


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

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To cite: Bergman E, Löyttyniemi E, Myllyntausta S, *et al*. Factors associated with quality of life and work ability among Finnish municipal employees: a cross-sectional study. *BMJ Open* 2020;**10**:e035544. doi:10.1136/bmjopen-2019-035544

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2019-035544>).

Received 05 November 2019
Revised 15 May 2020
Accepted 12 August 2020



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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 10 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-Quality of Life 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 to 4.11). QoL was positively associated with good sleep quality, cohabiting, university-level education and lower body mass index (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 to 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 healthcare.

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

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 email surveys.

evaluating the persons' perceptions about the condition with self-reported assessment tools.¹⁸⁻¹³ 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 would be important to recognise the factors associated with the 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 email by the managers of the selected ten work units (total number of employees 2570). 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 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 World Health Organization Quality of Life Assessment scale (WHOQOL-BREF), 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 with 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 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 ($\alpha=0.83$) 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 the 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 healthcare for further follow-up.

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 the 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. Body mass index (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 SD together with 95% CI. Categorical variables are summarised 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 ANOVA or with linear regression. A multivariable model was then built up, and age, gender and all factors with a significant association with QoL and/or work ability in the univariate approach were entered into the model. The method used was a linear model and assumptions were checked using studentised residuals.

All statistical tests were performed as two-sided, with a significance level set at 0.05. The analyses were performed using an SAS System V.9.4 for Windows (SAS Institute, Cary, North Carolina, 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 personalised 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, the 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). The measures from these two psychological symptoms were combined for multivariable analyses.

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, cohabiting, lower BMI and younger age, and negatively associated with occupational stress, depression, anxiety and disease burden.

In the multiway analysis of covariance, 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 (table 2).

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). 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 covariance, 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).

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)	
Cohabiting, 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 (22.4)	
No	620 (89.1)	87 (14.0)	386 (62.3)	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 to 27.13)	26.4 (25.50 to 27.25)	27.0 (26.54 to 27.46)	26.5 (25.72 to 27.24)	0.92
Disease burden*, 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)	
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 to 5.43)	2.4 (1.75 to 2.97)	4.1 (3.59 to 4.51)	9.2 (8.09 to 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)	
BB15 mean total score (95% CI)	31.6 (30.82 to 32.41)	28.3 (26.43 to 30.23)	31.0 (30.05 to 31.99)	35.4 (33.60 to 37.20)	<0.0001
Occupational stress (BB15), 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 to 7.07)	7.50 (7.35 to 7.66)	7.17 (7.09 to 7.24)	6.23 (6.09 to 6.38)	<0.0001
EUROHIS mean score (95% CI)	4.07 (4.03 to 4.11)	4.38 (4.30 to 4.45)	4.09 (4.05 to 4.14)	3.83 (3.75 to 3.91)	<0.0001
WAS mean score (95% CI)	8.31 (8.21 to 8.41)	8.99 (8.78 to 9.20)	8.34 (8.22 to 8.46)	7.80 (7.55 to 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 (15.2)	37 (34.6)	60 (56.1)	10 (9.4)	

*At least one chronic disease diagnosed by a physician.

BB15, Bergen Burnout Indicator 15; EUROHIS, EUROHIS QOL 8-item index; GAD-7, General Anxiety Disorder 7-item Scale; MDI, Major Depression Inventory; WAS, Work Ability Score.

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

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% CI	P value	EUROHIS total model based mean/slope	95% CI	F value	df	P value
Age	-0.0040	-0.0079 to -0.00008	0.046	-0.00028	-0.0042 to 0.0036	0.02	1	0.89
Gender			0.94			0.00	1	0.99
Female	4.07	4.03 to 4.11		3.54	3.38 to 3.69			
Male	4.07	3.96 to 4.18		3.54	3.36 to 3.72			
Education			0.036			4.17	2	0.016
Vocational school	3.83	3.61 to 4.05		3.37	3.11 to 3.62			
College-level	4.05	4.00 to 4.11		3.59	3.44 to 3.74			
University-level	4.11	4.05 to 4.16		3.66	3.51 to 3.81			
Cohabiting			0.011			5.72	1	0.017
Yes	4.09	4.05 to 4.13		3.59	3.43 to 3.75			
No	3.97	3.88 to 4.06		3.48	3.31 to 3.66			
Smoking			0.39					
Yes	4.02	3.89 to 4.14						
No	4.08	4.04 to 4.12						
Harmful alcohol consumption			0.33					
Yes	4.12	4.02 to 4.22						
No	4.06	4.02 to 4.11						
Body mass index	-0.020	-0.028 to -0.012	<0.0001	-0.018	-0.025 to -0.011	23.91	1	<0.0001
Disease burden*			<0.0001			13.35	1	0.0003
Yes	3.99	3.95 to 4.04		3.47	3.31 to 3.63			
No	4.22	4.16 to 4.29		3.61	3.44 to 3.77			
Depression†			<0.0001					
Yes	3.07	2.74 to 3.39						
No	4.08	4.05 to 4.12						
Level of anxiety‡			<0.0001					
No	4.19	4.16 to 4.23						
Mild	3.75	3.67 to 3.82						
Moderate	3.47	3.29 to 3.64						
Severe	3.66	3.32 to 4.00						
Depression and/or anxiety†§						13.92	2	<0.0001
No depression/ No anxiety				3.89	3.77 to 4.00			
Only anxiety				3.59	3.36 to 3.82			
Depression and anxiety				3.14	2.81 to 3.46			
Occupational stress¶			<0.0001			39.30	1	<0.0001
Yes	3.63	3.51 to 3.74		3.35	3.18 to 3.53			
No	4.13	4.09 to 4.17		3.72	3.56 to 3.88			
3-shift work			0.089			0.55	1	0.46
Yes	4.16	4.02 to 4.10		3.56	3.37 to 3.74			
No	4.06	4.05 to 4.28		3.52	3.36 to 3.67			
Self-reported sleep quality			<0.0001			22.02	2	<0.0001
Very good	4.38	4.30 to 4.45		3.74	3.56 to 3.92			
Good	4.09	4.05 to 4.14		3.53	3.36 to 3.69			
Poor	3.83	3.75 to 3.91		3.34	3.18 to 3.51			

*At least one chronic disease diagnosed by a physician.

†Defined by Major Depression Inventory diagnostic tool (DSM IV).

‡General Anxiety Disorder 7-item Scale.

§General Anxiety Disorder 7-item Scale, moderate or severe anxiety.

¶Bergen Burnout Indicator 15, at least mild occupational stress.

df, degrees of freedom; EUROHIS, EUROHIS QOL 8-item index.

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% CI	P value	WAS model based estimate/slope	95% CI	F value	df	P value
Age	-0.019	-0.029 to -0.0090	0.0002	-0.012	-0.022 to -0.0018	5.34	1	0.021
Gender			0.027			3.36	1	0.067
Female	8.35	8.24 to 8.46		7.83	7.43 to 8.23			
Male	7.99	7.68 to 8.29		7.56	7.09 to 8.04			
Education			0.0079			4.74	2	0.0091
Vocational school	7.90	7.30 to 8.50		7.42	6.76 to 8.07			
College-level	8.18	8.04 to 8.32		7.70	7.32 to 8.09			
University-level	8.48	8.33 to 8.63		7.98	7.58 to 8.37			
Cohabiting			0.91			0.04	1	0.85
Yes	8.31	8.20 to 8.42		7.69	7.27 to 8.10			
No	8.30	8.06 to 8.53		7.71	7.26 to 8.18			
Smoking			0.19					
Yes	8.10	7.76 to 8.44						
No	8.33	8.23 to 8.44						
Harmful alcohol consumption			0.35					
Yes	8.43	8.16 to 8.70						
No	8.30	8.18 to 8.40						
Body mass index	-0.036	-0.057 to -0.016	0.0006	-0.023	-0.042 to -0.0041	5.71	1	0.017
Disease burden*			<0.0001			12.23	1	0.0005
Yes	8.07	7.95 to 8.20		7.52	7.11 to 7.95			
No	8.77	8.60 to 8.93		7.87	7.44 to 8.30			
Depression†			0.0083					
Yes	7.11	6.22 to 8.01						
No	8.33	8.23 to 8.43						
Level of anxiety‡			<0.0001					
No	8.55	8.44 to 8.66						
Mild	7.59	7.38 to 7.81						
Moderate	7.44	6.95 to 7.94						
Severe	8.00	7.03 to 8.97						
Depression and/or anxiety†§						1.73	2	0.17
No depression / No anxiety				8.02	7.72 to 8.31			
Only anxiety				7.67	7.07 to 8.27			
Depression and anxiety				7.41	6.57 to 8.25			
Occupational stress¶			<0.0001			29.80	1	<0.0001
Yes	7.47	7.18 to 7.76		7.28	6.82 to 7.74			
No	8.47	8.37 to 8.57		8.12	7.70 to 8.54			
3-shift work			0.0040			3.75	1	0.053
Yes	8.74	8.43 to 9.05		7.84	7.36 to 8.33			
No	8.26	8.15 to 8.36		7.55	7.16 to 7.95			
Self-reported sleep quality			<0.0001			14.44	2	<0.0001
Very good	9.00	8.73 to 9.25		8.13	7.66 to 8.60			
Good	8.34	8.22 to 8.47		7.68	7.25 to 8.10			
Poor	7.80	7.59 to 8.00		7.29	6.86 to 7.72			

*At least one chronic disease diagnosed by a physician.

†Defined by Major Depression Inventory diagnostic tool (DSM IV).

‡General Anxiety Disorder 7-item Scale.

§General Anxiety Disorder 7-item Scale, moderate or severe anxiety.

¶Bergen Burnout Indicator 15, at least mild occupational stress.

df, degrees of freedom; WAS, Work Ability Score.

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 ability⁴ 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 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 and Chan 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 QoL¹ and with work ability.^{2 40} Lower BMI has been linked to better QoL⁴¹ and to better work ability,^{42 43} and higher education has been positively associated with QoL⁴⁴ 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 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 were categorised 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 generalisability 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 with 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.

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 effect⁵⁶ 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 email 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 2-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 emphasises 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 healthcare for the evaluation of these factors. The self-reported sleep quality question we used was from the 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 WAI 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 healthcare. We suggest that short, self-reported assessment tools could be used for this purpose.

Contributors EB, EL, SM, PR and PEK contributed to the conception or design of the work, and to the acquisition, analysis or interpretation of data for the work. EB and PEK 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.

Funding This study was supported by the Hospital District of Satakunta, the Hospital District of Southwest Finland and Etera Mutual Pension Insurance Company.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the 'Participants and Methods' section for further details.

Patient consent for publication Not required.

Ethics 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).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The datasets used and/or analysed during the current study are available from the corresponding author on request.

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