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Technostress operationalised as information and communication technology (ICT) demands among managers and other occupational groups – Results from the Swedish Longitudinal Occupational Survey of Health (SLOSH)

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A B S T R A C T

Exposure to technostress operationalised as ICT demands is more prevalent in higher socioeconomic groups, but little is known about the exposure in different occupational groups considering industry and position. The aim of the present study was to explore the exposure to ICT demands in managers and other occupational groups. Cross-sectional self-reported data from the Swedish Longitudinal Occupational Survey of Health (SLOSH), collected in 2016 was used, including 13 572 respondents (1 241 'managers', 12 331 'non-managers'). ICT demands based on a six-item Likert scale were analysed as the main measure. 'Managers' (varying industries and positions) in comparison with 'non-managers', including nine occupational groups separated by industry and education level, showed the highest prevalence (74.7%) of ICT demands. 'Managers in health care, other community services and education' showed the highest odds ratio (OR) with 95% Confidence Intervals (CI) of ICT demands, in comparison with 'non-managers' (OR 4.64 [CI 3.26–6.61], and with 'all other managers' (OR 1.55 [CI 1.01–2.38]), after adjustment for sex, age, job strain, and social support. In conclusion, managers have increased odds of exposure to ICT demands, especially managers in health care, other community services and education. Targeted actions to improve the digitalised work environment among managers are warranted.

1. Introduction

The digitalisation of working life, including increased use of information and communication technology (ICT), has a substantial impact on the work environment from a psychosocial, physical and cognitive point of view (Sandblad, Gulliksen, Lantz, Walldius, & Åberg, 2018; Swedish Work Environment Authority, 2015a). The digitalisation including use of ICT has improved work efficiency, facilitated information exchange, and contributed to increased work flexibility for many employees (Cardona, Kretschmer, & Strobel, 2013; Chesley, 2014; Swedish Work Environment Authority, 2015a). However, from a psychosocial perspective, ICT demands in terms of a high quantity of incoming emails, disturbances from different notifications (e.g. coming meetings), and technical difficulties with ICT might cause the experience of technostress. Which is defined as the experience of stress related to ICT use at work (Dragano & Lunau, 2020; Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008).

Technostress operationalised as ICT demands can be considered to be a type of work-related stress (Stadin et al., 2016). High job demands in general has not necessarily a negative impact on the health, as long as it is balanced with adequate resources, as proposed in the Job-Demands-Resources model (Bakker & Demerouti, 2007). These resources could be general and include characteristics such as control, reward (e.g. good salary and career prospects) and social support from co-workers and executives (Bakker & Demerouti, 2007; Karasek & Theorell, 1992; Siegrist, Klein, & Voigt, 1997). The resources can also be contextual, such as resources directed to the digitalised work environment (e.g. adequate IT support and administrative support) (Cregård & Corin, 2019; Day, Paquet, Scott, & Hambley, 2012; Ragu-Nathan et al., 2008). Typically, work-related stress refers to an imbalance between the job demands and the resources, as in the job strain and effort-reward imbalance models. Job strain as well as effort-reward imbalance

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increase the risk of several public health diseases such depression, sleep disturbances, cardiovascular diseases and type 2 diabetes (Akerstedt et al., 2015; Fransson et al., 2015; Kivimaki et al., 2013; Madsen, et al., 2017; S. T.; Nyberg et al., 2014). Exposure to technostress operationalised as ICT demands at work have also a negative impact on health. Self-reported ICT demands have been associated with health-related outcomes such as suboptimal (i.e. below the optimal standard) self-rated health, cognitive disturbances (concentration difficulties etc.), and symptoms of burnout (Barber & Santuzzi, 2015; Hennington, Janz, & Poston, 2011; Stadin et al., 2016, 2019; Stenfors, Hanson, Oxenstierna, Theorell, & Nilsson, 2013). Additionally, external ICT demands such as computer breakdown have been associated with temporarily increased cortisol levels (Riedl, Kindermann, Auinger, & Javor, 2012). Thus, exposure to ICT demands has a negative impact on health from various perspectives, regardless of whether it is self-reported or related to external factors.

The prevalence of ICT demands in the working context is more pronounced in people with a higher socioeconomic position (Stadin et al., 2016, 2019). This shows a contrast to frequently used indicators of work stress such as job strain and effort-reward imbalance which have been found to be more common among people with lower socioeconomic position (Stadin et al., 2016; Toivanen, 2011). One possible explanation for this is the different working conditions in different socioeconomic groups, in terms of screen time at work, administrative tasks channelled via ICTs, and daily inflow of emails etc. However, a previously used index of ICT demands has been observed to overlap with the job demands, and the effort dimensions in the job strain and effort-reward imbalance models, and especially in people with a higher socioeconomic position (Stadin et al., 2016).

The occurrence of technostress and indications of a non-sustainable digitalised work environment have been reported in different specific work positions and industries, such as in managers (from different industries and positions), healthcare professionals (physicians and nurses), social workers, sales staff, and teachers in higher education (änstesektor, 2019; Delpechitre, Black, & Farrish, 2019; Golay, 2019; Heponiemi et al., 2017; Lagsten & Andersson, 2018; (Ledarna privat tjänstesektor (2019)); Vision, 2015; Wang & Li, 2019; Zeike, Choi, Lindert, & Pfaff, 2019). However, deeper knowledge of the prevalence of technostress operationalised as ICT demands in different work positions (e.g. managers versus non-managers) and industries from a comparable perspective is insufficient. This information is necessary for future targeted actions to improve the digitalised work environment. Consequently, the aim of the present study was to explore the exposure to ICT demands in managers and other occupational groups with regard to industry and work position.

1.1. Research questions

RQ1) Have managers (in general) higher exposure to ICT demands, than non-managers?

RQ2) Have managers in specific industries higher exposure to ICT demands than other managers?

2. Methods

2.1. Procedure and participation

Data from the 2016 data collection of the Swedish Longitudinal Occupational Survey of Health (SLOSH) was used. SLOSH is an ongoing cohort study with the overall aim to investigate associations between work organisation, work environment, labour force participation, retirement and health and well-being, in the working population in Sweden (Magnusson Hanson et al., 2018). The participants of SLOSH were originally drawn from the Swedish Work Environment Surveys (SWES) 2003–2011, which in turn were randomised sampled from the Labour Force Survey (LFS), conducted by Statistics Sweden (Swedish Work Environment Authority, 2015b). The SWES is based on a nationally representative sample of the working population in Sweden, followed up by means of biennial self-administrated questionnaires through SLOSH, starting in 2006. All eligible SWES participants in SWES 2003–2011 were invited to respond to SLOSH questionnaires from 2014. In total, 13 572 individuals responded to the 'worker questionnaire' (responded by people in paid work 30% or more on average of full time during the past three months) in the 2016 data collection, which represents a response rate of 50.9%. A more comprehensive description of the cohort profile of SLOSH has been published elsewhere (Magnusson Hanson et al., 2018).

2.2. Occupational groups

Occupational group was categorised in line with Statistics Sweden's standard classification of occupations in 2012 (Statistics Sweden, 2012). This standard classification contains ten major occupational groups, including 'managers', 'occupations requiring an advanced level of higher education', 'occupations requiring higher education qualifications or equivalent', 'administration and customer service clerks', 'service, care and shop sales workers', 'agricultural, horticultural, forestry and fishery workers', 'building and manufacturing workers', 'mechanical manufacturing and transport workers, etc.', 'elementary occupations' and 'armed forces occupations'.

2.3. Managers

'Managers' referred to managers from different industries and in different hierarchical positions who participated in SLOSH 2016. The manager group was also divided, and analysed in seven subgroups of managers, separated by industry. These subgroups included 'politicians, managing directors and senior officials', 'managers in economics, HR, marketing, sales and other administration', 'managers in IT, logistics, R&D, real estate companies, construction, engineering, and manufacturing', 'managers in education', 'managers in healthcare and other community services', 'managers in banking, finance and insurance', and 'managers in other service industries' (Statistics Sweden, 2012).

The subgroup 'managers in health care and other community service' included 'managers in healthcare', 'managers in social work', 'managers in elderly care', 'managers and leaders in religious communities' and 'managers in other public services'.

The subgroup 'managers in education' included 'managers in primary and secondary school education and adult education', 'managers in pre-school education' and 'other managers in education'. Additional information about these and other manager subgroups are found in Statistics Sweden's standard classification of occupations from 2012 (Statistics Sweden, 2012).

2.4. ICT demands

ICT demands were measured using a six-item scale, specially developed for SLOSH (Stadin et al., 2016, 2019; Stenfors et al., 2013) and based on previous work by Johansson-Hidén et al. (Johansson-Hidén, Wästlund, & Wallin, 2003) (Appendix 1). In the SLOSH questionnaire, the index was introduced as follows: 'New technology and flexible working conditions have changed the working life of many people. Technology can be a great help but can also lead to new kinds of stress. Estimate the extent to which you are stressed by … ' Then the six items follow, e.g. '…too many calls and emails', and '…demands to give immediate answers to emails and telephone calls that require a lot of work'. The response options were rated on a Likert scale from 1 (to a very high degree) to 5 (I do not use telephone, email or computer in my job). In the statistical analyses, all items in the ICT demands index were reversed so that a high score indicated high ICT demands. An index of ICT demands was calculated as the mean score of the ICT demand items.

A dichotomised measure of the ICT demands index was calculated by using the median score (2.83) as the cut-off value for high and low ICT demands (high ICT demands were defined strictly as those rated above the median). The Cronbach's alpha of the ICT demands scale was 0.79 for the data collection from 2016.

2.5. Covariates

Sex was categorised as 'men' and 'women'. Age was analysed by using the categories 'Lowest age (22) to 39 years', '40–49 years', '50–59 years', '60 years to highest age (74)'. Job strain was calculated using the demand-control questionnaire, which covers the dimensions 'demand', based on four items, e.g. 'Does your work demand too much effort?' and 'control', based on six items, e.g. 'Do you have a choice in deciding what you do at work?' (Karasek & Theorell, 1992). The sample medians of the demands (2.60) and control dimensions (3.17) were used as cut-off values for the dimensions. Based on the combination of the demand and control dimensions, a dichotomised variable was created with the categories 'job strain' (combination of high demand (strictly above the median), and low control (strictly below the median)) and 'no strain' (all other combinations of the demand and control dimensions). Cronbach's alpha was 0.70 for the demand dimension, and 0.66 for the control dimension.

Social support was measured using the social support dimension in the demand-control-support questionnaire, which is based on six items, e.g. 'I get on well with my colleagues' (Karasek & Theorell, 1992). The sample median (3.17) was used as the cut-off value for high or low score of social support. Social support was categorised into 'low social support' (strictly below the median), and 'high social support' (equal to or above the median). The Cronbach's alpha for the social support scale was 0.86.

2.6. Statistical analyses

ICT demands were analysed in the following types of variables: i) a dichotomised variable based on the six-item ICT demands index, and ii) a continuous variable based on the mean score of the six-item ICT demands index. Normality tests indicated normal distribution of the continuous ICT demands variable in the data set. Chi-square tests were conducted to test differences between the prevalence of high ICT demands and other characteristics between the different occupational groups. The occupational groups with highest prevalence of high ICT demands based on the bivariate analyses were then used as predictors in the regression analyses. A one-way ANOVA including post hoc comparisons using the Tukey HSD was used to compare groups with regard to means of the ICT demand index. To estimate the association between occupational groups and ICT demands, two types of regression analysis were used. Multiple logistic regression analysis was used for calculating the OR with 95% CI of the dichotomised measure of ICT demands. Linear regression analysis was used for the calculation of the continuous measure of ICT demands with regard to occupational group. Three models were fitted for the multiple logistic regression analysis, and the linear regression models respectively. 'Model 1' referred to 'managers vs. non-managers'; 'Model 2' referred to 'managers in health care, other community services and education' vs. 'non-managers'; 'Model 3' referred to 'managers in health care, other community services and education' vs. 'all other managers'. Sex, age, job strain and social support were used as covariates, in three sets of covariates: 'sex and age', 'sex, age and job strain' and 'sex, age, job strain and social support. The unstandardized beta coefficient was used for presentation of the results obtained by the linear regression analyses. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern in the regression analyses (observed VIF scores: 1.00–1.30). Alpha was set to < 0.05. IBM SPSS Statistics 25 was used to calculate the results.

3. Results

3.1. Characteristics in managers and other occupational groups

Among managers, 48.6% were women, while the proportion of women among non-managers was 57.8%. Among managers, 8.9% were aged 22–39 years, 34.4% were 40–49 years, 37.7% were 50–59 years, and 18.9% were 60 years or above, while among non-managers 13.3% were aged 22–39 years, 24.8% were 40–49 years, 36.3% were 50–59 years, and 25.7% were 60 years or above. No difference in the proportion of job strain among managers (25.4%) and non-managers (26.2%) was observed. The proportion of high social support was 65.2% among managers, and 58.7% among non-managers (Table 1).

3.2. Prevalence of high ICT demands among managers and other occupational groups

Exposure to high ICT demands was most prevalent among 'managers' (74.7%), followed by 'occupations requiring higher education qualifications or equivalent' (59.6%), 'occupations requiring advanced level of higher education' (54.4%) and 'services, care and shop sales workers' (53.8%). 'Elementary occupations' showed the lowest exposure to ICT demands (21.7%) (Table 1). When analysing the separate items in the ICT demands index it was observed that experience of stress related to demands to give immediate answers to emails, and telephone calls that required a lot of work, and related to demands to be available for work-related issues during work hours or leisure time, were somewhat more pronounced than the other items concerning ICT demands (data not shown). The highest prevalence of ICT demands in managers stratified by industry, was observed among 'managers in the health care and other community services' (82.6%), followed by 'managers in education' (79.1%), 'managers in IT, logistics, R & D, real estate companies, construction, engineering, and manufacturing' (74.4%), 'managers in other service industries' (73.1%), 'managers in economics, HR, marketing, sales and other administration' (71.5%), 'politicians, managing directors and senior officials' (64.3%) and 'managers in banking, finance and insurance' (61.1%) (Table 2).

3.3. Comparison between 'managers in health care, community services and education', 'all other managers' and 'non-managers' with regard to ICT demands

Since the prevalence of ICT demands was observed to be more pronounced in 'managers', and especially in 'managers in health care and other community services' followed by 'managers in education' (Table 1, Table 2), further analyses of mean value comparisons were conducted. A significant association between ICT demands and occupational group was observed in the mean value comparison between 'managers in health care, other community services and in education', 'other managers' and 'non-managers' ($F = 242.46$, $p=<.001$) (Table 3). Post hoc comparisons indicated that the mean score for ICT demands among 'managers in health care, other community services and education' ($M = 3.47$, $SD=.66$) was significantly higher than 'other managers' ($M = 3.33$, $SD=.71$) and 'non-managers' ($M = 2.88$, $SD=.76$).

3.4. 'Managers' versus 'non-managers' regarding ICT demands

The association between managers and ICT demands was further analysed by multiple logistic regression analysis, and 'managers' had higher odds of having high ICT demands compared with 'non-managers' in crude analysis (OR 3.37 [CI 2.95–3.85]). The association remained after adjustment for sex, age, job strain and social support (OR 3.28 [CI 2.77–3.88]) (Table 4). A multiple linear regression showed that, 'managers' had higher scores of on average 0.46 (95% CI 0.40–0.51) points on the ICT demands index as compared with 'non-managers', after adjustment for sex, age, job strain and social support (Table 4).

Table 1
Characteristics in the total study sample, in 'managers' versus 'non-managers', and in different occupational groups among 'non-managers'.

		Total	Managers	Non-managers	*Occupational groups among non-managers*								
					Occupations requiring advanced level of higher education	Occupations requiring higher education qualifications or equivalent	Administration and customer service clerks	Service, care and shop sales workers	Agricultural, horticultural, forestry and fishery workers	Building and manufacturing workers	Mechanical manufacturing and transport workers	Elementary occupations	Armed forces occupations
n (%)		13 572 (100.0)	1 241 (9.1)	12 331 (90.9)	4 467 (33.7)	2 304 (17.4)	1 045 (7.9)	2 077 (15.7)	183 (1.4)	920 (6.9)	715 (5.4)	271 (2.0)	30 (0.2)
Sex, n (%)	Men	5 836 (43.0)	638 (51.4)	5 198 (42.2)	1 431 (32.0)	1 230 (53.4)	223 (21.3)	425 (20.5)	124 (67.8)	843 (91.6)	610 (85.3)	79 (29.2)	28 (93.3)
	Women	7 736 (57.0)	603 (48.6)	7 133 (57.8)	3 036 (68.0)	1 074 (46.6)	822 (78.7)	1 652 (79.5)	59 (32.2)	77 (8.4)	105 (14.7)	192 (70.8)	2 (6.7)
Age, n (%)	Lowest (22)-39 yrs	1 745 (12.9)	111 (8.9)	1 634 (13.3)	687 (15.4)	338 (14.7)	110 (10.5)	232 (11.2)	23 (12.6)	94 (10.2)	79 (11.0)	35 (13.0)	8 (26.7)
	40–49 yrs	3 481 (25.6)	427 (34.4)	3 054 (24.8)	1 237 (27.7)	626 (27.2)	266 (25.5)	394 (19.0)	30 (16.4)	211 (22.9)	148 (20.7)	50 (18.5	6 (20.0)
	50–59 yrs	4 944 (36.4)	468 (37.7)	4 476 (36.3)	1 459 (32.7)	812 (35.2)	392 (37.5)	849 (40.9)	72 (39.3)	371 (40.3)	292 (40.8)	101 (37.4)	14 (46.7)
	60-highest (77) yrs	3 402 (25.1)	235 (18.9)	3 167 (25.7)	1 084 (24.3)	528 (22.9)	277 (26.5)	602 (29.0)	58 (31.7)	244 (26.5)	196 (27.4)	84 (31.1)	2 (6.7)
ICT demands, n (%)	Low ICT demands	6 816 (50.7)	311 (25.3)	6 505 (53.3)	2 026 (45.6)	924 (40.4)	480 (46.2)	1 384 (67.6)	116 (65.5)	628 (69.0)	553 (78.3)	223 (85.8)	16 (53.3)
	High ICT demands	6 621 (49.3)	918 (74.7)	5 703 (46.3)	2 413 (54.4)	1 364 (59.6)	559 (53.8)	662 (32.4)	61 (34.5)	282 (31.0)	153 (21.7)	37 (14.2)	14 (46.7)
Job strain, n (%)	No strain	7 632 (73.9)	541 (74.6)	7 091 (73.8)	2 346 (78.8)	1 398 (76.8)	668 (70.2)	1 223 (67.6)	98 (69.5)	523 (73.2)	464 (69.0)	168 (66.1)	12 (75.0
	Job strain	2 697 (26.1)	184 (25.4)	2 513 (26.2)	632 (21.2)	423 (23.2)	284 (29.8)	585 (32.4)	43 (30.5)	191 (26.8)	208 (31.0)	86 (33.9)	4 (25.0)
Social support, n (%)	Low social support	5 397 (40.7)	428 (34.8)	4 969 (41.3)	1 654 (37.6)	924 (40.9)	434 (42.0)	877 (43.4)	64 (41.0)	412 (46.5)	344 (49.2)	126 (48.3)	10 (33.3)
	High social support	7 876 (59.3)	801 (65.2)	7 075 (58.7)	2 740 (62.4)	1 334 (59.1)	599 (58.0)	1 146 (56.6)	92 (59.0)	474 (53.5)	355 (50.8)	135 (51.7)	20 (66.7)

Table 2
Prevalence of ICT demands in 'managers', divided by industry.

		Politicians, managing directors and senior officials	Managers in economics, HR, marketing, sales and other administration	Managers in IT, logistics, R & D, real estate companies, construction, engineering, and manufacturing	Managers in education	Managers in health care, and other community services	Managers in banking, finance and insurance	Managers in other service industry	P-value
		n = 70	n = 355	n = 348	n = 115	n = 230	n = 18	n = 93	
ICT demands, n (%)	Low ICT demands	25 (37.5)	101 (28.5)	89 (25.6)	24 (20.9)	40 (17.4)	7 (38.9)	25 (26.9)	0.011
	High ICT demands	45 (64.3)	254 (71.5)	259 (74.4)	91 (79.1)	190 (82.6)	11 (61.1)	68 (73.1)	

Table 3
ANOVA between 'managers in health care, other community services and education', 'all other managers' and 'non-managers' considering ICT demands.

	Sum of squares	F	Mean	Sd	C.I.	P-value
ANOVA between groups	278.11	242.46				<.001
Predictors						
Managers in health care and other community services and education (n = 335)			3.47	.66	3.40-3.54	
All other managers (n = 884)			3.33	.71	3.29-3.38	
Non-managers (n = 12 208)			2.88	.76	2.86-2.89	

Note. Post hoc comparisons using the Tukey HSD test indicated that the mean score for ICT demands among 'managers in health care, other community services and education' was significantly higher than 'other managers' and 'non-managers'.

3.5. 'Managers in the health care, other community and education', versus 'non-managers' regarding ICT demands

'Managers in health care and other community services and education' had higher odds of having high ICT demands compared with 'non-manager' in crude analysis (OR 5.01 [CI 3.81–6.59]). The association remained also after adjustment for sex, age, job strain and social support (OR 4.64 [CI 3.26–6.61]). A multiple linear regression showed that, after adjustment for sex, age, job strain and social support, 'managers in health care, other community services and education' had higher scores of on average 0.55 (95% CI 0.44–0.65) points on the ICT demands index as compared with 'non-managers' (Table 4).

3.6. 'Managers in the health care, other community and education', versus 'all other managers' regarding ICT demands

'Managers in health care, other community services and education' also had increased odds of having high ICT demands compared with 'all other manager' in crude analysis (OR 1.70 [CI 1.25–2.32]), and after adjustment for sex, age, job strain and social support (OR 1.55 [CI 1.01–2.38]) (Table 4). A multiple linear regression also showed that 'managers in health care, other community services and education' had higher scores of on average 0.12 (95% CI 0.01–0.22) points on the ICT demands index as compared with 'all other managers' (Table 4).

4. Discussion

The aim of the present study was to explore the exposure to technostress operationalised as ICT demands in managers and other occupational groups with regard to industry and position. The research questions were: RQ1) Have managers (in general) higher exposure to ICT demands, than non-managers? RQ2) Have managers in specific industries have higher exposure to ICT demands than other managers? The results showed that managers have higher odds of exposure to ICT demands in comparison with non-managers in general, and in comparison, with nine occupational subgroups separated by industry among non-managers. Hence, managers are the most evident occupational group with regard to high exposure to ICT demands. The existence of a high amount of ICT demands in general, but also information overload that is channelled via ICTs has been observed among managers previously (Heponiemi et al., 2017; Ledarna privat tjänstesektor, 2019; Saxena & Lamest, 2018; Vision, 2015). However, this is to the best of our knowledge, the first study that compares managers with other occupational groups with regard to ICT demands.

The manager position entails a high inflow of emails that often require an action. Item-separated analyses showed that experience of

Table 4
Logistic regression analysis, and multiple linear regression analysis considering 'managers' exposure to ICT demands.

	Crude				Adjusted for sex and age				Adjusted for sex, age and job strain				Adjusted for sex, age, job strain and social support				
Characteristics	OR[a]	CI 95%	β[b]	CI 95%	OR[a]	CI 95%	β#	CI 95%	OR[a]	CI 95%	β[b]	CI 95%	OR[a]	CI 95%	β#	CI 95%	Adj. R2
Model 1																	
Managers vs. non-managers (ref)	3.37	2.95-3.85	0.50	0.45–54	3.34	2.92-3.82	0.50	0.45-0.54	3.20	2.71-3.78	0.44	0.39-0.50	3.28	2.77-3.88	0.46	0.40-0.51	0.10
Model 2																	
Managers in health care, other community services and in education vs. non-managers (ref)	5.01	3.81-6.59	0.59	0.51-0.68	4.87	3.70-6.41	0.58	0.50-0.67	4.64	3.27-6.57	0.54	0.43-0.64	4.64	3.26-6.61	0.55	0.44-0.65	0.08
Model 3																	
Managers in health care, other community services and education vs. all other managers (ref)	1.70	1.25-2.32	0.14	0.05-0.23	1.63	1.17-2.29	0.12	0.03-0.22	1.58	1.04-2.42	0.12	0.01-0.23	1.55	1.01–2.38	0.12	0.01-0.22	0.21

[a] Odds Ratio derived by logistic regression analyses comparing odds for having high ICT demands.
[b] Unstandardized regression coefficient derived by linear regression analysis comparing mean differences regarding ICT demands.

stress related to aspects of availability via ICTs and requirements to give immediate replies to email and telephone calls, which required much work, were the ICT demands of greatest concern among managers in general (data not shown). These aspects, and a supposedly restricted possibility to control the email inflow, along with little time to manage these emails, might have contributed to the high rates of ICT demands among managers, especially since many managers already face high job demands (Cregård & Corin, 2019; Nyberg, Leineweber, & Magnusson Hanson, 2015). Lack of work control and insufficient administrative support have been identified as reasons of managerial turnover in public sector managers previously (Cregård & Corin, 2019). In addition, the risk of managerial turnover is also associated with poor work-life balance, that stress related to availability via ICTs during leisure time might contribute to (Nyberg, Peristera, Bernhard-Oettel, & Leineweber, 2018). Possibly, strengthened administrative support (Cregård & Corin, 2019), along with an established email culture that allows managers to have some margin of time before replying to emails (if not urgent), may reduce the experience of technostress related to these ICT demands.

Unique information from the present study was also that 'managers in health care and other community services', along with 'managers in education' are the most pronounced occupational group as regards ICT demands. Even tough technostress or indications of a non-sustainable digital work environment, have been reported in healthcare managers, managers in social work, and managers in higher education previously (Heponiemi et al., 2017; Lagsten & Andersson, 2018; Wang & Li, 2019), the contrast between different occupational groups with regard to industry and position is new for this study, as far as we know. Interestingly, 'managers in health care and other community service' and 'managers in education' represent industries that are female-dominated and have a high exposure to different kinds of job demands (such as job strain, psychological demands, quantitative demands, emotional demands etc.) in general (Labrague, McEnroe-Petitte, Leocadio, Van Bogaert, & Cummings, 2018; Swedish Work Environment Authority, 2016). Possibly, the combined effect of different types of job demands, makes the experience of high ICT demands more stressful. Even though the working context and the implemented ICT systems might differ between 'managers in health care and community service' and 'managers in education', there are also similarities with regard to the digitalised work environment. These similarities involve o lot of administrative work duties that are channelled via ICTs, and work in many different complex ICT systems, but lack of time to time to manage these administrative work duties via ICT and lack of time to update the digital literacy in the ICT systems, due to an overall high workload (Cregård & Corin, 2019; Heponiemi et al., 2017; Lagsten & Andersson, 2018; Wang & Li, 2019). Possibly, this might also be part of the explanation for why these managers' report a higher degree of ICT demands.

The possible long-term consequences of high exposure to ICT demands for managers and other occupational groups with increased exposure to ICT demands may be health-related, but also associated with productivity loss (Addas & Pinsonneault, 2015; Dragano & Lunau, 2020; Ragu-Nathan et al., 2008; Stenfors et al., 2013). They may be health-related in terms of increased odds of suboptimal self-rated health and cognitive disturbances (Stadin et al., 2019; Stenfors et al., 2013). It is also possible that ICT demands in combination with low resources, are associated with the same public health diseases as job strain and effort-reward imbalance, such as coronary heart disease, type 2 diabetes and depression (Dragano et al., 2017; Kivimaki et al., 2013; I. E. H.; Madsen, et al., 2017; S. T.; Nyberg et al., 2014). This because ICT demands overlap with job strain and effort-reward imbalance to some extent (Stadin et al., 2016). The loss in productivity is explained by a complex combination of information overload and disruptions, along with misfit between ICT demands and role stress (the latter defined as stress caused by role conflict and role overload) (Addas & Pinsonneault, 2015; Ragu-Nathan et al., 2008)

As a result of this, it could be argued that it is necessary to develop targeted actions to improve the digitalised work environment among managers and other occupational groups with regard to ICT demands.

4.1. Strengths and limitations

The present study has several strengths. The cross-sectional design provides an overview of the current exposure to ICT demands in different occupational groups. The SLOSH cohort is drawn from SWES, which is a nationally representative sample of the working population in Sweden based on randomised sampling (Magnusson Hanson et al., 2018), and this improves the generalisability of the results. In addition, the main results are based on a large study sample, which improves the statistical power of the analyses. Efforts have been made to reduce the amount of systematic bias in the results by adjusting the statistical analyses for several potential confounders, thereby strengthening the internal validity. Additionally, no multicollinearity issues were observed.

The present study also has some limitations. Regarding the cross-

sectional design, a disadvantage with this type of design is that it does not provide information about exposure over time. In addition, the influence of sampling bias due to a response rate of 50.9% in SLOSH 2016 cannot be ruled out, which may influence the generalisability. The studied occupational groups, in particular 'managers in health care and other community service' merged with 'managers in education' include a broad variation of managers, from different working contexts. Consequently, differences regarding ICT demands in managers from separate industries within the group, cannot be ruled out. The statistical analyses were adjusted for different combinations of potential confounders to reduce the risk of systematic bias. However, the risk of residual confounding cannot be ruled out; nor can the risk of instrumentation bias due to over- or under-estimation in the self-rating measures. The experience of stress related to ICT demands may also have been influenced by the healthy worker effect (Baillargeon, 2001), since only people employed in paid work 30% or more on average of full time, were included in the study sample. It should also be noted that additional aspects (such as personality traits) than those that were covered in the present study could have impacted on the result if measured (Grawitch, Werth, Palmer, Erb, & Lavigne, 2017).

The ICT demands index derived from SLOSH gives rise to some methodological considerations. Primary, it can be considered as incomplete according to the Job Demands-Resources model (Bakker & Demerouti, 2007) since ICT demands have not been measured in relation to ICT-related resources. Two other models of technostress have a resource dimension, including features such as digital literacy facilitation, IT-support provision, and user involvement facilitation (Day et al., 2012; Ragu-Nathan et al., 2008). However, since the ICT demands index used in this study assesses to what extent people are feeling stressed about ICT demands such as too many telephone calls and emails, it can still be considered an indicator of work-related stress. Another limitation of the index is that it does not measure the duration of exposure to the experience of stress related to ICT demands. The ICT demands index can be perceived as an operationalisation of mainly the techno-overload and techno-invasion dimensions, and partly the techno-unreliability dimension in the broader concept of technostress (Dragano & Lunau, 2020; Ragu-Nathan et al., 2008). Consequently, technostress dimensions such as techno-complexity, techno-insecurity, techno-uncertainty, and technological workplace surveillance was not reflected in this study (Dragano & Lunau, 2020; Ragu-Nathan et al., 2008). Another consideration is that the ICT demands index in SLOSH might also be somewhat outdated since most of the items focus on communication via email or telephone, and not digital communication in general. New ICT demands might have occurred since the ICT demands index in SLOSH was introduced in 2006, such as potential ICT demands related to the use of 'robotic process automation' and artificial intelligence. Consequently, it is warranted to use updated measures of technostress that reflects both job demands and resources in the contemporary digitalised work environment.

4.2. Practical implications

This study has pointed out specific occupational groups (e.g. managers in general, and especially 'manager in healthcare and other community service', and 'managers in education') with increased likelihood of exposure to technostress operationalised as ICT demands. From an occupational health perspective, this information is recommended to be taken seriously since ICT demands may have a negative impact on the health (Stadin et al., 2016; Stenfors et al., 2013). Possibly, it may also increase the managerial turnover rate (Cregård & Corin, 2019; Nyberg et al., 2018). Strategies to improve the psychosocial dimension of the digital work environment in these occupational groups is thus recommended. Resources that may improve the digital work environment from a psychosocial perspective are access to IT support, administrative support, facilitating of practical training in ICT systems, and efficient user influence in the ICT systems (Cregård & Corin, 2019; Day et al., 2012; Ragu-Nathan et al., 2008). The need of increased administrative support has been reported to be extra relevant for managers in public sector (Cregård & Corin, 2019). It has also been recommended to evaluate the digital work environment to determine if it fulfils its purpose (Sandblad et al., 2018).

5. Conclusion

The present study has contributed new knowledge about occupational groups with increased odds of experience of technostress operationalised as ICT demands, by contrasting different occupational groups with each other. 'Managers' have increased odds of exposure to ICT demands in comparison with 'non-managers'. The highest odds of ICT demands were observed in 'managers in health care, other community services and education' that have increased odds in comparison with both 'non-managers' and 'all other managers'. Future research on this topic should preferably identify potential targeted resources that are needed at both the individual and organisational levels to balance the digitalised work environment for managers and other occupational with high exposure to ICT demands at work.

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Ethical approval

All procedures performed in the study were in accordance with the ethical standards of the Helsinki declaration (World Medical Association, 2013) or comparable ethical standards. Swedish Work Environment Authority. (2015a) from has been approved by the Regional Research Ethics Board in Stockholm #2015/2187-32, and the present study has also received complementary approval by the Swedish Ethical Review Authority #2019–05767.

Credit author statement

The first co-author M. Stadin come up with the main idea of this study (including aim and study design). M. Stadin has conducted the major part of ethical trial, literature search, data analysing, manuscript writing, interpretation of results etc. M. Stadin has completed the final version of the manuscript and approved its submission. Additionally, M. Stadin submitted the manuscript, and has been main responsible revising the manuscript after feedback from reviewers in the submission process. The second co-author M. Nordin has repeatedly revised all parts of the manuscript writing (literature, data analysing, manuscript writing, interpretation of results etc.) and contributed with feedback for improvement of the manuscript. M. Nordin has also reviewed the final version of the manuscript and approved its submission. The third co-author A. Broström has repeatedly revised all parts of the manuscript writing (literature, data analysing, manuscript writing, interpretation of results etc.) and contributed with feedback for improvement of the manuscript. A. Broström has also reviewed the final version of the manuscript and approved its submission. The fourth co-author L. Magnusson Hanson and the fifth co-author H. Westerlund are main responsible for the data collection of SLOSH and have also reviewed the final drafts of the manuscript before submission, and before acceptance for publication. L. Magnusson Hanson and H. Westerlund have approved the submission of the manuscript. The sixth co-author E. Fransson main responsible for the ethical trial of this study. E. Fransson has repeatedly revised all parts of the manuscript writing (literature, data analysing, manuscript writing, interpretation of results etc.) and contributed with feedback for improvement of the manuscript. E. Fransson has also reviewed the final version of the manuscript, and approved its

submission.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2020.106486.

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