Burnout, Age, and Cognitive Functioning: A Prospective Study with Nurses in Geriatric Care[1]

Marlen Rahnfeld*, Johannes Wendsche**, Andreas Ihle***,

Jürgen Wegge**** & Matthias Kliegel***

* German Social Accident Insurance, Dresden, Germany
** Federal Institute for Occupational Safety and Health, Dresden, Germany
*** University of Geneva, Genève, Switzerland
**** TU Dresden, University of Technology, Faculty of Psychology, Dresden, Germany

ABSTRACT

Geriatric nurses are both ageing and at high risk for developing burnout symptoms. Burnout symptomatology relates to lower job performance and lower care quality. Developing impairments in cognitive functioning might explain such relationships. We examined prospective relationships of burnout symptoms and cognitive functioning (memory and executive functions objectively assessed). We included age as well as several control variables as predictors and searched for interaction effects to explain prior inconsistencies. German nurses (N = 191) from geriatric care filled out self-administered questionnaires at the workplace (t1) and performed a comprehensive cognitive test battery in the lab six months later at t2. Results showed expected age effects on executive functions but no relationships between burnout symptoms and cognitive functioning nor any interaction effects with age. Exhausted subjects had a slightly better performance in updating. The nearly robust null findings in this study indicate that the relationship of burnout symptoms and decreased cognitive functioning may be a predominantly clinical issue.

Keywords

Age – burnout – cognitive functioning – memory – nurse – prospective

Emotional labour, time pressure, and an ongoing heavy workload in geriatric care place nurses at a comparatively high risk for developing burnout symptoms (Chan et al., 2013; Woo et al., 2020). Maslach et al. (2001) describe burnout as a three-dimensional syndrome of emotional exhaustion, cynicism (also called depersonalisation), and reduced professional efficacy (or low personal accomplishment) in response to work-related stressors. Large studies (e.g., NEXT and RN4CAST) in several European countries and the United States have revealed that one of every three or four nurses report burnout symptoms (Aiken et al., 2012; van der Schoot et al., 2003). The RN4CAST study also found that nurses who have a high burnout score are twice as likely to be at risk of leaving the profession (Heinen et al., 2013). This leads to a further increase in the worldwide nursing shortage (Flinkman et al., 2010; Oulton, 2006; Simoens et al., 2005). Furthermore, burnout can affect the quality of health care. For instance, a meta-analysis with data from 210,669 health care providers reports negative correlations between burnout and quality (r = -.26) as well as safety (r = -.23) in health care (Salyers et al., 2017). Past research has suggested that impaired cognitive capacities are responsible for burnout-induced reductions in work performance (Taris, 2007). We follow this line of research,

[1] The authors declare to have no actual or potential financial and other conflicts of interest related to this manuscript. An earlier draft was included in the first author's dissertation thesis entitled „Working in times of demographic change: Burnout and turnover intention of nurses in geriatric care" (defended 2022 at TU Dresden, Germany). This study was supported by research grants of the German Research Foundation awarded to Jürgen Wegge, Matthias Kliegel, and Winfried Hacker (project number: 186638718, „Organisationale und personale Determinanten des Erhalts von Arbeitsfähigkeit und Gesundheit älterer Pflegekräfte (ODEM)", 2010-2015). The publication was further supported by a PhD scholarship awarded by the German Social Accident Insurance to Marlen Rahnfeld.
The authors wish to thank the other members of the ODEM study group as well as their student assistants, who supported recruiting, data collection, and preparation of the cognitive test battery. The authors dedicate this article to Winfried Hacker as a collegial tribute to his 90th birthday and we express our heartfelt thanks for the many years of professional collaboration with him at TU Dresden.

examining burnout symptoms in nurses and the relation to impaired cognitive functioning.

Burnout Symptoms and Cognitive Functioning

Individuals who have burnout symptoms often complain about impaired cognitive functioning, such as attentional and memory problems (Maslach et al., 2001). In Shirom's (2003) definition of burnout, one of the key symptoms is cognitive weariness. Recent conceptualisations also include cognitive impairments as a primary dimension of burnout (Schaufeli et al., 2020). On the one hand, nurses' jobs in geriatric care include considerable demands for cognitive abilities (Ihle et al., 2015), such as memory (e.g., when distributing medication), updating (e.g., receiving new information about a patient's health status), or inhibition (e.g., suppressing undesired emotional reactions to patient, such as anger or disgust. In fact, employees in the health care sector report higher cognitive demands than those in the industry or public service sector (van den Broeck et al., 2010). On the other hand, adequate cognitive functioning is essential for appropriate quality of care as well as the safety and health of patients and employees by preventing work errors, minor injuries (e.g., by syringes), or accidents (Simpson et al., 2005; Wallace & Vodanovich, 2003). Thus, cognitive failures in nursing can lead to serious threats to the health or even the lives of others.

Empirical evidence for cognitive dysfunction and impairments related to burnout symptoms is based on both self-evaluations and objective tests of cognitive performance (Gavelin et al., 2021; Grossi et al., 2015). A literature review by Deligkaris et al. (2014) of 15 English-language articles published between 2005 and 2013 specifically addresses the connection between burnout and cognitive functioning through an objective assessment (i.e., by using psychometric tests rather than self-reported data). The review reveals that burnout is related to specific cognitive deficits, including executive function, attention, and memory. Yet, the review's authors criticise the scarcity and heterogeneity of available studies, the predominant cross-sectional designs, and the relatively small sample sizes used. Moreover, patients with comorbid mental disorders such as depression and anxiety were not excluded, and the studies did not consistently control for the effects of comorbidity (Grossi et al., 2015). Additionally, the majority of studies to date have either investigated patients who have a clinical diagnosis (Gavelin et al., 2021) or analysed exhaustion only as the core symptom of burnout syndrome in population-based samples (e.g., Diestel et al., 2013; Feuerhahn et al., 2012). However, from Maslach's burnout theory as well as the JD-R model's (Bakker et al., 2004) perspective, focussing on exhaustion only is a limited approach. For instance, Penz et al. (2018) and Wendsche et al. (2020) have also found relationships between a combined measure of burnout and hair cortisol, which is a reliable indicator of a person's stress level.

Cognitive Functioning, Burnout, and Age

Generally, the majority of people demonstrate a decline in many cognitive abilities with increasing age, although individual differences exist (e.g., Deary et al., 2009; Salthouse, 2009; Schnitzspahn et al., 2013). Meta-analyses regarding antecedents of burnout symptoms have revealed a negative but small relationship between age, emotional exhaustion, and depersonalisation (Brewer & Shapard, 2004; Gómez-Urquiza et al., 2017) while others have not found such a connection (Cañadas-De la Fuente et al., 2015). However, no study to date has examined a combination of both burnout symptomatology and age as well as their relationship with objectively measured cognitive functioning. The increasing share of older employees and the rising prevalence of burnout symptoms in the nursing profession could indicate a possible overlay or amplification of both. Few researchers have controlled for age (e.g., Diestel et al., 2013; van Dijk et al., 2020), and an additional few have matched their control group to the burnout group in age (e.g., Oosterholt et al., 2012; van Dam et al., 2011). Castaneda et al. (2011) used a young sample (22-35 years) and did not find a negative relationship between burnout symptoms and cognitive performance. However, age has typically been neglected in past studies, perhaps due to small sample sizes. New insights regarding the role of age combined with burnout might offer advice for geriatric care institutions in designing healthy workplaces and organisation for all ages to prevent employees from prematurely leaving their professions.

The Present Study

With this study, we extend existing research by scrutinising the relationship between burnout symptoms, age, and performance in a cognitive test battery using a prospective design. Our central research question is whether age, symptoms of burnout syndrome, and an interaction between the two predict cognitive functioning six months later. We aim to augment present knowledge in three ways. First, in response to the review by Deligkaris et al. (2014), our study contributes to the literature by using a larger and a non-clinical sample. Specifically, we collected data from registered nurses and nursing assistants in geriatric care, which included several potential control variables (such as depression, sleep problems, and negative affectivity), and applied a more comprehensive cognitive test battery. Second, the prospective view on relationships

credits the developmental character of burnout symptomatology (Maslach et al., 2001). To date, prospective and longitudinal research on this matter has been scarce. For example, Feuerhahn et al. (2012) suggest that emotional exhaustion relates only slightly to cognitive impairment and health six months later but does not relate to job performance. Finally, third, to our knowledge, this is the first study examining whether the anticipated relationship between burnout and cognitive functioning is strengthened by age, since the majority of cognitive abilities worsen with increasing age. Gavelin et al.'s (2021) meta-analysis of clinical burnout and cognitive functioning does not present a moderating effect of age, and we are unaware of any study that explicitly investigated an interaction effect of age in the burnout-cognition relationship. Furthermore, Gavelin et al. (2021) note that the studies included in their meta-analysis are homogeneous in age structure.

We examine the three core symptoms of burnout syndrome, namely, emotional exhaustion, cynicism, and reduced efficacy. Age is both an independent variable and a moderator in the long-term examination, since we propose interaction effects with age in the relationship between burnout and cognitive functioning. Almost all studies' samples in this research domain to date have been heterogeneous in the sample's occupational background; we are aware of three studies that have included nurses only (Diestel et al., 2013; McInerney et al., 2012; Vuori et al., 2014). We conducted several tests for memory (short-term, long-term, and working memory) and executive functions (such as inhibition, updating, and shifting) that varied in cognitive load. In their reviews, Deligkaris et al. (2014), Gavelin et al. (2021), and Grossi et al. (2015) as well as several other researchers (e.g., Feuerhahn et al., 2012; Jonsdottir et al., 2013; May et al., 2015) have noted the need to control for co-morbidities, such as sleep problems and depression or anxiety symptoms, in designs that focus specifically on burnout.

Hypotheses

The following hypotheses were tested:

Hypothesis 1: Nurses' burnout symptoms at t1 are negatively related to performance in a cognitive test battery of memory and executive functions at t2 when controlling for several potentially confounding variables (education, organisational or professional tenure, job status, depression, negative affectivity, and sleep problems).

Hypothesis 2: Employees' age is negatively related to performance in the cognitive test battery.

Hypothesis 3: The negative association of burnout symptoms and cognitive functioning is more pronounced in older employees than in younger employees.

Method

Participants

Participants were involved in a three-wave longitudinal study in Germany from 2012 to 2014. Approximately six months elapsed between measurements. Several analyses, including detailed descriptions of the target population, sample recruiting, sample composition, and dropout analyses, have been published from the study's data (e.g., Bilinska et al., 2016; Ihle et al., 2015; Rahnfeld et al., 2016; Schulz et al., 2021; Wendsche et al., 2014, 2016, 2020). For this analysis, only employees who had care duties in nursing homes or home-based care services in geriatric care were included as subjects; 191 nurses, of whom n = 147 were registered nurses (RNs) (77%) and n = 44 were nursing assistants (23%), participated both at t1 and the laboratory session at t2. Participants' data were anonymised but matched by individual codes. Age (t1) ranged from 20 to 62 years (M = 40.5, SD = 11.1), and 87.4% were women. The study was performed in accordance with the Declaration of Helsinki and was ethically approved by the German Research Foundation. Anonymity and privacy compliance were assured. Participants provided written informed consent before participating in the study.

Procedure

Self-Report Questionnaire

At t1, participants completed a questionnaire in a group session at their workplace; completion required approximately one hour (Bilinska et al., 2016). We measured the degree of burnout symptoms via the 16-item German version of the Maslach Burnout Inventory-General Survey (MBI-GS; Büssing & Perrar, 1992). Subjects rated items such as 'I feel emotionally drained from my work' (from the exhaustion subscale) on a 7-point Likert scale that ranged from 1 = 'Never' to 7 = 'Every day'. In line with Penz et al. (2018), we calculated a general burnout factor (MBI_{total}; α = .86) through the mean of all items and separate mean scores for the three subscales (emotional exhaustion: α = .83; cynicism: α = .85; and reduced efficacy: α = .84).

Laboratory Session

Six months after t1, participants attended a laboratory session (t2) in which they completed another questionnaire (assessing control variables that are detailed below) and a battery of cognitive tests. These tests were partially computerised and partially paper-and-pencil based with varying difficulty (see Ihle et al., 2015, for more details of the procedure). Prior to the analyses, the scores of each cognitive variable's construct (which were standardised previously) were averaged to derive a composite measure.

Memory. Short-term memory was assessed by the number of correct responses in the immediate word-pairs association task from the CogTel (Kliegel et al., 2007) and the forward digit-span test from the WAIS-R (Wechsler, 1981). Long-term memory was assessed by the number of correct responses in the delayed word-pairs association task from the CogTel (Kliegel et al., 2007) and the delayed story recall subtest from the WMS-R (Härting, 2000). Working memory was assessed by the number of correct responses in an adoption of the backward digit-span test from the WAIS-R (Wechsler, 1981) and the number of correct responses in the digit-ordering task (Cooper et al., 1991).

Executive Functions. Inhibition was assessed using the go or no-go task (Newman et al., 1985) and the stop-signal task (Logan, 1994). For both tasks, the score represents the rate of correct responses (the sum of correct trials divided by the total number of trials) per second for each task (see Ihle et al., 2015, for more details). To assess updating functions, we used the number of correct responses in the two-back task (Jäger & Kliegel, 2008) and the keep-track task (Friedman et al., 2006). Shifting was assessed by mixing costs (the mean of reaction time [RT] for mixed-task blocks minus the mean of RT for single-task blocks) in the number-switch task and the perceptual-switch task (Koch & Allport, 2006).

Control Variables. Age in years (t1), gender (0 = 'Female', 1 = 'Male'), job status (1 = 'RN', 2 = 'Nursing assistant'), education in years, and organisational as well as professional tenure in years at t2 were included in the study as potential moderators or control variables, as they demonstrate significant relationships with outcome variables in the correlational analyses (see Table 1). The mean score of five reversed items from the WHO-5 quality-of-life questionnaire (Bech, 2004) was an indicator for depressive symptoms (t2; answers ranged from 1 = 'At no time' to 6 = 'All of the time'; sample item 'I have felt cheerful and in good spirits'). We used the negative affect scale of the Positive and Negative Affectivity Scales (PANAS; Watson et al., 1988) to measure negative affectivity with 10 5-point items (1 = 'Very little or not at all' to 5 = 'Extremely'; the total score ranged from 10-50) at t2. A high total score suggests distress, nervousness, anxiety, upset, and guilt. Sleep disorders, such as trouble falling asleep or premature waking, were assessed at t2 using the sleep wake experience list (SWEL; van Diest, 1990). A high summary score calculated from 15 5-point items (0 = 'Never' to 4 = 'Always') implies the presence of sleep problems (summary scores ranged from 0-60).

Data Analysis

First, we calculated means and standard deviations for all variables. Next, we examined bivariate associations between all variables with the Pearson's product moment correlation coefficient or the Spearman's rank order correlation coefficient. Then, we examined linear relationships between burnout symptomatology and cognitive functioning in the prospective (t1, t2) part of the data using multiple regression analyses. For all, we tested the single effects from each MBI scale (exhaustion, cynicism, and reduced efficacy) and the total MBI score with age as well as the interaction terms from each MBI scale and the total score with age.

All statistical analyses were conducted with IBM SPSS Statistics Version 26. Statistical tests were applied in a two-tailed method with a significance level of $p \leq .05$ (to confirm indirect effects, the 95 % confidence interval should exclude zero).

Results

Descriptive and Correlational Analyses

In Table 1 presents descriptive statistics, intercorrelations, and Cronbach's alphas as measurements of reliability for all study variables. All internal consistencies were appropriately sized ($.83 \leq \alpha \leq .89$). As expected, the potential confounders of depression, negative affect, and sleep problems demonstrated substantial relationships with all three MBI scales ($.25 \leq r\text{s} \leq .42$), with the exception of reduced efficacy ($.11 \leq r\text{s} \leq .15$). Age presented significant relationships with almost all cognitive measures ($.15 \leq |r|\text{s} \leq .50$), with the exception of short-term memory ($r = -.09$) but no relationships with the MBI single or total scores ($.00 \leq r\text{s} \leq .09$). Furthermore, we found no significant correlations between burnout symptoms and cognitive functioning scores ($.00 \leq |r|\text{s} \leq .09$).

Prospective Linear Regression Analyses

The results of the prospective linear regression analyses are displayed in Tables 2 through 5. In the linear effects models, burnout symptomatology did not significantly relate to cognitive functioning, with the exception of emotional exhaustion and updating. In the models with exhaustion, cynicism, and the total MBI score (Tables 2, 3 and 5), age was a significant predictor of executive functions, such as updating (exhaustion: $b = -.23$), inhibition (exhaustion: $b = .35$; cynicism: $b = .50$), inhibition (in reaction times) (exhaustion: $b = .45$; cynicism: $b = .46$), and shifting (in mixing costs) (exhaustion: $b = -.27$; cynicism: $b = -.60$; $\text{MBI}_{\text{total}}$: $b = -.68$), even when controlling for several confounders. Contrary to our expectations, none of the interaction terms with age were significant.

Regarding covariates, education was significantly related to working memory as well as updating in all

Table 1: Descriptive Statistics and Intercorrelations of Study Variables.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Education (years) (t2)	-																	
2	Job Status (t2)	-.27**	-																
3	Professional Tenure (years) (t2)	.18*	-.21**	-															
4	Organisational Tenure (years) (t2)	.05	-.13	.68**	-														
5	Depressive Symptoms (t2)	.06	-.05	-.01	.02	(.89)													
6	Negative Affect (t2)	-.03	-.04	-.04	-.03	.46**	(.88)												
7	Sleep Problems (t2)	.08	-.03	.00	.05	.63**	.35**	(.85)											
8	Emotional Exhaustion (t1)	.07	-.05	.05	.12	.39**	.25**	.42**	(.83)										
9	Cynicism (t1)	.19*	-.06	.05	.10	.32**	.26**	.26**	.61**	(.85)									
10	Reduced Efficacy (t1)	-.09	-.02	-.08	-.06	.14	.15*	.11	.13	.24**	(.84)								
11	MBI_{total} (t1)	.08	-.04	.01	.08	.39**	.30**	.37**	.83**	.81**	.58**	(.86)							
12	Age (years) (t1)	.00	.17*	.53**	.44**	-.09	-.05	-.10	.08	.09	.00	.08	-						
13	Short-Term Memory (t2)	.17*	-.15*	-.08	-.11	.06	-.02	-.06	-.04	-.03	-.02	-.05	-.09	-					
14	Long-Term Memory (t2)	.13	-.11	-.07	-.10	.12	-.04	-.06	-.09	-.01	-.04	-.07	-.15*	.60**	-				
15	Working Memory (t2)	.18*	-.16*	-.15*	-.13	.04	-.08	-.05	.05	.00	.03	.04	-.22**	.45**	.34**	-			
16	Updating (t2)	.22**	-.15*	-.19*	-.18*	.04	-.07	-.04	.08	.03	-.06	.03	-.24**	.39**	.42**	.49**	-		
17	Inhibition (t2)	-.02	-.01	.05	.12	.00	-.15*	-.10	-.09	-.03	.05	-.05	.19**	.15*	.08	.07	-.07	-	
18	Inhibition Reaction Time (t2)	.01	.15*	.29**	.31**	-.06	.01	-.16*	-.09	-.04	-.03	-.08	.50**	-.04	-.11	-.14	-.23**	.46**	-
19	Shifting (t2)	.15*	-.21**	-.05	-.06	.10	-.06	-.01	.01	.00	.02	.02	-.27**	.13	.23**	.21**	.20**	.08	-.19**
	M	13.63	1.23	12.25	8.22	3.05	18.07	18.76	3.12	1.65	1.94	2.24	40.45	.12	.12	.09	.12	.00	.02
	SD	1.50	0.42	8.71	6.65	1.06	6.16	9.16	1.19	0.85	0.92	0.74	11.14	.71	.76	.83	.71	.80	.75

*Note: N = 191. t = time of assessment (t1 = start, t2 = six months later); Job Status (1 = RN, 2 = Nursing assistant); MBI_{total} = total score of Maslach Burnout Inventory. Internal consistency estimates (Cronbach's α) are in parentheses on the diagonal. * $p \leq .05$, ** $p \leq .01$.*

Table 2: Relationships Between Emotional Exhaustion and Cognitive Functioning.

	Memory			Executive Functions			
	Short-Term Memory	Long-Term Memory	Working Memory	Updating	Inhibition	Inhibition Reaction Time	Shifting
	b [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]
(Intercept)	.37 [-.17; .90]	.12 [-.39; .62]	.45 [-.08; .98]	.11 [-.38; .03]	.44 [-.05; .92]	-.15 [-.62; .32]	.21 [-.30; .72]
Education (years) (t2)	.14 [-.03; .31]	.08 [-.08; .24]	**.19 [.03; .36]**	**.21 [.06; .37]**	-.01 [-.16; .14]	.05 [-.09; .20]	.12 [-.04; .28]
Job Status (t2)	-.26 [-.68; .17]	-.07 [-.47; .33]	-.33 [-.76; .09]	-.09 [-.48; .30]	-.30 [-.68; .08]	.10 [-.27; .47]	-.14 [-.54; .27]
Professional Tenure (t2)	.00 [-.24; .25]	.14 [-.09;.37]	-.14 [-.38; .10]	.04 [-.19; .26]	**-.27 [-.49; -.06]**	-.08 [-.29; .13]	.14 [-.09; .37]
Organisational Tenure (t2)	-.06 [-.27; .15]	-.16 [-.36; .04]	-.01 [-.22; .20]	-.17 [-.36; .03]	.13 [-.06; .32]	**.22 [.04; .41]**	-.04 [-.25; .16]
Depression (t2)	**.26 [.04; 47]**	**.32 [.12; .52]**	.17 [-.04; .38]	.11 [-.08; .31]	.14 [-.05; .33]	.05 [-.14; .23]	**.23 [.02; .43]**
Negative Affect (t2)	-.10 [-.27; .07]	-.11 [-.27;.05]	-.13 [-.30; .04]	-.12 [-.28; .03]	-.10 [-.25; .06]	.12 [-.03; .26]	-.12 [-.29; .04]
Sleep Problems (t2)	-.20 [-.40; .00]	**-.23 [-.42; -.04]**	**-.23 [-.43; -.03]**	-.18 [-.36; .01]	-.12 [-.30; .06]	-.16 [-.34; .01]	**-.20 [-.39; .00]**
Exhaustion (t1)	-.01 [-.19; .16]	-.07 [-.24; .09]	.10 [-.07; .27]	**.18 [.02; .34]**	-.10 [-.26; .06]	-.12 [-.27; .04]	.02 [-.14; .19]
Age (t1)	-.04 [-.23; .16]	-.17 [-.35; .01]	-.12 [-.31; .07]	**-.23 [-.41; -.05]**	**.35 [.18; .53]**	**.45 [.28; .62]**	**-.27 [-.45; -.08]**
Exhaustion x Age (t1)	.02 [-.14; .17]	.11 [-.04; .25]	-.05 [-.20; .10]	-.07 [-.21; .07]	-.04 [-.17; .10]	.02 [-.12; .15]	.12 [-.02; .27]
R^2	.09	.14	.15	.20	.14	.32	.15

Note: t = time of assessment (t1 = start, t2 = six months later).
Significant parameter estimates with p ≤ .05 in boldface.

Table 3: Relationships Between Cynicism and Cognitive Functioning.

	Memory			Executive Functions			
	Short-Term Memory	Long-Term Memory	Working Memory	Updating	Inhibition	Inhibition Reaction Time	Shifting
	b [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]
(Intercept)	.44 [-.08; .97]	.23 [-.27; .74]	.36 [-.16; .88]	.27 [-.23; .77]	.36 [-.12; .83]	-.15 [-.61; .31]	.10 [-.41; .60]
Education (years) (t2)	**.17 [.00; .34]**	.08 [-.08; .25]	**.21 [.04; .38]**	**.21 [.04; .37]**	-.01 [-.16; .15]	.06 [-.09; .21]	.15 [-.02; .31]
Job Status (t2)	-.33 [-.74; .09]	-.16 [-.56; .24]	-.27 [-.69; .15]	-.20 [-.60; .20]	-.25 [-.63; .13]	.10 [-.26; .47]	-.06 [-.46; .34]
Professional Tenure (t2)	-.07 [-.30; .16]	.05 [-.17; .27]	-.12 [-.35; .11]	-.08 [-.30; .15]	**-.24 [-.45; -.03]**	-.09 [-.29; .11]	.14 [-.09; .36]
Organisational Tenure (t2)	-.06 [-.26; .14]	-.10 [-.30; .09]	-.02 [-.22; .18]	-.09 [-.29; .10]	.12 [-.06; .31]	**.24 [.06; .41]**	-.04 [-.23; .16]
Depression (t2)	**.24 [.03; .44]**	**.32 [.13; .52]**	.17 [-.03; .37]	.19 [-.01; .39]	.18 [-.01; .36]	.07 [-.11; .25]	**.21 [.01; .40]**
Negative Affect (t2)	-.07 [-.23; .10]	-.13 [-.29; .03]	-.13 [-.29; .04]	-.14 [-.30; .02]	-.14 [-.29; .02]	.10 [-.05; .24]	-.13 [-.29; .03]
Sleep Problems (t2)	**-.19 [-.38; .00]**	**-.26 [-.44; -.07]**	**-.19 [-.38; .00]**	**-.19 [-.37; .00]**	-.14 [-.32; .03]	**-.19 [-.36; -.02]**	-.16 [-.34; .03]
Cynicism (t1)	.20 [-.39; .80]	.01 [-.57; .58]	-.05 [-.64; .54]	.14 [-.43; .71]	.33 [-.21; .87]	-.05 [-.57; .47]	-.55 [-1.13; .03]
Age (t1)	.14 [-.24; .52]	-.12 [-.49; .24]	-.17 [-.54; .21]	-.10 [-.47; .26]	**.50 [.15; .85]**	**.46 [.13; .80]**	**-.60 [-.97; -.23]**
Cynicism x Age (t1)	-.31 [-1.01; .39]	-.02 [-.69; .66]	.06 [-.63; .76]	-.11 [-.78; .57]	-.45 [-1.09; .19]	-.05 [-.67; .56]	.68 [.00; 1.36]
R^2	.09	.12	.14	.16	.13	.32	.16

Note: t = time of assessment (t1 = start, t2 = six months later).
Significant parameter estimates with p ≤ .05 in boldface.

Table 4: Relationships Between Reduced Efficacy and Cognitive Functioning.

	Memory			Executive Functions			
	Short-Term Memory	Long-Term Memory	Working Memory	Updating	Inhibition	Inhibition Reaction Time	Shifting
	b [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]
(Intercept)	.37 [-.14; .88]	.21 [-.28; .70]	.37 [-.14; .87]	.24 [-.25; .73]	.29 [-.18; .75]	-.15 [-.60; .30]	.20 [-.29; .70]
Education (years) (t2)	.16 [-.01; .32]	.08 [-.08; .24]	**.21 [.05; .37]**	**.22 [.06; .38]**	-.02 [-.17; .13]	.03 [-.11; .18]	.15 [-.01; .31]
Job Status (t2)	-.26 [-.66; .14]	-.14 [-.53; .25]	-.28 [-.68; .13]	-.17 [-.56; .22]	-.19 [-.56; .18]	.10 [-.26; .45]	-.15 [-.54; .25]
Professional Tenure (t2)	-.05 [-.27; .18]	.05 [-.17; .26]	-.11 [-.34; .11]	-.08 [-.30; .14]	-.20 [-.41; .01]	-.07 [-.27; .12]	.10 [-.12; .32]
Organisational Tenure (t2)	-.07 [-.27; .13]	-.10 [-.30; .09]	-.01 [-.21; .19]	-.09 [-.28; .10]	.12 [-.07; .30]	**.22 [.05; .40]**	-.03 [-.22; .17]
Depression (t2)	**.22 [.02; .41]**	**.32 [.13; .51]**	.18 [-.02; .37]	**.20 [.00; .39]**	.16 [-.03; .34]	.05 [-.13; .23]	**.23 [.03; .43]**
Negative Affect (t2)	-.10 [-.26; .07]	-.14 [-.30; .02]	-.15 [-.31; .02]	-.14 [-.30; .02]	-.14 [-.30; .01]	.10 [-.05; .24]	-.13 [-.29; .03]
Sleep Problems (t2)	**-.20 [-.39; -.01]**	**-.26 [-.45; -.08]**	**-.21 [-.40; -.02]**	**-.19 [-.37; .00]**	-.14 [-.32; .04]	**-.19 [-.35; -.02]**	-.17 [-.36; .02]
Reduced Efficacy (t1)	.57 [-.03; 1.16]	.38 [-.19; .96]	.23 [-.36; .82]	.36 [-.21; .94]	-.11 [-.66; .44]	-.36 [-.89; .17]	.19 [-.39; .78]
Age (t1)	.28 [-.09; .66]	.09 [-.28; .45]	-.08 [-.45; .30]	.05 [-.31; .41]	.19 [-.16; .53]	.26 [-.08; .59]	-.20 [-.57; .17]
Red. Efficacy x Age (t1)	-.62 [-1.29; .06]	-.45 [-1.10; .20]	-.15 [-.82; .52]	-.40 [-1.05; .25]	.18 [-.44; .80]	.36 [-.24; .96]	-.17 [-.83; .49]
R^2	**.10**	**.13**	**.15**	**.16**	**.12**	**.32**	**.14**

Note: t = time of assessment (t1 = start, t2 = six months later).
Significant parameter estimates with p ≤.05 in boldface.

Table 5: Relationships Between MBI_{total} and Cognitive Functioning.

	Memory			Executive Functions			
	Short-Term Memory	Long-Term Memory	Working Memory	Updating	Inhibition	Inhibition Reaction Time	Shifting
	b [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]
(Intercept)	.43 [-.08; .95]	**.23 [-.26; .73]**	**.37 [-.14; .88]**	**.28 [-.21; .77]**	**.30 [-.17; .78]**	**-.16 [-.61; .29]**	**.15 [-.35; .65]**
Education (years) (t2)	.16 [-.01; .32]	.09 [-.07; .25]	**.20 [.03; .36]**	**.20 [.05; .36]**	-.01 [-.16; .14]	.05 [-.09; .20]	.14 [-.02; .30]
Job Status (t2)	-.32 [-.73; .09]	-.16 [-.55; .24]	-.28 [-.69; .13]	-.21 [-.60; .18]	-.21 [-.58; .17]	.11 [-.25; .47]	-.10 [-.50; .30]
Professional Tenure (t2)	-.06 [-.29; .17]	.04 [-.18; .27]	-.11 [-.34; .12]	-.08 [-.30; .14]	**-.22 [-.44; -.01]**	-.09 [-.29; .11]	.14 [-.09; .36]
Organisational Tenure (t2)	-.06 [-.27; .14]	-.10 [-.29; .10]	-.02 [-.22; .18]	-.09 [-.28; .10]	.12 [-.06; .31]	**.24 [.06; .41]**	-.04 [-.24; .15]
Depression (t2)	**.22 [.01; .42]**	**.33 [.13; .52]**	.15 [-.05; .35]	.18 [-.02; .37]	.16 [-.02; .35]	.07 [-.10; .25]	**.22 [.02; .42]**
Negative Affect (t2)	-.08 [-.25; .09]	-.12 [-.28; .04]	-.15 [-.31; .02]	-.15 [-.31; .01]	-.14 [-.29; .02]	.11 [-.04; .25]	-.13 [-.29; .04]
Sleep Problems (t2)	-.19 [-.38; .00]	**-.25 [-.44; -.06]**	**-.22 [-.41; -.03]**	**-.21 [-.39; -.02]**	-.13 [-.30; .05]	-.17 [-.33; .00]	-.18 [-.37; .01]
MBI_{total} (t1)	.31 [-.32; .94]	-.06 [-.67; .54]	.23 [-.39; .85]	.52 [-.08; 1.12]	.78 [-.50; .65]	-.30 [-.84; .25]	-.41 [-1.02; .20]
Age (t1)	.26 [-.28; .80]	-.15 [-.67; .37]	-.06 [-.59; .47]	.17 [-.34; .68]	.40 [-.10; .89]	.33 [-.14; .80]	**-.68 [-1.20; -.16]**
MBI_{total} x Age (t1)	-.44 [-1.26; .38]	.03 [-.76; .83]	-.16 [-.97; .65]	-.55 [-1.33; .24]	-.17 [-.92; .58]	.20 [-.51; .92]	.64 [-.15; 1.44]
R^2	**.09**	**.12**	**.15**	**.17**	**.12**	**.33**	**.16**

Note: MBI_{total} = total score of Maslach Burnout Inventory, t = time of assessment (t1 = start, t2 = six months later).
Significant parameter estimates with p ≤.05 in boldface.

four models (.17 ≤ *b*s ≤ .21). Professional tenure, which correlated with age, significantly predicted inhibition in all models (-.22 ≤ *b*s ≤ -.27), with the exception of the model with reduced efficacy (*b* = -.20). Organisational tenure, however, was significantly related to inhibition (reaction times) (.22 ≤ *b*s ≤ .24). Depression demonstrated relationships with memory (both short-term and long-term), updating, and shifting (in mixing costs) (.20 ≤ *b*s ≤ .33), whereas sleep problems significantly related to almost all measures of cognitive functioning. Contrary to expectations, negative affect was not a predictor of cognitive functioning.

Additional Exploratory Analyses

A potential limitation of our results might be that the cognitive mechanisms work in alternatives ways in different groups; for example, deficits might be observable only for extreme groups, as in Penz et al. (2018). Therefore, we conducted additional analyses. However, cross-sectional analyses; analyses without control variables; MANOVAs with groups of low, medium, and high burnout symptoms; and extreme group comparisons revealed a similar pattern of results. We further tested for nonlinear relationships and repeated our analyses with quadratic terms of single and total MBI scores (as in Wendsche et al., 2020), but none presented any significant relationships between burnout symptoms and cognitive functioning.

Discussion

This study connects with a small line of research that focusses on burnout symptomatology and objectively measured cognitive functioning. To overcome past studies' shortcomings in this field, we conducted our study with a relatively larger, non-clinical employee sample, sought prospective relationships, and included age as another predictor and moderator. Yet, contrary to our expectations as well as earlier findings (e.g., Deligkaris et al., 2014; Gavelin et al., 2021; Grossi et al., 2015), burnout symptoms demonstrated no prospective relationships with objectively measured performances in a battery of tests of memory and executive functions. The only exception was the relationship between exhaustion and updating in which exhausted subjects achieved slightly better performances, which means that the effect was in the opposite direction of our expectations. Castaneda et al. (2011) explain similar effects in their study: subjects expressed higher motivation, intelligence, and drive for perfection, which may also result in more exhaustion in the long run. Our study had sufficient power and many correlations; for example, cognitive measurements with age presented statistical significance in the expected directions. Therefore, we assumed that our results were typically caused by the character of the sample, since few individuals among our subjects revealed severe burnout symptomatology. Although exhaustion was frequent, few subjects in the sample demonstrated severe symptoms of cynicism or reduced efficacy, which resulted in wide confidence intervals. Results regarding cynicism and reduced efficacy therefore must be interpreted with highest caution. While many studies, especially those that address clinical samples, have implied cross-sectional relationships between burnout symptoms and decreased cognitive performance, the majority of studies with non-clinical or population-based subjects have failed to prove these effects (e.g., Castaneda et al., 2011; Horvat & Tement, 2020; McInerney et al., 2012). The connection between burnout syndrome and impaired cognitive functioning therefore seems to be a predominantly clinical matter. The almost consistent null effects could inform practitioners that initial burnout symptoms, such as exhaustion, do not yet have adverse effects on cognitive performance. Some researchers believe that the association of burnout and cognitive impairments are assured; consequently, they include it in newer conceptualisations of burnout syndrome (e.g., Schaufeli et al., 2020). This may be true in cases of severe symptoms with a clinical diagnosis. With less severe symptoms in preliminary states of burnout, however, we still lack a scientific basis, especially when measured objectively. Furthermore, previous studies may have overestimated these effects due to larger sampling errors caused by small samples. In fact, we often see that cognitive abilities are subjectively but not yet objectively impaired. Further research should clarify these differences, as it may be practically important for early measures in workplace health promotion. Nevertheless, the relatively low rate of burnout symptoms in the sample was unexpected since the nursing profession in Germany is known to be affected by high workloads, time pressure, and staff shortages that often result in high burnout rates (Aiken et al., 2012). Therefore, it remains important to use specific measures to prevent an aggravation of symptoms and avoid sick leave or premature departure from the profession (Westermann et al., 2014).

We further extended prior research by adding age and an interaction term with age to the regression equation, since, to our knowledge, no study to date has combined known burnout and age effects in a regression on cognitive functioning. Considering the rising share of older employees in the nursing profession, this was an overdue research question. As we found in our study, age was related to executive functions but not to memory. However, none of the proposed interaction effects between burnout symptoms and age were detected, confirming a result from a recent

meta-analysis (Gavelin et al., 2021). Additionally, we did not observe any correlations between age and the MBI subscales, which aligns with a meta-analysis regarding the nursing profession (Cañadas-De la Fuente et al., 2015). For control variables, we found that education, tenure, depression, and especially sleep problems must be considered when measuring burnout and cognitive functioning, whereas negative affect and job status had no significant effect in our study, contrary to expectations and past research (Deligkaris et al., 2014; Feuerhahn et al., 2012).

Readers must note several limitations of our study. Although ours is one of the rare studies in this field with a prospective design, the subjects in our time-lagged study performed cognitive tests only at t2; thus, causal conclusions are not supported. An important step in burnout research would be to measure cognitive functioning and burnout symptomatology several times over a long period. The sample, which was composed mostly of female geriatric care nurses and nursing assistants in an enclosed area in Germany, was quite homogeneous. Generalisations of results to nurses in other regions and countries or other occupational groups should be performed with caution. Since participation in our study was primarily voluntary, a self-selection bias might have occurred in which the majority of participants were from the fit and healthy group. Moreover, the healthy worker effect could be responsible for low rates of burnout symptomatology among our participants. This effect means that only the healthy stay in their professions, while those with severe burnout symptoms or another somatic or mental diagnosis are on sick leave or have left the profession (Baillargeon, 2001; Eisen et al., 2013). Hence, the question is whether interaction effects would be found if burnout symptoms were more common in the sample. We employed validated and widely used cognitive tests, but perhaps some of the tasks we presented in the laboratory were overly simple or difficult for the majority of our subjects. Since task difficulty seems to be an important factor (Diestel et al., 2013; Schapkin & Freude, 2013; van Dijk et al., 2020), future studies should apply tasks that are not excessively simple or difficult or – alternatively – compare performance in simple and difficult tasks to each other. Previous research has provided some indications (Simpson et al., 2005; Wallace & Vodanovich, 2003) that cognitive failures can result in errors at work, threats to patient and employee safety, and risks of work-related injuries and accidents; however, further research is needed to study causal relationships on this issue in the nursing profession.

Our study adds to the literature by examining prospective relationships between burnout and cognitive functioning, including the potential role of age as a moderator of this relationship. As stated, we found few significant relationships between burnout symptoms and cognitive functioning in a sample of geriatric care nurses; therefore, the connection might be a clinical matter only. Future research is needed to clarify the level at which burnout severity becomes associated with impaired cognitive functioning as well as whether such levels are particularly pronounced in specific age subgroups. However, it remains important to design healthy workplaces for all employees in the nursing workforce to prevent a manifestation of early burnout symptoms.

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Correspondence to:
Johannes Wendsche
Federal Institute for Occupational Safety and Health
Fabricestraße 8
D-01099 Dresden
wendsche.johannes@baua.bund.de

Author Note:
Marlen Rahnfeld
https://orcid.org/0000-0002-1694-524X
Johannes Wendsche
https://orcid.org/0000-0003-4228-4016
Andreas Ihle
https://orcid.org/0000-0001-9845-5190
Jürgen Wegge
https://orcid.org/0000-0002-0015-5120
Matthias Kliegel
https://orcid.org/0000-0002-2001-2522