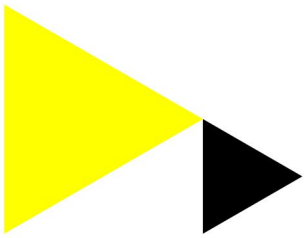
The association of fatigue and cognitive complaints with work-related outcomes and cancer-related anxiety among employees 2–10 years after cancer diagnosis



The association of fatigue and cognitive complaints among employees 2-10 years after cancer diagnosis, work-related outcomes, and cancer-related anxiety.

First author: Ingrid G. Boelhouwer, PhD, Department of Applied Psychology, Amsterdam University of Applied Sciences, Amsterdam, the Netherlands.

ORCID: https://orcid.org/0000-0001-6569-2480

Second author: Tinka van Vuuren, PhD, Faculty of Management, Open Universiteit, Heerlen, the Netherlands / Loyalis Knowledge & Consult, Heerlen, The Netherlands.

Address for correspondence

Wibauthuis / Wibautstraat 3b / 1091 GH Amsterdam, i.g.boelhouwer@hva.nl

Ingrid G. Boelhouwer and Tinka van Vuuren. The association of fatigue and cognitive complaints among employees 2-10 years after cancer diagnosis, work-related outcomes, and cancer-related anxiety, Journal of Health Psychology. DOI: 10.1177/13591053241234748.

Abstract

Objective This study investigated the association of fatigue and cognitive complaints among employees post-cancer diagnosis, with work-related outcomes, and moderation by cancer-related anxiety.

Methods A survey was carried out among workers 2 to 10 years after cancer diagnosis. Employees without cancer recurrence or metastases were selected (N = 566). Self-reported fatigue and cognitive complaints were classified into three groups. ANOVA's and regression analyses were used, controlling for age.

Results Group 1 (cognitive complaints, n = 25, 4.4%), group 2 (fatigue, n = 205, 36.2%), and group 3 (cognitive complaints and fatigue, n = 211, 37.3%) were associated with higher burnout complaints and lower work engagement, and group 2 and 3 with lower work ability. Cancer-related anxiety positively moderated the association of group 3 with higher burnout complaints.

Conclusions Employees with both fatigue and cognitive complaints report less favorable work functioning. Cancer-related anxiety needs attention in the context of burnout complaints.

Keywords

Anxiety, cognitive dysfunction, fatigue, neoplasms, work.

1. INTRODUCTION

Cancer is a common condition and a leading cause of death worldwide (Cancer - Our World in Data, 2023). However, survival rates for many types of cancers are improving (World Health Organization, 2023). This also concerns large groups of working age; the 15-69 year group represents 69% of the total cancer prevalence (Cancer - Our World in Data, 2023). Furthermore, workers who were confronted with cancer are increasingly returning to work. De Boer et al. (2020) reported that long-term work retention is 73% among cancer survivors working at the time of their diagnosis.

However, the long-term effects of cancer and cancer treatments may interfere with work activities (Mehnert, 2011), of which specifically fatigue and cognitive complaints are two well-known, complex, relatively invisible complaints. Furthermore, anxiety about cancer recurrence or metastases (cancer-related anxiety) is a common emotional response causing considerable disruption in social functioning, affecting well-being and quality of life (Mehnert et al., 2013) among those who have been confronted with a cancer diagnosis.

The present study aims to investigate groups with different profiles regarding the presence of fatigue and cognitive complaints among employees with a cancer diagnosis 2 to 10 years ago, associations with work-related outcomes, and the role of cancer-related anxiety.

Groups with different profiles regarding the presence of self-reported fatigue and cognitive complaints

Fatigue during or after cancer treatments may present as intense, disruptive, and unpredictable (Kiserud et al., 2018), persistent, interfering with usual functioning (Berger et al., 2010), and with a detrimental effect on the quality of life (Morrow et al., 2005). The experience of chronic cancer-related fatigue is described as an embodied experience, with predominating bodily sensations and symptoms experienced, for example, described as the experience of the whole body in disarray or the perception of being confined in an aging body (Bootsma et al., 2020). Various biological and mechanistic models have been explored, including inflammation and associated neurologic activation (Joly et al., 2019). People who are assumed to have been successfully treated for cancer may report severe fatigue for months or even years (Prue et al., 2006; Servaes et al., 2001, 2007). About a quarter of those who have or have had cancer suffer from severe symptoms of fatigue, a prevalence that is almost twice as high as in the general population (IKNL, 2019). Survivors with

higher scores on fatigue were more likely to report cognitive complaints within a large population-based cohort of cancer survivors compared to their matched controls (Oerlemans et al., 2022).

In all age categories up to 75 years of age, persons with a cancer history report more cognitive complaints compared to the general population although the differences are most pronounced in younger patients (Oerlemans et al., 2021). Imaging studies show long-term deviations in white matter integrity in the brain, possible effects on grey matter, and decreased responsiveness of brain regions related to memory encoding and executive functioning (Joly et al., 2019). Neuropsychological assessments may indicate cognitive impairments when scores fall below group norms (Schagen et al., 2008; Wefel et al., 2015). However, findings from review studies indicate that impaired neuropsychological functioning and self-reported cognitive complaints exhibit only modest to low correlations (Bray et al., 2018; Hutchinson et al., 2012; Pullens et al., 2010). Self-reported cognitive complaints may present as problems with for instance memory or attention (Boykoff et al., 2009). Nearly half of the patients with cancer at present or in the past report cognitive complaints (IKNL, 2019), even during their professional activities (Boykoff et al., 2009).

Fatigue and cognitive complaints are reported to be associated with each other in several populations, for instance in post-stroke populations (Graber et al., 2019), and also in cancer treatment populations (Dorland et al., 2018). Although both complaints may not be directly visible, it is conceivable that differences in their presence also have a different impact on functioning. Work functioning may show differences between the group that reports 1) only cognitive complaints, 2) only fatigue, or 3) both fatigue and cognitive complaints and 4) the group that reports neither cognitive complaints nor fatigue, according to scores on validated survey scales. Therefore, the first research question is aimed at exploring these groups.

Question 1: How do the groups with different profiles regarding the presence of cognitive complaints and fatigue among employees with a cancer diagnosis 2 to 10 years ago compare to each other in terms of descriptives?

Work-related outcomes

Furthermore, for groups with different profiles regarding the presence of cognitive complaints and fatigue, the relationship with work-related outcomes will be investigated. Work-related outcome measures that are widely used in research in the Netherlands and the Scandinavian countries are work ability, burnout complaints and work engagement. Work ability refers to one's ability to function well at work or to be able to achieve expected work goals (Ilmarinen, 2007). The few available cross-sectional studies show that fatigue and cognitive complaints are negatively related to work ability (Carlsen et al., 2013; Dahl et al., 2019; Ho et al., 2018; Von Ah et al., 2017, 2018). Burnout complaints concern

the presence of exhaustion experienced during or after work activities, mental distancing (i.e., cynicism or depersonalization), and reduced personal accomplishment (Demerouti et al., 2001). Work engagement concerns a positive, fulfilling, affective-motivational state of work-related well-being that is characterized by vigor, dedication, and absorption (Bakker and Leiter, 2010). Other researchers have not yet focused on burn-out complaints and only few studies focused on work engagement among workers who have been treated for cancer in the past. The authors of the present study published one paper on burnout complaints (Boelhouwer et al., 2022). Not one previous study is known that investigates combinations of the presence of fatigue and cognitive complaints in relation to work ability, burnout complaints and work engagement. The above leads to the following research questions:

Question 2: To what extent do groups with different profiles regarding the presence of cognitive complaints and fatigue differ on descriptives and work-related outcomes?
Question 3. Do the groups with different profiles regarding the presence of cognitive complaints and fatigue show associations with work-related outcomes (work ability, burnout complaints, or work engagement)?

Cancer-related anxiety

Anxiety about cancer recurrence or metastases (or cancer-related anxiety), is found across cancer types and for all time periods since cancer diagnosis (Luigjes-Huizer et al., 2022). This anxiety is regarded as a common emotional response to the real threat of this life-threatening illness, causing considerable disruption in social functioning, and affecting well-being and quality of life (Mehnert et al., 2013). Perceived cognitive problems have been reported to be related to depression and anxiety (Pullens et al., 2010). However, cancer-related anxiety is not studied in the context of work-outcome measures, as far as known. It is conceivable that the stress associated with cancer-related anxiety is also related to reduced functioning at work, as it may moderate the expected relationship of fatigue and cognitive complaints with work-outcome measures. Therefore, in the present study possible moderation of cancer-related anxiety will be examined. This leads to the following research question:

Question 4: Does a higher level of cancer-related anxiety (the anxiety of cancer recurrence or metastases) moderate the associations between the groups with different profiles regarding the presence of cognitive complaints and fatigue and work-related outcomes (work ability, burnout complaints or work engagement), so that a higher level of cancer-related anxiety is associated with less favorable work-related outcomes (lower work ability, higher burnout complaints, or lower work engagement)?

2. METHODS

2.1 Procedure

A survey study was carried out between June 2018 and January 2019 among Dutch-speaking workers with a cancer diagnosis 2 to 10 years ago. Various methods and communication channels were used to inform (potential) participants about the study and the (online) questionnaire such as social media, a short video clip, and a website (including the information letter with details regarding storage of the data and confidentiality). No reward for participation was promised. On the first page of the questionnaire, before it started, was stated that by clicking on "Next" the respondent indicated to have read the information, knew that participation was voluntary, and that consent was given to collect the data during this study for scientific research and that the respondent was older than 18 years.

The study was reviewed and approved by the Research Ethics Committee (cETO) of the Open Universiteit in the Netherlands who assessed the ethical acceptability of the study and agreed with the study design and method (reference cETO: U2018/03891/MQF).

2.2 Participants

All types of workers were recruited for the survey study (N = 750), from which the workers with exclusively salaried employment, and without recurrent cancer or metastases, were selected for the study sample of the present study (N = 566). The work activities of the employees could be primarily mental, physical, or a combination of both mental and physical activities.

2.3 Measures

The questionnaires included questions concerning (socio)demographics and information about health, cancer treatments, and work. For the present study, the data to be used were age, gender, educational level, years since cancer diagnosis, type of cancer, other chronic or severe diseases, type of work tasks, fatigue, cognitive complaints, work-related outcomes (work ability, burnout complaints, and work engagement), and cancer-related anxiety (anxiety of cancer recurrence or metastases). All variables were reported by the respondent. The years since diagnosis were calculated based on the reported year of the cancer diagnosis and the date the survey was filled in.

Fatigue was assessed by the subjective fatigue subscale (eight items, seven-point Likert scale) of the Checklist Individual Strength (CIS) (Vercoulen et al., 1994, 1999). The CIS is an instrument that is used in various research populations, including disease-free cancer populations (Servaes et al., 2007). The CIS score range is 8 to 56. The norm references for this scale are as follows: a score less than 27 is normal, a score of 27 to 35 is high, and scores higher than 35 indicate a severe level of fatigue (Bültmann et al., 2000; Vercoulen et al., 1994, 1999; Worm-Smeitink et al., 2017). In the present study the cut-off of 27 will be used to identify high or severe fatigue. The Cronbach's α in the present study was 0.91.

Cognitive complaints were assessed by the Cognitive Failure Questionnaire (CFQ) for subjective cognitive functioning (25 items, five-point Likert scale, score range 0 to 4) about the frequency of everyday cognitive errors (Ponds et al., 2006). The CFQ is useful in both clinical and non-clinical research studying cognitive functioning (Ponds et al., 2006), and is regularly used in studies, including cancer populations (Deprez et al., 2011; Tack et al., 2021). The CFQ score range is 0 to 100. The norm reference for this scale is as follows: a score 43 or higher is defined as high (Broadbent et al., 1982). The cut-off of 43 therefore will be used in the present study. The Cronbach's α in the present study was 0.93.

Work ability was measured by an item derived from the first item from the Work Ability Index (WAI) (Ilmarinen et al., 2005; Ilmarinen and von Bonsdorff, 2015), which is reported to have a very strong association with the complete WAI (Ahlstrom et al., 2010). The item in the present study indicates the extent to which the participant is physically and mentally able to perform current and future work on a scale from 0 (completely unable to work) to 10 (work ability at its best).

The general version of the Utrecht Burnout Scale (UBOS-A) was used to assess burnout complaints (Schaufeli and Van Dierendonck, 2000). The UBOS-A consists of 15 statements on which the respondent scores on a seven-point scale. The items concern complaints on three scales: exhaustion (5 items), cynicism or mental distance (4 items), and competence (6 items). The scores on the latter scale were reversed, so higher scores correspond to higher burnout complaints. After administration, the total UBOS-A score is calculated by adding up the scores on all items and indicated as burnout complaints, although only the higher scores may concern complaints. The Cronbach's α in the present study was 0.91.

The shortened version of the Utrecht Work Engagement Scale (UWES) was used to assess work engagement (Schaufeli et al., 2006). The 9 items consist of statements on which the respondent scores on a seven-point scale. The items concern complaints on three scales: vigor (3 items), dedication (3 items), and absorption (3 items). After

administration, the total UWES score is calculated by adding up the scores on all items and indicated as the level of work engagement. The Cronbach's α in the present study was 0.94.

Anxiety of cancer recurrence or metastases is assessed by the Dutch version of the Cancer Worry Scale (CWS) (8 items, four-point Likert scale) (Custers et al., 2014; Douma et al., 2010). Examples items are "How often have your thoughts about cancer affected your mood/affect?" and "How often have you worried about having cancer?". The Cronbach's α in the present study was 0.88.

2.4 Analysis

The data were analyzed using SPSS software, version 29 (IBM Corporation, Armonk NY, USA) for Windows®/Apple Mac®. The STROBE reporting rules were followed (STROBE Statement, 2007).

Standard descriptive statistics were computed to report (socio)demographics and to describe the correlations between the variables. Fatigue and cognitive complaints were classified according to the norm reference data of the CIS (Bültmann et al., 2000; Vercoulen et al., 1999; Vercoulen et al., 1994; Worm-Smeitink et al., 2017) for fatigue and the CFQ (Broadbent et al., 1982) for cognitive complaints, resulting in a maximum of four possible profiles for fatigue and cognitive complaints as the score on the CIS and the CFQ can fall in the normal range or above the normal range (high or severe). The four possible groups with different profiles regarding the presence of cognitive complaints and fatigue were 1) only cognitive complaints, 2) only fatigue, 3) both fatigue and cognitive complaints and 4) the group that reports neither cognitive complaints nor fatigue. The groups were compared using ANOVA tests, to identify significant differences on all variables, including the work-related outcomes.

Three separate multiple regression analyses were used to investigate the association of the groups with respectively work ability, burnout complaints, and work engagement, controlling for age, and possible moderation by cancer-related anxiety. Therefore the scores cancer-related anxiety were standardized by z scores. For the regression analyses, a dummy variable was used in order to establish the relationship with the type of profile with high or severe complaints. In doing so, we used participants without fatigue and/or cognitive complaints (that is scores in the normal range) as the reference category, according to the recommendations of Hardy (1993). The reference category is omitted from the regression analyses; the standardized coefficient (β) shows the extent to which the other groups deviate from the reference group and is regarded as the indicator of the effect size (Ferguson, 2009). A β coefficient of 0.2 is regarded as small, a β coefficient of 0.5 is regarded as medium, and a β coefficient of 0.8 is regarded as large (Sullivan and Feinn, 2012).

3. **RESULTS**

3.1 Descriptives.

The mean age of the participants (N = 566) was 48.3 (SD 8.75), on average 4.6 years (SD 2.69) after cancer diagnosis. The sample included 92.6% females. There were 77.9% breast cancer diagnoses reported. Other cancer diagnoses reported were 4.1% uterine or cervical cancer, 3.4% lymph node cancer, 2.7% melanoma, 2.5% colorectal cancer, 1.8% testicular cancer, 1.4% ovarian cancer, 1.2% leukemia, 0.4% prostate cancer, 0.2% lung cancer, and 6.2% other types of cancer. The question of whether there are other serious or chronic conditions could be answered with either no or yes, and in the case of the latter, further details could be provided, although this was not mandatory. Of the 40.4% who answered affirmatively, only some participants filled in the open space. Answers included, for example: heart failure, arrhythmias, angina pectoris, muscular diseases, thrombosis, thyroid problems, asthma, type 2 diabetes, and migraines.

Table 1 shows the descriptive statistics and bivariate correlations between the variables of this study. Correlations of age, fatigue, cognitive complaints, work-outcome measures (work ability, burnout complaints and work engagement), and anxiety of recurrent or metastatic cancer are presented. Fatigue and cognitive complaints are moderately correlated (r = .492, p < .01). Fatigue shows a strong correlation with lower work ability (r = -.558, p < .01) and with higher burnout complaints (r = .553, p < .01), and a moderate correlation with lower work engagement (r = -.334, p < .01). Cognitive complaints show a strong correlation with higher burnout complaints (r = .530, p < .01), and moderate correlations with lower work ability (r = -.408, p < .01) and with lower work engagement (r = -.304, p < .01). Fatigue and cognitive complaints are moderately correlated with higher anxiety of recurrent or metastatic cancer (r = .294, p < .01 resp. r = .324, p < .01). See Table 1.

Table 1. Descriptives and bivariate correlations of age, fatigue, cognitive complaints, work-outcome measures (work ability, burnout complaints and work engagement), and cancer-related anxiety (for recurrent or metastatic cancer) within the study sample (*N*=566).

Variables	Mean	Standard deviation	1	2	3	4	5	6	7
1. Age	48.3	8.75	1						
2. Fatigue	34.4	12.23	-.092*	1					
3. Cognitive complaints	40.4	16.10	-.156**	.492**	1				
4. Work ability	7.4	1.73	.088*	-.558**	-.408**	1			
5. Burnout complaints	47.0	14.44	-.058	.553**	.530**	-.621**	1		
6. Work engagement	40.0	10.76	.072	-.334**	-.304**	.415**	-.776**	1	
7. Cancer-related anxiety	14.7	4.30	-.133**	.294**	.324**	-.299**	.329**	-.237**	1

Notes: *Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed)

3.2 Question 1: How do the groups with different profiles regarding the presence of cognitive complaints and fatigue among employees with a cancer diagnosis 2 to 10 years ago compare to each other in terms of descriptives?

First of all, according to the norm references of the scales (the CIS for fatigue and the CFQ for cognitive complaints) for all four possible combinations a group with cases was found within the study sample. Group 1 concerns participants with a high level of cognitive complaints and a normal score on fatigue and contains 4.4% of the study sample (n = 25). Group 2 concerns participants with high or severe fatigue and a normal score on the measure of cognitive complaints and concerns 36.2% of the study sample (n = 205). Group 3 concerns participants with high cognitive complaints and with high or severe fatigue and concerns 37.3% of the study sample (n = 211). Group 4 concerns the group of participants with a normal score on both cognitive complaints and fatigue and concerns 22.1% of the study sample (n = 125), which is indicated as having no complaints. See Table 2.

Differences between the groups with complaints were as follows. Group 3 (both cognitive complaints and fatigue) is younger than group 1 and group 2, namely 46.6 years (*SD* 9.11) versus 48.0 years (*SD* 7.83) and 49.0 years

(SD 8.48) ($p < .05$). In the presence of other differences, the greatest discrepancy is observed between groups 1 and 3. Within group 1 (only cognitive complaints) most cases of higher education are reported (64%), the highest level of strictly mental work tasks (72%) and group 1 was more years after diagnosis, namely 4.7 years (*SD* 2.11). Group 3 (both cognitive complaints and fatigue) reported the highest number of other chronic or severe diseases (50.2%).

Table 2. Descriptives classified in groups by the level of fatigue and cognitive complaints and the complete the study sample (N=566) fatigue, cognitive complaints, age, gender, educational level, years since diagnosis, type of cancer, other or severe diseases, work-related outcomes (work ability, burnout complaints and work engagement), and cancer-related anxiety (anxiety about recurrent or metastatic cancer).

Variables *M (SD)* or %	Group 1 Cognitive complaints	Group 2 Fatigue	Group 3 Cognitive complaints and fatigue	Group 4 No complaints	Complete study sample.
	n = 25 4.4%	*n* = 205 36.2%	*n* = 211 37.3%	*n* = 125 22.1%	*N* = 566 100%
Fatigue [a b d e f]	20.6 (4.20)	38.0 (7.62)	42.4 (7.76)	17.8 (5.750	34.4 (12.23)
Range: 7 - 49					
Norm references:	Normal	High or severe	High or severe	Normal	
< 27 : normal					
≥ 27 : high or severe					
Cognitive complaints [a c d e f j]	49.6 (5.56)	31.5 (8.06)	56.5 (10.47)	26.0 (9.41)	40.4 (16.10)
Range: 0 - 100					
Norm references:	High	Normal	High	Normal	
< 43 : normal					
≥ 43 : high					
Age [h k]	48.0 (7.83)	49.0 (8.48)	46.6 (9.11)	50.1 (8.30)	48.3 (8.75)
Female gender [A]	96.0%	94.1%	95.7%	84.0%	92.6%
Educational level [C]					
Elementary and secondary	16.0%	24.9%	28.0%	21.6%	24.9%
Vocational secondary	20.0%	17.1%	30.8%	18.4%	22.6%
Higher	64.0%	56.1%	38.9%	60.0%	50.9%
Other or missing	0%	2.0%	2.4%	0%	1.6%
Years since diagnosis [C]	4.7 (2.11)	4.4 (2.33)	4.4 (2.36)	5.0 (2.69)	4.6 (2.69)
Type of cancer					
Breast cancer [C]	96.0%	78.0%	80.6%	69.6%	77.9%
Other	4.0%	12.0%	19.4%	30.4%	22.1%
Other chronic or severe diseases [A]	28.0%	38.1%	50.2%	29.8%	40.4%
Type of work tasks [C]					
Mental	72%	59%	53%	68%	59%
Physical	4%	9%	8%	6%	7%
Mental and physical	24%	32%	40% [R]	26%	33% [R]

Work ability [b d e f i] (1-10)	8.1 (1.30)	7.3 (1.29)	6.6 (1.89)	8.8 (1.14)	7.4 (1.73)
Burnout complaints [b c d e f] (15-105)	44.2 (14.25)	45.9 (11.46)	55.3 (14.13)	35.5 (10.12)	47.0 (14.44)
Work engagement [d e f g] (9-63)	38.5 (12.21)	40.5 (9.63)	36.1 (10.64)	45.8 (9.73)	40.0 (10.76)
Cancer-related anxiety (anxiety about cancer recurrence or metastases)[d f] (8-32)	14.4 (3.97)	14.2 (3.94)	16.2 (4.70)	13.0 (3.30)	14.7 (4.30)

Notes:

M = mean
SD = standard deviation
N or *n* = number of participants
[a] = significant difference between group 1 and 2 at .001 level.
[b] = significant difference between group 1 and 3 at .001 level.
[c] = significant difference between group 1 and 4 at .001 level.
[d] = significant difference between group 2 and 3 at .001 level.
[e] = significant difference between group 2 and 4 at .001 level.
[f] = significant difference between group 3 and 4 at .001 level.
[g] = significant difference between group 1 and 4 at .01 level.
[h] = significant difference between group 3 and 4 at .01 level.
[i] = significant difference between group 1 and 2 at .05 level.
[j] = significant difference between group 1 and 3 at .05 level.
[k] = significant difference between group 2 and 3 at .05 level.
[A] = Pearson Chi-Square < .001 level.
[B] = Pearson Chi-Square < .01 level.
[C] = Pearson Chi-Square < .05 level.
[R] = Not in total 100%, due to rounding differences

3.3 Question 2: To what extent do groups with different profiles regarding the presence of cognitive complaints and fatigue differ on descriptives and work-related outcomes?

Descriptive differences between the combinations of the presence of fatigue and cognitive complaints are observed for the following variables. Age shows a different mean value between group 2 and 3 (49.0 versus 46.6 years, $p < .05$) and between group 3 and 4 (46.6 versus 50.1 years, $p < .01$). More female participants are found in the groups with complaints (groups 1, 2 and 3, respectively 96.0%, 94.1%, 95.7%) compared to the group with normal scores (group 4, 84.0%) (Chi-square < .001). The educational level is at the highest level in group 1 (Chi-square < .05). Groups 1 and 4 are more years after cancer diagnosis (respectively 4.7 and 5.0 years), than groups 2 and 3 (both 4.4 years) (Chi-square < .05). There are more participants with a past breast cancer diagnosis in the groups with complaints (groups 1, 2 and 3, respectively 96.0%, 78.0%, 80.6%) compared to the group with normal scores (group 4, 69.6%) (Chi-square < .05). Other chronic or severe diseases are observed at the highest level in group 3 (50.2%), and at the lowest level is observed in group 1 (28.0%) (Chi-square < .001). Significant differences are also observed with regard to the type of work tasks (Chi-square < .05), where the highest percentage of strictly mental work tasks is observed in group 1 (72%) and in group 3 the

highest percentage of both physical and mental work tasks (40.0%). See Table 2. The level of cancer-related anxiety (anxiety of recurrent or metastatic cancer) differs between group 2 and 3 (14.2 versus 16.2, $p < .001$) and between group 3 and 4 (16.2 versus 13.0, $p < .001$). See table 2.

3.4. Question 3: Do the groups with different profiles regarding the presence of cognitive complaints and fatigue show associations with work-related outcomes (work ability, burnout complaints, or work engagement)?

Work ability in group 1, 2, 3 and 4 is respectively 8.1, 7.3, 6.6 and 8.8. Groups 1 and 4 do not differ significantly from each other, but the other group combinations do at two significance levels ($p < 0.5$ for group 1 and 2, and $p < .001$ for group 1 and 3, group 2 and 3, group 2 and 4 and group 3 and 4. Burnout complaints in group 1, 2, 3 and 4 are respectively 44.2, 45.9, 55.3 and 35.5. Groups 1 and 2 do not differ significantly from each other, but the other group combinations do at two significance levels ($p < 0.01$ for group 1 and 3, and $p < .001$ for group 2 and 3, group 2 and 4, group 3 and 4. Work engagement in group 1, 2, 3 and 4 is respectively 38.5, 40.5, 36.1 and 45.8. Groups 1 and 2 and groups 1 and 3 do not differ significantly from each other, but the other group combinations do at two significance levels ($p < 0.01$ for group 1 and 4, and $p < .001$ for group 2 and 3, group 2 and 4, group 3 and 4. See Table 2.

The results of the three regression analyses (cross-sectionally predicting work ability, burnout complaints and work engagement) are as follows. The explained variances of the regression models were 28% for work ability, 32% for burnout complaints and 13% for work engagement. Age is not a predictor for the level of work ability, nor for burnout complaints or work engagement. Group 2 and 3 were associated with lower work ability (β's respectively -.410 and -.547; $p < .001$), but no association with work ability was observed for group 1. However, all three groups were related to higher burnout complaints (β's respectively .123, .349 and .608; $p < .001$) and to lower work engagement (β's respectively -.142, -.241, and -. 393; $p < .001$). See Table 3.

Table 3. Summary of multiple regression analyses for variables cross-sectionally predicting work ability, burnout complaints and work engagement (N = 566).

	Work ability			Burnout complaints			Work engagement		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Age	.000	.007	.001	.071	.059	.043	.009	.049	.007
Group 1 – cognitive complaints	-.582	.332	-.069	8.636	2.698	.123***	-7.407	2.254	-.142***
Group 2 – fatigue	-1.475	.182	-.410***	10.483	1.477	.349***	-5.392	1.234	-.241***
Group 3 – cognitive complaints and fatigue	-1.955	.185	-.547***	18.143	1.499	.608***	-8.750	1.253	-.393***
Cancer-related anxiety	-.291	.173	-.168	.623	1.404	.043**	-.140	1.172	-.013
Group 1 x cancer-related anxiety	.537	.370	.059	-1.217	3.005	-.016	-2.979	2.510	-.053
Group 2 x cancer-related anxiety	.069	.207	.022	1.170	1.677	.045	-.952	1.401	-.049
Group 3 x cancer-related anxiety	-.147	.196	-.058	4.005	1.595	.191*	-2.228	1.333	-.143
R^2		.278			.317			.130	
F		26.785			32.343			11.533	

Notes:

*Correlation is significant at the 0.05 level (two-tailed)

**Correlation is significant at the 0.01 level (two-tailed).

***Correlation is significant at the 0.01 level (two-tailed). *Correlation is significant at the 0.01 level (two-tailed).

3.5 Question 4: Does a higher level of cancer-related anxiety moderate the associations between the groups with different profiles regarding the presence of cognitive complaints and fatigue and work-related outcomes, so that a higher level of cancer-related anxiety is associated with less favorable work-related outcomes?

The cancer-related anxiety (the anxiety of recurrent or metastatic cancer) demonstrates the highest level in group 3 (the group with both fatigue and cognitive complaints). The association of this group with one of the work-related outcomes also shows a significant moderation effect ($\beta = .191$, $p < .05$), namely in the positive relationship with burnout complaints. This result indicates that higher anxiety of cancer recurrence or metastases is associated with higher burnout complaints for employees with both fatigue and cognitive complaints. An additional finding was the positive association of cancer-related anxiety with burnout complaints ($\beta = .043$, $p < .01$), but not with work ability and work engagement. See Table 3. Three additional analyses (not shown), controlling for educational level, cancer type, or other chronic/severe diseases showed the same indications of the presence of significance in comparable segments of the analyses.

4 DISCUSSION

This study showed that the group of employees with both cognitive complaints and fatigue reported the least favorable work-related outcomes. Furthermore, this group is characterized by the lowest educational level and more other chronic or severe diseases than the other groups and is relatively young. The group with only cognitive complaints was small. This group deviates from the other two groups in certain aspects; more strictly mental work tasks, higher educational level, less other chronic or severe diseases and more years after cancer diagnosis, and reports a higher work ability compared to the groups with fatigue. Hence, it is important to be alert on the possibility of cognitive complaints among employees several years after cancer diagnosis, even if they report high work ability and no fatigue. Regression analyses showed that all three groups show an association with higher burnout complaints and lower work engagement, and both groups with fatigue also show lower work ability. Fatigue is clearly associated with less favorable work functioning examined from several perspectives. It is difficult to compare the results of the present study with previous studies, since comparable studies on combinations of the presence of fatigue and cognitive complaints investigating work ability, burnout complaints or work engagement among working cancer survivors are not known. However, negative cross-sectional relationships for fatigue (Carlsen et al., 2013; Dahl et al., 2019; Ho et al., 2018) and cognitive complaints (Ho et al., 2018; Von Ah et al., 2017, 2018) with work ability among workers more than two years after cancer diagnosis have

already been reported, but the associations of employees exclusively experiencing both complaints at an above normal level with work ability or other work-related outcomes were not studied before, as far as known by the authors.

Concerning cancer-related anxiety, the descriptives showed the highest level of this anxiety within the group with both fatigue and cognitive complaints. It is conceivable that experiencing both complaints gives rise to additional concerns related to cancer recurrence or metastases. Furthermore, for this group cancer-related anxiety moderated the association with higher burnout complaints. In other words, the anxiety about cancer recurrence or metastases showed an aggravating moderating effect on burnout complaints in the group with both fatigue and cognitive complaints. Although the indicated effect sizes are small, it is clearly important not only to be aware of the possible presence of cognitive complaints and fatigue, but also of the presence of this specific type of anxiety among employees with an cancer history. Cancer-related anxiety has not been included in previous studies into the quantitative relationship between fatigue and cognitive complaints and work-related outcomes, as far as known. The results of the present study indicate that cancer-related anxiety in combination with burnout complaints needs special attention and may need multidisciplinary interventions.

The strength of this study lies in being an initial exploration in the domain of cognitive complaints and fatigue together, and the association with work functioning, along with the potential unique role of cancer-related anxiety in this context. Of course, also limitations have to be mentioned. As representativeness was not pursued in the recruitment for this study, no conclusions can be drawn regarding the Dutch population of employees 2-10 years after cancer diagnosis in general from these results. Noteworthy is that the study sample contained 90% participants after breast cancer diagnoses. However, it is known that breast cancer is especially common at working age, has a relatively high mean 5 year survival of 88% across age groups in the Netherlands (Kanker.nl, 2023) and therefore will show a relatively high prevalence within the group of workers in the general population as well. Nevertheless, it is impossible to determine if and to what extent the study sample deviates from the actual population. However, as the present study was about associations with work-related outcomes, representative numbers of cases within the groups were not necessarily required. It should also be acknowledged as a limitation that it is impossible to conclusively attribute the reported fatigue or cognitive complaints solely to cancer or its treatments. Furthermore, the present study is cross-sectional, and this offers no insight in the course over time.

Several clinical implications are important to mention here. It is essential to know whether a worker several or many years after cancer diagnosis who reports fatigue also experiences cognitive complaints and vice versa. For

supervisors and managers in the workplace it will be difficult to observe any cognitive complaints or fatigue experienced by workers after cancer diagnosis if these problems are not shared. It may also be that the workers themselves have come to accept it as normal. Therefore, it is important for professionals guiding clients with fatigue or cognitive complaints to inquire about their work functioning and potential cancer-related anxiety. Therefore, screening for possibly unnoticed cognitive complaints and fatigue may be recommended, next to considering cancer-related anxiety, in the situation of less favorable work functioning. This helps ensure that the guidance aligns as closely as possible with the overall issues. The results of the present study stresses to take the interplay of various factors into account in determining the most suitable interventions as has been proposed before (Feuerstein, 2011; Moskowitz et al., 2014). It is important to identify long-term complaints after cancer diagnosis possibly impairing work functioning, to be able to deploy the most appropriate interventions.

To conclude, fatigue, cognitive problems and cancer-related anxiety need a comprehensive approach in view of work functioning. Therefore, the present study also shows that guiding employees who have had a cancer diagnosis in the past requires a tailor-made approach and collaboration between management professionals in the workplace and professionals in the field of psycho-oncology.

Authors' contributions

IB and TvV developed the study design. IB performed the analyses and wrote the first draft of the manuscript, and the later drafts of the manuscript were adjusted by both authors in collaboration. The authors both read and approved the submitted version.

Acknowledgments

We are very grateful to all participants for taking part in this study and to all who contributed to the recruitment of the participants. Furthermore, we would especially like to thank the colleagues from the staff departments of the Faculty of Applied Social Sciences and Law of the Amsterdam University of Applied Sciences for their advice and concrete assistance with regard to communication and the questionnaire, and the creation of the video clip. Also, we thank our research trainees for their contribution to the content and design of the questionnaire.

Data sharing statement

The dataset generated and analyzed during the current study is not publicly available due to the commitment to the participants that the data would be stored securely with access by the researchers only.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Funding The authors received no financial support for the research, authorship, and/or publication of this article.

Ethics approval and consent to participate

The study was reviewed and approved by the Research Ethics Committee (cETO) of the Open Universiteit in the Netherlands who assessed the ethical acceptability of the study and agreed with the study design and method (reference cETO: U2018/03891/MQF). The participants provided their informed consent to participate in this study.

Consent for publication

Not applicable.

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