severity of depressive symptoms, anxiety, and work stress,

and positively associated with QoL and work ability. Better sleep quality was associated with longer

sleep duration (p<0.0001). There were only five participants with a previously diagnosed obstructive

sleep apnoea and three with restless legs syndrome. During the past month, 14.8% of the

participants had used sleep medication at least occasionally. The use of sleep medication was more

common in women (15.1% in women vs. 12.6% in men, p=0.038).

8

Only 9 (1.3%) of the participants were diagnosed as depressive according to the MDI diagnostic tool.

All of them were also classified as anxious (GAD-7 score > 10). The measures from these two

psychological symptoms were combined for multivariable analyses.

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9

Table 1

Characteristics of all the participants and classified according to self-reported sleep quality

	All participants	Sleep quality			p-value
		Very good (n=103)	Good (n=441)	Poor (n=166)	
Age mean, years (SD)	49.0 (9.7)	47.5 (10.6)	49.1 (9.7)	49.8 (9.2)	0.072
Gender, n (%)					0.10
Female	631 (88.9)	85 (13.5)	397 (62.9)	149 (23.6)	
Male	79 (11.1)	18 (22.8)	44 (55.7)	17 (21.5)	
Education, n (%)					0.36
Vocational school	21 (3)	4 (19.1)	14 (66.7)	3 (14.3)	
College-level	361 (51.6)	53 (14.7)	232 (64.3)	76 (21.1)	
University-level	318 (45.4)	45 (14.2)	188 (59.1)	85 (26.7)	
Co-habiting, n (%)					0.64
Yes	575 (81.2)	83 (14.4)	353 (61.4)	139 (24.2)	
No	133 (18.8)	20 (15.0)	86 (64.7)	27 (20.3)	
3-shift work, n (%)					0.41
Yes	76 (10.9)	15 (19.7)	44 (57.9)	17 (23.4)	
No	620 (89.1)	87 (14.0)	386 (57.9)	147 (23.7)	
Smoking, n (%)					0.45
Yes	64 (9.0)	9 (14.1)	44 (68.8)	11 (17.2)	
No	645 (91.0)	94 (14.6)	396 (61.4)	155 (24.0)	
Harmful alcohol consumption, n (%)					0.55
Yes	101 (14.2)	18 (17.8)	59 (58.4)	24 (23.8)	
No	609 (85.8)	85 (14.0)	382 (62.7)	142 (23.3)	
Body mass index mean (95% CI)	26.8 (26.42 -27.13)	26.4 (25.50 - 27.25)	27.0 (26.54 - 27.46)	26.5 (25.72 - 27.24)	0.92
Disease burden[a], n (%)					0.0016
Yes	468 (65.9)	55 (11.8)	289 (61.8)	124 (26.5)	
No	242 (34.1)	48 (19.8)	152 (62.8)	42 (17.4)	

10

Depression (MDI), n (%)					0.016
Yes	9 (1.3)	0 (0.0)	3 (33.3)	6 (66.7)	
No	701 (98.7)	103 (14.7)	438 (62.5)	160 (22.8)	
MDI mean score (95% CI)	5.0 (4.57-5.43)	2.4 (1.75 - 2.97)	4.1 (3.59 - 4.51)	9.2 (8.09 - 10.27)	<0.0001
Level of anxiety (GAD-7), n (%)					<0.0001
No anxiety	534 (75.2)	92 (17.2)	343 (64.2)	99 (18.5)	
Mild anxiety	143 (20.1)	10 (7.0)	85 (59.4)	48 (33.6)	
Moderate anxiety	26 (3.7)	1 (3.9)	10 (38.5)	15 (57.7)	
Severe anxiety	7 (1.0)	0 (0.0)	3 (42.9)	4 (57.1)	
BBI15 mean total score (95% CI)	31.6 (30.82-32.41)	28.3 (26.43-30.23)	31.0 (30.05- 31.99)	35.4 (33.60-37.20)	<0.0001
Occupational stress (BBI15), n (%)					<0.0001
No stress	592 (89.4)	97 (16.4)	374 (63.2)	121 (20.4)	
Stress	70 (10.6)	3 (4.3)	38 (54.3)	29 (41.4)	
Sleep duration mean (95% CI)	7.00 (6.93 - 7.07)	7.50 (7.35 - 7.66)	7.17 (7.09 - 7.24)	6.23 (6.09 - 6.38)	<0.0001
EUROHIS mean score (95% CI)	4.07 (4.03 - 4.11)	4.38 (4.30 - 4.45)	4.09 (4.05 - 4.14)	3.83 (3.75 - 3.91)	<0.0001
WAS mean score (95% CI)	8.31 (8.21-8.41)	8.99 (8.78 - 9.20)	8.34 (8.22 - 8.46)	7.80 (7.55 - 8.04)	<0.0001
Level of work ability (WAS), n (%)					<0.0001
Poor	27 (3.8)	1 (3.7)	12 (44.4)	14 (51.9)	
Moderate	114 (16.1)	3 (2.6)	69 (60.5)	42 (36.8)	
Good	459 (64.9)	61 (13.3)	298 (64.9)	100 (21.8)	
Excellent	107 (15.1)	37 (34.6)	60 (56.1)	10 (9.4)	

ᵃ At least one chronic disease diagnosed by a physician, BBI15 = Bergen Burnout Indicator 15, CI = Confidence Interval, EUROHIS = EUROHIS-QOL 8-item

index, GAD-7= General Anxiety Disorder 7-item Scale, MDI = Major Depression Inventory, SD = Standard deviation, WAS = Work Ability Score

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Quality of life

As seen in Table 2, the EUROHIS-QOL mean score among all participants was 4.07 (SD 0.51) with no

significant difference between genders (p=0.94). In the univariate approach, QoL was positively

associated with good sleep quality, university-level education, co-habiting, lower BMI and younger

age, and negatively associated with occupational stress, depression, anxiety and disease burden.

In the multiway analysis of co-variance, QoL was positively associated with good sleep quality, co-

habiting, university-level education and lower BMI, and negatively associated with occupational

stress, depression and/or anxiety and disease burden (Table 2).

12

Table 2

Factors associated with quality of life in a univariate approach and in a multivariable model. EUROHIS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	EUROHIS total mean / slope	95% Confidence Interval	p-value	EUROHIS total model based mean / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.0040	(-0.0079, -0.00008)	0.046	-0.00028	-0.0042 - 0.0036	0.02	1	0.89
Gender			0.94			0.00	1	0.99
Female	4.07	4.03 - 4.11		3.54	3.38 - 3.70			
Male	4.07	3.96 - 4.18		3.54	3.36 - 3.72			
Education			0.036			4.17	2	0.016
Vocational school	3.83	3.61 - 4.05		3.37	3.11 - 3.62			
College-level	4.05	4.00 - 4.11		3.59	3.44 - 3.74			
University-level	4.11	4.05 - 4.16		3.66	3.51 - 3.81			
Co-habiting			0.011			5.72	1	0.017
Yes	4.09	4.05 - 4.13		3.59	3.43 - 3.75			
No	3.97	3.88 - 4.06		3.48	3.31 - 3.66			
Smoking			0.39					
Yes	4.02	3.89 - 4.14						
No	4.08	4.38 - 4.12						
Harmful alcohol consumption			0.33					
Yes	4.12	4.02 -4.22						
No	4.06	4.02 - 4.11						
Body mass index	-0.020	(-0.028, -0.012)	<0.0001	-0.018	(-0.025, -0.011)	23.91	1	<0.0001
Disease burden[a]			<0.0001			13.35	1	0.0003
Yes	3.99	3.95 - 4.04		3.47	3.31 - 3.63			
No	4.22	4.16 - 4.29		3.61	3.44 - 3.77			
Depression[b]			<0.0001					
Yes	3.07	2.74 - 3.39						

13

	EUROHIS	CI	p	EUROHIS	CI		DF	
No	4.08	4.05 - 4.12						
Level of anxiety^c			<0.0001					
No	4.19	4.16 - 4.23						
Mild	3.75	3.67 - 3.82						
Moderate	3.47	3.29 - 3.64						
Severe	3.66	3.32 - 4.00						
Depression and/or anxiety^bd						13.92	2	<0.0001
No depression/ No anxiety				3.89	3.77 - 4.08			
Only anxiety				3.59	3.36 - 3....			
Depression and anxiety				3.14	2.81 - 3.4.			
Occupational stress^e			<0.0001			39.30	1	<0.0001
Yes	3.63	3.51 - 3.74		3.35	3.18 - 3....			
No	4.13	4.09 - 4.17		3.72	3.56 - 3....			
3-shift work			0.089			0.55	1	0.46
Yes	4.16	4.02 - 4.10		3.56	3.37 - 3.74			
No	4.06	4.05 - 4.28		3.52	3.36 - 3.67			
Self-reported sleep quality			<0.0001			22.02	2	<0.0001
Very good	4.38	4.30 - 4.45		3.74	3.56 - 3.92			
Good	4.05	4.05 - 4.14		3.53	3.36 - 3.69			
Poor	3.83	3.75 - 3.91		3.34	3.18 - 3.51			

^a At least one chronic disease diagnosed by a physician, ^b Defined by Major Depression Inventory (MDI) diagnostic tool (DSM IV), ^c General Anxiety Disorder 7-item Scale (GAD-7), ^d General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, ^e Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI = Confidence Interval, DF = Degrees of freedom, EUROHIS = EUROHIS-QOL 8-item index

14

Work ability

Work ability was reported excellent by 15.2%, good by 64.9%, moderate by 16.1% and poor by 3.8%

of the participants. The WAS mean score among all participants was 8.31 (SD 1.37), and the median

was 9.0 (Q1:8.0, Q3:9.0). There was no difference in work ability between genders (p=0.11). In the

univariate approach, work ability was positively associated with good sleep quality, younger age,

lower BMI, university-level education, female gender, and 3-shift work, and negatively associated

with disease burden, depression, anxiety and occupational stress.

In the multiway analysis of co-variance, work ability was positively associated with good sleep

quality, younger age, lower BMI, and university-level education, and negatively associated with

occupational stress and disease burden (Table 3).

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Table 3

Factors associated with work ability in a univariate approach and in a multivariable model. WAS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	WAS estimate / slope	95% Confidence Interval	p-value	WAS model based estimate / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.019	(-0.029, -0.0090)	0.0002	-0.012	(-0.022, -0.0018)	5.34	1	0.021
Gender			0.027			3.36	1	0.067
Female	8.35	8.24 - 8.46		7.83	7.43 - 8.24			
Male	7.99	7.68 - 8.29		7.56	7.09 - 8.03			
Education			0.0079			4.74	2	0.0091
Vocational school	7.90	7.30 - 8.50		7.42	6.76 - 8.07			
College-level	8.18	8.04 - 8.32		7.70	7.32 - 8.09			
University-level	8.48	8.33 - 8.63		7.80	7.58 - 8.37			
Co-habiting			0.91			0.04	1	0.85
Yes	8.31	8.20 - 8.42		7.69	7.27 - 8.10			
No	8.30	8.06 - 8.53		7.71	7.26 - 8.18			
Smoking			0.19					
Yes	8.10	7.76 - 8.44						
No	8.33	8.23 - 8.44						
Harmful alcohol consumption			0.35					
Yes	8.43	8.18 - 8.40						
No	8.30	8.16 - 8.70						
Body mass index	-0.036	(-0.057, - 0.016)	0.0006	-0.023	(-0.042, -0.0041)	5.71	1	0.017
Disease burden[a]			<0.0001			12.23	1	0.0005
Yes	8.07	7.95 - 8.20		7.52	7.11 - 7.95			
No	8.77	8.60 - 8.93		7.87	7.44 - 8.30			
Depression[b]			0.0083					

16

	WAS	CI	p-value	WAS	CI	χ²	DF	p-value
Yes	7.11	6.22 - 8.01						
No	8.33	8.23 - 8.43						
Level of anxiety[c]			<0.0001					
No	8.55	8.44 - 8.66						
Mild	7.59	7.38 - 7.81						
Moderate	7.44	6.95 - 7.94						
Severe	8.00	7.03 - 8.97						
Depression and/or anxiety[bd]						1.73	2	0.17
No depression / No anxiety				8.02	7.72 - 8.32			
Only anxiety				7.67	7.07 - 8.28			
Depression and anxiety				7.41	6.57 - 8.24			
Occupational stress[e]			<0.0001			29.80	1	<0.0001
Yes	7.47	7.18 - 7.76		7.28	6.82 - 7.73			
No	8.47	8.37 - 8.57		8.12	7.70 - 8.54			
3-shift work			0.0040			3.75	1	0.053
Yes	8.74	8.43 - 9.05		7.84	7.36 - 8.33			
No	8.26	8.15 - 8.36		7.55	7.16 - 7.95			
Self-reported sleep quality			<0.0001			14.44	2	<0.0001
Very good	9.00	8.73 - 9.25		8.13	7.66 - 8.60			
Good	8.34	8.22 - 8.47		7.68	7.25 - 8.10			
Poor	7.80	7.59 - 8.00		7.29	6.86 - 7.72			

[a] At least one chronic disease diagnosed by a physician, [b] Defined by Major Depression Inventory (MDI) diagnostic tool (DSM IV), [c] General Anxiety Disorder 7-item Scale (GAD-7), [d] General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, [e] Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI= Confidence Interval, DF = Degrees of freedom, WAS = Work Ability Score

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DISCUSSION

In this study, we managed to show that occupational stress, self-reported sleep quality, and disease burden were strongly associated with both QoL and work ability in public sector employees. In addition, QoL was tightly associated with BMI and depression and / or anxiety. To our knowledge, few studies have evaluated QoL and work ability simultaneously among apparently healthy, working-age individuals, with information about a wide range of factors potentially influencing these two variables.

Occupational stress was the factor most strongly associated with both QoL and work ability in this study. It is well known, that job strain is an important factor affecting employees' health and well-being.[3,27,28] Occupational stress is known to be associated, for example, with poor sleep quality [29], lower work ability [4] and mental health problems.[30] Furthermore, work stress was found to be associated with elevated mortality rates in patients with cardiometabolic disease in a large multicohort study.[31] Work stress has also been found to have a negative association with QoL in several studies.[3,27] The interesting finding in our study was that the association of occupational stress with QoL and WAS was strong, regardless of the fact that our study population had low rates of occupational stress. Only 10.6% of the participants in our study had at least mild occupational stress symptoms, and severe symptoms were very rare. It is thus possible that even low levels of occupational stress can have an important influence on a person's work ability and QoL. These results highlight the need for screening and handling of work stress among municipal employees.

Self-reported sleep quality was tightly associated with both QoL and work ability in this study. A negative association between poor sleep quality and QoL has previously been demonstrated among patients with sleep disorders and other medical conditions [32–35], and studies on shift workers have shown a clear association between sleep quality and QoL.[36,37] Furthermore, in a previous work on higher education students, Marques et al. showed that self-reported sleep quality remained a significant predictor of most aspects of QoL, regardless of the presence of psychopathological

18

symptoms, such as depression.[5] Sleep problems have in previous literature also been linked to poorer work ability and an increased rate of sickness absence.[38,39] In addition, Ng et al. have shown a positive association between good sleep quality and work ability among Hong Kong construction workers.[6] However, in this study we managed to show that self-reported sleep quality is significantly associated with both QoL and work ability among apparently healthy employees not restricted to a specific occupation and working mainly in regular morning shifts. The associations remained significant also in the multivariable models, where many potential confounding factors could be taken into account.

Disease burden, higher BMI and lower educational level were negatively associated with both QoL and work ability in this study, as well as in previous literature. Chronic diseases are known to have a negative association with QoL [1] and with work ability.[2,40] Lower BMI has been linked to better QoL [41] and to better work ability [42,43], and higher education has been positively associated with QoL [44] and with work ability.[45] In our study, as well as in previous literature, older age was associated with poorer work ability [42,46], but no significant association was found between age and QoL. This finding is consistent with the Finnish reference values for the EUROHIS-QOL 8-item index.[47] Furthermore, cohabiting had a significant positive association with QoL in our study, as has previously been observed in a population based study in Sweden.[48] Cohabiting has previously been linked to better health and work ability, for example, in an unemployed population [49], but in our setting, where only active work force was studied, there was no significant association between cohabiting and work ability.

An interesting finding in our study was that depression and / or anxiety was strongly associated with QoL but did not have a significant association with work ability in the multivariable model. Depression and anxiety are known to have a negative impact on QoL [50–52], but depression also affects a person's ability to work.[2,53] However, depression often leads to sickness absence, which means that these people are not in the active work force. In our study population, depression and

19

anxiety were relatively rare conditions, and most of the cases were mild. Only 9 (1.3%) of the participants met the diagnostic criteria for major depression and 33 (4.6%) of the participants where categorized as moderately or severely anxious. It is known that not all depressive patients consider themselves unable to work.[53] These patients may benefit from the schedule and routine of work life and do not want to seek sick leave, while depression still affects their QoL. In the Finnish Current Care Guidelines for depression, sick leave is not recommended in mild depression and the need for sick leave in moderate depression should be evaluated individually.[54] According to these recommendations, those depressive patients whose work ability is not affected should remain in the active work force. Furthermore, as the prevalence of depression and anxiety in our study population was low, the generalizability of these results can be questioned.

In this study, 3-shift work was not significantly associated either with QoL or with work ability in the multivariable models. In the univariate approach, the work ability of the 3-shift workers was better (p=0.0040), but no significant difference was seen in QoL. Somewhat surprisingly, 3-shift work did not seem to have any adverse effects on the participants' well-being in our study. There was no difference in sleep quality or occupational stress compared to the regular morning shift workers. Almost all 3-shift workers in our study were women working as nurses or social workers. Their mean age was 45.6 years, which is 3.5 years younger than the mean age of the whole study population. In addition to the younger age, one possible explanation for their well-being is that they may have voluntarily chosen to work in shifts and feel that it is a suitable way of working for them. Those shift workers who have had health problems or difficulties with sleep due to shift work may have changed to day work.[55] Another unexpected result in this work was that harmful alcohol consumption did not have adverse effects on sleep quality, QoL or work ability. However, even though there were 101 (14.2%) participants that fulfilled the definition of "harmful drinking" in the AUDIT-C, heavy drinking was very rare in this predominantly female, active work force population. We assume that these people may consume alcohol mainly during weekends, which diminishes the effects on everyday life and work.

20

We acknowledge some limitations of the study. We cannot determine the causality of the found associations because of the cross-sectional nature of the study. A possible healthy worker effect [56] can be present because only subjects in the active work force were studied. In addition, the initial response rate in the first part of the study in 2014 was only 32.5% (and 84.9% of them attended the study in 2015). It is known that response rates in e-mail surveys tend to be lower than in mail surveys [57], but it can nevertheless cause selection bias. It is possible that the healthiest part of the work force is also the most willing to attend voluntary health surveys, which may result in the possibility that our results reflect the situation in the mainly healthy section of the work force. However, the mean annual rate of sickness absence days did not vary significantly between the study participants and the non-participants on the included employment sectors. According to the records obtained from the city of Pori, the mean incidence of sickness absence days was 11 days per year among the study participants during the two year time period (2014 – 2015).[58] The mean sickness absence rate among all employees of the selected work units was 12 days according to the personnel report of the city of Pori in 2015. [59] The gender distribution in our study (89% females) resembles the distribution among employees of the city of Pori and is close to the gender distribution of the large Finnish prospective study on the public sector employees.[60] The information about alcohol consumption was collected by self-assessment, which may be influenced by social desirability. In addition, we unfortunately do not have data of possible menopausal symptoms, which may have affected our results in women.

The strengths of our study are that we could take into account several aspects associated with the employees' QoL and work ability. All questionnaires were completed by the participants at home before the examination was performed. In this study, the approaches to sleep quality, QoL and work ability were all subjective, which emphasizes the importance of personal experience in evaluating these factors. We assessed self-reported sleep quality and work ability with single questions. This approach was chosen over longer questionnaires because a single question could also be used at a normal physician's appointment in primary or occupational health care for the evaluation of these

21

factors. The self-reported sleep quality question we used was from the Pittsburgh Sleep Quality

Index (PSQI), and it has previously been shown to be closely related with QoL.[5] With this question

we showed a clear association of sleep quality with QoL and with work ability. However, it would be

interesting to further assess this connection in a similar population with a more detailed

questionnaire to determine whether the different components of sleep have different impacts on

QoL and work ability. The WAS score we used for the evaluation of work ability has been shown to

have a strong association with the Work Ability Index and is reliable in evaluating work ability.[61]

WAS has also been shown to predict disability pension and long-term sickness absence according to

a Finnish register-based study.[62] The associations of self-reported sleep quality with both QoL and

with work ability were clear and in line with previous literature even when studied with these simple

tools.

CONCLUSIONS

In this paper we showed that occupational stress and self-reported sleep quality are strongly

associated with both QoL and work ability among Finnish public sector employees. According to our

results, even a low level of occupational stress has a significant negative association with QoL and

work ability. These findings highlight the need for screening and handling work stress and sleep

problems in occupational and primary health care. We suggests that short, self-reported assessment

tools could be used for this purpose.

CONTRIBUTORS

EB, EL, SM, PR and PK contributed to the conception or design of the work, and to the acquisition,

analysis or interpretation of data for the work. EB and PK drafted the manuscript. All authors

critically revised the manuscript, gave final approval, and agreed to be accountable for all aspects of

work ensuring integrity and accuracy.

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22

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DECLARATION OF COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the

ethical standards of the institutional and/or national research committee and with the 1964 Helsinki

Declaration and its later amendments or comparable ethical standards. The study protocol and

consent forms were reviewed and approved by the Ethics Committee of the Hospital District of

Southwest Finland (ETMK 43/180/2013).

INFORMED CONSENT

Written informed consent was obtained from all individual participants included in the study.

AVAILABILITY OF DATA

The datasets used and/or analysed during the current study are available from the corresponding

author on request.

REFERENCES

1   Schmidt S, Mühlan H, Power M. The EUROHIS-QOL 8-item index: Psychometric results of a

cross-cultural field study. *Eur J Public Health* 2006;**16**:420–8. doi:10.1093/eurpub/cki155

2   Leino-Arjas P, Kaila-Kangas L, Heliövaara M, *et al.* The Relation of Co-occurring

23

Musculoskeletal Pain and Depressive Symptoms With Work Ability. *J Occup Environ Med* 2013;**55**:1281–5. doi:10.1097/jom.0b013e3182a4ffc4

3   Sarafis P, Rousaki E, Tsounis A, *et al.* The impact of occupational stress on nurses' caring behaviors and their health related quality of life. *BMC Nurs* 2016;**15**:1–9. doi:10.1186/s12912-016-0178-y

4   Yong M, Nasterlack M, Pluto R-P, *et al.* Occupational stress perception and its potential impact on work ability. *Work* Published Online First: 2013. doi:10.3233/WOR-121556

5   Marques DR, Meia-Via AMS, da Silva CF, *et al.* Associations between sleep quality and domains of quality of life in a non-clinical sample: results from higher education students. *Sleep Heal* 2017;**3**:348–56. doi:10.1016/j.sleh.2017.07.004

6   Ng JYK, Chan AHS. The work ability of Hong Kong construction workers in relation to individual and work-related factors. *Int J Environ Res Public Health* 2018;**15**. doi:10.3390/ijerph15050990

7   THE WHOQOL GROUP. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychol Med* 1998;**28**:551–8. doi:10.5.12

8   Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997;**38**:21–37.http://www.ncbi.nlm.nih.gov/pubmed/9097506 (accessed 3 Sep 2019).

9   Ilmarinen J. The Work Ability Index (WAI). *Occup Med (Chic Ill)* 2006;**57**:160–160. doi:10.1093/occmed/kqm008

10 Buysse DJ, Reynolds CF, Monk TH, *et al.* The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res* Published Online First: 1989. doi:10.1016/0165-1781(89)90047-4

24

11   Bech P, Timmerby N, Martiny K, *et al.* Psychometric evaluation of the Major Depression

Inventory (MDI) as depression severity scale using the LEAD (Longitudinal Expert

Assessment of All Data) as index of validity. *BMC Psychiatry* 2015;:1–7. doi:10.1186/s12888-

015-0529-3

12   Spitzer RL, Kroenke K, Williams JBW, *et al.* A Brief Measure for Assessing Generalized Anxiety

Disorder. 2006;**166**:1092–7.

13   Näätänen P, Aro A, Mathiesen SB, *et al. Bergen Burnout Indicator 15*. Helsinki: : Edita 2003.

14   Bergman E, Löyttyniemi E, Rautava P, *et al.* Ideal cardiovascular health and quality of life

among Finnish municipal employees. *Prev Med Reports* 2019;**15**:100922.

doi:10.1016/j.pmedr.2019.100922

15   Chiu MC, Wang MJJ, Lu CW, *et al.* Evaluating work ability and quality of life for clinical nurses

in Taiwan. *Nurs Outlook* 2007;**55**:318–26. doi:10.1016/j.outlook.2007.07.002

16   Sörensen LE, Pekkonen MM, Männikkö KH, *et al.* Associations between work ability, health-

related quality of life, physical activity and fitness among middle-aged men. *Appl Ergon*

2008;**39**:786–91. doi:10.1016/j.apergo.2007.11.001

17   Veromaa V, Kautiainen H, Saxen U, *et al.* Ideal cardiovascular health and psychosocial risk

factors among Finnish female municipal workers. *Scand J Public Health* 2017;**45**:50–6.

doi:10.1177/1403494816677661

18   Power M. Development of A Common Instrument for Quality of Life. *EUROHIS Dev Common

Instruments Heal Surv* 2003;**57**:145–

59.http://www.euro.who.int/en/publications/abstracts/eurohis-developing-common-

instruments-for-health-surveys

19   WHOQOL Group. the World Health Organization Quality of Life Assessment (Whoqol):

25

Development and General Psychometric Properties* the Whoqol Group{. *Soc Sci Med* 1998;**46**:1569–85. doi:10.1016/S0277-9536(98)00009-4

20   Gould R, Ilmarinen J, Jarvisalo J, *et al. Dimensions of Work Ability*. 2008. doi:10.1108/02656710210415668

21   Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *J Psychosom Res* Published Online First: 1998. doi:10.1016/S0022-3999(97)00298-5

22   Gentili A, Weiner DK, Kuchibhatla M, *et al.* The Test-retest reliability of the Pittsburgh Sleep Quality Index in nursing home residents. 1995;**43**:1317–8.

23   Bech P, Rasmussen NA, Olsen LR, *et al.* The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *J Affect Disord* 2001;**66**:159–64. doi:10.1016/S0165-0327(00)00309-8

24   Bush K, Kivlahan DR, McDonell MB, *et al.* The AUDIT alcohol consumption questions (AUDIT-C). *Arch Interal Med* 1998;**158**:1789–95. doi:10.1097/00000374-199811000-00034

25   Aalto M, Tuunanen M, Sillanaukee P, *et al.* Effectiveness of structured questionnaires for screening heavy drinking in middle-aged women. *Alcohol Clin Exp Res* 2006;**30**:1884–8. doi:10.1111/j.1530-0277.2006.00233.x

26   Tuunanen M, Aalto M, Seppä K. Binge drinking and its detection among middle-aged men using AUDIT, AUDIT-C and AUDIT-3. *Drug Alcohol Rev* 2007;**26**:295–9. doi:10.1080/09595230701247756

27   Yang X, Ge C, Hu B, *et al.* Relationship between quality of life and occupational stress among teachers. *Public Health* 2009;**123**:750–5. doi:10.1016/j.puhe.2009.09.018

28   Lerner DJ, Levine S, Malspeis S, *et al.* Job strain and health-related quality of life in a national sample. *Am J Public Health* 1994;**84**:1580–5. doi:10.2105/AJPH.84.10.1580

26

29 Knudsen HK, Ducharme LJ, Roman PM. Job stress and poor sleep quality: Data from an American sample of full-time workers. *Soc Sci Med* 2007;**64**:1997–2007. doi:10.1016/j.socscimed.2007.02.020

30 Chen W-Q, Wong T-W, Yu T-S. Review Article: Influence of occupational stress on mental health among Chinese off-shore oil workers. *Scand J Soc Med* 2009;**37**:766–73. doi:10.1177/1403494809341097

31 Kivimäki M, Pentti J, Ferrie JE, *et al.* Work stress and risk of death in men and women with and without cardiometabolic disease: a multicohort study. *Lancet Diabetes Endocrinol* 2018;:7–9. doi:10.1016/S2213-8587(18)30140-2

32 LeBlanc M, Beaulieu-Bonneau S, Mérette C, *et al.* Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res* 2007;**63**:157–66. doi:10.1016/j.jpsychores.2007.03.004

33 Reimer MA, Flemons WW. Quality of life in sleep disorders. *Sleep Med Rev* 2003;**7**:335–49. doi:10.1053/smrv.2001.0220

34 Liu L, Fiorentino L, Rissling M, *et al.* Decreased Health-Related Quality of Life in Women With Breast Cancer Is Associated With Poor Sleep. *Behav Sleep Med* 2013;**11**:189–206. doi:10.1080/15402002.2012.660589

35 Liu J-C, Hung H-L, Shyu Y-K, *et al.* The Impact of Sleep Quality and Daytime Sleepiness on Global Quality of Life in Community-Dwelling Patients With Heart Failure. *J Cardiovasc Nurs* 2011;**24**:99–105. doi:10.1097/JCN.0b013e3181ed7d12

36 Palhares V de C, Corrente JE, Matsubara BB. Association between sleep quality and quality of life in nursing professionals working rotating shifts. *Rev Saude Publica* 2014;**48**:594–601. doi:10.1590/S0034-8910.2014048004939

27

37   Nena E, Katsaouni M, Steiropoulos P, *et al.* Effect of Shift Work on Sleep , Health , and Quality

of Life of Health-care Workers. *Indian J Occup Env Med* 2018;**22**:29–34.

doi:10.4103/ijoem.IJOEM

38   Lallukka T, Kaikkonen R, Härkänen T, *et al.* Sleep and Sickness Absence: A Nationally

Representative Register-Based Follow-Up Study. *Sleep* 2014;**37**:1413–25.

doi:10.5665/sleep.3986

39   Lian Y, Xiao J, Liu Y, *et al.* Associations between insomnia, sleep duration and poor work

ability. *J Psychosom Res* 2015;**78**:45–51. doi:10.1016/j.jpsychores.2014.09.009

40   Jędryka-Góral A, Bownik I, Michalak JM, *et al.* Work Ability in Ageing Workers Suffering From

Chronic Diseases. *Int J Occup Saf Ergon* 2015;**12**:17–30.

doi:10.1080/10803548.2006.11076665

41   Kroes M, Osei-Assibey G, Baker-Searle R, *et al.* Impact of weight change on quality of life in

adults with overweight/obesity in the United States: a systematic review. *Curr Med Res Opin*

2015;**32**:485–508. doi:10.1185/03007995.2015.1128403

42   Bridger RS, Bennett AI. Age and BMI interact to determine work ability in seafarers. *Occup*

Med (Chic Ill) 2011;**61**:157–62. doi:10.1093/occmed/kqr003

43   Andersen LL, Izquierdo M, Sundstrup E. Overweight and obesity are progressively associated

with lower work ability in the general working population: cross-sectional study among

10,000 adults. *Int Arch Occup Environ Health* 2017;**90**:779–87. doi:10.1007/s00420-017-1240-

0

44   Mielck A, Reitmeir P, Vogelmann M, *et al.* Impact of educational level on health-related

quality of life (HRQL): results from Germany based on the EuroQol 5D (EQ-5D). *Eur J Public*

Health 2011;**23**:45–50. doi:10.1093/eurpub/ckr206

28

45 Martimo KP, Varonen H, Husman K, *et al.* Factors associated with self-assessed work ability.

    Occup Med (Chic Ill) 2007;**57**:380–2. doi:10.1093/occmed/kqm028

46 Pohjonen T. Perceived work ability of home care workers in relation to individual and work-

    related factors in different age groups. *Occup Med (Chic Ill)* 2001;**51**:209–17.

    doi:10.1093/occmed/51.3.209

47 Koskinen S, Lundqvist A, Ristiluoma N. *Terveys, toimintakyky ja hyvinvointi Suomessa 2011*.

    2012.

    http://www.julkari.fi/bitstream/handle/10024/90832/Rap068_2012_netti.pdf?sequence=1

48 Helena Michelson, Christina Bolund,. Health-related Quality of Life Measured by the EORTC

    QLQ-C30: Reference Values From a Large Sample of the Swedish Population. *Acta Oncol*

    (Madr) 2002;**39**:477–84. doi:10.1080/028418600750013384

49 Hult M, Pietilä AM, Koponen P, *et al.* Association between good work ability and health

    behaviours among unemployed: A cross-sectional survey. *Appl Nurs Res* 2018;**43**:86–92.

    doi:10.1016/j.apnr.2018.07.008

50 Saarni SI, Suvisaari J, Sintonen H, *et al.* Impact of psychiatric disorders on health-related

    quality of life: General population survey. *Br J Psychiatry* 2007;**190**:326–32.

    doi:10.1192/bjp.bp.106.025106

51 Palacin C, Martinez-Alonso M, Codony M, *et al.* Use of mental health services in Europe:

    results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project.

    Acta Psychiatr Scand 2004;**109**:47–54. doi:10.1111/j.1600-0047.2004.00330.x

52 Da Rocha NS, Power MJ, Bushnell DM, *et al.* The EUROHIS-QOL 8-item index: Comparative

    psychometric properties to its parent WHOQOL-BREF. *Value Heal* 2012;**15**:449–57.

    doi:10.1016/j.jval.2011.11.035

29

53   Elinson L, Houck P, Marcus SC, *et al.* Depression and the Ability to Work. *Psychiatr Serv*

2003;**55**:29–34. doi:10.1176/appi.ps.55.1.29

54   Isometsä E, Kinnunen E, Kivekäs T, *et al.* Depression. Current Care Guidelines. Working group

set up by the Finnish Medical Society Duodecim and the Finnish Psychiatric Association.

Finnish Curr. Care Guidel. 2016.www.kaypahoito.fi (accessed 5 Sep 2019).

55   Linton SJ, Kecklund G, Franklin KA, *et al.* The effect of the work environment on future sleep

disturbances: A systematic review. *Sleep Med Rev* 2015;**23**:10–9.

doi:10.1016/j.smrv.2014.10.010

56   Li C, Sung E. A review of the healthy worker effect in occupational epidemiology. *Occup Med

(Chic Ill)* 1999;**49**:225–9.

57   Shih T, Fan X. Comparing response rates in e-mail and paper surveys : A meta-analysis. *Educ

Res Rev* 2009;**4**:26–40. doi:10.1016/j.edurev.2008.01.003

58   Vuorio T, Suominen S, Kautiainen H, *et al.* Determinants of sickness absence rate among

Finnish municipal employees. *Scand J Prim Health Care* 2019;**37**:3–9.

doi:10.1080/02813432.2019.1568710

59   Porin kaupunki Henkilöstöraportti 2015. 2015.https://docplayer.fi/28278945-Porin-kaupunki-

henkilostoraportti-2015.html

60   Kouvonen A, Kivimäki M, Väänänen A, *et al.* Job strain and adverse health behaviors: The

Finnish public sector study. *J Occup Environ Med* 2007;**49**:68–74.

doi:10.1097/JOM.0b013e31802db54a

61   Fassi M El, Bocquet V, Majery N, *et al.* Work ability assessment in a worker population :

comparison and determinants of Work Ability Index and Work Ability score. *BMC Public

Health* 2013;**13**:1–10.

30

62   Kinnunen U, Nätti J. Work ability score and future work ability as predictors of register-based

disability pension and long-term sickness absence: A three-year follow-up study. *Scand J*

Public Health 2018;**46**:321–30. doi:10.1177/1403494817745190

31

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors associated with quality of life and work ability among Finnish municipal employees: a cross-sectional study

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FACTORS ASSOCIATED WITH QUALITY OF LIFE AND WORK ABILITY AMONG FINNISH MUNICIPAL EMPLOYEES: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objectives: Quality of life (QoL) and work ability are elementary parts in defining the well-being of an employed person. The aim of this study was to demonstrate factors associated with QoL and self-reported work ability among public sector employees, while taking into account several confounding factors, including sleep quality, occupational stress and psychological symptoms.

Methods: A cross-sectional study was conducted in Finland among 710 employees (89% women, mean age 49 [SD = 10] years) from ten municipal work units in 2015. Information about the participants was collected by physical examination, self-administered questionnaire and from medical history. QoL was assessed with the EUROHIS-QOL 8-item index and work ability with the Work Ability Score (WAS).

Results: The EUROHIS-QOL mean score among all participants was 4.07 (95% CI 4.03–4.11). QoL was positively associated with good sleep quality, cohabiting, university-level education, and lower BMI, and negatively associated with occupational stress, depression and/or anxiety and disease burden. Work ability was reported good or excellent by 80% of the participants and the WAS mean score among all participants was 8.31 (95% CI 8.21–8.41). Work ability was positively associated with good sleep quality, younger age, lower BMI and university-level education, and negatively associated with occupational stress and disease burden.

Conclusions: Occupational stress and self-reported sleep quality were strongly associated with both QoL and work ability among Finnish public sector employees. These findings highlight the need for screening and handling of work stress and sleep problems in occupational and primary health care.

KEYWORDS

Quality of life, Work ability, Occupational health, Sleep quality, Occupational stress

2

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Several aspects associated with the employees' quality of life and work ability could be taken into account.

- The participants completed all questionnaires at home before the examination was performed.

- Psychological symptoms were assessed with well-validated instruments.

- Any causality cannot be determined due to the cross-sectional nature of the study.

- The response rate of the study was moderate at most, which is a common limitation in e-mail surveys.

INTRODUCTION

Quality of life (QoL) and work ability are elementary outcomes in defining the well-being of an employed person. Both of these can be affected by numerous conditions, including physical and mental health [1,2], occupational stress [3,4], sleep quality [5,6] , psychosocial risk factors and environmental aspects. [7] Many of these can be measured reliably by evaluating the persons' perceptions about the condition with self-reported assessment tools. [1,8–13] In our previous study, especially self-reported sleep quality was strongly associated with QoL among public sector employees. [14]

QoL and work ability have been studied also previously in currently employed populations, but most of the studies have concentrated on a specific occupational group or employees suffering from a certain medical condition. [2,15,16] To our knowledge, there is a gap of information about factors associated with QoL and work ability, studied simultaneously among apparently healthy public sector employees. Public sector is a large employer sector in the Scandinavian countries, and it

3

would be important to recognize the factors associated with well-being of the employees in

municipal work places.

The aim of this study was to demonstrate factors associated with QoL and self-reported work ability

among public sector employees, while taking into account several confounding factors, including

psychological symptoms, sleep quality and occupational stress. We wanted to use short, subjective

and user-friendly tools for the assessment of QoL, work ability and sleep quality. These instruments

could easily be used for screening also in occupational and primary healthcare.

PARTICIPANTS AND METHODS

Participants

This cross-sectional study was part of the PORTAAT (PORi To Aid Against Threats) study conducted

among employees of the city of Pori (83,497 inhabitants in 2014) in South-Western Finland in 2014

and 2015. The participating work units were selected by the chief of the Welfare Unit of Pori.

Invitations to participate and information of the study were sent to employees via e-mail by the

managers of the selected ten work units (total number of employees 2,570). The employees willing

to participate contacted the study contact person at their work unit, who then sent their contact

information to the study nurse. There were no exclusion criteria. A total of 836 employees (104

males, 732 females) participated in the study in 2014. The response rate in 2014 was 32.5%.

Complete information about data collection from that year has been described earlier. [17] All the

initial respondents were invited to the second part of the study in 2015, and 710 of them (79 males,

631 females) attended. In the present work, all the information is from the year 2015, and this data

was chosen, because complete information about psychosocial risk factors was available only from

that year. The gender distribution of the study participants corresponds to the standard gender

distribution of the employees of Pori. The participants' occupations included librarians, museum

4

employees, janitors, IT workers, social workers, nurses, physicians, administrative officials, and

general office staff. The involved employment sectors, reported according to the number of

employees participating in the study in 2015 were Health and Welfare (275 employees), Social Work

(198), Technical Services (143), Education and Culture (62) and Administration (32).

Quality of life

QoL was assessed with the EUROHIS-QOL 8-item index.[18] This is a shortened version of the

WHOQOL-Bref scale, a widely used instrument for the assessment of generic QoL.[7,19] The domains

in both questionnaires are the general, physical, psychological, social and environmental aspects of

QoL. The EUROHIS-QOL instrument has been validated in several European countries.[1] The

participants of the present study answered the questions at home before the study visits. Every

question was scored from 1 to 5 (1 for very poor and 5 for very good). All scores were then added

together and divided by 8 (the sum of the questions) to obtain the EUROHIS-QOL mean score.[1]

Work-related measures

Work ability was assessed with the question "What is your current work ability compared to your

lifetime best?". This is the first item of the widely used Work Ability Index (WAI) [9], referred to as

the Work Ability Score (WAS). It has a 0–10 response scale, where 0 stands for "completely unable to

work" and 10 stands for "work ability at its best". Work ability was considered poor for scores of 0–

5, moderate for scores of 6–7, good for scores of 8–9, and excellent for a score of 10 points, based

on the same values that have been used in the WAI.[20] Work-related stress was evaluated with

Bergen Burnout Indicator 15 (BBI-15).[13] The BBI-15 measures three dimensions of burnout:

exhaustion, cynicism, and reduced professional efficacy. Responses are rated on a 6-point Likert-

type scale (1 = totally disagree, 6 = totally agree). In this work, we used the total score from all three

dimensions, which can vary from 15 to 90, with higher scores indicating more severe burnout

symptoms. Burnout symptoms are in this indicator classified as severe, moderate, mild, and no

burnout, with specific threshold values according to gender and age.[13] We assessed burnout as a

5

binary variable where all scores from mild to severe burnout were set to indicate the presence of

burnout symptoms.

Sleep-related measures

Self-reported sleep quality was assessed with the question "During the past month, how would you

rate your sleep quality overall?" (very good, good, poor, or very poor). In the analyses, the two

lowest classes of sleep quality were combined and set to indicate poor sleep quality. Sleep duration

was assessed with the question "During the past month, how many hours of sleep did you normally

get at night?". The participants were asked to answer the question in a free field, and sleep duration

was handled as a continuous variable in the analyses. Both of these questions are items from the

well-validated Pittsburgh Sleep Quality Index (PSQI)[10], which has good internal consistency (α =

0.83) and test–retest reliability (r = 0.82; over an average of 19 days). [21,22]

Psychological symptoms

Depressive symptoms were assessed with the Major Depression Inventory (MDI) questionnaire.[23]

This inventory can be used as a diagnostic tool for major depression (according to DSM IV diagnostic

criteria) as well as an assessment tool for severity of depressive symptoms.[11,23] To assess severity

of depressive symptoms, a total score of 0–20 is considered as no symptoms, 21–25 as mild

symptoms, 26–30 as moderate symptoms, and 31–50 as severe depressive symptoms. In this work,

the diagnostic tool was used to determine whether a person had depression or not. Anxiety was

assessed with the General Anxiety Disorder 7-item Scale (GAD-7).[12] In the GAD-7, a total score of

0–4 is considered as no anxiety, 5–9 as mild anxiety, 10–14 as moderate anxiety, and 15–21 as

severe anxiety. A total score of 10 was used as a cut-off point when a binary variable for anxiety was

used in our analyses. This cut-off is recommended by the developers of the GAD-7

questionnaire.[12] The participants with severe depressive or anxious symptoms were referred to

the occupational health care for further follow-up.

6

Other measures

Smoking status was assessed by a questionnaire. Non-smoking was defined as having never smoked

or having quit smoking >12 months ago. Height and weight were measured by a study nurse with

subjects in standing position without shoes and outer garments. Weight was measured to the

nearest 0.1 kg with calibrated scales and height to the nearest 0.5 cm with a wall-mounted

stadiometer. BMI was calculated as weight (kg) divided by the square of height (m²). Information

concerning diseases diagnosed by a physician, medication used regularly, marital status (cohabiting

or not), working times (3-shift work or not) and education level (vocational school, college-level

education, or university-level education) was gathered using self-administered questionnaires and

medical records. Alcohol consumption was assessed using the 3-item Alcohol Use Disorders

Identification Test (AUDIT-C) [24] with a cut-off of 5 points for harmful alcohol use in women and 6

points in men.[25,26] Disease burden was defined as having at least one chronic disease diagnosed

by a physician.

Statistical analysis

Continuous variables are presented with means and standard deviations (SD) together with 95%

confidence intervals (CI). Categorical variables are summarized with counts and percentages (%).

Association between sleep quality and background variables was evaluated using a chi-square test or

a one-way analysis of variance (ANOVA).

Association between QoL / work ability and background variables including sleep quality were

examined first one by one (univariate approach), with one-way analysis of variance or with linear

regression. A multivariable model was then built up, and age, gender and all factors with significant

association with QoL and / or work ability in the univariate approach were entered into the model.

The method used was linear model and assumptions were checked using studentized residuals.

7

All statistical tests were performed as 2-sided, with a significance level set at 0.05. The analyses were

performed using an SAS System version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA).

Patient and public involvement

Information events about the PORTAAT Study with guidance for the management of physical and

psychosocial well-being were arranged for the employees of the selected work units. All participants

were given personalized lifestyle counselling at the study visits. The chief of the Welfare Unit of Pori

has been informed regularly about the published study results. The participants of this study were

not involved in the design or development of the study.

RESULTS

The study cohort consisted of 710 employees with a mean age of 49 years (SD 10, range 20 – 68),

89% of whom were female.

Characteristics of the participants

Table 1 displays the basic characteristics of all the participants, also classified according to their sleep

quality. Sleep quality was reported very good by 14.5%, good by 62.1%, poor by 21.2%, and very

poor by 2.1% of the participants. Poor and very poor sleep quality were combined and set to indicate

poor sleep quality in the analyses. Self-reported sleep quality was negatively associated with disease

burden, prevalence of depression and severity of depressive symptoms, anxiety, and work stress,

and positively associated with QoL and work ability. Better sleep quality was associated with longer

sleep duration (p<0.0001). There were only five participants with a previously diagnosed obstructive

sleep apnoea and three with restless legs syndrome. During the past month, 14.8% of the

participants had used sleep medication at least occasionally. The use of sleep medication was more

common in women (15.1% in women vs. 12.6% in men, p=0.038).

8

Only 9 (1.3%) of the participants were diagnosed as depressive according to the MDI diagnostic tool.

All of them were also classified as anxious (GAD-7 score > 10). The measures from these two

psychological symptoms were combined for multivariable analyses.

9

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Table 1
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Characteristics of all the participants and classified according to self-reported sleep quality
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	All participants	Sleep quality			p-value
		Very good (n=103)	Good (n=441)	Poor (n=166)	
Age mean, years (SD)	49.0 (9.7)	47.5 (10.6)	49.1 (9.7)	49.8 (9.2)	0.072
Gender, n (%)					0.10
Female	631 (88.9)	85 (13.5)	397 (62.9)	149 (23.6)	
Male	79 (11.1)	18 (22.8)	44 (55.7)	17 (21.5)	
Education, n (%)					0.36
Vocational school	21 (3)	4 (19.1)	14 (66.7)	3 (14.3)	
College-level	361 (51.6)	53 (14.7)	232 (64.3)	76 (21.1)	
University-level	318 (45.4)	45 (14.2)	188 (59.1)	85 (26.7)	
Co-habiting, n (%)					0.64
Yes	575 (81.2)	83 (14.4)	353 (61.4)	139 (24.2)	
No	133 (18.8)	20 (15.0)	86 (64.7)	27 (20.3)	
3-shift work, n (%)					0.41
Yes	76 (10.9)	15 (19.7)	44 (57.9)	17 (23.4)	
No	620 (89.1)	87 (14.0)	386 (57.9)	147 (23.7)	
Smoking, n (%)					0.45
Yes	64 (9.0)	9 (14.1)	44 (68.8)	11 (17.2)	
No	645 (91.0)	94 (14.6)	396 (61.4)	155 (24.0)	
Harmful alcohol consumption, n (%)					0.55
Yes	101 (14.2)	18 (17.8)	59 (58.4)	24 (23.8)	
No	609 (85.8)	85 (14.0)	382 (62.7)	142 (23.3)	
Body mass index mean (95% CI)	26.8 (26.42 -27.13)	26.4 (25.50 - 27.25)	27.0 (26.54 - 27.46)	26.5 (25.72 - 27.24)	0.92
Disease burden[a], n (%)					0.0016
Yes	468 (65.9)	55 (11.8)	289 (61.8)	124 (26.5)	
No	242 (34.1)	48 (19.8)	152 (62.8)	42 (17.4)	

10

Depression (MDI), n (%)					0.016
Yes	9 (1.3)	0 (0.0)	3 (33.3)	6 (66.7)	
No	701 (98.7)	103 (14.7)	438 (62.5)	160 (22.8)	
MDI mean score (95% CI)	5.0 (4.57-5.43)	2.4 (1.75 - 2.97)	4.1 (3.59 - 4.51)	9.2 (8.09 - 10.27)	<0.0001
Level of anxiety (GAD-7), n (%)					<0.0001
No anxiety	534 (75.2)	92 (17.2)	343 (64.2)	99 (18.5)	
Mild anxiety	143 (20.1)	10 (7.0)	85 (59.4)	48 (33.6)	
Moderate anxiety	26 (3.7)	1 (3.9)	10 (38.5)	15 (57.7)	
Severe anxiety	7 (1.0)	0 (0.0)	3 (42.9)	4 (57.1)	
BBI15 mean total score (95% CI)	31.6 (30.82-32.41)	28.3 (26.43-30.23)	31.0 (30.05- 31.99)	35.4 (33.60-37.20)	<0.0001
Occupational stress (BBI15), n (%)					<0.0001
No stress	592 (89.4)	97 (16.4)	374 (63.2)	121 (20.4)	
Stress	70 (10.6)	3 (4.3)	38 (54.3)	29 (41.4)	
Sleep duration mean (95% CI)	7.00 (6.93 - 7.07)	7.50 (7.35 - 7.66)	7.17 (7.09 - 7.24)	6.23 (6.09 - 6.38)	<0.0001
EUROHIS mean score (95% CI)	4.07 (4.03 - 4.11)	4.38 (4.30 - 4.45)	4.09 (4.05 - 4.14)	3.83 (3.75 - 3.91)	<0.0001
WAS mean score (95% CI)	8.31 (8.21-8.41)	8.99 (8.78 - 9.20)	8.34 (8.22 - 8.46)	7.80 (7.55 - 8.04)	<0.0001
Level of work ability (WAS), n (%)					<0.0001
Poor	27 (3.8)	1 (3.7)	12 (44.4)	14 (51.9)	
Moderate	114 (16.1)	3 (2.6)	69 (60.5)	42 (36.8)	
Good	459 (64.9)	61 (13.3)	298 (64.9)	100 (21.8)	
Excellent	107 (15.1)	37 (34.6)	60 (56.1)	10 (9.4)	

ᵃ At least one chronic disease diagnosed by a physician, BBI15 = Bergen Burnout Indicator 15, CI = Confidence Interval, EUROHIS = EUROHIS-QOL 8-item index, GAD-7= General Anxiety Disorder 7-item Scale, MDI = Major Depression Inventory, SD = Standard deviation, WAS = Work Ability Score

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Quality of life

As seen in Table 2, the EUROHIS-QOL mean score among all participants was 4.07 (SD 0.51) with no

significant difference between genders (p=0.94). In the univariate approach, QoL was positively

associated with good sleep quality, university-level education, co-habiting, lower BMI and younger

age, and negatively associated with occupational stress, depression, anxiety and disease burden.

In the multiway analysis of co-variance, QoL was positively associated with good sleep quality, co-

habiting, university-level education and lower BMI, and negatively associated with occupational

stress, depression and/or anxiety and disease burden (Table 2).

12

Table 2

Factors associated with quality of life in a univariate approach and in a multivariable model. EUROHIS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	EUROHIS total mean / slope	95% Confidence Interval	p-value	EUROHIS total model based mean / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.0040	(-0.0079, -0.00008)	0.046	-0.00028	-0.0042, 0.0036	0.02	1	0.89
Gender			0.94			0.00	1	0.99
Female	4.07	4.03 - 4.11		3.54	3.38 - 3.70			
Male	4.07	3.96 - 4.18		3.54	3.36 - 3.72			
Education			0.036			4.17	2	0.016
Vocational school	3.83	3.61 - 4.05		3.37	3.11 - 3.62			
College-level	4.05	4.00 - 4.11		3.59	3.44 - 3.74			
University-level	4.11	4.05 - 4.16		3.66	3.51 - 3.81			
Co-habiting			0.011			5.72	1	0.017
Yes	4.09	4.05 - 4.13		3.59	3.43 - 3.75			
No	3.97	3.88 - 4.06		3.48	3.31 - 3.66			
Smoking			0.39					
Yes	4.02	3.89 - 4.14						
No	4.08	4.38 - 4.12						
Harmful alcohol consumption			0.33					
Yes	4.12	4.02 -4.22						
No	4.06	4.02 - 4.11						
Body mass index	-0.020	(-0.028, -0.012)	<0.0001	-0.018	(-0.025, -0.011)	23.91	1	<0.0001
Disease burden[a]			<0.0001			13.35	1	0.0003
Yes	3.99	3.95 - 4.04		3.47	3.31 - 3.63			
No	4.22	4.16 - 4.29		3.61	3.44 - 3.77			
Depression[b]			<0.0001					
Yes	3.07	2.74 - 3.39						

13

	Mean	95% CI	p	Mean	95% CI		DF	p
No	4.08	4.05 - 4.12						
Level of anxiety[c]			<0.0001					
No	4.19	4.16 - 4.23						
Mild	3.75	3.67 - 3.82						
Moderate	3.47	3.29 - 3.64						
Severe	3.66	3.32 - 4.00						
Depression and/or anxiety[bd]						13.92	2	<0.0001
No depression/ No anxiety				3.89	3.77 - 4.00			
Only anxiety				3.59	3.36 - 3.81			
Depression and anxiety				3.14	2.81 - 3.48			
Occupational stress[e]			<0.0001			39.30	1	<0.0001
Yes	3.63	3.51 - 3.74		3.35	3.18 - 3.53			
No	4.13	4.09 - 4.17		3.72	3.56 - 3.89			
3-shift work			0.089			0.55	1	0.46
Yes	4.16	4.02 - 4.10		3.56	3.37 - 3.74			
No	4.06	4.05 - 4.28		3.52	3.36 - 3.67			
Self-reported sleep quality			<0.0001			22.02	2	<0.0001
Very good	4.38	4.30 - 4.45		3.74	3.56 - 3.92			
Good	4.05	4.05 - 4.14		3.53	3.36 - 3.69			
Poor	3.83	3.75 - 3.91		3.34	3.18 - 3.51			

[a] At least one chronic disease diagnosed by a physician, [b] Defined by Major Depression Inventory (MDI) diagnostic tool (DSM IV), [c] General Anxiety Disorder 7-item Scale (GAD-7), [d] General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, [e] Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI = Confidence Interval, DF = Degrees of freedom, EUROHIS = EUROHIS-QOL 8-item index

14

Work ability

Work ability was reported excellent by 15.2%, good by 64.9%, moderate by 16.1% and poor by 3.8% of the participants. The WAS mean score among all participants was 8.31 (SD 1.37), and the median was 9.0 (Q1:8.0, Q3:9.0). There was no difference in work ability between genders (p=0.11). In the univariate approach, work ability was positively associated with good sleep quality, younger age, lower BMI, university-level education, female gender, and 3-shift work, and negatively associated with disease burden, depression, anxiety and occupational stress.

In the multiway analysis of co-variance, work ability was positively associated with good sleep quality, younger age, lower BMI, and university-level education, and negatively associated with occupational stress and disease burden (Table 3).

15

Table 3

Factors associated with work ability in a univariate approach and in a multivariable model. WAS means/slope together with 95% CI are based on model estimates.

	Univariate			Multivariable				
	WAS estimate / slope	95% Confidence Interval	p-value	WAS model based estimate / slope	95% Confidence Interval	F-value	DF	p-value
Age	-0.019	(-0.029, -0.0090)	0.0002	-0.012	(-0.022, -0.0018)	5.34	1	0.021
Gender			0.027			3.36	1	0.067
Female	8.35	8.24 - 8.46		7.83	7.43 - 8.24			
Male	7.99	7.68 - 8.29		7.56	7.09 - 8.03			
Education			0.0079			4.74	2	0.0091
Vocational school	7.90	7.30 - 8.50		7.42	6.76 - 8.07			
College-level	8.18	8.04 - 8.32		7.70	7.32 - 8.09			
University-level	8.48	8.33 - 8.63		7.80	7.58 - 8.37			
Co-habiting			0.91			0.04	1	0.85
Yes	8.31	8.20 - 8.42		7.69	7.27 - 8.10			
No	8.30	8.06 - 8.53		7.71	7.26 - 8.18			
Smoking			0.19					
Yes	8.10	7.76 - 8.44						
No	8.33	8.23 - 8.44						
Harmful alcohol consumption			0.35					
Yes	8.43	8.18 - 8.40						
No	8.30	8.16 - 8.70						
Body mass index	-0.036	(-0.057, - 0.016)	0.0006	-0.023	(-0.042, -0.0041)	5.71	1	0.017
Disease burden[a]			<0.0001			12.23	1	0.0005
Yes	8.07	7.95 - 8.20		7.52	7.11 - 7.95			
No	8.77	8.60 - 8.93		7.87	7.44 - 8.30			
Depression[b]			0.0083					

16

	WAS	CI	p-value	WAS	CI		DF	p-value
Yes	7.11	6.22 - 8.01						
No	8.33	8.23 - 8.43						
Level of anxiety[c]			<0.0001					
No	8.55	8.44 - 8.66						
Mild	7.59	7.38 - 7.81						
Moderate	7.44	6.95 - 7.94						
Severe	8.00	7.03 - 8.97						
Depression and/or anxiety[bd]						1.73	2	0.17
No depression / No anxiety				8.02	7.72 - 8...			
Only anxiety				7.67	7.07 - 8...			
Depression and anxiety				7.41	6.57 - 8...			
Occupational stress[e]			<0.0001			29.80	1	<0.0001
Yes	7.47	7.18 - 7.76		7.28	6.82 - 7...			
No	8.47	8.37 - 8.57		8.12	7.70 - 8...			
3-shift work			0.0040			3.75	1	0.053
Yes	8.74	8.43 - 9.05		7.84	7.36 - 8.33			
No	8.26	8.15 - 8.36		7.55	7.16 - 7.95			
Self-reported sleep quality			<0.0001			14.44	2	<0.0001
Very good	9.00	8.73 - 9.25		8.13	7.66 - 8.60			
Good	8.34	8.22 - 8.47		7.68	7.25 - 8.10			
Poor	7.80	7.59 - 8.00		7.29	6.86 - 7.72			

[a] At least one chronic disease diagnosed by a physician, [b] Defined by Major Depression Inventory (MDI) diagnostic tool (DSM IV), [c] General Anxiety Disorder 7-item Scale (GAD-7), [d] General Anxiety Disorder 7-item Scale (GAD-7), moderate or severe anxiety, [e] Bergen Burnout Indicator 15 (BBI15), at least mild occupational stress, CI= Confidence Interval, DF = Degrees of freedom, WAS = Work Ability Score

17

DISCUSSION

In this study, we managed to show that occupational stress, self-reported sleep quality, and disease burden were strongly associated with both QoL and work ability in public sector employees. In addition, QoL was tightly associated with BMI and depression and / or anxiety. To our knowledge, few studies have evaluated QoL and work ability simultaneously among apparently healthy, working-age individuals, with information about a wide range of factors potentially influencing these two variables.

Occupational stress was the factor most strongly associated with both QoL and work ability in this study. It is well known, that job strain is an important factor affecting employees' health and well-being.[3,27,28] Occupational stress is known to be associated, for example, with poor sleep quality [29], lower work ability [4] and mental health problems.[30] Furthermore, work stress was found to be associated with elevated mortality rates in patients with cardiometabolic disease in a large multicohort study.[31] Work stress has also been found to have a negative association with QoL in several studies.[3,27] The interesting finding in our study was that the association of occupational stress with QoL and WAS was strong, regardless of the fact that our study population had low rates of occupational stress. Only 10.6% of the participants in our study had at least mild occupational stress symptoms, and severe symptoms were very rare. It is thus possible that even low levels of occupational stress can have an important influence on a person's work ability and QoL. These results highlight the need for screening and handling of work stress among municipal employees.

Self-reported sleep quality was tightly associated with both QoL and work ability in this study. A negative association between poor sleep quality and QoL has previously been demonstrated among patients with sleep disorders and other medical conditions [32–35], and studies on shift workers have shown a clear association between sleep quality and QoL.[36,37] Furthermore, in a previous work on higher education students, Marques et al. showed that self-reported sleep quality remained a significant predictor of most aspects of QoL, regardless of the presence of psychopathological

18

symptoms, such as depression.[5] Sleep problems have in previous literature also been linked to poorer work ability and an increased rate of sickness absence.[38,39] In addition, Ng et al. have shown a positive association between good sleep quality and work ability among Hong Kong construction workers.[6] However, in this study we managed to show that self-reported sleep quality is significantly associated with both QoL and work ability among apparently healthy employees not restricted to a specific occupation and working mainly in regular morning shifts. The associations remained significant also in the multivariable models, where many potential confounding factors could be taken into account.

Disease burden, higher BMI and lower educational level were negatively associated with both QoL and work ability in this study, as well as in previous literature. Chronic diseases are known to have a negative association with QoL [1] and with work ability.[2,40] Lower BMI has been linked to better QoL [41] and to better work ability [42,43], and higher education has been positively associated with QoL [44] and with work ability.[45] In our study, as well as in previous literature, older age was associated with poorer work ability [42,46], but no significant association was found between age and QoL. This finding is consistent with the Finnish reference values for the EUROHIS-QOL 8-item index.[47] Furthermore, cohabiting had a significant positive association with QoL in our study, as has previously been observed in a population based study in Sweden.[48] Cohabiting has previously been linked to better health and work ability, for example, in an unemployed population [49], but in our setting, where only active work force was studied, there was no significant association between cohabiting and work ability.

An interesting finding in our study was that depression and / or anxiety was strongly associated with QoL but did not have a significant association with work ability in the multivariable model. Depression and anxiety are known to have a negative impact on QoL [50–52], but depression also affects a person's ability to work.[2,53] However, depression often leads to sickness absence, which means that these people are not in the active work force. In our study population, depression and

19

anxiety were relatively rare conditions, and most of the cases were mild. Only 9 (1.3%) of the

participants met the diagnostic criteria for major depression and 33 (4.6%) of the participants where

categorized as moderately or severely anxious. It is known that not all depressive patients consider

themselves unable to work.[53] These patients may benefit from the schedule and routine of work

life and do not want to seek sick leave, while depression still affects their QoL. In the Finnish Current

Care Guidelines for depression, sick leave is not recommended in mild depression and the need for

sick leave in moderate depression should be evaluated individually.[54] According to these

recommendations, those depressive patients whose work ability is not affected should remain in the

active work force. Furthermore, as the prevalence of depression and anxiety in our study population

was low, the generalizability of these results can be questioned.

In this study, 3-shift work was not significantly associated either with QoL or with work ability in the

multivariable models. In the univariate approach, the work ability of the 3-shift workers was better

(p=0.0040), but no significant difference was seen in QoL. Somewhat surprisingly, 3-shift work did

not seem to have any adverse effects on the participants' well-being in our study. There was no

difference in sleep quality or occupational stress compared to the regular morning shift workers.

Almost all 3-shift workers in our study were women working as nurses or social workers. Their mean

age was 45.6 years, which is 3.5 years younger than the mean age of the whole study population. In

addition to the younger age, one possible explanation for their well-being is that they may have

voluntarily chosen to work in shifts and feel that it is a suitable way of working for them. Those shift

workers who have had health problems or difficulties with sleep due to shift work may have changed

to day work.[55] Another unexpected result in this work was that harmful alcohol consumption did

not have adverse effects on sleep quality, QoL or work ability. However, even though there were 101

(14.2%) participants that fulfilled the definition of "harmful drinking" in the AUDIT-C, heavy drinking

was very rare in this predominantly female, active work force population. We assume that these

people may consume alcohol mainly during weekends, which diminishes the effects on everyday life

and work.

20

We acknowledge some limitations of the study. We cannot determine the causality of the found associations because of the cross-sectional nature of the study. A possible healthy worker effect [56] can be present because only subjects in the active work force were studied. In addition, the initial response rate in the first part of the study in 2014 was only 32.5% (and 84.9% of them attended the study in 2015). It is known that response rates in e-mail surveys tend to be lower than in mail surveys [57], but it can nevertheless cause selection bias. It is possible that the healthiest part of the work force is also the most willing to attend voluntary health surveys, which may result in the possibility that our results reflect the situation in the mainly healthy section of the work force. However, the mean annual rate of sickness absence days did not vary significantly between the study participants and the non-participants on the included employment sectors. According to the records obtained from the city of Pori, the mean incidence of sickness absence days was 11 days per year among the study participants during the two year time period (2014 – 2015).[58] The mean sickness absence rate among all employees of the selected work units was 12 days according to the personnel report of the city of Pori in 2015. [59] The gender distribution in our study (89% females) resembles the distribution among employees of the city of Pori and is close to the gender distribution of the large Finnish prospective study on the public sector employees.[60] The information about alcohol consumption was collected by self-assessment, which may be influenced by social desirability. In addition, we unfortunately do not have data of possible menopausal symptoms, which may have affected our results in women.

The strengths of our study are that we could take into account several aspects associated with the employees' QoL and work ability. All questionnaires were completed by the participants at home before the examination was performed. In this study, the approaches to sleep quality, QoL and work ability were all subjective, which emphasizes the importance of personal experience in evaluating these factors. We assessed self-reported sleep quality and work ability with single questions. This approach was chosen over longer questionnaires because a single question could also be used at a normal physician's appointment in primary or occupational health care for the evaluation of these

21

factors. The self-reported sleep quality question we used was from the Pittsburgh Sleep Quality

Index (PSQI), and it has previously been shown to be closely related with QoL.[5] With this question

we showed a clear association of sleep quality with QoL and with work ability. However, it would be

interesting to further assess this connection in a similar population with a more detailed

questionnaire to determine whether the different components of sleep have different impacts on

QoL and work ability. The WAS score we used for the evaluation of work ability has been shown to

have a strong association with the Work Ability Index and is reliable in evaluating work ability.[61]

WAS has also been shown to predict disability pension and long-term sickness absence according to

a Finnish register-based study.[62] The associations of self-reported sleep quality with both QoL and

with work ability were clear and in line with previous literature even when studied with these simple

tools.

CONCLUSIONS

In this paper we showed that occupational stress and self-reported sleep quality are strongly

associated with both QoL and work ability among Finnish public sector employees. According to our

results, even a low level of occupational stress has a significant negative association with QoL and

work ability. These findings highlight the need for screening and handling work stress and sleep

problems in occupational and primary health care. We suggests that short, self-reported assessment

tools could be used for this purpose.

CONTRIBUTORS

EB, EL, SM, PR and PK contributed to the conception or design of the work, and to the acquisition,

analysis or interpretation of data for the work. EB and PK drafted the manuscript. All authors

critically revised the manuscript, gave final approval, and agreed to be accountable for all aspects of

work ensuring integrity and accuracy.

22

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DECLARATION OF COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the

ethical standards of the institutional and/or national research committee and with the 1964 Helsinki

Declaration and its later amendments or comparable ethical standards. The study protocol and

consent forms were reviewed and approved by the Ethics Committee of the Hospital District of

Southwest Finland (ETMK 43/180/2013).

INFORMED CONSENT

Written informed consent was obtained from all individual participants included in the study.

AVAILABILITY OF DATA

The datasets used and/or analysed during the current study are available from the corresponding

author on request.

REFERENCES

1   Schmidt S, Mühlan H, Power M. The EUROHIS-QOL 8-item index: Psychometric results of a

cross-cultural field study. *Eur J Public Health* 2006;**16**:420–8. doi:10.1093/eurpub/cki155

2   Leino-Arjas P, Kaila-Kangas L, Heliövaara M, *et al.* The Relation of Co-occurring

23

Musculoskeletal Pain and Depressive Symptoms With Work Ability. *J Occup Environ Med* 2013;**55**:1281–5. doi:10.1097/jom.0b013e3182a4ffc4

3   Sarafis P, Rousaki E, Tsounis A, *et al.* The impact of occupational stress on nurses' caring behaviors and their health related quality of life. *BMC Nurs* 2016;**15**:1–9. doi:10.1186/s12912-016-0178-y

4   Yong M, Nasterlack M, Pluto R-P, *et al.* Occupational stress perception and its potential impact on work ability. *Work* Published Online First: 2013. doi:10.3233/WOR-121556

5   Marques DR, Meia-Via AMS, da Silva CF, *et al.* Associations between sleep quality and domains of quality of life in a non-clinical sample: results from higher education students. *Sleep Heal* 2017;**3**:348–56. doi:10.1016/j.sleh.2017.07.004

6   Ng JYK, Chan AHS. The work ability of Hong Kong construction workers in relation to individual and work-related factors. *Int J Environ Res Public Health* 2018;**15**. doi:10.3390/ijerph15050990

7   THE WHOQOL GROUP. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. *Psychol Med* 1998;**28**:551–8. doi:10.5.12

8   Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997;**38**:21–37.http://www.ncbi.nlm.nih.gov/pubmed/9097506 (accessed 3 Sep 2019).

9   Ilmarinen J. The Work Ability Index (WAI). *Occup Med (Chic Ill)* 2006;**57**:160–160. doi:10.1093/occmed/kqm008

10   Buysse DJ, Reynolds CF, Monk TH, *et al.* The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res* Published Online First: 1989. doi:10.1016/0165-1781(89)90047-4

24

11   Bech P, Timmerby N, Martiny K, *et al.* Psychometric evaluation of the Major Depression

Inventory (MDI) as depression severity scale using the LEAD (Longitudinal Expert

Assessment of All Data) as index of validity. *BMC Psychiatry* 2015;:1–7. doi:10.1186/s12888-

015-0529-3

12   Spitzer RL, Kroenke K, Williams JBW, *et al.* A Brief Measure for Assessing Generalized Anxiety

Disorder. 2006;**166**:1092–7.

13   Näätänen P, Aro A, Mathiesen SB, *et al. Bergen Burnout Indicator 15*. Helsinki: : Edita 2003.

14   Bergman E, Löyttyniemi E, Rautava P, *et al.* Ideal cardiovascular health and quality of life

among Finnish municipal employees. *Prev Med Reports* 2019;**15**:100922.

doi:10.1016/j.pmedr.2019.100922

15   Chiu MC, Wang MJJ, Lu CW, *et al.* Evaluating work ability and quality of life for clinical nurses

in Taiwan. *Nurs Outlook* 2007;**55**:318–26. doi:10.1016/j.outlook.2007.07.002

16   Sörensen LE, Pekkonen MM, Männikkö KH, *et al.* Associations between work ability, health-

related quality of life, physical activity and fitness among middle-aged men. *Appl Ergon*

2008;**39**:786–91. doi:10.1016/j.apergo.2007.11.001

17   Veromaa V, Kautiainen H, Saxen U, *et al.* Ideal cardiovascular health and psychosocial risk

factors among Finnish female municipal workers. *Scand J Public Health* 2017;**45**:50–6.

doi:10.1177/1403494816677661

18   Power M. Development of A Common Instrument for Quality of Life. *EUROHIS Dev Common*

Instruments Heal Surv 2003;**57**:145–

59.http://www.euro.who.int/en/publications/abstracts/eurohis-developing-common-

instruments-for-health-surveys

19   WHOQOL Group. the World Health Organization Quality of Life Assessment (Whoqol):

25

Development and General Psychometric Properties* the Whoqol Group{. *Soc Sci Med* 1998;**46**:1569–85. doi:10.1016/S0277-9536(98)00009-4

20   Gould R, Ilmarinen J, Jarvisalo J, *et al. Dimensions of Work Ability*. 2008. doi:10.1108/02656710210415668

21   Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *J Psychosom Res* Published Online First: 1998. doi:10.1016/S0022-3999(97)00298-5

22   Gentili A, Weiner DK, Kuchibhatla M, *et al.* The Test-retest reliability of the Pittsburgh Sleep Quality Index in nursing home residents. 1995;**43**:1317–8.

23   Bech P, Rasmussen NA, Olsen LR, *et al.* The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *J Affect Disord* 2001;**66**:159–64. doi:10.1016/S0165-0327(00)00309-8

24   Bush K, Kivlahan DR, McDonell MB, *et al.* The AUDIT alcohol consumption questions (AUDIT-C). *Arch Interal Med* 1998;**158**:1789–95. doi:10.1097/00000374-199811000-00034

25   Aalto M, Tuunanen M, Sillanaukee P, *et al.* Effectiveness of structured questionnaires for screening heavy drinking in middle-aged women. *Alcohol Clin Exp Res* 2006;**30**:1884–8. doi:10.1111/j.1530-0277.2006.00233.x

26   Tuunanen M, Aalto M, Seppä K. Binge drinking and its detection among middle-aged men using AUDIT, AUDIT-C and AUDIT-3. *Drug Alcohol Rev* 2007;**26**:295–9. doi:10.1080/09595230701247756

27   Yang X, Ge C, Hu B, *et al.* Relationship between quality of life and occupational stress among teachers. *Public Health* 2009;**123**:750–5. doi:10.1016/j.puhe.2009.09.018

28   Lerner DJ, Levine S, Malspeis S, *et al.* Job strain and health-related quality of life in a national sample. *Am J Public Health* 1994;**84**:1580–5. doi:10.2105/AJPH.84.10.1580

26

29   Knudsen HK, Ducharme LJ, Roman PM. Job stress and poor sleep quality: Data from an

       American sample of full-time workers. *Soc Sci Med* 2007;**64**:1997–2007.

       doi:10.1016/j.socscimed.2007.02.020

30   Chen W-Q, Wong T-W, Yu T-S. Review Article: Influence of occupational stress on mental

       health among Chinese off-shore oil workers. *Scand J Soc Med* 2009;**37**:766–73.

       doi:10.1177/1403494809341097

31   Kivimäki M, Pentti J, Ferrie JE, *et al.* Work stress and risk of death in men and women with

       and without cardiometabolic disease: a multicohort study. *Lancet Diabetes Endocrinol*

       2018;:7–9. doi:10.1016/S2213-8587(18)30140-2

32   LeBlanc M, Beaulieu-Bonneau S, Mérette C, *et al.* Psychological and health-related quality of

       life factors associated with insomnia in a population-based sample. *J Psychosom Res*

       2007;**63**:157–66. doi:10.1016/j.jpsychores.2007.03.004

33   Reimer MA, Flemons WW. Quality of life in sleep disorders. *Sleep Med Rev* 2003;**7**:335–49.

       doi:10.1053/smrv.2001.0220

34   Liu L, Fiorentino L, Rissling M, *et al.* Decreased Health-Related Quality of Life in Women With

       Breast Cancer Is Associated With Poor Sleep. *Behav Sleep Med* 2013;**11**:189–206.

       doi:10.1080/15402002.2012.660589

35   Liu J-C, Hung H-L, Shyu Y-K, *et al.* The Impact of Sleep Quality and Daytime Sleepiness on

       Global Quality of Life in Community-Dwelling Patients With Heart Failure. *J Cardiovasc Nurs*

       2011;**24**:99–105. doi:10.1097/JCN.0b013e3181ed7d12

36   Palhares V de C, Corrente JE, Matsubara BB. Association between sleep quality and quality of

       life in nursing professionals working rotating shifts. *Rev Saude Publica* 2014;**48**:594–601.

       doi:10.1590/S0034-8910.2014048004939

27

37   Nena E, Katsaouni M, Steiropoulos P, *et al.* Effect of Shift Work on Sleep , Health , and Quality

of Life of Health-care Workers. *Indian J Occup Env Med* 2018;**22**:29–34.

doi:10.4103/ijoem.IJOEM

38   Lallukka T, Kaikkonen R, Härkänen T, *et al.* Sleep and Sickness Absence: A Nationally

Representative Register-Based Follow-Up Study. *Sleep* 2014;**37**:1413–25.

doi:10.5665/sleep.3986

39   Lian Y, Xiao J, Liu Y, *et al.* Associations between insomnia, sleep duration and poor work

ability. *J Psychosom Res* 2015;**78**:45–51. doi:10.1016/j.jpsychores.2014.09.009

40   Jędryka-Góral A, Bownik I, Michalak JM, *et al.* Work Ability in Ageing Workers Suffering From

Chronic Diseases. *Int J Occup Saf Ergon* 2015;**12**:17–30.

doi:10.1080/10803548.2006.11076665

41   Kroes M, Osei-Assibey G, Baker-Searle R, *et al.* Impact of weight change on quality of life in

adults with overweight/obesity in the United States: a systematic review. *Curr Med Res Opin*

2015;**32**:485–508. doi:10.1185/03007995.2015.1128403

42   Bridger RS, Bennett AI. Age and BMI interact to determine work ability in seafarers. *Occup*

Med (Chic Ill) 2011;**61**:157–62. doi:10.1093/occmed/kqr003

43   Andersen LL, Izquierdo M, Sundstrup E. Overweight and obesity are progressively associated

with lower work ability in the general working population: cross-sectional study among

10,000 adults. *Int Arch Occup Environ Health* 2017;**90**:779–87. doi:10.1007/s00420-017-1240-

0

44   Mielck A, Reitmeir P, Vogelmann M, *et al.* Impact of educational level on health-related

quality of life (HRQL): results from Germany based on the EuroQol 5D (EQ-5D). *Eur J Public*

Health 2011;**23**:45–50. doi:10.1093/eurpub/ckr206

28

45 Martimo KP, Varonen H, Husman K, *et al.* Factors associated with self-assessed work ability. *Occup Med (Chic Ill)* 2007;**57**:380–2. doi:10.1093/occmed/kqm028

46 Pohjonen T. Perceived work ability of home care workers in relation to individual and work-related factors in different age groups. *Occup Med (Chic Ill)* 2001;**51**:209–17. doi:10.1093/occmed/51.3.209

47 Koskinen S, Lundqvist A, Ristiluoma N. *Terveys, toimintakyky ja hyvinvointi Suomessa 2011.* 2012. http://www.julkari.fi/bitstream/handle/10024/90832/Rap068_2012_netti.pdf?sequence=1

48 Helena Michelson, Christina Bolund,. Health-related Quality of Life Measured by the EORTC QLQ-C30: Reference Values From a Large Sample of the Swedish Population. *Acta Oncol (Madr)* 2002;**39**:477–84. doi:10.1080/028418600750013384

49 Hult M, Pietilä AM, Koponen P, *et al.* Association between good work ability and health behaviours among unemployed: A cross-sectional survey. *Appl Nurs Res* 2018;**43**:86–92. doi:10.1016/j.apnr.2018.07.008

50 Saarni SI, Suvisaari J, Sintonen H, *et al.* Impact of psychiatric disorders on health-related quality of life: General population survey. *Br J Psychiatry* 2007;**190**:326–32. doi:10.1192/bjp.bp.106.025106

51 Palacin C, Martinez-Alonso M, Codony M, *et al.* Use of mental health services in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. *Acta Psychiatr Scand* 2004;**109**:47–54. doi:10.1111/j.1600-0047.2004.00330.x

52 Da Rocha NS, Power MJ, Bushnell DM, *et al.* The EUROHIS-QOL 8-item index: Comparative psychometric properties to its parent WHOQOL-BREF. *Value Heal* 2012;**15**:449–57. doi:10.1016/j.jval.2011.11.035

29

53   Elinson L, Houck P, Marcus SC, *et al.* Depression and the Ability to Work. *Psychiatr Serv*

2003;**55**:29–34. doi:10.1176/appi.ps.55.1.29

54   Isometsä E, Kinnunen E, Kivekäs T, *et al.* Depression. Current Care Guidelines. Working group

set up by the Finnish Medical Society Duodecim and the Finnish Psychiatric Association.

Finnish Curr. Care Guidel. 2016.www.kaypahoito.fi (accessed 5 Sep 2019).

55   Linton SJ, Kecklund G, Franklin KA, *et al.* The effect of the work environment on future sleep

disturbances: A systematic review. *Sleep Med Rev* 2015;**23**:10–9.

doi:10.1016/j.smrv.2014.10.010

56   Li C, Sung E. A review of the healthy worker effect in occupational epidemiology. *Occup Med*

(Chic Ill) 1999;**49**:225–9.

57   Shih T, Fan X. Comparing response rates in e-mail and paper surveys : A meta-analysis. *Educ*

Res Rev 2009;**4**:26–40. doi:10.1016/j.edurev.2008.01.003

58   Vuorio T, Suominen S, Kautiainen H, *et al.* Determinants of sickness absence rate among

Finnish municipal employees. *Scand J Prim Health Care* 2019;**37**:3–9.

doi:10.1080/02813432.2019.1568710

59   Porin kaupunki Henkilöstöraportti 2015. 2015.https://docplayer.fi/28278945-Porin-kaupunki-

henkilostoraportti-2015.html

60   Kouvonen A, Kivimäki M, Väänänen A, *et al.* Job strain and adverse health behaviors: The

Finnish public sector study. *J Occup Environ Med* 2007;**49**:68–74.

doi:10.1097/JOM.0b013e31802db54a

61   Fassi M El, Bocquet V, Majery N, *et al.* Work ability assessment in a worker population :

comparison and determinants of Work Ability Index and Work Ability score. *BMC Public*

Health 2013;**13**:1–10.

30

62   Kinnunen U, Nätti J. Work ability score and future work ability as predictors of register-based

disability pension and long-term sickness absence: A three-year follow-up study. *Scand J*

Public Health 2018;**46**:321–30. doi:10.1177/1403494817745190

31

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.