BMC Medical Education

RESEARCH

Open Access

The relationship between mindfulness and burnout in physicians

Fen Huang[1], Jinfang Lei[1], Chenchen Zhang[1] and Xiaowen Li[2*]

Abstract

Background To investigate the relationship between mindfulness and burnout in physicians and its underlying mechanisms.

Methods Study 1 employed a multiverse-style analysis based on a large sample of 8,462 physicians to examine the robust relationship between mindfulness(MAAS) and burnout(MBIES). Study 2 conducted a 21-day intensive longitudinal assessment on 471 physicians to explore the internal mechanisms by which mindfulness affects burnout.

Results Study 1 found that the negative association between mindfulness and burnout is robust. Study 2 discovered that Perceived Organizational Support(POS) and Psychological Safety(PS) play a sequential mediating role in the effect of mindfulness on burnout.

Conclusions These findings provide a theoretical basis for formulating interventions at the organizational level and have important practical and theoretical significance for optimizing physicians' work environments and improving the medical quality.

Clinical trial number Not applicable.

Keywords Physicians, Burnout, Multiverse-style, Intensive longitudinal, Mindfulness

Introduction

Burnout is a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment and is commonly experienced by individuals in human service professions [1]. It is the result of high occupational stress commonly faced by physicians [2]. Burnout in physicians not only affects individual mental health but also has negative impacts on overall medical quality. Studies have shown that burnout is closely related to emotional exhaustion, depersonaliation, and decreased personal accomplishment, which can increase the workload of medical staff and affect work efficiency [3]. Physicians experiencing burnout are prone to reduced empathy and increased decision-making errors, thereby affecting the quality and safety of patient care [4]. Burnout is associated with higher turnover rates among physicians, increased depressive symptoms, and elevated suicide risk, posing a potential threat to the stability of the healthcare system [5]. Therefore, research on physician burnout within China's healthcare system is highly necessary.

The relationship between mindfulness and burnout

Mindfulness is a psychological state involving the conscious attention to present experiences with a non-judgmental, open, and accepting attitude, emphasizing awareness of the current moment [6]. In the Job Demands-Resources (JD-R) model, mindfulness acts as a

*Correspondence:
Xiaowen Li
psylxw@gmail.com
[1]Anhui Wenda University of Information Engineering, Hefei 230601, China
[2]Institute of Mental Health Education, Anhui Normal University, Wuhu 241000, China

personal resource that not only influences job demands and resources and interacts with them but also reduces the negative stress appraisal processes leading to burnout symptoms [7]. By enhancing individuals' ability to cope with and manage stressful situations or adverse stimuli, mindfulness can function as a protective factor [8]. The levels of mindfulness in physicians can be a useful starting point for reducing stress and enhancing their well-being; mindfulness not only helps physicians cope with occupational stress but also enhances their ability to provide emotional support to young children [9]. However, some studies have pointed out that its effects are limited or even insignificant. For example, the results of Marques et al. indicated that mindfulness does not significantly reduce burnout in physicians, especially in high-stress work environments [10]. Pires and his research team also noted that mindfulness needs to be combined with other psychological interventions to be effective in reducing burnout [11].

In humanities and social science research, study variables often encompass intricate humanistic and societal factors, making measurement errors and diverse variable selections commonplace. Confronted with varying findings regarding mindfulness and burnout, a pressing need exists for a statistical approach that can display and compare multiple analytic results, thereby allowing researchers to more clearly demonstrate the degree of consistency or discrepancy of findings under different analytic pathways. If outcomes remain consistent across most analytic pathways, it reinforces confidence in the conclusion. Conversely, if notable differences arise under various pathways, further investigation into the theoretical or methodological underpinnings of these disparities is warranted.

Multiverse-style Analysis systematically examines how diverse decisions in data analysis influence results by defining and executing multiple "universes," i.e., different analytic pathways [12]. Each "universe" reflects a specific analytic strategy. By comparing the outcomes from these different universes, researchers can evaluate the robustness of primary findings and pinpoint potential biases stemming from analytic choices. Conventional correlation and regression analyses typically adhere to a single analytic pathway, leaving results susceptible to particular analytic decisions [13]. multiverse-style analysis aligns with open science principles by urging researchers to disclose all possible analytic routes and findings, thereby mitigating the risk of selective reporting [12]. Traditional methods often report only the main results, raising concerns about "publication bias" or "selective reporting." In contrast, exploring multiple analytic pathways through this approach delivers a more comprehensive appraisal of result robustness. Therefore, although mindfulness alleviates burnout in physicians in certain situations, its general effectiveness still requires further research and verification. Based on the above analysis, this study proposes Hypothesis 1 (H1): There is a robust link between mindfulness and burnout in physicians.

The mechanism of mindfulness affecting burnout

Perceived Organizational Support(POS) is the general perception and view of employees regarding the extent to which the organization values their contributions and cares about their well-being [14]. This perception can be seen as a valuable job resource [15]. For physicians, the support they feel provided by hospitals in their work helps them believe they can receive organizational assistance when facing work stress, thereby reducing burnout. Organizational-level support is crucial for alleviating burnout in physicians; studies have shown that providing organizational support can effectively lower levels of burnout in physicians [16]. Enhancing POS in physicians is an effective way to strengthen the impact of mindfulness on burnout; POS partially mediates the relationship between mindfulness and burnout in physicians. Physicians with higher levels of mindfulness report higher levels of social support and lower levels of burnout [17]. Based on the Job Demands–Resources(JD-R) Model, the factors in a work environment are categorized into job demands and job resources. Job demands refer to those aspects requiring sustained physical and psychological effort, such as a high workload and time pressure. Job resources, on the other hand, encompass various forms of support that assist employees in achieving their work objectives and mitigating both job demands and related costs, such as organizational support and coworker relationships [18]. As a job resource in the JD-R model [19], POS may jointly influence burnout along with mindfulness, individual wellness strategy. Based on the above analysis, this study proposes Hypothesis 2 (H2): T1 mindfulness leads to an increase in T2 POS over time, which in turn negatively affects T3 burnout in physicians.

Psychological Safety(PS) is a manifestation of employees' individual characteristics and a subjective perception of their internal psychological state. It refers to the inner activities or beliefs that employees will not receive negative evaluations or treatment from others regarding their self-image, identity, and career when they display or express themselves [20]. PS is an important job resource and is considered a significant predictor of burnout. When individuals perceive lower PS, the likelihood of emotional exhaustion increases, while employees with higher PS are less likely to experience emotional exhaustion [21]. Incorporating the research perspective of PS into the relationship between mindfulness and burnout has particular value. PS originates from the combination of personal attributes and situational conditions, which together prompt individuals to feel their own agency

and exhibit willingness to take risks, grow, and change [22]. Although the impact of mindfulness on PS is a relatively new research area, Trait Activation Theory (TAT) provides a framework for understanding how PS interacts with individuals' personality traits to predict work behaviors and attitudes. According to this theory, the influence of personality traits may depend on the incentives provided by the situation (situational cues) [23], which means that personality traits and PS may interact to jointly influence work outcomes [24]. Based on the above analysis, this study proposes Hypothesis 3 (H3): T1 mindfulness leads to an increase in T2 PS over time, which in turn negatively affects T3 burnout in physicians.

Mindfulness, a psychological intervention aimed at enhancing individual awareness and focus, has recently seen extensive application in healthcare settings, demonstrating notable success in alleviating burnout in physicians. Furthermore, mindfulness can augment POS and PS in physicians, functioning as a mediator between mindfulness and burnout [25]. In line with the JD-R Model, mindfulness training specifically improves physicians' self-awareness and emotional regulation, enabling them to manage work pressures and challenges more effectively [26]. Such self-regulation reduces negative emotions arising from job demands and also strengthens physicians' positive perceptions of their work environment. By focusing more keenly on their current tasks and personal needs, they become more receptive to organizational support. When physicians perceive sufficient provision of resources, emotional backing, and career development opportunities, their POS accordingly increases [27].

Higher POS directly affects PS in physicians. Physicians with stronger POS are more likely to trust that their organization provides ample care and safeguards for both their professional growth and mental health [28]. This trust and sense of security allow them to feel supported when confronting workplace stressors and challenges, rather than stifling their emotions or needs out of fear of negative repercussions [29] (Edmondson, 1999). Strengthening PS fosters greater confidence, openness, and positivity in daily work, thus lowering the psychological burden and stress responses associated with uncertainty [30].

Elevated PS also plays a pivotal role in reducing burnout. Physicians with higher PS cope with job pressures more effectively, maintain a positive attitude toward work, and sustain elevated engagement levels, consequently alleviating symptoms of emotional exhaustion and depersonalization [31]. In addition, PS promotes mutual collaboration and support among physicians, solidifying team cohesion and job satisfaction—factors that collectively help mitigate burnout [32].

Consistent with the resource accumulation principle under the JD-R Model, mindfulness heightens POS in physicians, which in turn boosts PS, ultimately diminishing burnout. Accordingly, the current study proposes H4:POS and PS in physicians form a serial mediation mechanism between mindfulness and burnout.

Taking into account the dynamic nature of these mediators (POS and PS) over time, they not only exhibit relatively stable trait-like attributes but also display temporal fluctuations—variations that may influence the mechanisms of burnout differently [33]. Through daily high-frequency data collection, an intensive longitudinal design captures short-term changes in these variables, unveiling time-series properties that conventional cross-sectional research often cannot discern. More critically, this design undergirds the testing of a serial mediation effect. In this framework, mindfulness (T1) incrementally enhances POS and PS (T2), thereby reducing burnout (T3)—a progression that is more precisely delineated through intensive longitudinal data. Moreover, employing such a design mitigates recall bias and measurement error commonly associated with one-off assessments, strengthening the reliability of the mediation analyses.

In summary, this paper consists of two sub-studies. Study 1 uses a multiverse-style Analysis on a large sample to explore whether the relationship between mindfulness and burnout is robust. Study 2 adopts an intensive longitudinal design to investigate whether POS and PS mediate the effect of mindfulness on burnout. The study proposes the following hypotheses:

Study 1.

- H1: There is a robust link between mindfulness and burnout in physicians.

Study 2.

- H2: T1 mindfulness leads to an increase in T2 POS over time, which in turn negatively affects T3 burnout in physicians.
- H3: T1 mindfulness leads to an increase in T2 PS over time, which in turn negatively affects T3 burnout in physicians.
- H4: The levels of T2 POS and T2 PS not only serve as individual mediators but also form a sequential mediation in the relationship between T1 mindfulness and T3 burnout in physicians.

Study 1: the relationship between mindfulness and burnout in physicians

Methods

Participants

Participants were drawn from a large-scale project on the health of physician groups in mainland China. Using a cluster sampling method, physicians from 85 hospitals across four provinces and cities in the eastern and central regions were selected in 2022. Questionnaires were distributed and collected by institution during the survey. A total of 12,102 individuals were approached; after excluding non-respondents, 8,462 participants remained, the response rate of the questionnaire was 69.9%. The relatively low questionnaire return rate in this study was primarily due to rigorous screening criteria. Specifically, respondents were required to (1) answer the lie-detection item correctly (i.e., choose "relatively appropriate"), (2) spend more than 300 s completing the survey, and (3) avoid patterned numeric responses.Missing values were handled using the EM imputation method (missing proportion = 0.30% ~ 8.20%, mean missing rate = 1.55%). Utilizing Statistics Kingdom's web calculator, it was determined that a minimum sample size of 2,833 was required to achieve a statistical power of 0.80.

Instruments

Mindful attention awareness scale The revised Chinese version of the Mindful Attention Awareness Scale was used to measure participants' mindfulness [34], consisting of 15 items (e.g., "I sometimes am not aware of some of my emotions until later."). The scale employs a 6-point Likert scoring system, ranging from 1 ("almost always") to 6 ("almost never"). Higher scores indicate higher levels of mindfulness. In this study, the McDonald's omega coefficient for the scale was 0.93.

Burnout inventory The revised Chinese version of the Maslach Burnout Inventory-Educators Survey was used to measure participants' burnout [35], comprising 22 items (e.g., "I feel exhausted after a day's work"), covering three dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment. The scale uses a 5-point Likert scoring system, from 1 ("never") to 5 ("always"). Items in the reduced personal accomplishment dimension are reverse-scored, while items in the emotional exhaustion and depersonalization dimensions are positively scored. Higher total scores indicate higher levels of burnout in physicians. In this study, the McDonald's omega coefficient for the scale was 0.91.

Demographic questionnaire A self-administered demographic questionnaire was used to collect participants' gender, age, years of work experience, highest educational attainment, and the nature of their hospital(e.g., public, private), Department(e.g., Internal Medicine, Surgery, Pediatrics).

Analytical procedure

First, common method bias tests and descriptive statistics were conducted (results are presented in the supplementary materials). Then, the multiverse-style analysis method was used to explore the robustness of the relationship between mindfulness and burnout (an explanation of the multiverse-style Analysis is provided in the supplementary materials). Due to the nested structure of the data, intraclass correlation coefficients (ICC) were calculated; the ICCs for mindfulness and burnout were 0.119 and 0.101, respectively, indicating a certain degree of between-group variance according to McGraw et al.'s research. Multilevel models in the *R* package "specr" were utilized to perform the multiverse-style analysis [36].

Results

Figures 1 and 2 presents the descriptive results of the multiverse-style analysis. Figure 1 demonstrates that there are 64 possible strategy combinations for mindfulness and burnout (independent variable = 1, covariates = 6, dependent variable = 1).

Figure 2 further illustrates the predictive effect of mindfulness on burnout ranged from − 0.495 to − 0.410, and all 64 strategy combinations were significant. Statistical inference showed that mindfulness negatively predicted burnout (Median β = −0.45, $p < 0.001$, partial r^2 = 0.011; number of significant results in predominant direction, NSRPD = 64/64, $p < 0.001$).

Discussion

Compared to previous single regression studies, Study 1 is based on a large cross-sectional sample and considers statistical inferences from multiple analysis strategy combinations, which can reduce subjective selectivity and bias in the data analysis process, revealing more general patterns. The results of the multiverse-style analysis in Study 1 confirmed the robust and practically significant effect between mindfulness and burnout, verifying H1. This is consistent with previous studies [37, 38]. Physicians with high levels of mindfulness are able to focus more on present awareness, exhibit more compassion and acceptance, and possess more positive emotional regulation abilities. By effectively managing negative emotions, these physicians can generate additional positive impacts, which not only make them more energetic and confident at work but also help reduce burnout. Incorporating mindfulness into daily life and work can help physicians maintain focus on the present moment, thereby improving quality of life and work efficiency, and consequently reducing burnout [39]. Therefore,

Fig. 1 Combination of multiverse-style analysis strategies. *Note* Controls on the right-hand vertical axis represents the control variables, y denotes the dependent variable, and x indicates the independent variable. YWE stands for years of work experience; EQ for Educational Qualification; TH for Type of hospital. Red indicate significant strategy combinations

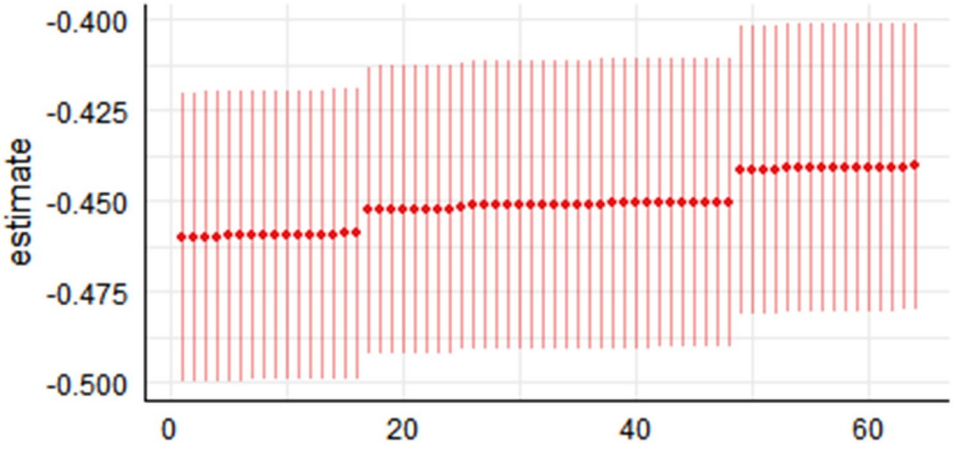

Fig. 2 Multiverse-style analysis strategies curves. *Note*:The vertical coordinates on the curve represent the regression coefficients of the independent variable on the dependent variable under different strategy combinations, with the shaded area indicating the confidence interval of these coefficients. Red indicate significant strategy combinations

enhancing mindfulness levels is considered a promising approach to support occupational health and well-being in physicians [40]. Moreover, many studies have recognized that mindfulness intervention training can effectively improve mindfulness levels in physicians, reduce psychological symptoms, and burnout [38], indicating that through systematic mindfulness practice and intervention, mental health and job satisfaction in physicians can be promoted.

Study 2: the mechanism of mindfulness affecting burnout

Methods

Participants

In Anhui Province, China, 10 hospitals were randomly selected, and a total of 550 physicians were invited to participate in the pre-test (T1 mindfulness). One week later, they engaged in a 21-day intensive tracking survey using the diary method, reporting daily on T2 POS and T2 PS. One week after that, a post-test was conducted (T3 burnout). Participants who did not respond for more than 3 days in T2 or T3 were excluded. Ultimately, there were 471 valid participants. Missing data were handled using the EM imputation method (missing proportion = 0.30% ~ 8.20%, mean missing rate = 1.55%). Using the Statistics Kingdom web calculator, it was found that a minimum sample size of 418 was required to achieve a statistical power of 0.80.

Instruments

Perceived organizational support questionnaire The 8-item Chinese abbreviated "Perceived Organizational Support Scale" was used to assess POS in physicians [41]. Example items include "My organization cares about my opinions." The scale employs a 5-point Likert scoring system, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Higher scores indicate a higher level of perceived organizational support. In this study, the McDonald's omega coefficient for this scale was 0.90.

Psychological safety scale The revised Chinese version of the Psychological Safety Scale was used to measure PS in physicians [42], consisting of 5 items (e.g., "At work, I don't always need to be overly cautious"). A 5-point scoring system was used, and after reverse scoring, higher scores indicate stronger psychological safety. In this study, the McDonald's omega coefficient for this scale was 0.73.

The measurement tools for mindfulness(MAAS), burnout(MBIES) and demographic variables were the same as in Study 1.

Analytical procedure

First, common method bias tests, descriptive statistics, and correlation analyses were conducted in SPSS 24.0 (results are provided in the supplementary materials). Second, to test the mediating roles of POS and PS, a chain mediation effect analysis was performed using SPSS macro PROCESS Model 6. We controlled for the influence of covariates and established the direct path from mindfulness to burnout in physicians. Then, POS and PS were incorporated into the mediation model, constructing an influence path from POS to PS to generate a chain mediation model. Bootstrap methods (resampling 5,000 times) were used for significance testing of regression coefficients to obtain standard errors and 95% bias-corrected confidence intervals (*CI*) for parameter estimation. Results with $P < 0.05$ were considered statistically significant. The ICCs for mindfulness, POS, PS, and burnout were 0.011, 0.000, 0.014, and 0.027, respectively; therefore, multilevel models were not used.

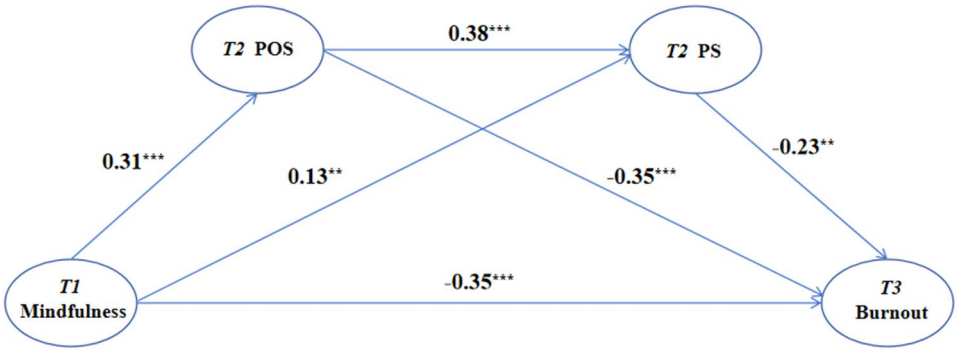

Fig. 3 Mediation diagram for testing the chain mediation effect

Table 1 Bootstrap analysis for mediation effect test

Effect	Path relationship	Effect	Boot SE	Boot LL CI	Boot UL CI
Direct Effect	T1 mindfulness → T3 burnout	-0.346	0.018	-0.383	-0.291
Mediating Effect	T1 mindfulness → T2 POS → T3 burnout	-0.0713	0.011	-0.146	-0.061
	T1 mindfulness → T2 PS → T3 burnout	-0.045	0.006	-0.055	-0.011
	T1mindfulness →T2 POS → T2 PS → T3 burnout	-0.027	0.003	-0.038	-0.019
Total Mediating Effect		-0.144	0.021	-0.219	-0.138
Total Effect		-0.490	0.019	-0.580	-0.422

Results

Using SPSS PROCESS Model 6 to perform Bootstrap-based mediation effect tests, under the conditions of 5,000 resamples and controlling for covariates, mindfulness was used as the independent variable, POS and PS as mediating variables, and burnout as the dependent variable to establish a chain mediation model (Fig. 3). The results showed that T1 mindfulness significantly negatively predicted T3 burnout (β = -0.35, $p < 0.001$), verifying H1. T1 mindfulness significantly positively predicted T2 POS ($\beta = 0.31$, $p < 0.001$) and T2 PS ($\beta = 0.13$, $p < 0.05$); T2 POS positively predicted T2 PS ($\beta = 0.38$, $p < 0.001$) and negatively predicted T3 burnout (β = -0.35, $p < 0.01$); T2 PS negatively predicted T3 burnout (β = -0.23, $p < 0.01$).

Further examination of the mediation effects (see Table 1) revealed that the *95% CI* for the total mediation effects of POS and PS in the impact of T1 mindfulness on T3 burnout did not include zero. The results indicate that T2 POS and T2 PS mediate the effect of T1 mindfulness on T3 burnout (*effect size* = -0.144, *95% CI*: [-0.219 ~ -0.138]). This mediation effect comprises the following three pathways:

T1 mindfulness → T2 POS → T3 burnout, where the confidence interval for the mediation effect does not include zero, indicating a significant mediation effect (*effect size* = -0.0713, *95% CI*: [-0.146 ~ -0.061]), thus confirming Hypothesis 2.

T1 mindfulness → T2 PS → T3 burnout, where the confidence interval for the mediation effect does not include zero, indicating a significant mediation effect (*effect size* = -0.045, *95% CI*: [-0.055 ~ -0.011]), thus confirming Hypothesis 3.

T1 mindfulness → T2 POS → T2 PS → T3 burnout, where the confidence interval for the mediation effect does not include zero, indicating a significant mediation effect (*effect size* = -0.027, *95% CI*: [-0.038 ~ -0.019]), thus confirming Hypothesis 4.

These results demonstrate that T2 POS and T2 PS indirectly influence the process by which T1 mindfulness alleviates T3 burnout among physicians in China. Additionally, T2 PS and T2 PS further affect the impact of T1 mindfulness on T3 burnout through a serial mediation mechanism.

Discussion

Study 2 used an intensive longitudinal design to reveal the internal mechanism between mindfulness and burnout from a time-series perspective.

POS mediated the relationship between mindfulness and burnout in physicians; levels of mindfulness in physicians reduced the degree of burnout by enhancing their perception of organizational support. This indicates that physicians with high levels of mindfulness report higher perceived organizational support and lower levels of burnout. The core elements of mindfulness include present-moment attention, openness, non-judgment, and acceptance, which help physicians to be more understanding, tolerant, perceptive, and supportive [43]. Furthermore, mindfulness can enhance physicians' sense of belonging and satisfaction with the organization [44], thereby reducing feelings of isolation, increasing work motivation and satisfaction, and ultimately reducing

burnout. The enhancement of POS can be seen as an important mediating variable in the relationship between mindfulness and burnout, providing an additional supportive pathway for occupational health and job satisfaction in physicians. When organizations care about well-being in physicians and recognize their value and work, they also help physicians build a sense of importance within the organization. This positive interaction and supportive environment are crucial for reducing burnout in physicians, turnover intentions, and actual turnover behaviors [16].

Study 2 also identified that PS mediates the relationship between mindfulness and burnout in physicians, meaning that mindfulness can alleviate burnout by enhancing PS in physicians. This result is consistent with previous findings [45]. In the workplace, when stressors increase, PS tends to decrease, and symptoms of burnout increase and intensify. The non-judgmental attitude and acceptance of present awareness emphasized by mindfulness can act as a buffer against stressors, helping individuals reduce stress [46]. This stress-reduction effect not only helps improve individuals' PS but also reduces burnout in physicians. This suggests that medical institutions would benefit from value and take measures to enhance PS in physicians, such as through mindfulness practices, providing supportive work environments, and establishing positive organizational cultures, to help physicians better cope with work stress, reduce burnout, and thereby maintain the health and sustainability of their careers.

Overall, Study 2 confirmed the sequential mediating effect of POS and PS in the relationship between mindfulness and burnout in physicians. This means that mindfulness first enhances POS, which in turn strengthens their PS, ultimately effectively reducing burnout in physicians. This finding indicates that physicians with high levels of mindfulness are better able to perceive organizational support; this sense of support makes them feel respected and valued, thereby helping to enhance PS. PS can enhance self-awareness, regulate emotional responses, and avoid emotional exhaustion [47], ultimately reducing burnout. Some studies suggest that mindfulness represents a transformation in an individual's relationship with themselves and the surrounding world [48]. Individuals with high levels of mindfulness tend to observe their own thoughts and feelings, and even when faced with unpleasant thoughts and feelings, they can exhibit more constructive behaviors rather than reacting in maladaptive ways. This is precisely the benefit of high levels of mindfulness, namely having positive self-regulation or self-control abilities [49]. Through this sequential mediation model, we can more comprehensively understand how mindfulness reduces burnout in physicians by improving work resources.

Overall discussion: study 1 and 2

This study explored the robust relationship between mindfulness and burnout in physicians, as well as the mediating roles of POS and PS. Study 1 confirmed H1—that there is a robust and practically significant relationship between mindfulness and burnout, warranting attention from researchers and society. Study 2 confirmed H2/H3/H4: that the initial measurement of mindfulness led to increases in POS and PS over time, thereby negatively affecting subsequent burnout, and that POS and PS also constituted a sequential mediation.

This paper contributes to the theory in related fields in several ways. On one hand, mindfulness as an important factor in enhancing mental health influences burnout through pathways similar to traditional psychological interventions (such as emotional regulation models and coping strategy models), which expands the breadth (scope of application) of previous theories. On the other hand, unlike cross-sectional data, the chain mediation mechanism of POS and PS revealed by the intensive longitudinal design further deepens traditional theories from a dynamic developmental perspective. Moreover, previous studies on mediation mechanisms often focused on a single mediator, while this paper integrates POS and PS, exploring their potential differences across different mental health dimensions, thereby expanding the depth (connotation) of previous theories. Finally, from the perspectives of effect robustness and mechanism of action, this study verifies and develops the chain mediation theoretical model of mindfulness–POS–PS–burnout. Through research on this specific group of physicians, it enriches the study of burnout and provides new intervention ideas and practical references.

This study benefits from multiple strengths, including a large sample size, time-series data, and methodological innovations. Nonetheless, certain limitations are unavoidable. First, it relies entirely on self-reported data, which may introduce subjective biases. Second, complex interactive effects may exist among mindfulness, POS, and PS, rather than being strictly unidirectional chain mediators. For instance, the interplay between POS and PS could influence burnout—an area warranting deeper examination in future research. Third, the present design did not repeatedly measure the same variables at multiple time points but instead assessed different variables in separate stages, making it less aligned with the traditional notion of a longitudinal approach and consequently affecting the inference of the results. Fourth, the sample was drawn from a single population in China; given cultural and social factors, the generalizability of the findings to global contexts remains uncertain. Lastly, mindfulness is not a stable personality trait; rather, it can be cultivated through practice and training. Previous research has shown that suitable mindfulness interventions can

effectively enhance physicians' mindfulness levels and thus reduce psychological symptoms and burnout [50]. Future investigations could employ a pre-post controlled experimental design to provide mindfulness training for physicians, examining its concrete impact on POS, PS, and burnout, thereby validating this study's findings.

Conclusion

This study investigated the impact of mindfulness on burnout in physicians and its underlying mechanisms through two separate inquiries. The findings indicate that mindfulness not only directly alleviates burnout, but can also achieve similar outcomes by boosting POS and PS in physicians. Hospitals and healthcare institutions should therefore consider integrating mindfulness training into their regular work schedules to help physicians enhance their self-awareness and emotional regulation skills. At the same time, the study suggests that creating a supportive work environment and offering additional psychological and emotional support are vital strategies for hospital management. Such measures might include establishing psychological counseling services, providing dedicated avenues for emotional assistance, organizing mental health seminars, and hosting team-building events. These strategies can heighten PS in physicians by helping them feel the organization's care and backing, thereby effectively reducing burnout. From an organizational perspective, these findings furnish a theoretical basis for designing targeted interventions, holding significant practical and theoretical value for optimizing physicians' work environments and raising the standard of early childhood education.

Abbreviations

POS	Perceived Organizational Support
PS	Psychological Safety
H	Hypothesis
JD-R	Job Demands-Resources
TAT	Trait Activation Theory
COR	Conservation of Resources Theory
ICC	Intraclass correlation coefficients
NSRPD	Number of significant results in predominant direction

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-06923-3.

Supplementary Material 1

Author contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work was supported by Exploratory Research on the Integration of Horticultural Therapy into Mental Health Education in Private Colleges under the Background of Labor Education (A School-level Project of Anhui Wenda Information Engineering College), Grant No.:XSK2023A12 and Research on the Impact of Labor Education on College Students' Mental Health (A School-level Project of Anhui Wenda Information Engineering College), Grant No.:XSK2023A11.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical standards of Anhui Normal University's Review Board and with the 1964 Helsinki declaration. The studies involving human participants were reviewed and approved by Ethics Approval Committee Anhui Normal University (Approval No: 2021168). Informed consent was obtained from all subjects.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 1 November 2024 / Accepted: 25 February 2025
Published online: 03 March 2025

References

1. Knudsen HK, Ducharme LJ, Roman PM. Clinical supervision, emotional exhaustion, and turnover intention: A study of substance abuse treatment counselors. J Subst Abuse Treat. 2020;35(4):387–95.
2. Goia L, Procopciuc LM. A narrative review of burnout syndrome in medical personnel. Diagnostics. 2024;14(17):1971. https://doi.org/10.3390/diagnostics14171971.
3. Shanafelt TD, Hasan O, Dyrbye LN, Sinsky C, Satele D, Sloan J, West CP. Changes in burnout and satisfaction with work-life balance in physicians and the general US working population between 2011 and 2014. Mayo Clin Proc. 2015;90(12):1600–13. https://doi.org/10.1016/j.mayocp.2015.08.023.
4. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: A systematic review and meta-analysis. Lancet. 2018;388(10057):2272–81. https://doi.org/10.1016/S0140-6736(16)31279-X.
5. Dyrbye, L. N., West, C. P., Satele, D., Boone, S., Tan, L., Sloan, J.,… Shanafelt,T. D. (2017). Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. Academic Medicine, 89(3), 443–451. https://doi.org/10.1097/ACM.0000000000000134.
6. Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, Devins G. Mindfulness: A proposed operational definition. Clin Psychol Sci Pract. 2004;11(3):230–41. https://doi.org/10.1093/clipsy/bph077.
7. Guidetti G, Viotti S, Badagliacca R, Colombo L, Converso D. Can mindfulness mitigate the energy-depleting process and increase job resources to prevent burnout? A study on the mindfulness trait in the school context. PLoS ONE. 2019;14(4). https://doi.org/10.1371/journal.pone.0214935.
8. Wilson JM, Weiss A, Shook NJ. Mindfulness, self-compassion, and savoring: factors that explain the relation between perceived social support and well-being. Pers Indiv Differ. 2020;152:109568. https://doi.org/10.1016/j.paid.2019.109568.
9. Shonin E, Van Gordon W. The health benefits of mindfulness-based interventions for healthcare professionals. BMJ. 2015;351:h4708. https://doi.org/10.1136/bmj.h4708.
10. Marques DL, Pires IM, Silva NM. Mindfulness-Based interventions to reduce burnout in primary healthcare professionals: A systematic review and Meta-Analysis. Healthcare. 2021;9(10):1342. https://doi.org/10.3390/healthcare9101342.

11. Hani Malik& Carrie Amani Annabi. The impact of mindfulness practice on physician burnout: A scoping review. Front Psychol. 2022. https://doi.org/10.3389/fpsyg.2022.956651. 11.
12. 12.Steegen S, Tuerlinckx F, Gelman A, Vanpaemel W. Am I replicable? A multiverse analysis of the most cited psychological paper. Adv Methods Practices Psychol Sci. 2016;1(4):379–90. https://doi.org/10.1177/2515245916669134.
13. Gelman A, Loken E. The garden of forking paths: why multiple comparisons can be a problem, even when there is no fishing expedition or p-hacking and the research hypothesis was posited ahead of time. Department of Statistics; 2014. https://stat.columbia.edu/~gelman/research/unpublished/p_hacking.pdf. Columbia University.
14. Bobbio A, Bellan M, Manganelli AM. Empowering leadership, perceived organizational support, trust, and job burnout for nurses: A study in an Italian general hospital. Health Care Manage Rev. 2012;37(1):77–87. https://doi.org/10.1097/HMR.0b013e31820e1121.
15. Kurtessis JN, Eisenberger R, Ford MT, Buffardi LC, Stewart KA, Adis CS. Perceived organizational support: A meta-analytic evaluation of organizational support theory. J Manag. 2017;43(6):1854–84. https://doi.org/10.1177/0149206315575554.
16. Shanafelt TD, Noseworthy JH. (2017). Executive leadership and physician well-being: Nine organizational strategies to promote engagement and reduce burnout. Mayo Clinic Proceedings, 92(1), 129–146. https://doi.org/10.1016/j.mayocp.2016.10.004
17. Sari N, Putra MS. The role of job burnout in mediating the effect of perceived organizational support on work satisfaction at Perumda Tirtaamerthabuana in Tabanan. Am J Humanit Social Sci Res (AJHSSR). 2021;5(3):204–11. https://doi.org/10.22541/ajhssr.v5i3.204.
18. Bakker AB, Demerouti E. The job demands–resources model: state of the Art. J Managerial Psychol. 2007;22(3):309–28. https://doi.org/10.1108/02683940710733115.
19. Tang YX, Wang YX, Zhou HY, Wang J, Zhang R, Lu QH. The relationship between psychiatric nurses' perceived organizational support and job burnout: Mediating role of psychological capital. Front Psychol. 2023;14. https://doi.org/10.3389/fpsyg.2023.1099687.
20. Edmondson AC, Lei Z. Psychological safety: the history, renaissance, and future of an interpersonal construct. Annual Rev Organizational Psychol Organizational Behav. 2014;1(1):23–43. https://doi.org/10.1146/annurev-orgpsych-031413-091305.
21. Sherf EN, Parke MR, Isaakyan S. Distinguishing voice and silence at work: unique relationships with perceived impact, psychological safety, and burnout. Acad Manag J. 2021;64(1):77–106. https://doi.org/10.5465/amj.2018.1428.
22. Silla I, Gamero N. Psychological safety climate and professional drivers' well-being: the mediating role of time pressure. Transp Res Part F: Traffic Psychol Behav. 2018;56:31–42. https://doi.org/10.1016/j.trf.2018.03.016.
23. Tett RP, Burnett DD. A personality trait-based interactionist model of job performance. J Appl Psychol. 2003;88(3):500–17. https://doi.org/10.1037/0021-9010.88.3.500.
24. Bashkirova A, Compagner A, Henningsen DM, Henningsen ML. An adaptive modelling approach to employee burnout in the context of the big five personality traits. Cogn Syst Res. 2023;68:24–35. https://doi.org/10.1016/j.cogsys.2022.1127.
25. Demerouti E, Bakker AB, Nachreiner F, Schaufeli WB. The job demands-resources model of burnout. J Appl Psychol. 2001;86(3):499–512.
26. Kabat-Zinn J. Mindfulness-based interventions in context: past, present, and future. Clin Psychol Sci Pract. 2003;10(2):144–56.
27. Eisenberger R, Huntington R, Hutchison S, Sowa D. Perceived organizational support. J Appl Psychol. 1986;71(3):500–7.
28. Rhoades L, Eisenberger R. Perceived organizational support: A review of the literature. J Appl Psychol. 2002;87(4):698–714.
29. Edmondson A. Psychological safety and learning behavior in work teams. Adm Sci Q. 1999;44(2):350–83.
30. Kahn WA. Psychological conditions of personal engagement and disengagement at work. Acad Manag J. 1990;33(4):692–724.
31. Schaufeli WB, Bakker AB. Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. J Organizational Behav. 2004;25(3):293–315.
32. Leiter MP, Maslach C. Nurse turnover: the mediating role of burnout. J Nurs Adm Manag. 2009;17(3):331–9.
33. Sonnentag S. Dynamics of well-being. Annual Rev Organizational Psychol Organizational Behav. 2015;2(1):261–93. https://doi.org/10.1146/annurev-orgpsych-032414-111347.
34. Deng YQ, Li S, Tang YY, Zhu LH, Ryan R, Brown K. Psychometric properties of the Chinese translation of the mindful attention awareness scale (MAAS). Mindfulness. 2012;3(1):10–4. https://doi.org/10.1007/s12671-011-0074-1.
35. Zhao Y, Zhang Q. Research on professional burnout among Doctors. Psychol Sci. 2004;2(2):99–113.
36. McGraw KO, Wong SP. Forming inferences about some intraclass correlation coefficients. Psychol Methods. 1996;1(1):30–46. https://doi.org/10.1037/1082-989X.1.1.30.
37. Krasner MS, Epstein RM, Beckman H, et al. Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. JAMA. 2009;302(12):1284–93. https://doi.org/10.1001/jama.2009.1384.
38. Braun E, Kinser P, Carrico CK. Effect of a brief Mindfulness-Based program on stress in health care professionals at a US biomedical research hospital: A randomized clinical trial. JAMA Netw Open. 2019;2(9):e1913424. https://doi.org/10.1001/jamanetworkopen.2019.13424.
39. Epstein RM, Krasner MS. Physician resilience: what it means, why it matters, and how to promote it. Acad Med. 2013;88(3):301–3. https://doi.org/10.1097/ACM.0b013e318280cff0.
40. Goodman MJ, Schorling JB. A mindfulness course decreases burnout and improves well-being among healthcare providers. Fam Med. 2012;44(5):318–27.
41. Xu S. (2008). Research on perceived organizational support. J Chongqing Inst Technol (Social Sciences). 22(3).
42. Ning Li, Jin Y. The mechanis of how trust climate impacts on individual performance. Acta Physiol Sinica. 2007;5(06):11–21.
43. Hsieh CC, Ho SSH, Li HC, Liang JK. Mindfulness as moderator against emotional exhaustion due to online teaching during COVID-19 pandemic: an investigation using job Demands-Resources model and conservation of resource theory. Front Psychol. 2021;12. https://doi.org/10.3389/fpsyg.2021.781804.
44. Zeshan M, de la Villarmois O, Rasool S, Niazi ARK. The perfect moment is this one. The effect of mindfulness on employees: a perspective from self-determination theory. Int J Organizational Anal. 2023;31(7):3617–33. https://doi.org/10.1108/ijoa-07-2022-3346.
45. Kassandrinou M, Lainidi O, Mouratidis C, Montgomery A. Employee silence, job burnout and job engagement among teachers: the mediational role of psychological safety. Health Psychol Behav Med. 2023;11(1). https://doi.org/10.1080/21642850.2023.2213302.
46. McBride EE, Chin GR, Clauser KS, Greeson JM. Perceived stress mediates the relationship between trait mindfulness and physical symptoms of stress: a replication study using structural equation modeling. Mindfulness. 2022;13(8):1923–30. https://doi.org/10.1007/s12671-022-01928-1.
47. Gan R, Chen S, Xue J. Feasibility and effectiveness of the mindfulness-based stress reduction programs on relieving burnout of healthcare providers during the COVID-19 pandemic: a pilot randomized controlled trial in China. Hum Resour Health. 2024;22(1). https://doi.org/10.1186/s12960-024-00959-0.
48. Garro A, Janal M, Kondroski K, Stillo G, Vega V. Mindfulness initiatives for students, teachers, and parents: a review of literature and implications for practice during COVID-19 and beyond. Contemp School Psychol. 2023;27(1):152–69. https://doi.org/10.1007/s40688-022-00446-0.
49. Prudenzi A, Graham CD, Flaxman PE, O'connor DB. Wellbeing, burnout, and safe practice among healthcare professionals: predictive influences of mindfulness, values, and self-compassion.Psychology. Health Med. 2021;27(5):1130–43. https://doi.org/10.1080/13548506.2021.1898651.
50. Ong NY, Teo FJJ, Ee JZY, Yau CE, Thumboo J, Tan HK, Ng QX. Effectiveness of mindfulness-based interventions on the well-being of healthcare workers: a systematic review and meta-analysis. Gen Psychiatry. 2024;37(3):e101115. https://doi.org/10.1136/gpsych-2023-101115.

Publisher's note