

Title

Key drivers of nurse burnout and work engagement in Europe: A cross-sectional dominance analysis

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Declaration of Competing Interest

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Abstract

Background: Following the Job Demands-Resources model, job resources are key drivers of work engagement, while excessive job demands and insufficient job resources are linked to job strain and burnout. Yet, little is known about the relative importance of different job demands and resources in comparison to one another.

Objective: Using dominance analysis, this study aimed to investigate the relative importance of specific job demands and job resources for burnout and work engagement among direct care nurses in Europe.

Design: A cross-sectional survey study.

Setting: 64 general acute care hospitals in Belgium (13), Germany (20), Ireland (15), Norway (1), Sweden (4), and England (11).

Participants: Direct care nurses ($n = 5,023$).

Methods: Data were collected between May 2022 and August 2022. To evaluate the measurement model, structural equation modeling was performed in the pooled sample and within each country. Due to model misfit (Tucker Lewis Index $< .89$), Norway and Sweden were excluded from further analysis, resulting in a final sample of 4,591 nurses. Multiple-group confirmatory factor analysis was used to test configural and metric measurement invariance across countries. In the next step, the main propositions of the Job Demands-Resources model were tested, followed by dominance analysis to determine the relative importance of specific job demands and job resources on overall work engagement and burnout.

Results: In line with the Job Demands-Resources model, job demands contributed to burnout ($\beta = 0.681$, $p < 0.001$), while job resources were positively linked to work engagement ($\beta = 0.614$, $p < 0.001$) and negatively associated with burnout ($\beta = -0.258$, $p < 0.001$). These relationships were consistent across countries. Dominance analyses further revealed that skill utilization was the strongest predictor of work engagement, explaining between 27.4% and 41.9% of the variance, while emotional dissonance ($\%R^2 = 17.0\%-23.8\%$) and emotional demands ($\%R^2 = 17.3\%-20.8\%$) were the strongest predictors of burnout. Overall, these findings were consistent across countries.

Conclusions: This study adds to existing research on Job Demands-Resources theory by uncovering the relative importance of specific job demands and resources for burnout and work engagement among European nurses. The findings can guide hospitals in prioritizing policies and practices to enhance nurses' well-being.

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Keywords

Burnout; burnout assessment tool; work engagement; Job Demands-Resources model; nursing; dominance analysis; Europe

What is already known

- The Job Demands-Resources model posits that job resources foster work engagement, while excessive job demands combined with insufficient job resources contribute to job strain and burnout.
- Previous research has examined the individual or combined effects of job demands and resources on well-being, but little is known about their relative importance in explaining burnout and engagement.

What this paper adds

- Emotional dissonance and emotional demands were the strongest predictors of burnout across all countries.
- Skill utilization consistently emerged as the most important predictor of nurse work engagement across all countries.
- Dominance analysis offers unique insights into the relative importance of job demands and job resources, advancing the understanding of nurse work-related well-being.

Background

Burnout and work engagement in nursing

Nurses play a key role in healthcare (WHO, 2020). At work, they perform a wide and varied array of tasks ranging from acute emergencies to end-of-life palliative care. They treat patients who are sometimes in life-threatening conditions, make critical decisions under time pressure, and face emotionally demanding situations (Montgomery et al., 2015, Sinclair et al., 2015). Consequently, nurses are exposed to several work-related stressors that may deplete their available resources and hamper their normal functioning. In this sense, high levels of workload, role conflict, emotional demands, low autonomy, limited support from co-workers, and poor leadership have been associated with job strain and burnout among nursing professionals (Dall'Ora et al., 2020, McVicar, 2016, Sundin et al., 2011). Particularly in Europe, healthcare employees, including nurses, report the highest levels of work-related stress compared to other professionals (Parent-Thirion et al., 2016). Despite the emotional and interpersonal stressors, nursing can be extraordinarily rewarding, too. Nurses relieve patients' pain and suffering, they save lives, teach patients to care for themselves, and comfort distressed family members. These positive factors are often experienced as meaningful and provide them with essential resources, which in turn help them to cope with the demands and challenges of their work (Hakanen et al., 2019a, Sinclair et al., 2015). In this context, research has shown that job resources such as autonomy or performance feedback have a favorable effect on well-being, fostering work engagement and reducing burnout (Christian et al., 2011, Halbesleben,

2010). In this study, burnout is defined as a work-related state of mental exhaustion, which is characterized by extreme tiredness and reduced ability to regulate cognitive and mental distancing. This extreme tiredness impairs the functional capacity for regulating emotional and cognitive processes (Schaufeli et al., 2020). Work engagement, by contrast, refers to a positive, fulfilling, work-related state of mind that is characterized by vigor (experiencing high levels of energy and mental resilience while working), dedication (referring to a sense of significance, enthusiasm, and challenge), and absorption (being focused and happily engrossed in one's work) (Schaufeli et al., 2002; Schaufeli & Bakker, 2004).

While there is sound evidence that various workplace characteristics play an important role in nurses' well-being (Holland et al., 2019, Jourdain and Chenevert, 2010, Montgomery et al., 2015), previous research has fallen short when it comes to examining the differential predictive validity of such characteristics. Most studies have focused on the independent or combined effects of job demands and job resources and therefore, little is known about the relative importance of different job demands and resources in comparison to one another (Hakanen et al., 2021, 2019a). This, however, is crucial to assess as it seems unlikely that nurses will experience them in isolation (Oppel and Mohr, 2021). A central question that remains is whether some job demands and resources are key drivers of nurses' burnout and work engagement. Following the Job Demands-Resources (JD-R) Model, the present study aims to fill this void by using dominance analysis to compare the relative importance of job demands and job resources to nurse well-being in a large European sample. By using dominance analysis, our study takes a novel approach to quantifying the relative contributions of these job demands and job resources, offering a more nuanced understanding of drivers of nurse well-being. In addition, by adopting a cross-national perspective, this study acknowledges that healthcare systems and workplace conditions vary significantly across countries, influencing nurses' autonomy, workload, and access to critical job resources (Aiken et al., 2012). These structural differences might lead to variation in how specific job demands and job resources impact well-being. However, despite these contextual differences, there may be common patterns across countries, indicating that certain job characteristics are universally critical for nurses' well-being. Identifying the most influential predictors is crucial theoretically and practically, given the severe consequences of nurse burnout such as high turnover, reduced patient safety, and lower quality of care (Garcia et al., 2019, Heinen et al., 2013, Jun et al., 2021). In addition, such insights can inform targeted interventions to prevent burnout and foster work engagement among nursing professionals, strengthening healthcare sustainability and improving patient outcomes (Bargagliotti, 2012).

The Job Demands-Resources Model

The JD-R model is well-established in occupational health psychology (Bakker and Demerouti, 2014, Bakker and Demerouti, 2017). It posits that every job comes with job demands and resources. Job demands are those "aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs" (Demerouti et al., 2001). Their presence is not necessarily problematic as long as they do not exceed the capacity of resources available, but if they do, they may turn into stressors fostering burnout. Job resources, in turn, are defined as "those physical, psychological, social, or organizational aspects of the job that are either/or (1) functional in achieving work goals, (2) reduce job

demands and the associated physiological and psychological costs, (3) stimulate personal growth, learning, and development” (Demerouti et al., 2001). Job resources are said to have both extrinsic and intrinsic motivational potential as they may not only promote work engagement but also negatively impact burnout. An extension of the original JD-R model further proposes two key processes: the *health impairment process* wherein excessive demands lead to burnout, and second, the *motivational process*, wherein job resources promote work engagement and reduce burnout (Schaufeli and Taris, 2014). The main advantage of the JD-R model is that it is considered an open, heuristic rather than specific model. Due to its flexibility, it has been widely applied in research, including in healthcare, using different methodologies, ranging from diary studies (Xanthopoulou et al., 2009) to long-term follow-up studies (Hakanen et al., 2008), demonstrating that job demands and resources have unique and independent effects on employee well-being.

The relative importance of job demands and resources for nurse burnout and engagement

While the JD-R model is based on the universality of job demands (health-impairing potential) and job resources (motivating potential) (Schaufeli and Taris, 2014), earlier motivational theories (Hackman and Oldham, 1975, Herzberg et al., 1959) propose that task-level job resources (such as job autonomy, skill use, feedback) are the main predictors of employee well-being and motivation. Work engagement, in particular, emerges in the process of working, i.e., when dealing with a specific task. Following Sonnentag (2017), we argue that task-related resources substantially contribute to the experience of work engagement. For instance, tasks that require the use of skills and abilities may contribute to the feeling of competence, thus fostering work engagement. Tasks that provide clear and immediate feedback provide the opportunity to learn, grow, and develop, and hence stimulate motivation and work engagement. The absence of feedback, on the other hand, can increase ambiguity and interpersonal conflicts as employees lack guidance on how to complete certain tasks, which in turn can lead to increased feelings of stress. Therefore, in a similar vein, we argue that task-related job demands (such as workload and emotional demands) are essential contributors to burnout. In line with this reasoning, various meta-analyses and reviews show that task-level job resources may be stronger predictors of work engagement than, for example, organizational or interpersonal resources (Christian et al., 2011, Hakanen et al., 2021, Sonnentag, 2017). Similarly, task-related demands such as role conflict, high workload, and emotional demands have been consistently reported as key predictors of burnout among healthcare professionals (e.g., Dall’Ora et al., 2020, Marzocchi et al., 2024).

Yet, an important question that remains is: are some task-related job demands and resources more important for the emergence of burnout and work engagement than others? Previous research using the JD-R model usually relies on correlational designs or traditional multiple regression analyses to identify relationships between predictors and outcomes (Lesener et al., 2019). While such statistical methods are valuable in identifying relationships between variables, they fail to determine the relative importance of individual predictors, especially when predictors are highly interrelated (Hakanen et al., 2021, Hakanen et al., 2019a, Oppel and Mohr, 2021). Dominance analysis, introduced by Budescu (1993), addresses this challenge by offering a way to better quantify and compare the influence of predictors, even in cases of multicollinearity. Based on the present state of knowledge, only a few studies have

investigated the relative importance of job demands and job resources for burnout and work engagement. For instance, Hakanen et al. (2021) showed in their study among Finnish employees that skill discretion and job feedback made the strongest contribution to concurrent and future work engagement. Among health professionals, particularly nurses, job feedback and skill discretion contributed most to explaining work engagement. In a large-scale study using aggregated national data from 30 European countries, Hakanen et al. (2019a) further examined the relative importance of job demands and resources for employees' vitality (i.e., burnout and work engagement) among different employment contract groups. The results revealed that – regardless of the employment group – job feedback made the strongest contribution by explaining 37-41% of the total variance in work engagement. In relation to job demands, workload made the strongest contribution to exhaustion in all three groups, accounting for 34-37% of the total variance explained by dominance analysis in exhaustion (a core dimension of burnout), followed by emotional demands. Similarly, in a sample of 2423 Finnish physicians, Gluschkoff et al. (2022) found that time pressure was the most important predictor of emotional exhaustion.

The present study

In the present study, the focus is on five job demands: workload, role conflict, emotional demands, emotional dissonance, and red tape (bureaucracy), and four job resources: job autonomy, performance feedback, role clarity, and skill utilization. These task-related job demands and resources were selected based on their prominence in existing literature (Galanakis and Tsitouri, 2022, Marzocchi et al., 2024) and documented relevance to nurse work engagement and burnout (Broetje et al., 2020, Keyko et al., 2016, McVicar, 2016). A unique aspect of this study is its cross-national perspective, which allows for a comparison of how different healthcare systems shape nurses' working conditions and well-being. Across Europe, these systems vary in organization and financing, potentially influencing job demands, available resources, and stress levels among nurses (Pisljar et al., 2011). For example, the UK's National Health Service (NHS) and Ireland's Health Service Executive (HSE) operate as publicly funded systems, where healthcare is largely financed through taxation, and access to care is generally free at the point of use. In contrast, Belgium and Germany follow a social health insurance model, where multiple sickness funds provide coverage, and both public and private providers coexist within a highly regulated framework (Thomson et al., 2009). Importantly, while this study uses a cross-national approach, it does not aggregate data at the country level. Instead, it examines individual-level relationships within and across countries, providing a more detailed understanding of how job demands and job resources impact nurses' well-being in different healthcare contexts.

Following the predictions of the JD-R model (Figure 1), we hypothesized that, regardless of the country, job resources are more strongly related to work engagement than job demands, and that job demands, in turn, are more strongly related to burnout than job resources. In addition, our main goal was to examine whether the relative importance of each job demand and job resource for work engagement and burnout is similar or differs across countries.

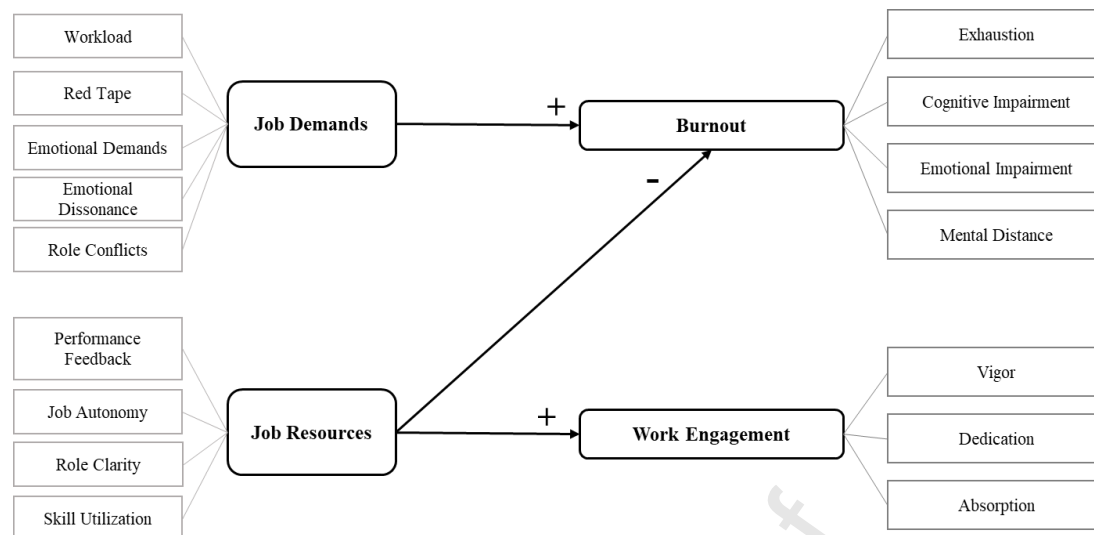


Figure 1: Theoretical framework based on the Job Demands-Resources model (Schaufeli and Taris, 2014)

Methods

Data collection

This study uses a cross-sectional dataset of 5,023 direct care nurses from 6 European countries. The data were collected between May 2022 and August 2022 in the context of the Horizon 2020-funded Magnet4Europe project (Sermeus et al., 2022). A subset of the data used in this study (the Belgian sample) has previously been analyzed in Kohnen et al. (2024), which examined the relationship between engaging leadership and nurse well-being, with job characteristics and work motivation as mediators. In contrast, the current study analyzes data from the full European sample using a different methodological approach to identify key factors of nurse well-being and to explore cross-country similarities and differences.

Setting and sample

A convenience sample was recruited, consisting of 64 general acute care hospitals in Belgium (13), Germany (20), Ireland (15), Norway (1), Sweden (4) and England (11). Included were hospitals which had at least 150 beds, provided acute care for adults, and had internal medicine and/or surgery wards. Highly specialized hospitals providing only e.g., pediatric or psychiatric care were excluded. A total of 37,758 registered nurses were invited to participate in the survey. Within each hospital, registered nurses were eligible to participate if they had direct patient contact and worked on adult inpatient units, including intensive care units (ICU) and the emergency room (ER). Of the 37,758 questionnaires sent, 7,147 were completed and returned, yielding an overall response rate of 18.9%. For the sake of homogeneity and comparability, the target population for this study included nursing professionals of the same job level, i.e., direct care nurses (De Jonge et al., 1999). Therefore, the final, overall dataset consisted of 5,023 nurses. Additionally, since there was only one Norwegian hospital, it was combined with the Swedish hospitals and presented jointly as “Scandinavia” throughout the study. The sample characteristics of each country are presented in the supplementary material (see Supplementary Material, Appendix A).

Measures

We used previously validated scales which were available in the primary spoken

languages of the participating hospitals (Dutch, English, German, Norwegian, and Swedish). A description including the internal consistency (Cronbach's alpha) of each scale is presented below. All variables were scored on a five-point Likert scale ranging from 1 (never) to 5 (always).

Burnout

Burnout was assessed using the short version of the Burnout Assessment Tool (BAT, Schaufeli et al., 2020). The short version of the BAT (Hadzibajramovic et al., 2022) consists of 12 items that assess the presence of the four core burnout syndromes, with three items each. Example items include "At work, I feel mentally exhausted" (exhaustion), "I feel a strong aversion towards my job" (mental distance), "At work, I may overreact unintentionally" (emotional impairment), and "When I'm working, I have trouble concentrating" (cognitive impairment). The Cronbach's alpha for the total burnout scale was 0.91.

Work Engagement

Work engagement was measured using the ultra-short version from the Utrecht Work Engagement Scale (UWES, Schaufeli et al., 2019). The UWES-3 assessed the three core dimensions of work engagement, with one item each: "At my work, I feel bursting with energy" (vigor), "I am enthusiastic about my job" (dedication), and "I am immersed in my work" (absorption). The Cronbach's alpha for this scale was 0.81.

Job Resources

Four job resources were included in this study using the Energy Compass (Schaufeli, 2017). Performance feedback was measured with three items ($\alpha = .82$). An example item was "Does your supervisor provide information about how well you perform your job?" The job autonomy scale consisted of four items ($\alpha = .84$), such as: "Can you decide when you perform your work?". Role clarity was assessed with two items ($\alpha = .83$). An example item was "Do you know exactly what is expected of you at work?" Lastly, skill utilization was measured with three items ($\alpha = .75$), such as, "I have sufficient opportunities at work to use my skills and abilities."

Job Demands

Similarly, the questionnaire captured a set of five job demands which, except for emotional dissonance (Zapf et al., 1999), all derived from the Energy Compass (Schaufeli, 2017). Workload was assessed using four items ($\alpha = .82$). One example item was "Do you have too much work to do?" Role conflicts covered three items ($\alpha = .66$), such as "I have to do things that should be done differently." The three remaining job demands were assessed with single items: Red tape ("Are you prevented from carrying out your work properly because of unnecessary rules, procedures and regulations?"), emotional dissonance ("How often does it occur in your job that you have to display emotions which do not correspond to your inner feelings at that moment?", Zapf et al., 1999), and emotional demands ("Does your work put you in emotionally upsetting situations?").

Statistical analysis

The analysis was conducted in three main steps. First, we tested whether the measurement model underlying the JD-R framework was valid and comparable across countries using structural equation modeling (SEM). Second, we established configural and metric measurement invariance across countries using multiple-group

confirmatory factor analysis (MGCFA). Third, we used dominance analysis to determine which job demands and resources most strongly predicted burnout and work engagement. To account for the nested data structure (nurses within hospitals), we employed mixed-effects modeling.

Step 1: Structural Equation Modeling - Testing the Measurement Model

Before testing the general assumptions of the JD-R model and conducting dominance analysis, we assessed whether the model could be compared across countries. First, we estimated the measurement model in the pooled sample and then separately for each country, using SEM with maximum likelihood (ML) estimation in Mplus (Version 8.6, Muthén and Muthén, 2017). Model fit was evaluated based on the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) (Hu and Bentler, 1999, van de Schoot et al., 2012). Values above 0.90 indicate an adequate fit, while values above 0.95 suggest an even better fit. In contrast, values below 0.90 may indicate poor fit. Additionally, we considered the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR). While $RMSEA \leq 0.06$ indicates a good model fit (Hu and Bentler, 1999), values between 0.06 and 0.08 are typically considered acceptable (Browne and Cudeck, 1992). For SRMR, values below 0.08 indicate an acceptable model fit (Hu and Bentler, 1999).

Step 2: Multiple-Group CFA – Testing for Measurement Invariance

In the next step, we used multiple-group confirmatory factor analysis with ML estimation to examine configural and metric invariance. Configural invariance was assessed by specifying the same factor structure across groups while allowing factor loadings, item intercepts, and residual variances to vary freely. In the metric invariance model, we further constrained factor loadings to be equal across countries to ensure that constructs were measured similarly across groups. Latent means were estimated freely, with the first indicator in each factor fixed at zero in each group (Rudnev et al., 2018). While configural invariance is established if the model shows an acceptable fit to the data, metric invariance is supported if the model fit does not deteriorate substantially compared to the configural model. This is typically indicated by a change in CFI ($\Delta CFI \geq -0.01$) and in RMSEA ($\Delta RMSEA \leq 0.015$, Chen, 2007). Establishing metric invariance ensures that the latent constructs are comparable across countries, allowing us to proceed to test the general assumptions of the JD-R and to conduct dominance analysis.

Step 3: Dominance Analysis – Identifying Key Predictors of Burnout and Engagement

To assess the relative importance of the predictors included in our study, we used dominance analysis, a technique that ranks predictors according to their unique contribution in explaining the variance in an outcome (Azen and Budescu, 2003). More specifically, dominance analysis works by calculating the contribution of each predictor (demand or resource) in explaining the variance – or the degree of difference – in the outcome (burnout and work engagement). This type of analysis is particularly useful in overcoming the methodological difficulties associated with traditional regression models, which focus on estimating the effect size of each predictor. For instance, regression models, including stepwise and hierarchical approaches, tend to overestimate the importance of the strongest predictors and to underestimate the significance of the less important predictors. In other words: multiple regression fails to accurately estimate the relative importance of different predictors, especially when dealing with multicollinearity (Behson, 2005, Johnson,

2000). Unlike traditional regression models, dominance analysis helps to understand which predictors contribute most to the total variance explained by the model. Therefore, it is especially useful when dealing with complex models where multiple predictors may interact or when assessing the contribution of each variable in the most informative and unbiased way possible (Azen and Budescu, 2003, Budescu and Azen, 2004).

In the current study, the focus was on General Dominance which estimates the relative importance of predictors by assessing their average contribution to the explained variance (R^2) across all possible models. Specifically, it represents the mean difference in R^2 when a given predictor (e.g., skill utilization or workload) is included in or excluded from models of all sizes, ranging from single-predictor models to full models with all predictors. Compared to other dominance statistics (e.g., conditional or complete dominance), the main advantage of General Dominance is that it can almost always be established (Luo and Azen, 2013). Therefore, in the present study, it helps to identify which predictors (job demands and resources) contribute most consistently to explaining the outcomes (burnout and work engagement), considering all possible model combinations.

In this study, the level of analysis was at the individual level. Given the hierarchical structure of the data, where nurses were clustered within healthcare organizations across several countries, we first calculated the intraclass correlation coefficients (ICCs) of the scales. The ICC estimates the proportion of the total variance in an observed variable that is attributable to differences between organizations (Heck, 2001). In our study, the ICC for job demands had an average value of 4.4% (ranging from 1.8% for emotional dissonance to 6.2% for workload). Similarly, we found an average value of 4.3% for job resources (ranging from 2.4% for skill utilization to 8.3% for feedback). Both values can be considered indicative of a low to moderate grouping effect (Hox, 2010). Therefore, we employed a linear mixed model for the individual-level dominance analysis, adjusting for each healthcare organization, using mixed-effects regression with the wrapper "mixdom" in Stata's DOMIN module (Luchman, 2021). This approach accounts for the nested structure of the data, recognizing that responses from nurses within the same hospital are likely to be more similar to each other than those from nurses in different hospitals.

As the primary interest was to determine the relative importance of each predictor while controlling for random effects (i.e., clustering within hospitals), we used the R^2 measure at Level 1 to assess the importance of each predictor in the hierarchical models (Luo and Azen, 2013, Snijders and Bosker, 1994). Specifically, we evaluated the contribution of job demands and job resources in explaining variance in work engagement and burnout, while accounting for the clustering of nurses within hospitals. Similar to the first part of our analysis, we measured the relative importance of predictors for burnout and work engagement first in the pooled sample and, second, separately in each country. In addition to examining the impact of the organization, we controlled for gender, age, and country to account for potential confounding effects.

Ethical considerations

This study was approved by the Research Ethics Committee UZ/KU Leuven, Belgium (S64213), and in participating countries either through a central or decentralized

authority. Data collection took place using an online data collection platform. Every participant had to agree to participate in the study before they could continue and engage in the survey. Data were processed in line with the General Data Protection Regulation 2016/679 of the European Union (EU, 2016). Kohnen et al. (2023) provide a more detailed description of the data collection process in general.

Results

Measurement model and measurement invariance

First, we conducted a CFA to test whether measures of the included constructs are consistent with the expected underlying structure (see Figure 1). The measurement model consisted of four correlated latent variables: job demands (a first-order factor represented by items assessing workload, role conflict, emotional demands, red tape, and emotional dissonance), job resources (a first-order factor represented by items assessing job autonomy, performance feedback, role clarity, skill utilization), burnout (a second-order factor represented by its four dimensions exhaustion, mental distance, cognitive impairment, and emotional impairment; each represented by its three corresponding items), and, lastly, work engagement (a first-order factor represented by its three items). The model demonstrated an acceptable fit in all countries (see Supplementary Material, Appendix B), except for Scandinavia (Sweden and Norway), where the TLI was slightly below the acceptable range (TLI = 0.89). Therefore, we decided to exclude Scandinavia from further analysis.

In the next step, we used multiple-group confirmatory factor analysis to examine configural and metric invariance across the four remaining countries (Belgium, Germany, Ireland, England). Model 1, which included no cross-group constraints, was evaluated using multiple fit indices ($\chi^2 = 4272.938$, $df = 968$, CFI = 0.930, TLI = 0.920, RMSEA = 0.060, SRMR = 0.053) (see Supplementary Material, Appendix C). The model showed good fit, with all indices meeting or exceeding accepted thresholds. In addition, all indicators showed statistically significant factor loadings on their respective latent factors ($p < 0.001$) with λ values ranging from 0.434 to 0.920 in Belgium, from 0.422 to 0.895 in Germany, from 0.602 to 0.933 in Ireland, and from 0.566 to 0.945 in England. These results confirm that each construct was measured by the same items in each country, establishing configural invariance. Model 2, which tested for metric invariance, also displayed a good fit ($\chi^2 = 4646.804$, $df = 1028$, CFI = 0.923, TLI = 0.918, RMSEA = 0.061, SRMR = 0.066). Furthermore, the differences in CFI and RMSEA did not exceed the indicated thresholds. A reliable measurement model was therefore obtained.

Descriptive statistics, reliabilities, and correlations

After excluding the Scandinavian countries, the final sample consisted of 4,591 registered direct care nurses from 59 hospitals. Regarding demographic characteristics, 82% of the nursing staff were female, with an average age of 38 years (SD = 11). On average, they had 15 years of overall work experience (SD = 11) and had been employed at their current hospital for 11 years (SD = 11). The sample included registered nurses from various departments: 24.1% worked in intensive care, followed by surgical (20.5%), internal medicine (15.5%), emergency (7.6%), geriatrics (6.6%), neurology (4.2%), and oncology (2.6%) units.

Table 1 presents the means, standard deviations, reliabilities, and correlations for all constructs in the pooled sample. Cronbach's α coefficients were above 0.70 for all the

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me	6	7 1	5	4*	*	9*	0*	7*	1*	2*	*	*	*	*
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(12)	1	6 1	5	0	0*	3*	8*	7*	4*	1*	27	36	34	41
		7	.		*	*	*	*	*	*	5*	2*	6*	7*
			0			*	*	*	*	*	*	*	*	*
			0											

Note. Sample includes all countries except Norway and Sweden; SD = standard deviation; the scoring of all variables is 1-5. **p < 0.01, * p < 0.05; gender was coded 1 = men, 2 = women.

Job Demands-Resources Model

Next, we proceeded to test the structural relationships proposed by the JD-R model using SEM, as described at the beginning of the results section. Specifically, we examined these relationships first in the pooled sample and then separately for each country. In the pooled sample, our results indicated a positive relationship of job demands with burnout ($\beta = 0.681$, $p < 0.001$) as well as a positive relationship between job resources and work engagement ($\beta = 0.614$, $p < 0.001$). In addition, job resources were negatively related to burnout ($\beta = -0.258$, $p < 0.001$). As for the country-specific analysis, we found a positive and statistically significant relationship of job demands with burnout in all countries, with values ranging from 0.511 (Belgium) to 0.774 (England). Similarly, job resources were statistically significantly

and positively related to work engagement, with values ranging from 0.558 (Ireland) to 0.684 (Belgium). Lastly, we found a negative and statistically significant association between job resources and burnout across countries. Here, values ranged from -0.196 (Ireland) to -0.378 (Belgium).

Country-specific dominance analysis

The results of the dominance analysis are presented in Tables 2 and 3. Job resources and job demands explained between 29% (Ireland) and 38% (Germany) of the variance in work engagement, with job resources accounting for the majority (65.0%-79.1%) and job demands explaining a smaller proportion of variance (17.5%-26.5%). Skill utilization emerged as the strongest predictor in all countries (% R^2 varied from 27.4% in Ireland to 41.9% in Belgium and Germany). This was followed by job autonomy, with values ranging from 10.8% (Germany) to 20.1% (England), and job feedback, varying from 8.6% (Ireland) to 16.2% (Germany), respectively. Role clarity also explained variation with values ranging from 3.4% in Germany to 13.5% in England. On the other hand, job demands contributed much less to the variance in work engagement, with emotional dissonance contributing the most (% R^2 ranged from 4.3% in Ireland to 10.2% in Germany), followed by role conflict (% R^2 varied from 2.1% in England to 9.6% in Belgium) and red tape (% R^2 ranged from 2.3% in Ireland to 4.4% in Belgium), respectively. While emotional demands explained between 0.7% (Belgium) and 7.4% (England) of the overall variance in work engagement, workload emerged as the least important predictor, accounting for only 1.2% (Ireland) to 3.8% (Belgium) of the explained variance.

For burnout, job demands and job resources explained between 47% (Belgium) and 59% (Ireland) of the variance across countries, with job demands explaining a much larger proportion (67.9%-78.4%) compared to job resources (18.9%-29.8%). Emotional dissonance consistently emerged as one of the strongest predictors across all countries (% R^2 varied from 17.0% in Germany to 23.8% in Belgium). While emotional dissonance explained most of the variance in burnout in Belgium and England, emotional demands were slightly more important in Germany (% R^2 = 17.3) and Ireland (% R^2 = 20.8). Role conflict and workload both showed more or less similar values across all countries, ranging from 12.4% (England) to 16.5% (Belgium) for role conflict, and from 12.6% (Ireland) to 16.0% (Belgium) for workload. Red tape also played a notable role, though to a lesser extent than other demands (% R^2 varied from 8.6% in Germany to 10.2% in England). Job resources explained much less of the total variance in burnout with skill utilization contributing the largest proportion across countries (% R^2 ranged from 6.2% in Ireland to 16.1% in Belgium), followed by job autonomy, role clarity, and feedback, respectively.

Table 2: Results of the general dominance analysis for nurse work engagement (n = 4,591)

Variables	Belgium (n=1,117)		Germany (n=1,907)		Ireland (n=667)		England (n=900)		Pooled Sample (n=4,591)	
	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.
Control variables (age, gender)	0.012	3.5%	0.007	1.9%	0.050	17.5%	0.003	0.9%	.039	11.5%
Job demands										
• Workload	0.013	3.8% (8)	0.010	2.7% (9)	0.004	1.2% (9)	0.004	1.4% (9)	.007	1.9% (9)
• Red Tape	0.015	4.4% (7)	0.016	4.3% (6)	0.007	2.3% (8)	0.012	4.0% (7)	.012	3.5% (7)
• Emotional Demands	0.003	0.7% (9)	0.015	3.9% (7)	0.014	4.8% (6)	0.023	7.4% (5)	.011	3.3% (8)
• Emotional Dissonance	0.026	7.9% (5)	0.038	10.2% (4)	0.012	4.3% (7)	0.016	5.1% (6)	.025	7.2% (4)
• Role Conflict	0.032	9.6% (4)	0.018	4.7% (5)	0.014	4.8% (5)	0.007	2.1% (8)	.016	4.7% (6)
Job resources										
• Job Feedback	0.036	10.9% (3)	0.061	16.2% (2)	0.025	8.6% (4)	0.028	9.1% (4)	.040	11.6% (3)

• Job Autonomy	0.039	11.5% (2)	0.040	10.8% (3)	0.046	16.0% (2)	0.062	20.1% (2)	.044	12.8% (2)
• Role Clarity	0.019	5.8% (6)	0.013	3.4% (8)	0.038	13.1% (3)	0.042	13.5% (3)	.022	6.4% (5)
• Skill Utilization	0.140	41.9% (1)	0.157	41.9% (1)	0.079	27.4% (1)	0.112	36.4% (1)	.128	37.1% (1)
R ² / % R ² rank	0.34	100%	0.38	100%	0.29	100.0%	0.31	100%	.34	100%

Note. control variables: age, gender, organization, country.

Table 3: Results of the general dominance analysis for burnout among nurses (n = 4,591)

Variables	Belgium (n=1,117)		Germany (n=1,907)		Ireland (n=667)		England (n=900)		Pooled Sample (n=4,591)	
	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.	Dominance Stat.	Standardized Domin. Stat.
Control variables (age, gender)	0.010	2.2%	0.002	0.3%	0.057	9.5%	0.006	1.0%	.085	15.2%
Job Demands										
• Workload	0.075	16.0% (4)	0.077	14.8% (4)	0.075	12.6% (4)	0.074	13.0% (3)	.071	12.8% (4)
• Red Tape	0.041	8.9% (5)	0.045	8.6% (6)	0.034	5.8% (6)	0.058	10.2% (5)	.042	7.5% (6)
• Emotional Demands	0.013	2.8% (9)	0.090	17.3% (1)	0.124	20.8% (1)	0.112	19.8% (2)	.072	12.9% (2)
• Emotional Diss	0.111	23.8% (1)	0.088	17.0% (2)	0.107	18.0% (2)	0.131	23.0% (1)	.097	17.5% (1)

onance										
• Role Conflict	0.077	16.5% (2)	0.078	15.0% (3)	0.085	14.4% (3)	0.070	12.4% (4)	.071	12.8% (3)
Job Resources										
• Job Feedback	0.014	3.0% (8)	0.024	4.6% (9)	0.022	3.7% (9)	0.016	2.9% (9)	.018	3.2% (9)
• Job Autonomy	0.030	6.4% (6)	0.026	4.9% (8)	0.029	4.9% (7)	0.025	4.5% (8)	.025	4.5% (8)
• Role Clarity	0.020	4.3% (7)	0.033	6.3% (7)	0.025	4.1% (8)	0.037	6.4% (7)	.028	4.9% (7)
• Skill Utilization	0.075	16.1% (3)	0.058	11.2% (5)	0.037	6.2% (5)	0.039	6.8% (6)	.049	8.7% (5)
R ² / % R ² rank	0.47	100%	0.52	100%	0.59	100%	0.57	100%	.56	100%

Note. control variables: age, gender, organization, country.

Discussion

Following the premises of the JD-R model, the current study examined the relationship between job demands and job resources with burnout and work engagement among direct care nurses in four European countries. Additionally, the aim was to contribute to JD-R theory by examining the relative importance of specific job demands and resources in predicting nurse burnout and work engagement across four European countries. So far, the majority of JD-R studies have focused on the separate and interaction effects of job demands and resources on burnout and work engagement, thereby assuming that each job demand or job resource is equally important. Using dominance analysis, this study used a novel approach to quantify the relative contributions of specific job demands and resources, offering a more nuanced understanding of drivers of nurse well-being.

Overall, our results align with previous research linking job demands and resources with burnout and work engagement among nurses, but also in other occupations (Alarcon, 2011, Lesener et al., 2020, Lesener et al., 2019). Job demands showed a positive relationship with burnout while job resources showed positive associations with work engagement and a negative relationship with burnout. These findings were consistent across all European countries and corroborate key propositions of the JD-R model.

In addition, dominance analyses highlighted the differing roles of job demands and

job resources and their associations with work engagement and burnout. Job resources were the primary drivers of work engagement, explaining between 65% and 79.1% of the total variance, whereas job demands played a much smaller role (17.5%-26.5%). Among job resources, skill utilization emerged as the strongest predictor, followed by job autonomy and job feedback. Together, these predictors explained over half of the total variance in work engagement. Our findings further align with previous research demonstrating that job resources, particularly skill utilization, job feedback, and job autonomy serve as key drivers of work engagement (Hakanen et al., 2021, Hakanen et al., 2019a, Humphrey et al., 2007). These results corroborate the Job Characteristics Model (JCM) that considers skill utilization, job feedback, and job autonomy as the core job characteristics that increase work motivation and job satisfaction (Hackman and Oldham, 1975, Oldham and Hackman, 2010). According to the JCM, skill variety (or skill utilization) contributes to meaningful work, autonomy fosters a sense of responsibility, and feedback enhances knowledge of work outcomes, factors that collectively drive engagement. Particularly, our findings emphasize the crucial role of skill utilization in work engagement, aligning with concerns about skill mismatches in nursing. The OECD (2016) reports that many nurses complain that they are not employed at their full competency, which can lead to frustration and disengagement. Ensuring that nurses can fully apply their competencies could therefore enhance both work engagement and care quality.

Job demands, in contrast, were more dominant for burnout, explaining between 67.9% and 78.4% of the total variance, while job resources contributed considerably less (18.9%-29.8%). Among the different job demands, emotional factors stood out as particularly relevant across all countries. Specifically, emotional dissonance emerged as the strongest predictor, followed by emotional demands, role conflict, and workload, respectively. Emotional dissonance and emotional demands are conceptually related but distinct constructs. Emotional demands refer to the extent to which nurses are confronted with emotionally challenging situations at work, such as dealing with suffering patients or emotionally charged interactions. These demands require them to invest considerable effort in managing their emotions, which, when excessive, can lead to exhaustion and strain (Vegchel et al., 2004). In contrast, emotional dissonance arises when employees are required to display emotions that conflict with their true feelings (Zapf et al., 1999), which may occur in interactions with patients, patients' relatives, colleagues, supervisors, or physicians, where professional display rules apply (Grandey, 2000). This discrepancy between felt and expressed emotions is particularly common in professions requiring emotional labor, such as nursing. Similar to emotional demands, emotional dissonance is also associated with psychological strain and increased risk of burnout (Hülshager and Schewe, 2011, Kenworthy et al., 2014). While previous research has often identified workload or role conflict as the most significant contributors to burnout (Alarcon, 2011, Lee and Ashforth, 1996), our findings suggest that the emotional component of job demands may be even more critical, particularly for nurses. Interestingly, while emotional demands ranked among the top contributors to burnout in Germany, Ireland, and England, they played a surprisingly minor role in Belgium, ranking last among all job demands and resources. At first glance, this may appear contradictory to previous research showing that emotional demands significantly contribute to burnout among health professionals in Belgium (Vandenbroeck et al., 2017, Vander Elst et al., 2016). According to Azen and Budescu (2003), a predictor's dominance is based on its incremental contribution to the explained variance, meaning that

variables with lower variability tend to have a reduced ability to contribute to the model's explained variance. A more detailed examination of the data revealed that while emotional demands were frequently reported in Belgium, their variability was significantly lower compared to other countries. This lower variability may explain why emotional demands showed a weaker correlation with burnout and appeared less important in the dominance analysis for our Belgian sample.

Limitations

The present study is not without limitations. The first limitation is its cross-sectional design, which means that no causal inferences can be made. Future studies could revalidate the model using longitudinal designs. Second, the reliability of the role conflict scale was low, particularly in England ($\alpha = 0.58$) and Ireland ($\alpha = 0.63$). This may be attributed to the scale's relatively few items. Despite the lower reliability, the role conflict scale was validated in previous research and aligns conceptually with the expected theoretical framework (Schaufeli, 2017). Additionally, its associations with the other variables in this study were in line with theoretical expectations, suggesting that it still captures meaningful variance in role conflict. Another limitation is the relatively low response rates in all countries, ranging from 12.6% (England) to 26.6% (Germany). Data collection took place between May 2022 and August 2022, a period still marked by the aftermath of the COVID-19 pandemic. While the pandemic and associated survey fatigue among health professionals might explain the overall low response rates (de Koning et al., 2021), previous research on nursing staff reported similar if not even lower response rates (Timmins et al., 2023). Moreover, the Scandinavian sample, consisting of four Swedish and one Norwegian hospital, was excluded due to its relatively low TLI value (0.89), indicating suboptimal model fit. A possible explanation is the smaller sample size and the limited number of clusters (i.e., hospitals) compared to the other countries. Previous research has indicated that the TLI tends to show lower values in smaller samples and in models with many observed variables (Shi et al., 2019). Overall, it can be assumed that the relationships proposed by the JD-R model also hold in Sweden and Norway, as previous studies have validated the model among health professionals in these countries (Ahlstedt et al., 2024, Kaiser et al., 2020, Thapa et al., 2022). Nevertheless, future research should aim to test the model with larger samples in Sweden and Norway to further strengthen its robustness and generalizability in these contexts. Another limitation is that our sample consisted solely of direct care nurses, which limits the generalizability of the results. However, it also minimizes contextual influences, allowing for a clear test of our hypotheses. A key strength of this study is its cross-national dataset, which includes hospitals from Germany, Belgium, Ireland, and England. By incorporating data from multiple countries, the study provides valuable insights into how job demands and resources affect nurses' well-being in diverse settings. Lastly, the results of the dominance analysis certainly depend on the set of predictor variables included in the analysis. The results could therefore be different if other or additional factors were considered.

Implications for practice

Despite these limitations, our study has some important implications. First, in line with previous research, our results confirm that job demands are the main drivers of burnout, while job resources have the power to boost work engagement. In particular, the emotional aspects of nursing work emerged as significant contributors to burnout. While these factors are an integral, if not even vital, part of the profession and cannot

be entirely eliminated, targeted strategies can help nurses to better cope with the emotional aspects of their work. For example, structured debriefing sessions, individual counseling, or peer support meetings facilitated by an external professional or a senior nurse can serve as valuable outlets for frustration and emotional stress (Cortese et al., 2010). Additionally, training in interpersonal skills can equip nurses with the tools needed to navigate challenging patient interactions more effectively (Chou et al., 2012). While reducing job demands can help lower job strain, strengthening job resources appears to be a more promising strategy due to their dual impact, i.e., enhancing work engagement and reducing burnout. Our findings highlight the pivotal role of skill utilization, job feedback, and job autonomy in fostering work engagement among nurses. Therefore, healthcare organizations should focus on implementing interventions or offering programs that enhance these aspects. For instance, nurses should be provided with opportunities to fully use and develop their skills, for example, by offering continuous professional development, job enrichment strategies, and opportunities to take on challenging tasks (Hakanen et al., 2021). Additionally, performance feedback can be improved through job crafting, where nurses actively seek constructive input from colleagues and supervisors (Gordon et al., 2018). Overall, while these interventions can be beneficial in helping nurses manage their job demands and job resources, they place too much responsibility on the individual, overlooking the need for systemic workplace improvements (Demerouti, 2024). Instead, a combined approach that integrates individual and organizational interventions is needed in order to tackle the underlying root causes of nurse well-being within the work environment. This view is supported by a recent systematic review, showing that organizational-level interventions such as improved work organization, flexible scheduling, and enhanced professional competencies can lead to better mental health outcomes among healthcare workers, particularly in relation to burnout (Aust et al., 2024). This is further supported by research showing that such integrated interventions, ranging from reorganization (e.g., of work schedules) and work shift evaluation to participatory action research and professional supervision, are particularly effective in reducing burnout and increasing well-being among health professionals (for an overview: Awa et al., 2010, Demerouti, 2024). Importantly, recent research highlights that nurses themselves favor structural changes to improve working conditions and well-being (Aiken et al., 2024). A study by Aiken et al. (2024) found that most nurses (79%) preferred increasing nurse staffing as an intervention to reduce burnout and improve well-being, followed by reducing clinical documentation burdens (41%), and implementing minimum safe nurse staffing ratios (38%). Accordingly, to be truly effective, these interventions must be tailored to the specific needs of hospitals and their workforce, ensuring their feasibility and long-term impact.

Conclusions

This study contributes to existing research on JD-R theory by uncovering, across countries, the relative importance of specific job demands and resources for nurse burnout and work engagement. Our findings indicate that job demands, particularly emotional dissonance and emotional demands, are the strongest contributors to burnout, whereas job resources, especially skill utilization, play a crucial role in fostering work engagement.

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Data availability

De-identified individual participant data underlying the results reported in this article will be made available to researchers who provide a methodologically sound proposal.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of generative AI in scientific writing

During the preparation of this work the authors used ChatGPT (OpenAI) in order to improve language and typographical errors. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the final content of the published article.

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