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Burnout as a predictor of all-cause mortality among industrial employees: A 10-year prospective register-linkage study☆

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Abstract

Objective: Burnout, a psychological consequence of prolonged work stress, has been shown to coexist with physical and mental disorders. The aim of this study was to investigate whether burnout is related to all-cause mortality among employees. **Methods:** In 1996, of 15,466 Finnish forest industry employees, 9705 participated in the 'Still Working' study and 8371 were subsequently identified from the National Population Register. Those who had been treated in a hospital for the most common causes of death prior to the assessment of burnout were excluded on the basis of the Hospital Discharge Register, resulting in a final study population of 7396 people. Burnout was measured using the Maslach Burnout Inventory–General Survey. Dates of death from 1996 to 2006 were extracted from the National Mortality Register. Mortality was predicted with Cox hazard regression models, controlling for baseline sociodemographic factors and register-based health status according to entitled medical reimbursement and prescribed medication for mental health problems, cardiac risk factors, and pain problems. **Results:** During the 10-year 10-month follow-up, a total of 199 employees had died. The risk of mortality per one-unit increase in burnout was 35% higher (95% CI 1.07–1.71) for total score and 26% higher (0.99–1.60) for exhaustion, 29% higher for cynicism (1.03–1.62), and 22% higher for diminished professional efficacy (0.96–1.55) in participants who had been under 45 at baseline. After adjustments, only the associations regarding burnout and exhaustion were statistically significant. Burnout was not related to mortality among the older employees. **Conclusion:** Burnout, especially work-related exhaustion, may be a risk for overall survival.

Keywords: Burnout; Exhaustion; Forest industry; Mortality; Prospective; Work

Introduction

Extensive overwork is acknowledged as a serious health risk [1]. In Japan, the phenomenon of *Karoshi*—death from overwork—has recently been recognized as a social concern [2]. Also, other psychosocial work conditions, such as low job control [3,4], high job strain, and effort–reward imbalance [5], and major downsizing in the organization [6] have been found to contribute to the risk of early death. Furthermore, high experienced justice at work has been shown to buffer against premature death [7].

Burnout is a psychological reaction to chronic work stress [8,9] with the core content of gradual depletion of employees' intrinsic energetic resources over time [10–12]. The most widely used conceptualization (e.g., Ref. [13]) views burnout as consisting of three major components: exhaustion, cynicism, and diminished professional efficacy [14,15]. The estimated prevalence of severe burnout has ranged from 3% to 7% in representative working populations [13,16,17]. Several work characteristics, such as high workload, role conflict and ambiguity, low predictability, lack of participation and support, and experienced unfairness, have also been shown to predict burnout [18–20].

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In some European countries, burnout has entitled financial compensation and the use of rehabilitation services for employees. In Sweden, for example, burnout has been a legitimate diagnosis for medical certificates [17,21], and in the Netherlands, burnout has been considered an occupational disease justifying work disability benefits [22,23]. In Finland, burnout does not justify compensation, but it has been shown to independently associate with physician-diagnosed sickness absences [24] and to predict disability pensions [25,26]. Burnout-related absences tend to last for relatively long periods [17], the excess risk being approximately 50–65 working days [24]. However, to our knowledge, there are no prospective studies linking burnout to overall survival.

Burnout has been shown to often coexist with depressive, anxiety, and alcohol use disorders [16,27] and musculoskeletal disorders and cardiovascular diseases [28]. In addition, in a 4-year prospective study of initially healthy men, burnout was associated with a twofold risk of developing a myocardial infarction [29]. Burnout has also been found to predict diabetes [30], the common cold [31], and sick leaves due to musculoskeletal disorders and diseases of the respiratory system [32]. Furthermore, burnout has been found to predict depressive symptoms [33], new cases of insomnia [34], and sickness absences due to mental and behavioral disorders [32].

The process between stress and health problems can be direct (i.e., stress predisposing to illness or accelerating the disease process in its subclinical phase), indirect (i.e., stress increasing unfavorable health behavior), or even reversed (i.e., coping with illnesses at work further increasing stress) [35]. As burnout reflects past accumulated exposure to a variety of stressful conditions at work [9], it may be a phase in the process between adverse psychosocial factors at work and ill health. However, it is equally possible that the early phases of illnesses reduce the possibilities to reach one's goals at work, eventually leading to burnout [26,33,36,37]. For example, in a prospective study among Finnish dentists, a reciprocal relationship between burnout and depression was established. However, the relationship between job strain and depression was totally mediated by burnout, while the relationship between job strain and burnout was only partially mediated by depression [33]. The mechanisms linking chronic stress and strain with mortality [38,39] are relevant in explaining the biological plausibility of the work stress process.

In a long-term cohort study, the association between burnout and diseases may differ between workers of separate age groups. Older workers are more likely to leave the work force or retire during the follow-up period. Therefore, those who continue working until the official retirement age may be characterized by especially high resiliency and effective health-enhancing coping strategies. Supporting this line of reasoning, recent longitudinal evidence showed that the association between chronic work-related stress and an increased risk of cardiovascular disease was emphasized in the group of workers less than 50 years of age [40]. Since burnout develops as a consequence of prolonged work stress [13], it is possible also that the association between burnout and mortality might differ according to the age of the workers.

The aim of the present study was to investigate whether burnout predicts all-cause mortality among forest industry employees. We took the baseline health status of the participants into account by excluding those with major health problems and by adjusting for minor health problems. Following the above rationale, we examined age group as a potential moderator of the relationship between burnout and mortality.

Methods

Data collection

This study is a part of the ongoing 'Still Working' cohort study examining work-related antecedents of health, morbidity, and mortality in a multinational private sector forest industry corporation [41,42]. The researchers gave each employee in the corporation an identification code, which was marked in the questionnaire. The link between this identification code and the national personal identification number given to all Finns at birth was known only to the researchers and used later to merge the questionnaire data collected in 1996 to data from several national Finnish registers till the end of 2006. During spring 1996, the questionnaires which at that point did not contain any personal information were sent to the work units, distributed to employees by their supervisors, and, once completed, mailed directly to the Finnish Institute of Occupational Health. Participation was voluntary, and confidentiality was assured to all employees. Approval of the Ethics Committee of the Finnish Institute of Occupational Health was obtained for the study.

Participants

Of the eligible Finnish employees aged 16–65 years (n=15,466) who returned the questionnaire (n=9705, response rate 63%), 8371 could later be identified from the database of the National Population Register Centre containing the personal information. Of this base population, the 542 people who before baseline, according to the Finnish Hospital Discharge Register, had already been treated as an in-patient for the most common causes of death in Finland, i.e., alcohol problems, heart disease, cancer, and suicide attempt [43], were excluded. Furthermore, 433 persons were excluded due to missing values in the relevant items in the questionnaire leaving 7396 employees in the final study population. Women (24% vs. 21%, P<.001), nonmanual workers (38% vs. 19%, P<.001), and married participants (65% vs. 60%, P<.001) were overrepresented in the final

study sample compared to the original population, whereas no difference emerged regarding age group, formed by dichotomizing the age distribution at its medium, i.e., 44 years (P=.146). In addition, mortality was higher among those excluded compared to those in the final study population (5% vs. 3%, P<.001).

Measures

Burnout was measured using the Maslach Burnout Inventory–General Survey (MBI-GS) [15,44]. The MBI-GS consists of the following three subscales: exhaustion (five items, Cronbach's α=0.87), cynicism (five items, α=0.76), and (diminished) professional efficacy (six items, α=0.83). Satisfactory reliability and validity of the MBI-GS have been confirmed [45,46]. In the present study, one of the cynicism items was left out due to its low correlation with the other items intended to measure cynicism (α=0.83 afterwards). The items were scored on a seven-point frequency rating scale ranging from 0 (*never*) to six (*daily*). High scores for exhaustion and cynicism and low scores for professional efficacy are indicative of burnout. The items of professional efficacy were reversed (diminished professional efficacy). One missing value per burnout subscale was allowed. A sum score, in which exhaustion, cynicism, and lack of professional efficacy have different weights (0.4×exhaustion+0.3×cynicism+0.3×lack of professional efficacy), was calculated [44].

The date of dying from the death certificate was extracted from the National Mortality Register maintained by Statistics Finland from 1 March 1996 to 31 December 2006. Registered medication use was taken as an indicator of minor health problems affecting the coping resources of the workers. All Finns are entitled to drug reimbursement as part of the national public health insurance [47]. Firstly, approved drugs qualify for partial reimbursement under the basic refund category. All outpatient drug purchases are contained in the Prescription Register according to the Anatomical Therapeutic Chemical classification code [48]. Secondly, drugs used to treat certain chronic illnesses are fully reimbursed under the special refund category. These entitlements are contained in the Special Refund Entitlement Register. The totally reimbursed medication (for example, diabetes mellitus, chronic hypertension, chronic coronary artery disease, and hyperlipidemia) until 1996 and the partially reimbursed medication for mental health problems (psycholeptics and antidepressants), cardiac risk factors (cardiac therapy, antihypertensive, and lipid-modifying agents), and pain problems (anti-inflammatory and antirheumatic products) during 1994 and 1995, as the most common causes for work disability in Finland, were adjusted for in the analyses.

Sociodemographic factors, i.e., age, gender, marital status, and occupational status, were used as covariates in the analyses because they have been shown to relate to the level of burnout [49,50] as well as to mortality [51]. Data on age, gender, and marital status were obtained from the National Population Register Centre. Marital status was dichotomized as married vs. unmarried based on the register information. Occupational status was collected from employer's records. It was dichotomized as manual (i.e., production and maintenance) vs. nonmanual worker (i.e., supervisory, research, developmental, and office work).

Statistical analysis

The associations between the burnout and the subscales and mortality were analyzed using Cox proportional hazard regression models. For each participant, person-days of follow-up were calculated from 1 March 1996 to either the event of death or 31 December 2006, whichever came first. Hazard ratios (HR) and their 95% confidence intervals (95% CI) provided risk estimates associated with the 1-S.D. increase in the standardized burnout and subscale sum scores for overall mortality. The time-dependent interaction terms between the burnout and the subscales and logarithm of the follow-up period were examined to confirm that the proportional hazards assumptions were justified. The analyses were adjusted stepwise for sociodemographic factors and health problems at baseline. The significance of interaction effects on mortality between total burnout and its three subscales, and age group or gender of the respondents was systematically tested by including interaction terms in the models. In case of a significant interaction, the analyses were stratified. Two-tailed P values below .05 were considered to indicate statistical significance. The analyses were performed using the SAS statistical program package, version 9.1 (SAS Institute, Cary, NC, USA).

Results

The majority of the study participants were men (76%), manual workers (62%), and married (65%) employees. The mean age of the participants was 43 (S.D. 9 years, median 44 years, range 16–65 years). The detailed characteristics of the study population are presented in Table 1 according to the age group of the participants.

All of the time-dependent interaction terms between burnout and the subscales and the logarithm of the follow-up period were nonsignificant (P>.20), indicating that the association between burnout and mortality was not moderated by the time elapsed between survey and death, therefore justifying the use of proportional hazard models. Significant interaction effects between burnout and the exhaustion component and age group (P=.02 and .04, respectively) were found. Therefore, the analyses were stratified by age group.

A total of 199 (3%) of the employees died during the follow-up. The results showed that a one-unit increase in the standardized burnout sum score was related to a 35% increase in the risk of all-cause mortality among workers younger than 45. The association attenuated (HR=1.31) but

Table 1
Characteristics of the study population by age group

	Age of the participants			
	Below 45 years		45 years or over	
Characteristic	*n* (%)	Mean (S.D.)	*n* (%)	Mean (S.D.)
Gender				
Men	3042 (78)		2577 (74)	
Women	879 (22)		898 (26)	
Age		35.6 (6.21)		50.6 (3.98)
Marital status				
Unmarried	1712 (44)		843 (24)	
Married	2209 (56)		2632 (76)	
Occupational status				
Manual	2590 (66)		1966 (57)	
Nonmanual	1331 (34)		1509 (43)	
Burnout		1.39 (0.83)		1.55 (0.94)
Exhaustion		1.46 (1.02)		1.60 (1.23)
Cynicism		1.36 (1.15)		1.60 (1.23)
Diminished professional efficacy		1.31 (1.18)		1.43 (1.31)
Prescribed medication				
Special entitlement	264 (7)		560 (16)	
Partially reimbursed	647 (17)		661 (19)	
Cases of death	62 (2)		137 (4)	
Total	3921 (100)		3475 (100)	

remained significant after all adjustments (Table 2). Exhaustion sum score was related to a 26% increase in the risk of mortality among younger workers, but the association failed to reach significance. However, when adjusted for sociodemographic factors, this association was statistically significant. After further adjustment for health problems at baseline, the excess risk of mortality related to a 1-S.D. increase in exhaustion was 28% (Table 2). Cynicism predicted mortality among the younger workers. Each one-unit increase in the sum score was related to a 29% increase in the risk of mortality. However, this association attenuated after adjustment for sociodemographic factors and was no longer statistically significant. The younger workers who reported diminished professional efficacy were at a 22% excess risk of mortality, but this association did not reach statistical significance before or after adjustments. The burnout subscales did not predict mortality among the older workers, i.e., those who had been at least 45 years old at baseline (Table 2).

Discussion

In this prospective cohort study linking various independent health-related national registers, overall burnout and the exhaustion component were related to all-cause mortality during the 10-year 10-month follow-up period among those forest industry workers who at baseline were under 45 years of age, after the sociodemographic factors and health problems of the participants at baseline had been taken into account. The cynicism component of burnout predicted mortality before but not after adjustments, suggesting that this association was affected by sociodemographic factors. The association between the third subscale of burnout, i.e., diminished professional efficacy, and mortality was weak and did not reach statistical significance. Among employees aged 45 or over, burnout was not associated with mortality.

Burnout is a result of chronic work stress [8,13]. The present results concerning the association between burnout and subsequent mortality are in accordance with Japanese findings that working too much can lead to death, i.e., the

Table 2
Hazard ratios of one-unit increase in the standardized burnout subscales for overall mortality among Finnish forest industry workers between 1996 and 2006 by age group

		Mortality					
		Model 1[a]		Model 2[b]		Model 3[c]	
Burnout dimension by age group (years)	*n* (Cases)	HR	95% CI	HR	95% CI	HR	95% CI
Burnout							
Below 45	3921/ 62	1.35	1.07–1.71	1.32	1.05–1.67	1.31	1.04–1.66
45 or over	3475/137	0.97	0.83–1.14	1.00	0.85–1.18	0.99	0.84–1.17
Exhaustion							
Below 45	3921/ 62	1.26	0.99–1.60	1.29	1.01–1.64	1.28	1.01–1.63
45 or over	3475/137	0.94	0.80–1.01	0.97	0.82–1.14	0.96	0.82–1.13
Cynicism							
Below 45	3921/ 62	1.29	1.03–1.62	1.24	0.99–1.56	1.24	0.99–1.55
45 or over	3475/137	1.02	0.87–1.20	1.04	0.89–1.23	1.04	0.88–1.22
Lack of PE							
Below 45	3921/ 62	1.22	0.96–1.55	1.17	0.92–1.49	1.16	0.91–1.48
45 or over	3475/137	0.99	0.85–1.17	1.01	0.86–1.18	1.00	0.85–1.17

HR, Hazard ratio; CI, confidence interval; PE, professional efficacy.

[a] Model 1 is unadjusted.

[b] Model 2 is adjusted for baseline gender, marital status, and socioeconomic status.

[c] Model 3 is adjusted for baseline gender, marital status, socioeconomic status, and common risk factors for health and work ability (by register-based medication, for example, for coronary artery disease, depression, diabetes, hyperlipidemia, hypertension, and pain).

Karoshi phenomena—death by overwork [2]. Also, other aspects of overload have in prospective studies shown lethal consequences for workers, for example, high job strain and effort–reward imbalance [5], low job control [3,4], experienced injustice [7], and major downsizing in the organization [6].

The most common specific causes of death among working-age Finns are alcohol-related causes, coronary artery disease, accidents, suicide, and specific cancers (breast cancer in women and lung cancer in men) [43]. The possible pathways linking burnout to mortality should be further explored in future research. There may be several plausible mechanisms to account for the observed associations. For example, there is a body of evidence supporting the association between burnout and the risk factors for cardiovascular disease: at least several components of the metabolic syndrome, i.e., change in stress hormone levels, low-grade inflammation, impairment of the immune system, blood coagulation, and fibrinolysis, have been found to be associated with burnout [9]. The evidence on burnout and health-risk behaviors is scarce and inconsistent [9,13], but the results that have linked work stress to a higher likelihood of adverse health behaviors [52,53] support the possibility of an additional, indirect path between burnout and cardiovascular mortality.

Furthermore, burnout is related to an increase in the level of depressive symptoms [33] and it often coexists with depressive disorders [16]. Depression may in turn predispose to suicide [54] and hazardous behavior leading to accidents [55,56], as well as to cardiovascular diseases [57–59]. It also has high comorbidity with alcohol problems [60]. These observations support the mental health-related link between burnout and mortality as another possible mechanism.

To our knowledge, there is no specific evidence on the mechanism linking burnout to cancer or other kinds of neoplasm. It is possible that, in addition to the cause-specific links between burnout and mortality, part of the burnout-related mortality risk is general in nature, i.e., associated with the depletion of total health resources. A previous study on the current cohort showed that, in addition to associating with disability pensions due to mental disorders, exhaustion-related chronic work disability was related to the combined group of miscellaneous disorders as the diagnosed cause of disability [26].

In previous population-based studies, all three burnout components have been shown to relate to health when indicated by coexisting illnesses [16,28], while the exhaustion and cynicism subscales have mediated the association with work disability [24,25]. However, in the present prospective study in an industrial sample, in addition to burnout syndrome, only the exhaustion subscale predicted mortality after adjustments. The components of burnout have been shown to relate differently to various aspects of the work environment [61] and individual well-being [18]. It has previously been suggested that the exhaustion subscale, closely resembling vital exhaustion [62] and chronic fatigue [63], is the core of burnout [11,12] and especially related to the process of deteriorating health [64,65].

The association between burnout and exhaustion and mortality was observed only among younger workers, a group formed by dichotomizing the baseline age distribution at its medium, i.e., 44 years. In the WOLF Stockholm Study, it was suggested that the inclusion of older employees may dilute the association between job strain and cardiovascular disease as a result of the healthy worker survivor bias [40]. Because work disability increases with age, it has been found that men in manual jobs in particular are healthier than those who drift outside the work force [66]. Therefore, the level of job strain may decrease in the group still working and its effects may be weaker among the remaining participants leading to a lower risk of burnout-related mortality in the group of workers who were older at baseline. The association between exhaustion and mortality was not statistically significant until adjusted for gender, marital status, and occupational status. This indicates that there may be other factors, in addition to age, which affect the exhaustion-related mortality risk.

There are several limitations to be taken into consideration in this study. First, we used a nonrandom sample in only one occupational branch, the forest industry. Although our target organization, a large private sector company, employs heterogeneous personnel ranging from production to managerial work, the majority of the study sample comprised manual workers. However, it has been shown that burnout can evolve in all types of work [67] and that the process of burning out is similar among blue- and white-collar workers [68]. In the final study sample, women were overrepresented compared to the original, male-dominated personnel. However, the risk of burnout was shown not to differ by gender in the Finnish working population [49]. Furthermore, there was no statistically significant interaction between gender and burnout on mortality.

Second, even though the original response rate (63%) was of a satisfactory level in relation to observational studies in general [69], the final identified sample with no missing information at baseline covered only 48% of all employees. Fortunately, the mortality data were complete, i.e., covered all employees, and were therefore not influenced by the degree of burnout. The final study sample suffered from the healthy worker effect, i.e., that the participants were healthier according to mortality than those missing. This observation suggests increased pathology among those excluded. Therefore, the most likely consequence, if any, is a possible underestimation of the association between burnout and mortality. However, caution is warranted regarding generalization of these results to other, dissimilar populations.

Thirdly, even though the sample was large, mortality was quite rare during the approximately 10-year follow-up period which may have caused diminished statistical power in the stratified analyses. All in all, these findings need to be replicated in representative samples with a larger number of participants.

We took employee's health status at baseline into account in two ways. Firstly, we included only workers who have not already been treated as in-patients in a hospital due to alcohol problems, cancer, cardiovascular diseases, or suicide, which are the most common causes of death in Finland [43]. Secondly, we adjusted for other health problems at baseline with register-based medication use. This adjustment covered, for example, diabetes, hypertension, hyperlipidemia, and depression and cardiac and pain problems which most probably affect the coping resources of the workers. It must be acknowledged that these factors did not cover all possible health problems and left out untreated illnesses in particular. In future studies, the baseline health assessment should cover all participants regardless of their need for treatment. On the other hand, our study benefited from the use of independent national register data for exclusion, adjustment, and assessing the outcome, which helped us to avoid common method bias. Finally, we were not able to control for the health behaviors (such as physical activity, smoking, or heavy drinking) of the employees [70] because they were not covered in the data collection phase in 1996 in the 'Still Working' study.

In conclusion, our study showed that work-related exhaustion was a risk factor for all-cause mortality for over 10 years among young industrial employees, i.e., those less than 45 years of age. Regarding the other subscales of burnout, the relationship between cynicism and mortality was affected by sociodemographic factors and between diminished efficacy and mortality it was weak. Burnout did not predict mortality among the older employees. These results point to the importance of tackling exhausting work-related problems. The association between burnout and mortality needs to be studied further in a representative sample with possibilities to explore the cause-specific associations.

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