Doctors' Perceived Working Conditions, Psychological Health, and Patient Care: A Meta-Analysis of Longitudinal Studies

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Abstract

Background: Studies have demonstrated an association between doctors' perceived working conditions, and their psychological wellbeing and patient care. However, few have examined inter-relationships among these three domains, and even fewer using longitudinal designs. Using meta-analytic structural equation modelling, we tested longitudinal relationships among doctors' perceived working conditions, their psychological wellbeing, and patient care. We further tested if doctors' psychological wellbeing mediates the relationship between perceived working conditions and patient care.

Methods: We carried out a systematic review using Academic Search Premier; Business Source Premier; PsycInfo, PsycArticles, and Medline for the twenty-year period between January 2000 and the start of the pandemic (January 2020). We included studies with practicing doctors as participants, and that reported a quantifiable bivariate effect size between at least two of the three constructs of interest – perceived working conditions (i.e., job demands, job resource), psychological wellbeing (i.e., emotional exhaustion, work engagement), and patient care (i.e., clinical care, patient safety). We pooled relationship effect sizes using random-effects meta-analysis, before testing for indirect effects using two-stage structural equation modelling.

Results: Twenty-three samples from 11 countries representing 7,275 doctors were meta-analysed. The results indicated that job resources predicted work engagement (ρ=.18; 95% CI .11, .24) and emotional exhaustion (ρ=-.21; 95% CI -.38, -.11), while job demands predicted emotional exhaustion (ρ=.27; 95% CI .17, .36). Better clinical care was also associated with higher levels of job resources (ρ=.16; 95% CI .04, .29), and lower levels of emotional exhaustion (ρ=-.23; 95% CI -.35, -.10) and job demands (ρ=-.27; 95% CI -.43, -.10). Both factors of the work environment were associated with clinical care through doctors' emotional exhaustion, but there were insufficient studies to test the indirect effects for work engagement or patient safety.

Conclusion: Our results demonstrate the need for a systems perspective to address working conditions to support both doctors' psychological wellbeing and patient care. Interventions should target doctors' job resources as they are more strongly associated with psychological wellbeing. However, given that job demands were strongly associated with emotional exhaustion, and in turn, clinical care, there is a need to better manage doctors' workload,

conflict, and pressure to support the current psychological wellbeing crises amongst this occupational group.

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Research Highlights

What is already known on this topic: Doctors perceived working conditions are associated with their psychological wellbeing and patient care. However, much of this is drawn from cross-sectional studies and little is known about the process in which these three domains are interlinked, including the role that different types of perceived working conditions and psychological wellbeing have on patient care.

What this study adds: Our study provides longitudinal evidence that doctors' job demands are primarily associated with emotional exhaustion, and that their job resources are primarily associated with positive wellbeing (work engagement). In addition, emotional exhaustion functions as a mediator between doctors' work environment and patient care.

How this study might affect research, practice or policy: Our findings emphasise the need for more comprehensive approaches that target improvements in doctors' work environments, as a way to improve their psychological wellbeing and patient care. We also show that targeting different aspects of their work environment can differentially affect different types of doctors' psychological wellbeing and patient care.

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Introduction

Poor psychological wellbeing of doctors has been a concern for decades now. The pandemic has exacerbated the situation with additional challenges on healthcare, with recent studies observing 57% of doctors emotionally exhausted[1], 44% having sleep disorders[2], and 68% high levels of depressive symptoms[3]. Doctors' psychological wellbeing should be of particular importance when planning healthcare provision, as reduced wellbeing has a negative impact on patient care through increased number of errors, reduced quality of care, and through shortages due to sickness absence or staff turnover[4,5]. A growing body of research suggests that doctors' psychological wellbeing and patient care are strongly influenced by their working conditions, including how workplaces are designed, organised, and managed[6–8]. However, there remains limited understanding of how these three domains interlink with each other, especially as the majority of studies in this field have focused on cross-sectional studies[4,7,9]. Understanding how these three domains interface is of critical importance when planning targeted and evidenced-based interventions to improve doctors' wellbeing and patient care. This study draws together different lines of research to investigate the longitudinal evidence linking doctors' perceived work conditions, psychological wellbeing, and patient care using a meta-analytic approach.

Doctors' perceived working conditions, psychological wellbeing, and patient care

Given the focus on working conditions, we utilised the Job Demands-Resources (JD-R)[10] model as a theoretical framework to help us conceptualise and understand the postulated inter-relationships among doctors' perceived working conditions, their psychological wellbeing (including negative (i.e., burnout) and positive (i.e., work engagement) facets), and the quality of care provided to patients. Psychological wellbeing in this paper refers to a dynamic mental state whereby the person is able to live and work productively, cope and adapt to their changing environments, and to achieve their potential[11]. This allows us a broader measure of psychological wellbeing congruent with the JD-R model which seeks to understand the causal link of working conditions to both negative wellbeing (i.e., emotional exhaustion) and positive manifestations (i.e., work engagement).

The JD-R model categorises work characteristics as job demands or job resources. Job demands are those aspects of work that require sustained physical, psychological, or

emotional effort that comes at a cost to a worker's wellbeing and work performance. For doctors, examples include high workload, time pressure, bureaucracy, and team conflicts[12–14].

There is, however, growing evidence of a differential impact of job demands on worker wellbeing, with some resulting in challenge and pressure at work that afford workers the opportunities for growth and development (conceptualised as challenge demands); while others involve excessive or undesirable constraints that interfere with a worker's ability to achieve valued goals and, in turn, has the potential to cause harm (conceptualised as hindrance demands). This model postulates that exposure to job demands (*hindrance* and *challenges demands*) are differentially associated with the positive and negative facets of worker well-being, and in turn, work performance. In the context of this study, we explore an important dimension of doctor's work performance: quality of patient care (conceptualised as clinical care and patient care)[15,16].

In contrast, job resources encompass aspects of work that help reduce job demands, achieve work goals, and/or foster personal development. Examples among doctors includes having autonomy and control over work environment, feeling supported, good management, and effective teams[12,17,18]. These work factors broadly relate to the way that jobs are designed (*structural resources*) and workers' social networks (*social resources*). Conceptually, job resources are understood to enhance worker well-being and work performance (see Figure 1).

These distinctions are important as they recognise that psychological wellbeing is a complex and multifaceted construct with different contributing factors to psychological wellbeing. Consequently, there have been calls for meta-analysis using the JD-R model to examine the separate relationships between challenge demands, hindrance demands, social resources, and structural resources in relation to worker wellbeing and performance[19], that other related meta-analysis and reviews have overlooked. Such findings would not only help validate theoretical frameworks such at the JD-R model but strengthen the postulation that doctors' psychological wellbeing is a proxy for patient care[20,21] and is associated with a wider organisational system[22]. This is vital in improving evidence-based advocacy and workforce planning in healthcare, but can also provide a framework to structure and guide workplace interventions.

Previous research has observed a significant association between job demands and resources in relation to doctors' wellbeing and patient care, independently. However, the vast majority of these studies utilise cross-sectional and/or self-report measures, increasing the likelihood of common method bias and the inflation of effect sizes[23]. In addition, a limited body of existing research has examined inter-relationships among these three domains.

Therefore, we draw on the JD-R model[10] to meta-analyse the extant longitudinal literature to provide stronger evidence on: (i) whether doctors' perceived working conditions are associated with their psychological wellbeing and patient care; and (ii) whether the psychological wellbeing of doctors is associated with patient care. Using meta-analytic structural equation modelling, we further aim to specify models that have not previously been tested in their primary studies[19], and test (iii) if doctors' psychological wellbeing mediates the relationship between perceived working conditions and patient care.

[Insert Figure 1]

Methods

We and structured this review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[24].

Inclusion Criteria

Four inclusion criteria and exclusion criteria were used to identify studies:

1. *Participants* had to be practicing doctors. Studies with only medical students, nurses, and allied health professionals were excluded. Mixed samples were only included if results for doctors were reported separately.
2. *Constructs.* Studies had to investigate at least two of the three constructs of interest: perceived working conditions, psychological wellbeing, and patient care.
    a. For perceived working conditions this had to reflect the experience of individuals (e.g., workload, support) and not objective measures of working conditions (e.g., hours worked). We grouped predictors into job demands and job resources as earlier. According to the JD-R model, we further classified *job demands* into challenge demands (have potential to promote mastery, personal growth, or future gains; e.g., job complexity, intellectual stimulation, pressure to complete tasks) and hindrance demands (prevent personal growth, learning, and goal attainment; e.g., patient demands, bureaucracy, bullying, team conflicts[12–14,25,26]) and *job resources* into structural resources (e.g., autonomy, creativity, and development) and social resources (e.g., networks and relationships that provide support and feedback).
    b. For psychological wellbeing, studies had to measure either emotional exhaustion or work engagement. Emotional exhaustion represents the primary

exhaustion dimension in various burnout definitions and measures[27–29], and refers to feeling worn-out and drained as a result of accumulated stress and pressures. Work engagement is defined as a positive, fulfilling, work-related state of mind characterised by vigour, dedication, and absorption[30].

c. For patient care, studies had to utilise a measure that mapped onto clinical care (e.g., self-rated care provided, readmission) or patient safety (e.g., errors reported).

3. *Statistics*. Studies had to provide a quantifiable bivariate effect size between at least two of the constructs of interest.
4. *Publication type.* Studies were limited to journal articles, technical reports, and dissertations. Unpublished papers and conference proceedings were excluded. We limited the search period across twenty years between January 2000 and January 2020. This excluded studies published at the start of the pandemic which could have skewed the included data as working conditions, doctors' psychological wellbeing and patient care were substantially impacted within a short period[31–33]. No language restrictions were included.

Data Sources and Search Terms

We searched five databases: Academic Search Premier; Business Source Premier; PsycInfo, PsycArticles, and Medline. We also reviewed the reference lists of related systematic reviews and meta-analyses found during the search process. Our search terms included variants of the three constructs of interest and the target sample: perceived working conditions, quality of patient care, wellbeing, and doctors (e.g., in medical training, general practitioners, consultants; see Supplementary Material 1 for search strings).

Search Strategy and Data Extraction

We used the online review platform Covidence to facilitate the review process. The search strategy yielded 18,485 hits with 6,435 duplicates removed (Figure 2). Two authors reviewed each abstract against the inclusion criteria. In case of discrepancy, an abstract was moved on to the full-text stage for review. Three authors reviewed 569 full-text articles out of which 546 were excluded. Half of the full-text reviews (n=281) were reviewed by two reviewers, with strong inter-observer agreement observed (K=.75 & .83).

Data extraction was also carried out on Covidence using a standardised form to capture study details and quality. The effect sizes of individual relationships were extracted into an Excel

spreadsheet. The first author carried out data extraction, which was then checked by the second author.

To carry out the meta-analysis, we extracted *r* coefficients to allow examination of effect sizes. Studies that reported different effect sizes (e.g., mean differences, odds ratios) were converted into *r* coefficients[34]. Where a suitable effect size was not reported or available on request from study authors, the study was excluded from the review. To prevent double-counting, average coefficients were used for multiple estimates of the same relationship within a study. Studies which had two or more effect sizes from two different sample (e.g., males and females) were treated as independent samples (*k*). Where studies had multiple waves, we used the effect size for the further time point. For patient care outcomes, we reversed the direction of effect sizes where needed so a higher score indicated better patient care outcomes.

Study quality was assessed using the Newcastle - Ottawa Quality Assessment Scale[35]. Seven items assessed studies on their sample, compatibility, and measures. Studies that meet all six or more criteria were classed as "good", between three and five as "fair", and fewer than three are "poor".

[Insert Figure 2]

Analysis

We used the *meta* and *metafor* packages for R version 4.1 to carry out the meta-analysis. Due to expected study heterogeneity, we used a random effect model and the Restricted Maximum Likelihood estimator. Confidence intervals were calculated using Knapp-Hartung adjustments[36] and we used Higgins'[37] I^2 statistic to estimate heterogeneity.

Meta-correlations were calculated for the direct relationships between each perceived working condition and doctor wellbeing and/or patient care. We only reported relationships if at least two studies were available to pool[38].

Next, subgroup analyses tested whether observed direct effects had any difference in relation to the time between measurement points (less than one year, one to two years, more than two years), quality (good, fair, poor), workplace setting (hospital, community/ primary practice, mixed), and study region (Europe, North America, East Asia). To ensure sufficient power this was only conducted on relationships with at least ten samples[39]. To assess for publication bias, we generated funnel plots and performed Egger's test for each relationship with at least ten studies[40].

We tested for indirect effects using two-stage structural equation modelling[19,41]. Since it requires full pooled correlation matrices[42], we pooled separate matrixes for each individual effect (i.e., one predictor, one mediator, and one outcome) using the pooled effects described above. This meant only indirect effects where there was at least one full correlation matrix were tested. Using the metaSEM package version 1.2.5.1[41,43], we ran two-stage structural equation models for each indirect effect and assessed its model fit[44].

Results

Sample characteristics

Our search strategy found 23 studies (*k*) with *N*=7,275. Mean *n* was 321 (median *n* = 250). Doctors were sampled from 11 countries, with the majority coming from the United States (k=6) and Germany (*k*=6), (Table 1). The range of time between first and final data collection ranged from 50 days up to 12 years, with a one-year lag the most common (*k*=6), followed by 6 months (*k*=5) and 2 years (*k*=3). See Supplementary Material 2 for details of each specific study.

[Insert Table 1]

Sixteen samples examined doctors' perceived working conditions. Most measures were from the Activity and Work Analysis in Hospitals (*k*=6) and the Job Content Questionnaire (*k*=2) Of twenty samples that looked at doctors' psychological wellbeing, emotional exhaustion (*k*=17) was the most commonly measured variable with 14 studies using the Maslach Burnout Inventory[27] to assess it and three using Oldenburg Burnout Inventory[29]. All five studies that measured work engagement used the Utrecht Work Engagement Scale[45].

Twelve studies examined patient care (i.e., clinical care, patient safety). For clinical care, four used self-report measures to assess performance or quality of care provided. Two used patient records while another used patient ratings. Patient safety outcomes were all self-reported medical errors or near misses (*k*=5).

Main meta-analysis

Meta-analysed direct effects are presented in Tables 2 and 3 with an overview of the findings presented in Figure 3.

[Insert Table 2]

Perceived working conditions and wellbeing

The meta-correlations in Table 2 show that higher overall job demands are correlated with higher levels of emotional exhaustion reported by doctors (ρ=.27; 95% CI .17, .36; I^2=75.6%). The same pattern is observed for hindrance demands (ρ=-.29; 95% CI .20, .37; I^2=72.7%) but not for challenge demands (ρ=.08; 95% CI -.19, -.34; I^2=0.1%).

No meta-correlations were observed for work engagement with job demands (ρ=-.05; 95% CI -.26, .34; I^2=58.5%), hindrance demands (ρ=-.05; 95% CI -.11, .02; I^2=0.1%) or challenge demands (ρ=-.15; 95% CI -.35, .58; I^2=0.1%).

Overall job resources had a positive meta-correlation with work engagement (ρ=.18; 95% CI .11, .24; I^2=0.1%), and was negatively associated with emotional exhaustion (ρ=-.21; 95% CI -.31, -.11; I^2=87.7%). A similar pattern is seen for structural resources with emotional exhaustion (ρ=-.24; 95% CI -.38, -.09; I^2=91.7%) and work engagement (ρ=-.21; 95% CI -.12, .29; I^2=0.1%). However, social resources had no associations with emotional exhaustion (ρ=-.21; 95% CI -.26, -.04; I^2=47.5%) or work engagement (ρ=-.22; 95% CI -.84, .93; I^2=69.3%) (Table 2).

Perceived working conditions and patient care

Higher levels of job demands were associated with lower levels of clinical care (ρ=-.27; 95% CI -.43, -.10; I^2=15.1%) (Table 2). More specifically, hindrance demands (ρ=-.30; 95% CI -.45, -.13; I^2=0.1%) was negative associated with clinical care.

Both job resources (ρ=.16; 95% CI .04, .29; I^2=0.1%) and social resources (ρ=.18; 95% CI .14, .23; I^2=0.1%) had a positive meta-correlation with clinical care.

Table 2 further shows that no relationships were observed for clinical in relation to challenge demands (ρ=-.23; 95% CI -.87, .70; I^2=51.5%) or structural resources (ρ=.16; 95% CI -.10, .41; I^2=23.7%). No studies were found that examined the relationships between patient safety and any measure of job demands or job resources.

Wellbeing and patient care

Higher levels of emotional exhaustion was associated with lower levels of reported clinical care (*k*=4, *n*=712, ρ=-.21; 95% CI -.37, -.02; I^2=45.3%) and patient safety (*k*=5, *n*=1,763, ρ=-.24; 95% CI -.32, -.15; I^2=34.3%). As only one study was found for the relationship between work engagement and clinical care.

[Insert Figure 3]

Subgroup analysis

We present the subgroup analyses for the reported relationships between job demands and job resources with emotional exhaustion. Due to the lack of studies involving work engagement and clinical care we do not report these results here, but they are available in Supplementary Material 3 to 8).

Time between measurement points

Subgroup analyses showed that the length of time between the measurement points influenced the strength of the relationship that both job demands (Cohen Q=52.90, 2, p< 0.001; *k*=4; ρ=.34; 95% CI .25, .43) and job resources (Cohen Q=18.49, 2, p< 0.001; *k*=4; ρ=-.29; 95% CI -.50, -.05) had with emotional exhaustion. In both instances, stronger effect sizes were reported where the time between data collection was one to two years; compared to when this period was less than one year, or more than two years apart (Supplementary Material 3).

Study quality

A stronger effect size for the relationship between job demands and emotional exhaustion was reported for studies that were assessed to be of "fair" quality (Cohen Q=52.90, 2, p< 0.001), compared to where studies were rated as "poor" or "good" (Supplementary Material 4). However, no differences were observed for study quality for the job resources and emotional exhaustion relationship (Cohen Q=1.63, 2, p> 0.05).

Workplace setting

Doctors working in community or primary care settings reported a stronger relationship between job resources and emotional exhaustion (Cohen Q=6.14, 2, p< 0.05; *k*=3; ρ=-.32; 95% CI -.62, .05; I^2=82.5%), than samples working in hospital (*k*=3; ρ=-.02; 95% CI -.46, .08; I^2=12.0%) or mixed settings (*k*=3; ρ=-.11; 95% CI -.26, .05; I^2=71.1%).

No subgroup differences were observed for workplace setting in the job demands and emotional exhaustion relationship (Supplementary Material 5; Cohen Q=1.83, 1, p>.05),

Study region

The region of the study (Europe versus North America) made no difference on the reported effect size for the relationship that job demands (Cohen Q=0.35, 1, p>.05) or job resources (Cohen Q=3.46, 1, p>.06) had with emotional exhaustion (Supplementary Material 6).

Indirect effects

Due to the requirement for at least one full correlation matrix involving the predictor, mediator, and outcome measure, we only assessed the indirect effects of two relationships with both indicating the presence of indirect effects. More specifically, job demands had an indirect effect on clinical care via emotional exhaustion (estimate=-0.06; 95% CI -0.08, -0.04). Job resources also had an indirect effect on clinical care via emotional exhaustion (estimate=0.04; 95% CI 0.01, 0.07) with a better fitting model (Supplementary Material 7).

Small-Study Bias

As none of the relationships required had the recommended minimum test of $k \geq 10$ for Egger's test we focused our interpretation on the funnel plots for those relationships where $k \geq 5$[46,47]. Visual inspection did not indicate evidence of small study effect in any of the six relationships carried out (Supplementary Material 8). This supported the findings of Egger's test which showed that none of the examined relationships were significant.

Discussion

The findings from this meta-analysis provides longitudinal support that doctors' perceived work environment impact their wellbeing and, in turn, quality of care. More specifically, we found that while job resources predicted both work engagement and emotional exhaustion, job demands predicted emotional exhaustion. Both components of the work environment (i.e., job demands, job resources) had a direct relationship with clinical care, which was also mediated by emotional exhaustion. Doctors' emotional exhaustion was also negatively associated with clinical care and patient safety. However, there were insufficient studies to test the indirect effect involving work engagement.

Perceived work conditions, wellbeing, and patient care triad: So what?

There has been increasing studies examining the link between doctors' psychological wellbeing and patient care, evidenced by reviews attesting to this relationship[4,5]. Nevertheless, examination of the antecedents of doctors' wellbeing and patient care and, in turn, interventions based on the findings from these studies have often focused on individual-level factors (such as, personality, resilience, training, and ability[12]). This meta-analysis of longitudinal studies observes that doctors' perceived working conditions are associated with both their psychological wellbeing and patient care. These important findings emphasise the need for a systems and holistic perspective (e.g., *HealthyHealthcare*[22]), where interventions focus on addressing primary factors within the organisational system. Attempts to improve doctors' psychological wellbeing and patient care should not exist as interventions in separate silos, but instead should exist as a coherent approach that recognises the antecedent role of doctors' working conditions.

While most interventions still focus on individual-level efforts such as raising awareness or changing behaviours (e.g., psychoeducation, mindfulness, skills training, resilience[12]), our study's findings emphases the value of targeting working conditions. Identifying and actively managing work and organisational factors can improve doctors' working conditions and in turn their psychological wellbeing and the quality of patient care provided[48,49]. Although making targeted changes to the work environment is challenging in an under-resourced and overstretched sector, growing evidence highlights that local-level interventions such as changes to shift patterns, work processes, decision making, and team structures can be effective in reducing job demands and increasing job resources[50–52].

Recognising that psychological wellbeing consists of both positive and negative manifestations, our findings show that different perceived working conditions need to be addressed to improve doctors' psychological wellbeing and, in turn, patient care. Congruent with previous research[53–55], our meta-analysis shows that there are different pathways between different perceived working conditions and psychological wellbeing. To reduce emotional exhaustion, interventions should focus on reducing job demands (including both challenge and hindrance demands, e.g., job complexity, workload, bureaucracy, bullying, team conflicts) as they have a stronger influence than job resources. This is particularly the case for the inherently negative hindrance demands. Although challenge demands – which promote mastery and development - were expected to associate with work engagement, this was not the case[25]. While this may be due to an underpowered relationship, it attests to the need for a more nuanced exploration of different forms of job demands.

Attempts to increase work engagement should focus on building job resources (e.g., autonomy, creativity, development) in the workplace. Job resources help meet the psychological needs of individuals and buffers the detrimental effects of job demands, explaining its respective relationships with work engagement and emotional exhaustion. Surprisingly, social resources were not associated with either work engagement or emotional exhaustion. This may again be due to fewer studies examining these relationships, although the challenges of teamwork across shifts, the lack of breaks and time to foster relationships, and the high use of agency and locum staff[56–58] means that the potential benefit of social resources may not always be fully realised.

Both job demands and job resources had a direct relationship with clinical care, as well as one indirectly through emotional exhaustion. Congruent with the JD-R model's health impairment pathway, a stronger effect size was noted for the indirect effect involving job demands and emotional exhaustion. This is as job demands arouse a stress process that leads to energy depletion[59] which affects an individual cognitively and behaviourally, and in turn their performance. This is evident in the negative relationship that emotional exhaustion had with both clinical care and patient safety. Job resources, in comparison, are expected to influence more strongly clinical care via work engagement, which is associated with better decision making and attention[60,61], as well as more extra-role behaviours[62]. All of these are associated with better patient care[63]. These results highlight the need to focus on often neglected positive aspects of wellbeing when considering doctors' health and patient care which we were not able to sufficiently test in this study, and remains an action point for future longitudinal studies in this area.

Context

Subgroup analyses unpacked the context that within the relationships studied. We did not find any differences in the relationships between studies set in Europe compared to those in North America. The stronger reported relationship between job resources and emotional exhaustion amongst doctors working in community or primary care settings compared to those working in hospital may be due to their settings, typically, being smaller than hospitals. Changes to one's working conditions may therefore have a more salient impact on doctors' levels of emotional exhaustion.

Methodologically, studies where the time lag between two measures was between one and two years reported stronger effect sizes than studies with a shorter or longer time lag. This is congruent with assertions from previous longitudinal analyses[64,65] that the

consequence of working conditions manifests approximately a year later. This is important when planning measurement points during longitudinal research, as well as emphasising that building a sustainable workforce requires longer term planning.

Limitations

First, while some constructs had very narrow and precise measures (e.g., emotional exhaustion and work engagement), others (e.g., job demands, job resources, quality of care) included a wide range of measures pooled together that could show considerable variation. For example, emotional demands and patient demands were pooled together as part of hindrance demands when focusing on these more specific forms of demands may yield different results.

Second, few longitudinal studies examined the constructs of interest, restricting the number of relationships examined – most notably work engagement and patient safety. Fewer studies also limited the depth of the subgroup analysis carried out and could lead to underpowered studies – although most of the anticipated relationships were observed. This meta-analysis was not initially restricted to longitudinal studies but this change was made in response to feedback during the review process, thereby deviating from the original pre-registered protocol[66].

Third, we only tested a part of the JD-R model focusing on perceived working conditions. More recent iterations of the model[10] integrates the role of personal resources at the individual level (e.g., hope, efficacy, resilience) as another factor that interacts with job resources to predicts psychological wellbeing. Few studies have considered both individual and workplace factors from a longitudinal basis, with one meta-analysis of cross-sectional studies finding that workplace factors were stronger predictors of doctor burnout than individual coping behaviours[54]. Another aspect we did not test was for reciprocal relationships between the constructs of interests over time, as there is evidence that doctors' psychological wellbeing is associated with their perceptions of their future working environment[65,67]. This is an essential development to further understanding the causal link between doctors' perceived working conditions, their psychological wellbeing, and the care provided.

Finally, we did not include studies published since the start of the COVID-19 pandemic. Different examples of job demands have emerged or become more salient, including adequacy of personal protective equipment, fear of contagion, redeployments, and increased abuse from segments of the public doubting the seriousness of the

pandemic[31,32,68,69]. Nevertheless, we believe the results of this meta-analysis are still relevant as most of the perceived working conditions still apply to the current context, evidenced by doctors reporting more intense working pressures, lack of staffing, higher emotional demands, longer working hours, and greater conflict between home and work lives[70,71]. However, for some doctors this upheaval has also provided more job resources, including stronger support and comradeship and greater autonomy in decision making. Nevertheless, as more research is published pandemic-related working conditions should be compared against pre-pandemic work.

Conclusion

Our meta-analysis provides further support that doctors' psychological wellbeing and patient care are associated with their working conditions, emphasising the need for a systems perspective to address these. The findings are congruent with the JD-R model, providing a useful framework in which to explore how doctors' psychological wellbeing mediates the relationship between their working conditions and the care they provide. It is also useful to understand how different working conditions influence doctors' psychological wellbeing. Future interventions should target doctors' job resources as they are more strongly associated with work engagement. Moreover, given that job demands were strongly associated with emotional exhaustion there is a need to better manage doctors' workloads, conflict, and pressures to address the current psychological wellbeing crises amongst this occupational group. While it is encouraging to see healthcare organisations attempt more comprehensive and systematic interventions to address job demands and job resources[72], more effort is needed for us all to better understand what works for whom, and in what context.

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Table 1

Characteristics of included samples (*k*=23)

Characteristic	*K*
Regions	
Europe	15
North America	6
East Asia	2
Settings	
Hospitals	16
Primary care	3
Mixed	4
Study design	
Panel	11
Cohort	8
Non-randomised experiment	1
Observational	2
Diary study	1
Study quality	
High	4
Fair	16
Low	3
Time between first and last data collection	
< 1 year	9
1 – 2 years	9
> 2 years	5
Perceived working conditions	16
Job demands	12
Challenge demands	5
Hindrance demands	10
Job resources	14
Structural resources	14
Social resources	10
Psychological wellbeing	20
Emotional exhaustion	17
Work engagement	5
Patient care	12
Clinical care	7
Patient safety	5

Table 2

Meta-correlations for perceived working conditions with psychological wellbeing and clinical care

			Emotional Exhaustion				Work Engagement				Clinical Care			
Job resource	Definition	Examples	*k*	*n*	ρ	95% CI	*k*	*n*	ρ	95% CI	*k*	*n*	ρ	95% CI
Job demands	Aspects of work that which require sustained physical, psychological, or emotional effort	Challenge demands; Hindrance demands	7	3401	.27**	.17, .36	3	805	.05	-.26, .34	4	456	-.27**	-.43, -.10
Challenge demands	Demands that have the potential to promote mastery, personal growth, or future gains.	Intellectual demands; Task complexity	2	490	.08	-.19, .34	2	472	.15	-.35, .58	2	346	-.23	-.87, .70
Hindrance demands	Demands that have the potential to thwart personal growth, learning, and goal attainment	Emotional demands; Patient demands; Interpersonal conflict; Work-life imbalance; Work overload; Role conflict	6	3311	.29**	.20, .37	2	733	-.05	-.11, .02	3	366	-.30*	-.45, -.14
Job resources	Aspects of work that help reduce job demands; achieve work goals; and/or stimulate personal development	Structural resources; Social resources	9	3680	-.21**	-.31, -.11	5	1340	.18**	.11, .24	4	480	.16*	.04, .29
Structural resources	Aspects of the work provide opportunities for autonomy, creativity and development.	Role clarity; Job control; Professional development; Justice	7	3030	-.24**	-.38, -.09	4	940	.21**	.12, .29	3	390	.16	-.10, .41
Social resources	The network and relationships that provide support and feedback	Effective teams; Peer support; Supervisor support; Sense of community	4	2074	-.11	-.26, .04	2	488	.22	-.84, .93	3	361	.18*	.14, .23

Note. CI=Confidence Interval; *k*=number of samples; *n*=sample size across k; ρ, weighted mean meta-correlation; *p <0.05; **p <0.01.

Figure 1. The Proposed Model Between Perceived Working Conditions, Doctors' Psychological Wellbeing, and Patient Care

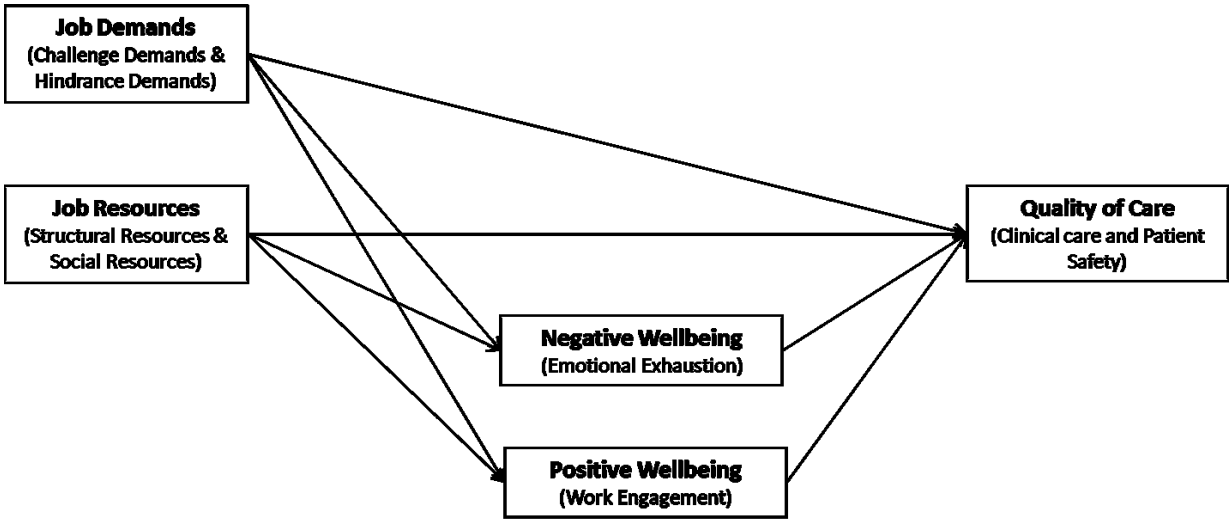


Figure 2. The Review Process

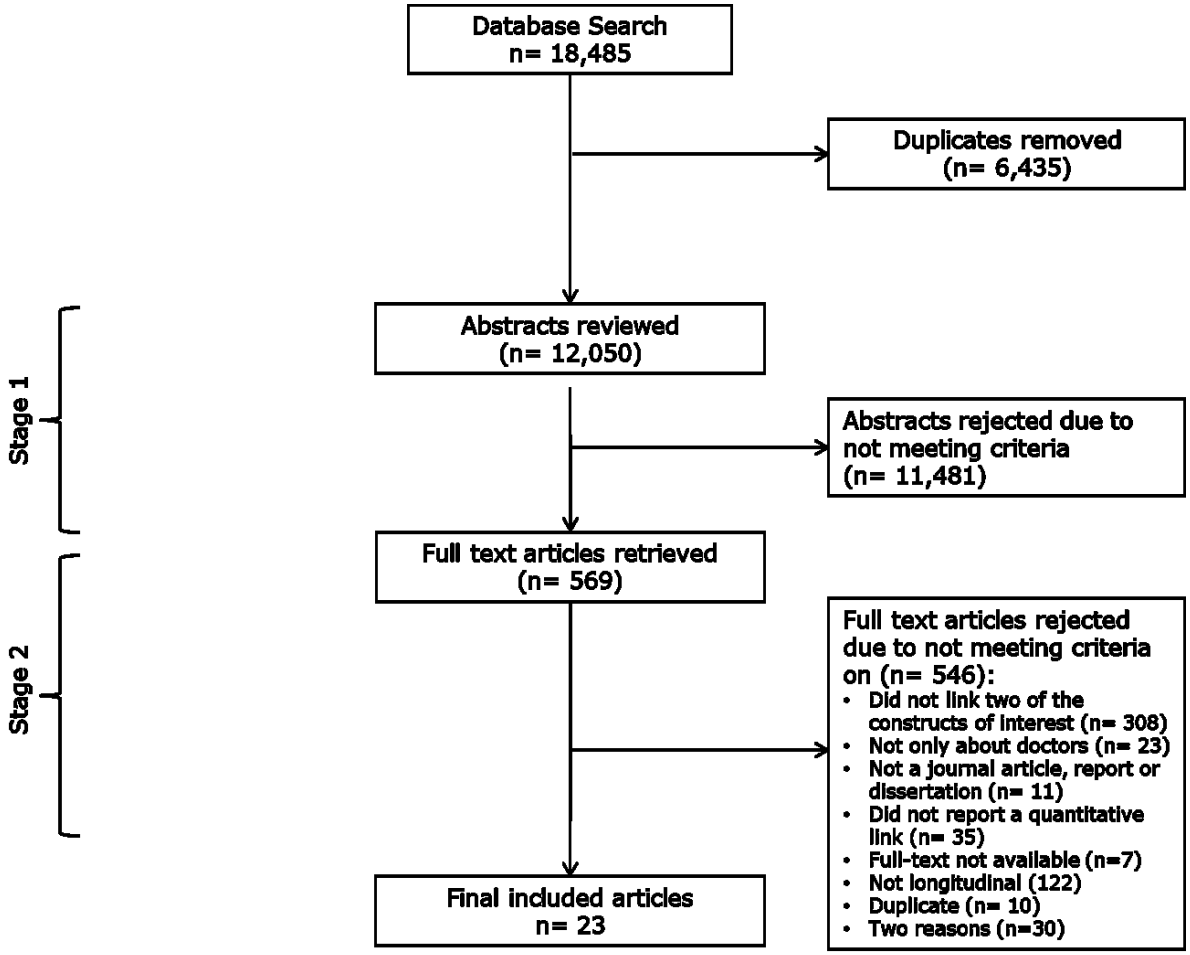
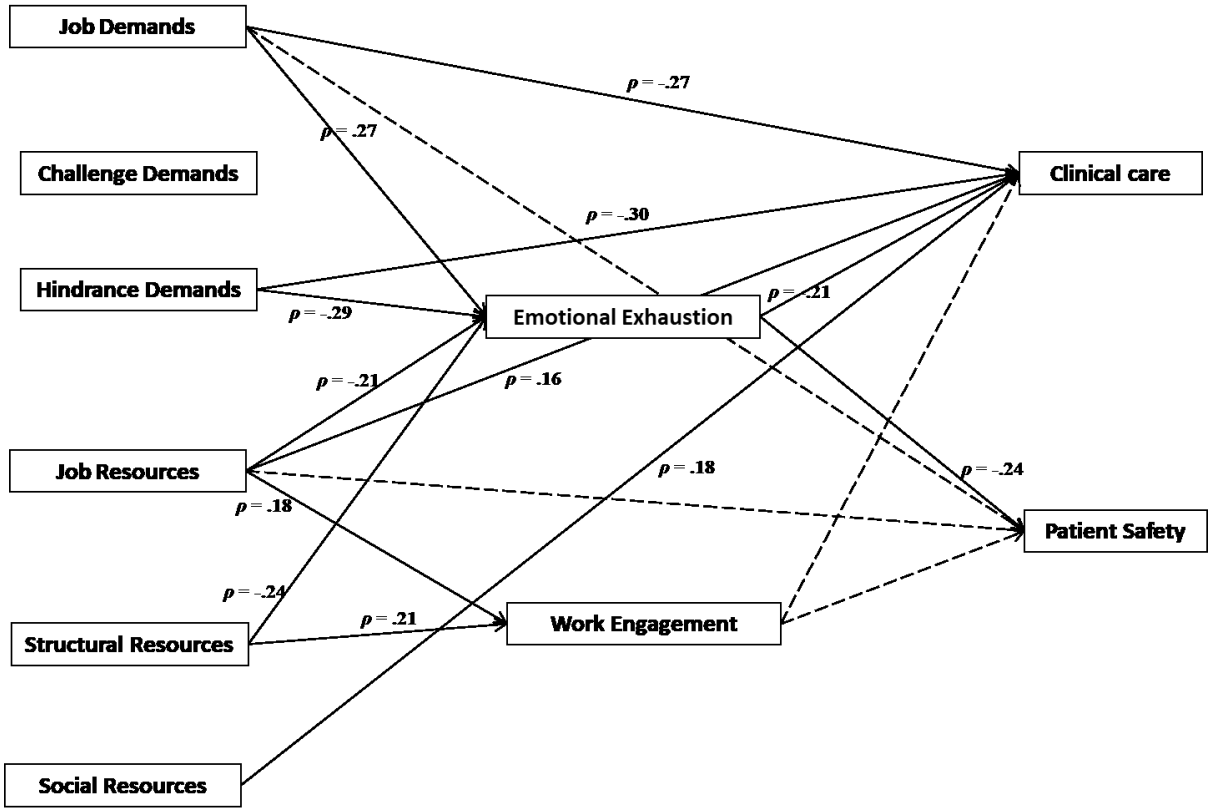


Figure 3. Overview of Direct Relationships Between Perceived Working Conditions, Doctors' Psychological Wellbeing, and Patient Care



Note. ρ, weighted mean meta-correlation; Solid lines represent reported significant direct relationships; Dashed lines represent hypothesised relationships that were not tested due to insufficient studies.

Supplementary Material 1 – EBSCO Search Strategy

1. "house officer#" OR physician# OR "medical officer#" OR “medical resident#” OR “surgical resident#” OR “surgical trainee#” OR "medical trainee#" OR doctor# OR surgeon# OR “general practitioner#” OR “hospital consultant#” OR “medical specialist#”
2. “job demand#” OR “job control” OR “decision latitude” OR “decision authority” OR “job strain” OR “social support” OR “job resource#” OR stressor OR “working condition#” OR “psychosocial work*” OR “challenge demand#” OR “hindrance demand#” OR “structural resource#” OR “social resource#” OR “job autonomy” OR workload OR “role ambiguity” OR “role conflict” OR feedback
3. Burnout OR anxiety OR “affective symptoms” OR “job satisfaction” OR “work satisfaction” OR “work engagement” OR “vigo#r” OR dedication OR absorption OR “emotional exhaustion”
4. “quality of care” OR "patient safety" OR "patient outcomes" OR "patient satisfaction" OR “adverse impact” OR “patient care” OR “clinical excellence” OR “mortality” OR perform OR performance OR performing OR “Professional Competence" OR Efficiency OR “clinical effectiveness” OR "Medical Errors" OR “diagnostic error#” OR “treatment outcome” OR “patient outcome#” OR “clinical outcome#” OR Morbidity OR “Length of Stay” OR Reoperation OR “patient readmission” OR "Postoperative Complications" OR "Intraoperative Complications" OR “quality of health$care” OR "Professional Practice" OR "Patient Compliance" OR "Patient-Centered Care" OR "Professional-Patient Relations" OR "Physician-Patient Relations" OR “adverse event#” OR “unintended event*” OR “unintended consequence#” OR complaint* OR “guideline adherence” OR “inappropriate prescribing” OR "Malpractice” OR “medical error” OR “patient experience” OR “near miss”
5. Search 2 AND 3
6. Search 2 AND 4
7. Search 3 AND 4
8. Search 5 OR 6 OR 7
9. Search 1 AND 8
10. Search 10 (restrict search to academic journals, journals, technical reports, dissertations)
11. Search 11 (restrict search since 2000)

Supplementary Material 2 – Study Characteristics

Study	Country	Sample Size	Mean Age (T1)	Gender	Sample Details	Measurement Points	Time between measurement	Design
Belfrage et al. (2018)	Norway	256	28 years	57% female	Young Doctor Cohort of the Longitudinal Study of Norwegian Medical Students and Doctors (NORDOC)	3	10 years	Cohort
Gordon et al. (2018)	Netherlands	118	50.8 years in experimental group; 51.3 years in control group	58% male in experimental group; 82% male in control group	Hospital-based medical specialists	2	3 months	Experimental
Hayashino et al. (2012)	Japan	836	23% <39 years; 47% between 40-49 years; 26% between 50-59 years; 4% >60 years	92% male	Generalists, specialized internists, paediatricians and surgeons	2	1 year	Cohort
Heinrichs et al. (2019)	Germany	333	30.4 years	49% male	Junior doctors in their second and third year of residency at baseline registered with the Bavarian Chamber of Medical Doctors.	4	10 years	Panel
Hornung et al. (2013)	Germany	95	39.8 years	52% male	Physicians at two German hospitals	2	1 year	Panel
Houkes et al. (2008)	Netherlands	261	48.7 years	52% male	GPs working on a permanent basis	2	2 years	Panel
Kramer et al. (2016)	Germany	95	39.8 years	52% male	Physicians of two acute-care hospitals (one general urban and one children hospital)	2	1 year	Panel
Langballe et al. (2011)	Norway	523	41.8 years for female; 48.1 years for male	64% male	A representative sample of Norwegian physicians	2	2 years	Panel
Lindeman et al. (2017)	United States	55	58% between 26-30 years; 37.5% between 31-34 years; 4.5% >35 years	52% male	Surgical residents	3	2 years	Cohort

McManus et al. (2004)	United Kingdom	1668	30.4 years	n/a	House officers, senior house officers, specialist registrars and general practitioners	3	12 years	Cohort
Noroxe et al. (2019)	Denmark	392	56.4 years	56% male	General practitioners	2	6 months	Cohort
O'Connor et al. (2017)	Ireland	172	45% between 21-24 years; 37% between 25-28 years; 19% >28 years	44% male	Junior doctors from the five national intern training programmes	2	6 months	Cohort
Passalacqua (2020)	United States	90	29.6 years	67% male	Internal medicine residents	2	24-30 hours	Panel
Portoghese et al. (2017)	Italy	40	40% aged between 30-39 years	25% male	Doctor on duty ("guardia medica") - a Continuous Assistance Service for first aid service cases when the General Practitioner is not available	5	50 days	Diary
Rabatin et al. (2016)	United States	364	n/a	56% Male	Primary care physicians	2	1 year	Panel
Schneider et al. (2017)	Germany	400	31.5 years	48% male	Doctors in their third or fourth year of medical speciality training at baseline	3	9 years	Panel
Strecker et al. (2020)	Austria	72	32.9 years	35% men	Trainees and specialists from various disciplines	2	6 months	Panel
Sturm et al. (2019)	Germany	224	36.8 years	51% male	Hospital-based doctors (16% were specialists, and 18% were interns)	2	3 months	Observational
Trockel et al. (2017)	United States	250	51.2% 30-39 years; 33% <30 years; 8.8% 40-49 years; 6% >50 years; 1% unknown	50% male; 49% female; 1% unknown	Physicians with varied specializations.	2	3 weeks	Panel
Weigl et al. (2010)	Germany	416	30.5 years	51% male	Junior doctors in their second and third years of training	3	2.5 years	Panel
Weng et al. (2011)	Taiwan	110	40.8 years	85.4% male	Doctors from paediatrics, nephrology and neurology departments	2	8 months	Observational

West et al. (2006)	United States	184	70% <30; 16% >30; 14% unknown	51% male; 36% female; 13% unknown	Internal medicine residents	4	1 year	Cohort
West et al. (2009)	United States	321	63% aged <30; 15% aged >30; 22% unknown	62% male	Internal medicine residents	4	1 year	Cohort

Supplementary Material 3 – Subgroup analysis for time between measurement points

	Job Demands					Job Resources				
	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)
Outcome: Emotional Exhaustion					.001**					.001**
Less than 1 year	2	.14	.25, .43	0.1%		4	-.15	-.21, -.10	0.1%	
1 to 2 years	4	.34	.25, .43	13.7%		4	-.30	-.50, -.05	87.5%	
More than 2 years	1	.21	.17, .26	-		1	-.05,	-.09, .01	-	
Outcome: Work Engagement					.17					0.01*
Less than 1 year	2	.11	-.81, .07	59.4%		3	.17	-.03, .36	25.7%	
1 to 2 years	-					-				
More than 2 years	1	-.04	-.15, .07	-		2	.19	-.11, .45	-	
Outcome: Clinical Care					.05*					.24
Less than 1 year	2	-.14	-.39, -.16	.1%		3	.13	-.12, .33	0.1%	
1 to 2 years	1	-.39	-.54, -.20	-		-				
More than 2 years	1	-.28	-.39, -.16	-		1	.21	.09, .32	-	

Note. CI = Confidence Interval; k = number of samples; ρ, weighted mean meta-correlation; *p <0.05; **p <0.001

Supplementary Material 4 – Subgroup analysis for study quality

	Job Demands					Job Resources				
	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)
Outcome: Emotional Exhaustion					.01*					.44
Good	1	.14	.04, .24	-		1	-.14	-.25, -.04	-	
Fair	5	.31	.20, .40	76.6%		6	-.24	-.40, -.07	92%	
Poor	1	.13	-.08, .33	-		2	-.16	-.45, .18	0.1%	
Outcome: Work Engagement					.06					.29
Good	2	.01	-.47, .47	13.4%		3	.17	.10, .25	0.1%	
Fair	1	.24	.01, .45	-		1	.35	.12, .53	-	
Poor	-					1	.14	-.04, .32	-	
Outcome: Clinical Care					.05*					.05
Good	-					-				
Fair	3	-.31	-.45, -.15	0.1%		2	.21	-.12, .50	0.1%	
Poor	1	-.13	-.33, .08	-		2	.10	-.52, .66	0.1%	

Note. CI = Confidence Interval; k = number of samples; ρ, weighted mean meta-correlation; *p <0.05; **p <0.001

Supplementary Material 5 – Subgroup analysis for workplace setting

	Job Demands					Job Resources				
	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)
Outcome: Emotional Exhaustion					.40					.04*
Hospital	2	.23	-.82, .92	52.6%		3	-.21	-.46, .08	12.0%	
Community/ Primary Care	2	.35	-.54, .87	71.2%		3	-.32	-.62, .05	82.5%	
Mixed	3	.23	-.03, .46	82.7%		3	-11	-.27, .05	71.1%	
Outcome: Work Engagement					.78					.45
Hospital	2	.08	-.94, .96	78.4%		4	.19	.10, .28	0.1%	
Community/ Primary Care	-					-				
Mixed	1	.04	-.06, .14	-		1	.15	.05, .25	-	
Outcome: Clinical Care					.89					.24
Hospital	3	-.26	-.58, .13	43.1%		3	.11	-.11, .33	0.1%	
Community/ Primary Care	-					-				
Mixed	1	-.28	-.39, -.16	-		1	.21	.09, .32	-	

Note. CI = Confidence Interval; k = number of samples; ρ, weighted mean meta-correlation; *p <0.05; **p <0.001

Supplementary Material 6 – Subgroup analysis for study region

	Job Demands					Job Resources				
	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)	k	ρ	95% CI	I^2	Test for subgroup differences (Sig.)
Outcome: Emotional Exhaustion					.55					.06
Europe	5	0.38	.14, .42	82.4%		6	-.14	-.21, -.06	60.6%	
North America	2	0.23	-.64, .84	47.1%		3	-.33	-.66, .12	77.2%	
Outcome: Work Engagement					-					-
Europe	3	.05	-.26, .34	58.5%		5	.18	.11, .24	0.1%	
North America	-					-				
Outcome: Clinical Care					.10					.99
Europe	3	-.35	-.45, -.15	0.1%		3	.16	-.10, .40	14.0%	
North America	1	-.13	-.33, .08	-		1	.16	-.05, .36	-	

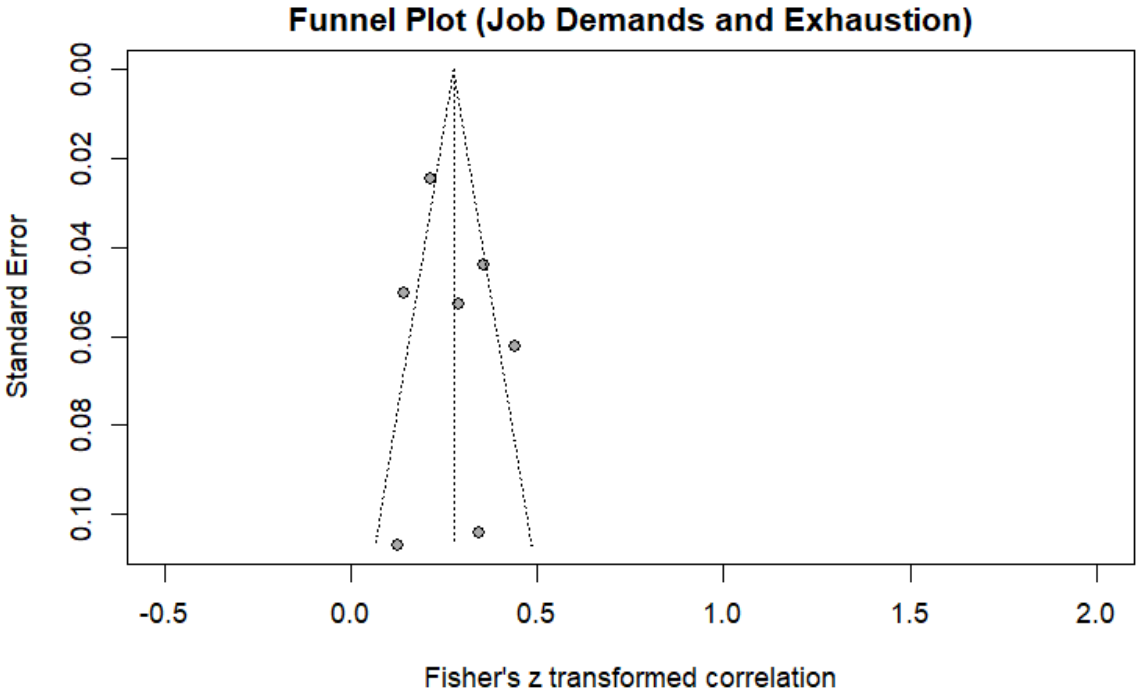
Note. CI = Confidence Interval; k = number of samples; ρ, weighted mean meta-correlation; *p <0.05; **p <0.001

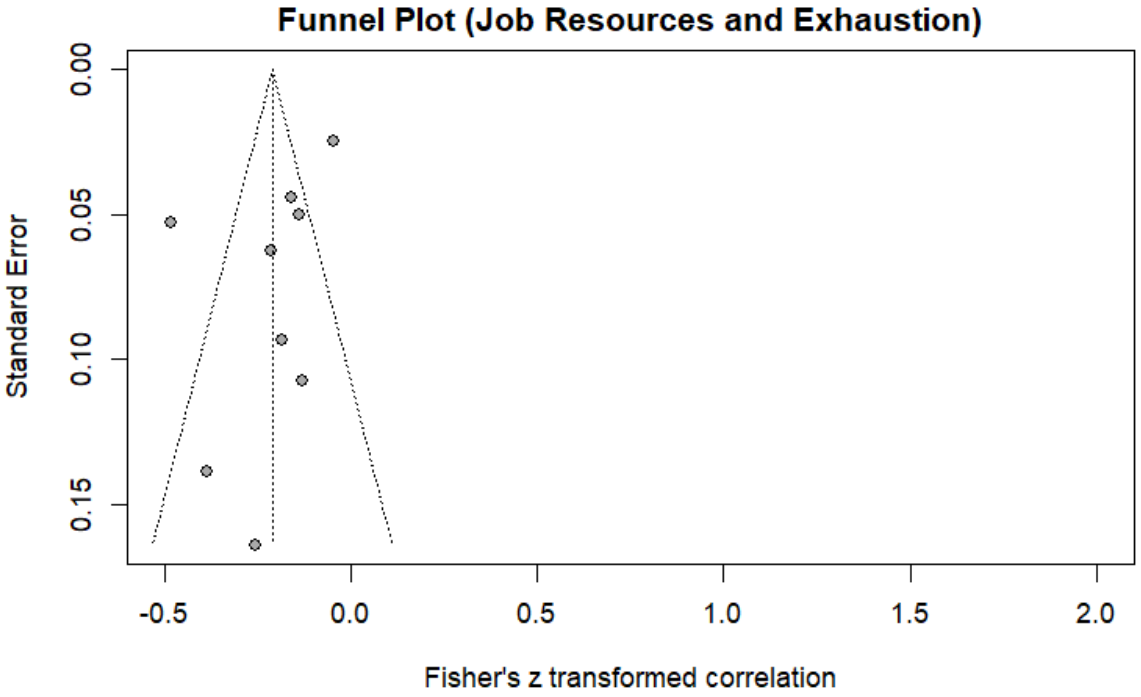
Supplementary Material 7 – Indirect effects for clinical care

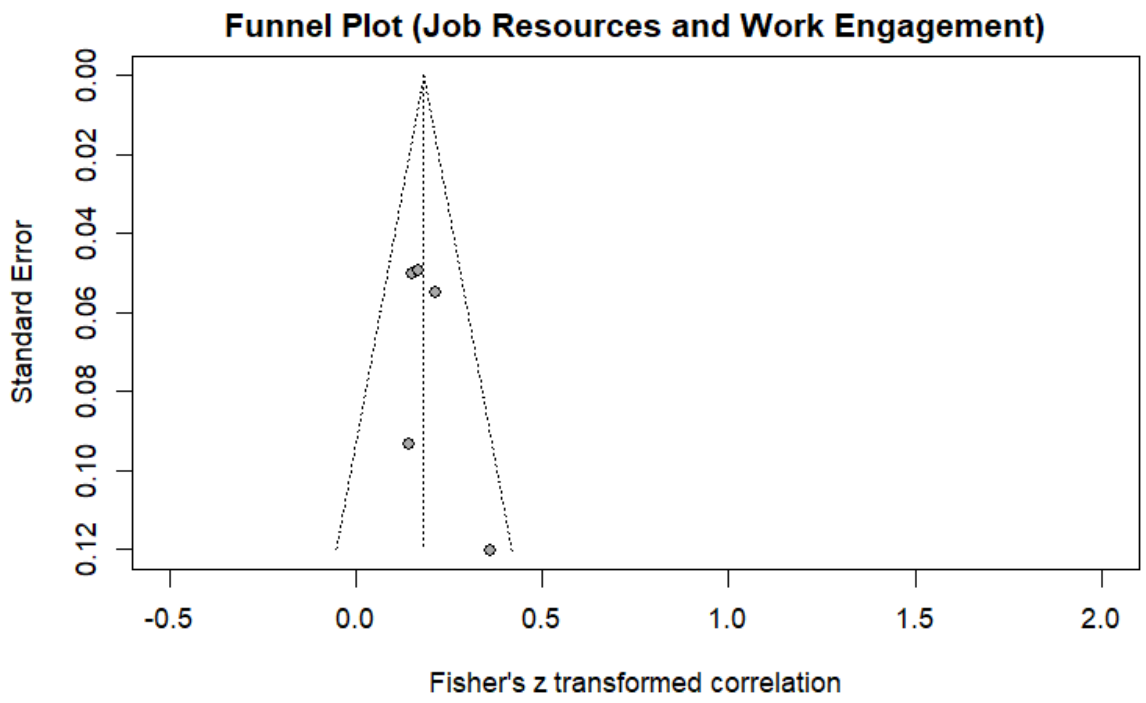
Predictor	Mediator	Outcome	indirect effect	95% CI	RMSEA	SRMR	TLI	CFI
Job demands	Emotional exhaustion	Clinical care	-0.06	-0.08, -0.04	0.07	0.12	0.75	0.92
Job resources	Emotional exhaustion	Clinical care	0.04	0.01, 0.07	0.01	0.03	0.99	0.99

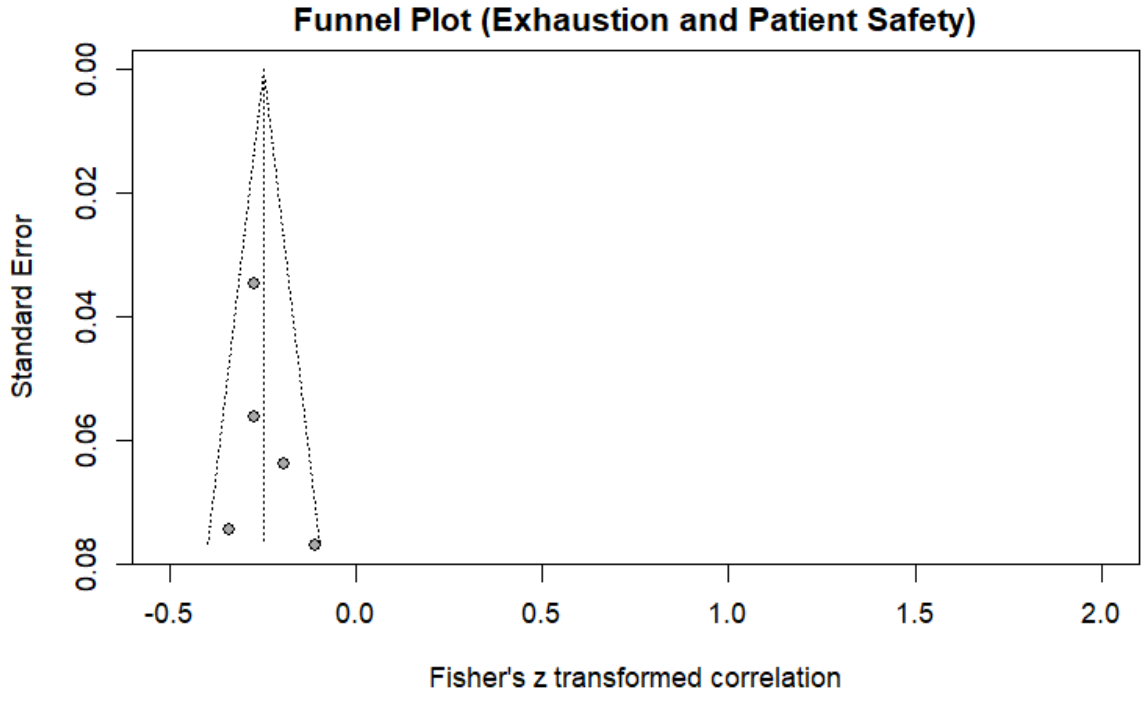
Note. CI=Confidence Interval; RMSEA=Root-mean-square error of approximation; SRMR=Standardised root-mean-square residual; TLI=Tucker–Lewis Index; CFI=Comparative Fit Index

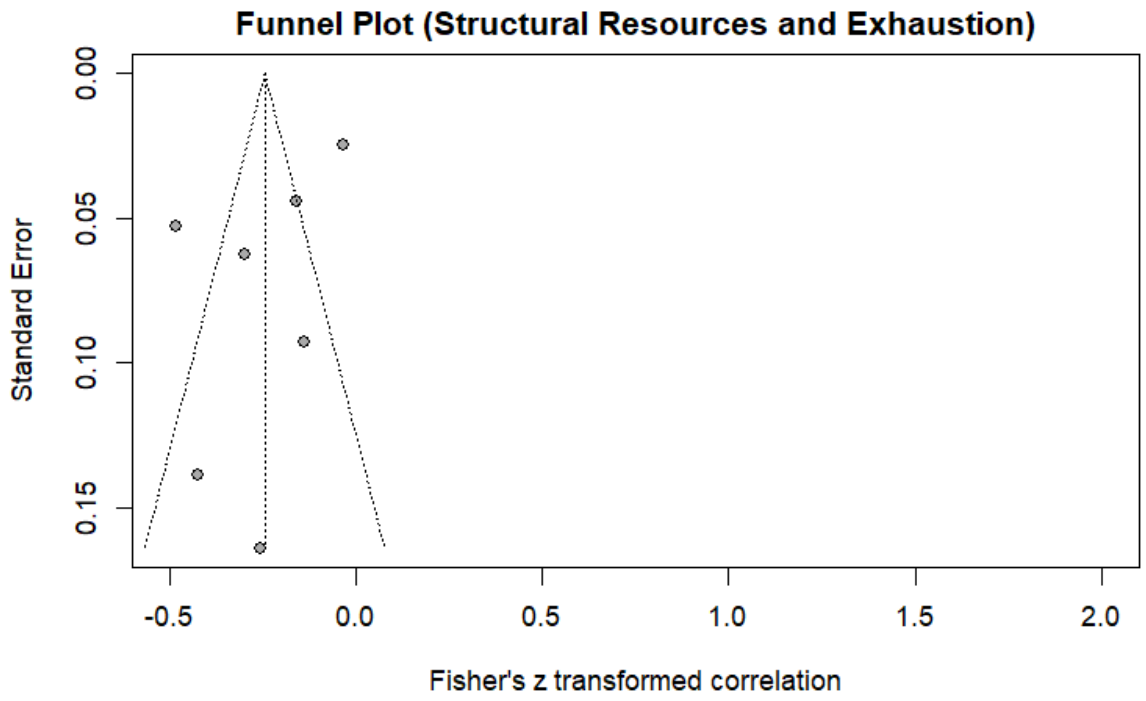
Supplementary Material 8 – Funnel Plots

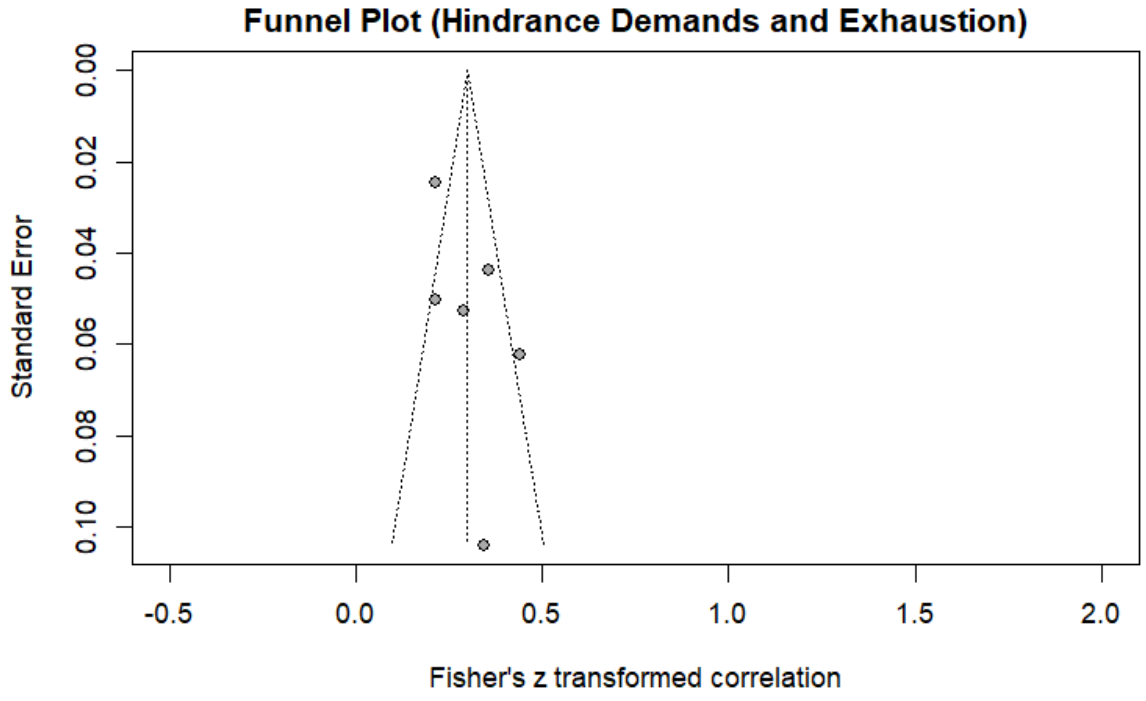





Funnel Plot (Job Resources and Work Engagement)
Standard Error
0.00
0.02
0.04
0.06
0.08
0.10
0.12
-0.5
0.0
0.5
1.0
1.5
2.0
Fisher's z transformed correlation


Funnel Plot (Exhaustion and Patient Safety)
Standard Error
0.00
0.02
0.04
0.06
0.08
-0.5
0.0
0.5
1.0
1.5
2.0
Fisher's z transformed correlation


Funnel Plot (Structural Resources and Exhaustion)
Standard Error
0.00
0.05
0.10
0.15
-0.5
0.0
0.5
1.0
1.5
2.0
Fisher's z transformed correlation


Funnel Plot (Hindrance Demands and Exhaustion)
Standard Error
0.00
0.02
0.04
0.06
0.08
0.10
-0.5
0.0
0.5
1.0
1.5
2.0
Fisher's z transformed correlation