Research Square

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Clinical workload dimensions, multidimensional physician well-being, and turnover intention across primary healthcare facilities and hospitals in China: a cross-sectional study

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Abstract

Background

Physician well-being is important for maintaining a stable health workforce and the continuity of healthcare delivery. However, existing research often focuses on psychological distress alone or represents workload using total working hours, potentially overlooking the distinct relevance of different clinical demands. This study examined associations between disaggregated clinical workload measures and physiological, psychological, and work-related well-being, and assessed how these well-being dimensions were associated with turnover intention among physicians in China.

Methods

A cross-sectional survey was conducted among 1,324 practicing physicians working in primary healthcare facilities and hospitals across four provinces and municipalities in China. Clinical workload was assessed using total weekly working hours and setting-specific measures, including weekly night-shift frequency and outpatient encounters. Multivariable linear and logistic regression models were used to examine associations between workload measures and three dimensions of physician well-being, and between well-being and high turnover intention.

Results

The mean EQ-VAS score was 70.3 (SD 16.7). Overall, 42.3% of physicians screened positive for anxiety or depression, and 27.6% met the threshold for good work-related well-being. Compared with physicians working no more than 45 hours per week, those working more than 57 hours had a 12.64-point lower physiological well-being score (β=-12.64, 95% CI -15.56 to -9.72), lower odds of good psychological well-being (OR = 0.38, 95% CI 0.27–0.54), and lower odds of good work-related well-being (OR = 0.17, 95% CI 0.11–0.27). More frequent night shifts were associated with poorer physiological and work-related well-being in both primary healthcare facilities and hospitals, and with poorer psychological well-being in hospitals. Higher weekly outpatient volume was associated with lower odds of good psychological well-being in primary healthcare facilities (OR = 0.80, 95% CI 0.67–0.97) and hospitals (OR = 0.78, 95% CI 0.63–0.97). Good psychological and work-related well-being were associated with lower odds of high turnover intention (OR = 0.36, 95% CI 0.25–0.50 and OR = 0.35, 95% CI 0.22–0.57, respectively); higher physiological well-being was also associated with lower turnover intention.

Conclusions

Physicians experienced substantial challenges across multiple dimensions of well-being, which were associated with turnover intention. Total working hours alone did not fully capture the workload characteristics related to physician well-being, as night shifts and outpatient volume showed additional,

setting-specific associations. Health workforce management should therefore consider both the duration and composition of clinical workload. Differentiated workload monitoring and organizational support may help protect physician well-being and support workforce retention.

Background

Physicians are the central element of any healthcare system, and their well-being and clinical work output are two interdependent imperatives for achieving high-quality patient care, operational efficiency, and long-term system sustainability [1,2]. As the direct providers of specialized medical services, the competence and availability of practicing physicians form a critical pillar of any universal health coverage system[3], with the World Health Organization (WHO) establishing the health workforce as the core determinant of medical quality and service delivery[4]. On one hand, physician productivity, measured by metrics like working hours, patient volume, and surgical cases, is fundamental for ensuring service capacity and organizational stability. On the other hand, physician well-being is the inherent guarantee of service quality. Extensive research confirms that poor well-being, particularly burnout, is tightly linked to increased medical errors, reduced patient satisfaction, and high physician turnover, thereby threatening overall medical quality and patient safety[5,6].For instance, an increase in emotional exhaustion has been associated with a 6% to 10% increase in the probability of reporting a major medical error[7,8], and heavy workloads disrupt clinical workflows, increasing the likelihood of inefficiency and error[9].

Despite their critical and interdependent nature, healthcare institutions and managers often prioritize easily quantifiable productivity metrics over well-being, especially under fiscal pressures and rising service demands[10]. This focus can lead to organizational “mission drift”, where external pressures shift an organization's vision and goals toward more operational ones[11]. This “efficiency-first paradigm” is further fueled by compensation models that reward high patient throughput and long hours[10], risking the systemic health of the workforce[12,13]. Consequently, this persistent reliance on aggregated operational metrics has led to a critical lack of strategic focus on the comprehensive health of the physician workforce, resulting in suboptimal Health Human Resource Management (HRM). While existing research has highlighted the issue of burnout[**14,15**], a broader, integrated perspective that captures the full multidimensional construct of well-being is needed to truly inform policy.

These challenges are particularly salient within the Chinese healthcare system, where the confluence of systemic pressures and structural deficits exacerbates the problem. China has achieved a physician density comparable to the OECD median (3.4 practicing physicians per 1,000 population by 2023[16]), but a substantial gap remains when benchmarked against high-income nations, and the distribution of qualified personnel remains highly uneven[17]. The ongoing rapid population aging and the still-developing tiered referral system mean that large numbers of patients bypass primary care and seek treatment at higher-level hospitals[18]. Consequently, physicians across all types of institutions face immense pressure. While physicians in large, urban institutions grapple with excessive clinical volume and work intensity, those in primary care, community health centers, and CDCs settings often face distinct structural strains, including

resource scarcity and lack of support[19]. Recent national data confirm that heavy workload is a universal challenge; nearly a third of physicians working over 60 hours per week and this intensity is directly linked to the high prevalence of turnover intention observed across Chinese healthcare settings [20–22].

The existing quantitative literature lacks the comprehensive integration required to inform granular policy, thereby creating two critical research gaps that this study aims to address. First, research is often unidimensional, failing to capture the full spectrum of physician health, necessitating a multidimensional well-being framework that integrates both positive and negative states. First, research has failed to adopt a holistic view of health, relying instead on a unidimensional focus, such as job satisfaction[23,24],that neglects to capture the full spectrum of physician health, which needs to include the multidimensional construct of physiological, psychological, and work-related well-being. Second, the reliance on single, aggregated workload measures oversimplifies the true nature of work strain[20,25,26]. It is crucial to use disaggregated workload metrics to precisely identify which specific component of work input is the most critical determinant of physician well-being and retention. Understanding this multi-level interplay between work strain and well-being in the unique, high-pressure Chinese context is a high-priority policy objective.

Therefore, this study adopts a multidimensional well-being perspective to assess the status of physician well-being in China. Subsequently, the main purpose is to systematically investigate the associations between work input (total hours and disaggregated workload) and physician well-being, and subsequently, how well-being relates to the critical organizational outcome of turnover intention., among a large, nationwide sample of Chinese physicians. The findings are intended to provide empirical evidence to guide the development of more balanced, effective health human resource policies and sustainable talent management strategies in China and other similar high-pressure healthcare settings globally.

Methods

Study Design, Sampling, and Participants

A cross-sectional survey was conducted between July and October 2024. The questionnaire and survey referred to the same instrument in this study, which was developed specifically for this survey and has not been previously published elsewhere. An English-language version is provided as Supplementary File S1.To maximize sample representativeness, the study selected four geographically and economically distinct provincial-level regions in China: Xi'an (Shaanxi Province), Xinxiang and Luoyang (Henan Province), Shanghai Municipality, and Tianjin Municipality. These regions were deliberately chosen because they collectively represent diverse geographical locations (eastern, central, and western China), a wide range of socioeconomic status (tier-1 municipalities versus key regional centers), and varying levels of healthcare resource density, thereby enhancing the generalizability of the findings across China’s varied healthcare landscape.

In China, healthcare services are primarily delivered through a hierarchical system, broadly categorized into tertiary, secondary, and primary healthcare facilities. Tertiary hospitals are typically large, comprehensive medical centers responsible for complex specialized care, while secondary hospitals provide general and

regional medical services. Primary healthcare facilities (such as community health centers and township hospitals) serve as the foundation of the system and are a focus of ongoing national health reform. The public health and disease prevention functions, which are critical components of the national health system, are primarily managed by the local Centers for Disease Control (CDC)[27].

To ensure the representation of diverse practice settings across this tiered structure and public health functions, a quota sampling strategy was utilized. In each geographical region, a fixed set of institutions was selected as survey sites: one tertiary hospital, one secondary hospital, one local Center for Disease Control (CDC), and 3–4 primary healthcare facilities. The target study population included all actively practicing physicians (including assistant physicians) working on the day of the survey within the sampled institutions. Participants were required to voluntarily participate, and physicians on long-term leave (e.g., sabbatical, sick leave, maternity/paternity leave, or training/further study) on the survey day were excluded.

The initial target sample size was 1,000 physicians (250 physicians per region), with the quota stratified by institutional type: 100 from the tertiary hospital, 50 from the secondary hospital, 50 from the CDC, and 50 from the primary healthcare facilities. A total of 1,463 questionnaires were collected. After stringent quality control procedures, 1,324 valid responses were retained, yielding an effective response rate of 90.5%.

Data Collection and Quality Control

Data were collected via an anonymous electronic questionnaire platform (“WenJuanXing”), a widely adopted tool for distributing questionnaires in China. The survey was administered using two distinct modes to maximize reach and convenience: group-administered completion and self-administered completion. In the group-administered mode, local coordinators gathered physicians in a central location where investigators organized the session, explained the study protocol, and answered questions as participants scanned a QR code to complete the survey. In the self-administered mode, investigators coordinated with institutional and departmental heads to provide physicians with a unique QR code, allowing them to complete the survey anonymously during their work breaks. Crucially, in both settings, at least two investigators were present (physically or virtually) to monitor data submission in real-time and provide on-site support, thereby ensuring the authenticity and validity of the questionnaire responses. All participants provided electronic informed consent on the first page of the questionnaire. The study protocol was approved by the Peking University Biomedical Ethics Committee (IRB00001052-24072).

To ensure data reliability, rigorous quality control measures were implemented throughout the process. The survey platform was configured to allow only one submission per device or WeChat ID to prevent duplicate entries. Investigators monitored the backend in real-time to check for completeness and logic flow. Furthermore, all collected questionnaires were centrally audited. Responses were excluded if the completion time was deemed too short (e.g., less than 10 minutes), if essential information was missing, or if clear logical inconsistencies were present.

Measurement of Variables

Multidimensional Physician Well-being

Physician well-being was assessed using a comprehensive framework covering three dimensions: physiological, psychological, and work-related well-being. Physiological well-being was measured continuously using the EuroQol Visual Analogue Scale (EQ-VAS)[28], where respondents rated their overall health status from 0 (worst) to 100 (best). Psychological well-being was assessed via the single-item question: “Did you feel anxious or depressed today?”. Individuals who answered “No” were defined as having good psychological well-being (coded as 1).

Work-related well-being was assessed using a composite index based on three sub-dimensions[29] : job satisfaction, work-life balance (WLB), and absence of burnout. job satisfaction and WLB were each measured with a single item using a 5-point Likert scale (1 = Very Dissatisfied/Strongly Disagree, 5 = Very Satisfied/Strongly Agree). An affirmative state (defined as “Satisfied” or “Very Satisfied” for Job Satisfaction, and “Agree” or “Strongly Agree” for WLB) was classified as achieving the positive status. Burnout was measured by the Maslach Burnout Inventory - Human Services Survey (MBI-HSS) [30] using a 7-point scale (0=“Never” to 6=“Every Day”). Burnout was defined based on established criteria[24] as having an emotional exhaustion (EE) subscale score ≥ 27 and/or a depersonalization (DP) subscale score ≥ 10. The scale demonstrated good reliability in this study (Cronbach’s α: EE = 0.906, DP = 0.769, PA = 0.902). A 0–3 composite score was constructed via unit-weighting[31], representing the number of these three sub-dimensions for which the physician met the positive benchmark. Good work-related well-being was strictly defined as achieving the benchmark for all three indicators (i.e., a composite score of 3).

Workload and Workforce Stability

This study employed specific metrics to assess physician workload and the indicator of workforce stability. Workload was assessed using two categories of metrics to capture the multi-dimensional nature of work strain. First, total working hours was a continuous variable assessed by the question: “How many hours do you work per week?”. Second, for clinical physicians, disaggregated clinical workload was measured by four distinct variables to reflect multi-dimensional work strain. These variables were weekly outpatient visits (calculated as the number of outpatient units in the past week multiplied by the average number of patients per unit), monthly inpatient management, weekly surgical hours (calculated as the average number of surgical cases per week multiplied by the average time per surgery), and weekly night shifts. Due to differences in scale and variability, the four disaggregated workload variables were robustly standardized by subtracting the median and dividing by the interquartile range to reduce the influence of extreme outliers and enable fair comparison in regression models[32].Finally,turnover intention, which serves as a key proxy for workforce stability, was measured as the primary outcome indicator of the study. This intention was assessed using a single-item question: “In the next few years, I am very likely to look for a new job,” using a 5-point Likert scale. Turnover Intention (the primary outcome for the third set of models) was defined as a binary variable (coded as 1) if the physician responded “Strongly Agree” or “Agree”, and 0 otherwise.

Statistical Analysis

Statistical analysis was performed using STATA 18.0 statistical software package. Continuous variables were reported as mean ±standard deviation (SD) for normally distributed data, or as median (P25, P75) for non-normally distributed data. Categorical variables were presented as percentages. Group differences were tested using $\chi 2$ tests for categorical variables, and Mann-Whitney U Tests (ranksum) or Kruskal-Wallis Tests (kwallis) for non-normally distributed continuous or ordinal variables.

To address the study aims, three main sets of multivariable regression models were constructed. The first set of models examined the association between total weekly working hours and the three dimensions of physician well-being. The second set of analyses was conducted on clinical physicians, where subgroup analyses were performed by stratifying the sample into hospital and primary healthcare facilities to account for differences in workplaces. Separate multivariable models were established within each subgroup to examine the association between the four robustly standardized disaggregated clinical workload metrics and the three well-being dimensions. The third set of models analyzed the association between the three dimensions of multidimensional well-being and the binary outcome of turnover intention. Multivariable linear regression was used for the continuous outcome (physiological well-being), while multivariable logistic regression (reporting odds ratios, ORs) was used for the dichotomous outcomes (psychological well-being, work-related well-being, and turnover intention). All regression models controlled for a comprehensive set of potential confounding factors, including age, sex, professional technical title, institutional type, province, and monthly income level. The level of statistical significance was set at $P < 0.05$.

Results

Table 1 describes the summary statistics of the entire study sample and the characteristics by institutional type. A total of 1,324 practicing physicians were included in the final analysis. The sample was predominantly female (59.5%), and physicians aged 35–49 years constituted the largest age group (50.2%). The study sample was collected from four provinces/municipalities in China: Henan (34.5%), Shaanxi (22.4%), Shanghai (22.0%), and Tianjin (21.1%). The institutional distribution was comprised of 756 physicians in hospitals (57.1%), 301 in primary healthcare facilities (22.7%), and 267 in CDCs (20.2%). Over half of the physicians (54.8%) held a postgraduate degree, and 45.3% possessed an Intermediate professional technical title. Regarding clinical roles, 67.1% of the total sample were engaged in clinical practice. These clinical physicians were exclusively located in hospitals and primary healthcare facilities, as all physicians in CDCs were non-clinical. In terms of compensation, the mean monthly income for physicians was CNY 8,245.1.

Table 1
Summary Statistics of the Sample

	Primary Healthcare Facilities	Hospitals	Centers for Disease Control and Prevention	Total	Z/χ^2	*P*
	N = 301	**N = 756**	**N = 267**	**N = 1324**		
Clinical Status					683.21	< 0.001
Non-Clinical Physician	58 (19.3%)	111 (14.7%)	267 (100.0%)	436 (32.9%)		
Clinical Physician	243 (80.7%)	645 (85.3%)	0 (0.0%)	888 (67.1%)		
Gender					57.17	< 0.001
Female	224 (74.4%)	385 (50.9%)	179 (67.0%)	788 (59.5%)		
Male	77 (25.6%)	371 (49.1%)	88 (33.0%)	536 (40.5%)		
Age					63.52	< 0.001
< 35 Years	72 (23.9%)	288 (38.1%)	131 (49.1%)	491 (37.1%)		
35–49 Years	171 (56.8%)	401 (53.0%)	92 (34.5%)	664 (50.2%)		
≥ 50 Years	58 (19.3%)	67 (8.9%)	44 (16.5%)	169 (12.8%)		
Educational Level					290.06	< 0.001
College Degree or Below	34 (11.3%)	5 (0.7%)	11 (4.1%)	50 (3.8%)		
Bachelor's Degree	224 (74.4%)	226 (29.9%)	98 (36.7%)	548 (41.4%)		
Postgraduate Degree	43 (14.3%)	525 (69.4%)	158 (59.2%)	726 (54.8%)		
Province					10.46	0.107
Shaanxi	79 (26.2%)	162 (21.4%)	55 (20.6%)	296 (22.4%)		

Note: Total percentages for some variables do not add up to 100 due to rounding. Categorical data in tables were presented as frequency (percentage). Continuous variables were reported as were reported as mean (standard deviation, SD) for normally distributed data, or as for normally distributed data, or as median (P25, P75) for non-normally distributed data.

	Primary Healthcare Facilities	Hospitals	Centers for Disease Control and Prevention	Total	Z/χ^2	*P*
	N = 301	N = 756	N = 267	N = 1324		
Henan	93 (30.9%)	272 (36.0%)	92 (34.5%)	457 (34.5%)		
Shanghai	77 (25.6%)	160 (21.2%)	54 (20.2%)	291 (22.0%)		
Tianjin	52 (17.3%)	162 (21.4%)	66 (24.7%)	280 (21.1%)		
Professional Title					14.47	0.006
Junior or Below	90 (29.9%)	205 (27.1%)	74 (27.7%)	369 (27.9%)		
Intermediate	149 (49.5%)	349 (46.2%)	102 (38.2%)	600 (45.3%)		
Senior	62 (20.6%)	202 (26.7%)	91 (34.1%)	355 (26.8%)		
Monthly income	6302.3 (3598.8)	9363.1 (4786.3)	7269.7 (3315.3)	8245.1 (4470.5)	128.59	< 0.001

Note: Total percentages for some variables do not add up to 100 due to rounding. Categorical data in tables were presented as frequency (percentage). Continuous variables were reported as were reported as mean (standard deviation, SD) for normally distributed data, or as for normally distributed data, or as median (P25, P75) for non-normally distributed data.

Basic characteristics demonstrated significant differences across the three institutional types in terms of gender, age, education level, professional title, and monthly income ($P < 0.05$). Physicians in hospitals reported the highest proportion of postgraduate degrees (69.4%) and the highest mean monthly income (CNY 9,363.1). Primary healthcare facilities had the highest female physician ratio (74.4%) and were predominantly composed of middle-aged physicians aged 35–49 (56.8%). CDCs were characterized by the highest percentage of younger physicians (under 35 years, 49.1%) and the highest proportion of advanced professional titles (27.4%).

(Table 1 inserted here)

Table 2 details the workload metrics, turnover intention, and multidimensional physician well-being status, along with institutional comparisons. In terms of total working hours, 55.0% of physicians reported working more than 46 hours per week. Hospitals reported the highest prevalence of extremely long working hours (57 hours or more per week), with 36.8% of their physicians exceeding this threshold ($P < 0.05$).Clinical workload metrics were evaluated and presented as median (P25, P75).For general workload components, which apply to all physicians, the values were: weekly night shift frequency 1 (0, 2) times, weekly public

health service hours 4 (1, 19) hours, management and administrative time 1 (0, 3) hour, and training and meeting time 3 (2, 5) hours. For clinical physicians (n = 888), clinical workload components were measured. The median weekly clinical service hours were 45 (40, 53) hours. The median number of outpatient units was 2 (1, 5) per week, and patients per unit was 15 (5, 30). For inpatient care, the median monthly managed inpatients were 20 (2, 35). Surgical workload included weekly surgical cases at a median of 0 (0, 5) and average time per surgery at a median of 0 (0, 1) hour. Significant variations in workload metrics were evident across all three institutional types *(P < 0.05)*. For general workload components, CDCs reported the longest median weekly public health service hours, management/administrative time, and training/meeting time. Differences in clinical workload components were observed between hospitals and primary healthcare facilities. Hospitals reported the highest weekly night shift frequency and the longest weekly clinical service time. Hospitals also showed a greater median number of monthly managed inpatients, weekly surgical cases, and average time per surgery compared to primary healthcare facilities. Primary healthcare facilities, conversely, reported a greater median number of weekly outpatient units and patients per unit than hospitals. Overall, 13.7% of all physicians expressed a definite intention to leave their current job. The institutional difference in turnover intention did not reach statistical significance across the three institutional types (*P = 0.234*).

Table 2
Workload Metrics, Turnover Intention, and Well-being by Institution

	Primary Healthcare Facilities	Hospitals	Centers for Disease Control and Prevention	Total	Z/χ^2	*P*
	N = 301	**N = 756**	**N = 267**	**N = 1324**		
Workload Metrics						
Weekly Working Hours					375.05	< 0.001
≤ 45 Hours	225 (74.8%)	175 (23.1%)	196 (73.4%)	596 (45.0%)		
46–57 Hours	64 (21.3%)	303 (40.1%)	61 (22.8%)	428 (32.3%)		
> 57 Hours	12 (4.0%)	278 (36.8%)	10 (3.7%)	300 (22.7%)		
Weekly Night Shift Frequency	0 (0,1)	1 (1,2)	0 (0,0)	1 (0,2)	504.60	< 0.001
Weekly Clinical Service Hours (Hours)	40 (35,41)	50 (40,57)	NA	45 (40,53)	141.03	< 0.001
Weekly Public Health Service Hours (Hours)	6 (2,12)	1 (0,4)	30 (20,40)	4 (1,19)	476.40	< 0.001
Comprehensive Administrative Time (e.g., Party-building/HR)	0 (0,2)	1 (0,2)	2 (1,8)	1 (0,3)	145.92	< 0.001
Time Spent on Learning/Training	2 (2,4)	3 (2,5)	5 (2,5)	3 (2,5)	57.14	< 0.001
Outpatient Units in the Past Week	8 (3,10)	2 (0,3)	NA	2 (1,5)	203.11	< 0.001
Patients per Outpatient Unit	20 (10,30)	15 (2,30)	NA	15 (5,30)	10.79	0.001
Monthly Inpatient Management Count	0 (0,4)	30 (16,40)	NA	20 (2,35)	349.51	< 0.001
Weekly Surgical Cases	0 (0,0)	2 (0,7)	NA	0 (0,5)	162.80	< 0.001

Note: Total percentages for some variables do not add up to 100 due to rounding. Categorical data in tables were presented as frequency (percentage). Continuous variables were reported as were reported as mean (standard deviation, SD) for normally distributed data, or as for normally distributed data, or as median (P25, P75) for non-normally distributed data.

	Primary Healthcare Facilities	Hospitals	Centers for Disease Control and Prevention	Total	Z/χ^2	*P*
	N = 301	N = 756	N = 267	N = 1324		
Average Time per Surgical Case (Hours)	0 (0,0)	1 (0,2)	NA	0 (0,1)	160.42	< 0.001
Turnover Intention					2.91	0.234
No	253 (84.6%)	644 (85.9%)	235 (89.4%)	1132 (86.3%)		
Yes	46 (15.4%)	106 (14.1%)	28 (10.6%)	180 (13.7%)		
Well-being						
Physiological Well-being	69.3 (17.0)	69.8 (16.9)	72.2 (15.8)	70.2 (16.7)	5.61	0.0605
Psychological Well-being					1.53	0.465
Poor	118 (39.2%)	327 (43.3%)	115 (43.1%)	560 (42.3%)		
Good	183 (60.8%)	429 (56.7%)	152 (56.9%)	764 (57.7%)		
Work-related well-being					7.97	0.019
Poor	199 (66.1%)	559 (73.9%)	201 (75.3%)	959 (72.4%)		
Good	102 (33.9%)	197 (26.1%)	66 (24.7%)	365 (27.6%)		

Note: Total percentages for some variables do not add up to 100 due to rounding. Categorical data in tables were presented as frequency (percentage). Continuous variables were reported as were reported as mean (standard deviation, SD) for normally distributed data, or as for normally distributed data, or as median (P25, P75) for non-normally distributed data.

The status of physician well-being was evaluated across three dimensions. Physiological well-being was measured by the mean self-rated health score (EQ-VAS), which was 70.3 ± 16.7. No significant difference in physiological well-being was observed across the three institutional types (*P = 0.070*). For psychological well-being, 42.3% of physicians reported experiencing anxiety or depression (defined as poor psychological well-being). This dimension also showed no significant difference among the three institutional types (*P* = 0.465). Regarding work-related well-being, 27.6% of the physicians achieved a good work-related well-being status. This good status was strictly defined as meeting the positive benchmark for all three sub-dimensions: job satisfaction, work-life balance, and absence of burnout. Significant differences in work-

related well-being were observed across institutions ($P < 0.05$). Primary healthcare facilities reported the highest rate of good work-related well-being, while CDCs reported the lowest rate.

(Table 2 inserted here)

Table 3 presents the results of multivariable regression models examining the association between total weekly working hours and the three dimensions of physician well-being. Results demonstrated a highly significant negative association between increased weekly working hours and all three dimensions of physician well-being *(P < 0.001).* Specifically, when compared to physicians working ≤ 45 hours, those working > 57 Hours per week were associated with a 12.64-point decrease in physiological well-being *(β=−12.64)*, had significantly lower odds of achieving good psychological well-being *(OR = 0.38)*, and had substantially lower odds of achieving good work-related well-being *(OR = 0.17)*.

Table 3
Multivariable Analysis of the Association between Total Weekly Working Hours and Multidimensional Physician Well-being

Variable	Physiological Well-being (β (95% CI))	Psychological Well-being (OR (95% CI))	Work-related well-being (OR (95% CI))
Weekly Working Hours			
Reference: ≤ 45 Hours			
46–57 Hours	-5.99 (-8.23, -3.74) ***	0.53 (0.40, 0.71) ***	0.34 (0.24, 0.47) ***
> 57 Hours	-12.64 (-15.56, -9.72) ***	0.38 (0.27, 0.54) ***	0.17 (0.11, 0.27) ***
Province			
Reference: Shaanxi			
Henan	1.09 (-1.39, 3.57)	1.75 (1.28, 2.38) ***	1.64 (1.16, 2.32) **
Shanghai	-3.94 (-6.83, -1.06) **	0.86 (0.60, 1.23)	0.80 (0.53, 1.22)
Tianjin	-0.93 (-3.65, 1.79)	1.17 (0.82, 1.65)	1.10 (0.73, 1.65)
Gender			
Reference: Female			
Male	2.29 (0.44, 4.13) *	0.84 (0.66, 1.07)	0.84 (0.64, 1.11)
Age			
Reference:< 35 Years			
35–49 Years	-4.15 (-6.47, -1.82) ***	0.84 (0.62, 1.16)	0.99 (0.70, 1.40)
≥ 50 Years	-2.07 (-5.71, 1.57)	0.98 (0.63, 1.53)	1.51 (0.92, 2.48)
Professional Title			
Reference: Junior or below			
Intermediate	-1.66 (-4.01, 0.69)	0.64 (0.47, 0.89) **	0.83 (0.58, 1.18)
Senior	0.30 (-3.00, 3.60)	0.55 (0.36, 0.85) **	0.77 (0.48, 1.24)
Institution Type			

Note: P values are indicated as: **P < 0.05; **P < 0.01; ***P < 0.001*.

Variable	Physiological Well-being (β (95% CI))	Psychological Well-being (OR (95% CI))	Work-related well-being (OR (95% CI))
Reference: Primary Healthcare Facilities			
Hospitals	3.21 (0.65, 5.77) *	1.09 (0.78, 1.52)	1.34 (0.93, 1.93)
Centers for Disease Control and Prevention	0.87 (-1.86, 3.59)	0.76 (0.53, 1.09)	0.59 (0.40, 0.89) *
Monthly income	3.59 (1.60, 5.58) ***	1.65 (1.27, 2.13) ***	1.32 (0.98, 1.79)
Note: P values are indicated as: **P < 0.05; **P < 0.01; ***P < 0.001*.			

(Table 3 inserted here)

Table 4 displays the results of the subgroup regression analysis, which assessed the impact of standardized disaggregated clinical workload metrics on physician well-being separately for hospital and primary healthcare facilities. Across both institutional types, weekly night shift frequency consistently demonstrated a pervasive negative influence, significantly impacting well-being across almost all dimensions(*P < 0.05*). Furthermore, the standardized weekly outpatient visits were significantly associated with lower odds of achieving good psychological well-being in both primary healthcare facilities *(OR = 0.80, P < 0.05)* and hospitals *(OR = 0.78, P < 0.05)*. A distinct finding was that the standardized weekly surgical hours significantly predicted a decrease in well-being specifically for primary healthcare physicians *(OR = 0.01, P < 0.05)*, an effect not similarly observed in hospital settings.

Table 4
Multivariable Analysis of the Association between Clinical Workload Metrics and Multidimensional Physician Well-being

Variable	Primary Healthcare Facilities (N = 243)			Hospitals (N = 645)		
	Physiological Well-being (β (95% CI))	Psychological Well-being (OR (95% CI))	Work-related well-being (OR (95% CI))	Physiological Well-being (β (95% CI))	Psychological Well-being (OR (95% CI))	Work-related well-being (OR (95% CI))
Standardized weekly outpatient visits	-0.61 (-2.16, 0.94)	0.80 (0.67, 0.97) *	0.95 (0.79, 1.14)	-0.63 (-2.65, 1.38)	0.78 (0.63, 0.97) *	1.00 (0.77, 1.29)
Standardized monthly inpatient management count	0.04 (-3.20, 3.27)	0.57 (0.22, 1.46)	1.43 (0.88, 2.32)	-1.23 (-3.44, 0.99)	0.93 (0.75, 1.16)	0.86 (0.66, 1.12)
Standardized weekly surgical hours	-29.75 (-64.31, 4.81)	0.01 (0.00, 0.98) *	0.04 (0.00, 1.59)	-0.20 (-1.09, 0.68)	0.97 (0.86, 1.09)	0.96 (0.83, 1.11)
Standardized weekly night shift frequency	-6.41 (-11.89, -0.94) *	0.71 (0.37, 1.38)	0.49 (0.26, 0.91) *	-2.78 (-4.68, -0.88) **	0.76 (0.60, 0.96) *	0.65 (0.47, 0.90) **
Province						
Reference: Shaanxi						
Henan	6.70 (0.01, 13.38) *	3.05 (1.39, 6.73) **	1.03 (0.46, 2.29)	1.93 (-1.82, 5.67)	2.06 (1.33, 3.20) **	1.97 (1.17, 3.29) *
Shanghai	-5.30 (-13.40, 2.81)	2.47 (0.94, 6.53)	0.76 (0.28, 2.02)	-2.73 (-7.34, 1.87)	1.25 (0.74, 2.11)	1.11 (0.59, 2.10)
Tianjin	1.67 (-6.41, 9.76)	3.15 (1.17, 8.49) *	1.27 (0.48, 3.33)	-2.04 (-6.37, 2.28)	1.11 (0.67, 1.84)	1.07 (0.57, 2.01)
Gender						
Reference: Female						

Note: P values are indicated as: **P < 0.05; **P < 0.01; ***P < 0.001*.

Variable	Primary Healthcare Facilities (N = 243)			Hospitals (N = 645)		
	Physiological Well-being (β (95% CI))	**Psychological Well-being (OR (95% CI))**	**Work-related well-being (OR (95% CI))**	**Physiological Well-being (β (95% CI))**	**Psychological Well-being (OR (95% CI))**	**Work-related well-being (OR (95% CI))**
Male	-0.45 (-5.41, 4.51)	1.33 (0.72, 2.43)	0.87 (0.46, 1.66)	1.78 (-0.85, 4.41)	0.81 (0.58, 1.13)	0.94 (0.64, 1.37)
Age						
Reference:< 35 Years						
35–49 Years	-6.64 (-12.33, -0.94) *	0.49 (0.22, 1.07)	1.18 (0.53, 2.61)	-2.15 (-5.67, 1.38)	0.93 (0.58, 1.50)	1.02 (0.58, 1.78)
≥ 50 Years	-4.65 (-12.44, 3.14)	0.69 (0.24, 1.99)	2.22 (0.78, 6.27)	2.41 (-3.64, 8.47)	1.34 (0.62, 2.88)	1.43 (0.60, 3.40)
Professional Title						
Reference: Junior or below						
Intermediate	-3.50 (-9.61, 2.60)	0.71 (0.32, 1.59)	0.76 (0.35, 1.67)	-1.67 (-5.43, 2.09)	0.63 (0.37, 1.05)	0.76 (0.42, 1.39)
Senior	0.84 (-6.59, 8.27)	0.71 (0.25, 2.07)	1.00 (0.36, 2.79)	-0.37 (-5.76, 5.02)	0.61 (0.31, 1.18)	0.65 (0.30, 1.42)
Monthly income	11.22 (6.17, 16.26) ***	1.55 (0.78, 3.08)	1.51 (0.70, 3.27)	1.40 (-1.55, 4.34)	1.37 (0.97, 1.93)	1.13 (0.75, 1.70)

Note: P values are indicated as: **P < 0.05; **P < 0.01; ***P < 0.001*.

(Table 4 inserted here)

Table 5 shows the results of the multivariable logistic regression models that analyzed the association between the three dimensions of physician well-being and the binary outcome of turnover intention The results indicated a significant negative association between all three dimensions of physician well-being and the odds of expressing a definite intention to leave their job. A higher score on physiological well-being was significantly associated with lower odds of turnover intention (*OR = 0.99, P < 0.01*). Similarly, achieving

good psychological well-being (*OR = 0.36, P < 0.001*) and good work-related well-being (*OR = 0.35, P < 0.001*) were both significantly associated with lower odds of turnover intention.

Table 5
Multivariable Logistic Regression Analysis of the Association between Multidimensional Physician Well-being and Turnover Intention

variable	Model 1 Physiological Well-being	Model 2 Psychological Well-being	Model 3 Work-related well-being
dependent variable: Turnover Intention	OR (95% CI)	OR (95% CI)	OR (95% CI)
independent variable			
Physiological Well-being	0.99 (0.98, 1.00) **		
Psychological Well-being			
Reference: Poor			
Good		0.36 (0.25, 0.50) ***	
Work-related well-being			
Reference: Poor			
Good			0.35 (0.22, 0.57) ***
Weekly Working Hours			
Reference: ≤ 45 Hours			
46–57 Hours	1.01 (0.65, 1.56)	0.97 (0.62, 1.51)	0.91 (0.58, 1.42)
> 57 Hours	1.77 (1.07, 2.92) *	1.72 (1.05, 2.82) *	1.62 (0.98, 2.68)
Province			
Reference: Shaanxi			
Henan	0.44 (0.28, 0.67) ***	0.49 (0.31, 0.75) **	0.46 (0.30, 0.71) ***
Shanghai	0.91 (0.56, 1.49)	0.93 (0.57, 1.53)	0.95 (0.58, 1.55)
Tianjin	0.51 (0.31, 0.84) **	0.53 (0.32, 0.89) *	0.53 (0.32, 0.88) *
Gender			
Reference: Female			
Male	2.43 (1.71, 3.45) ***	2.29 (1.61, 3.27) ***	2.34 (1.64, 3.33) ***
Age			
Reference:< 35 Years			
35–49 Years	1.15 (0.73, 1.82)	1.16 (0.73, 1.85)	1.20 (0.76, 1.91)

Note: P values are indicated as: **P < 0.05; **P < 0.01; ***P < 0.001*.

variable	Model 1 Physiological Well-being	Model 2 Psychological Well-being	Model 3 Work-related well-being
≥ 50 Years	0.62 (0.29, 1.31)	0.63 (0.30, 1.34)	0.68 (0.32, 1.45)
Professional Title			
Reference: Junior or below			
Intermediate	0.56 (0.36, 0.88) *	0.51 (0.32, 0.80) **	0.56 (0.36, 0.88) *
Senior	0.64 (0.35, 1.16)	0.55 (0.30, 1.01)	0.62 (0.34, 1.13)
Institution Type			
Reference: Primary Healthcare Facilities			
Hospitals	0.83 (0.51, 1.34)	0.79 (0.48, 1.28)	0.83 (0.51, 1.35)
Centers for Disease Control and Prevention	0.81 (0.47, 1.40)	0.73 (0.42, 1.27)	0.72 (0.42, 1.26)
Monthly income	0.44 (0.32, 0.62) ***	0.46 (0.33, 0.65) ***	0.43 (0.31, 0.61) ***
Note: P values are indicated as: *P < 0.05; **P < 0.01; ***P < 0.001.			

(Table 5 inserted here)

Discussion

Physician well-being and clinical work productivity are equally critical and interdependent components for achieving high-quality patient care, operational efficiency, and long-term healthcare system sustainability[2,33]. To provide robust, up-to-date insights across diverse institutional types and regions in China, this study conducted primary data collection, utilizing 1,324 physician questionnaires collected from hospitals, primary healthcare facilities, and CDCs systems. Adopting a multidimensional perspective, we systematically investigated the associations between workload and physician well-being, and subsequently examined how well-being relates to the critical organizational outcome of turnover intention.

This study highlights three key findings. First, we measured physician well-being from a multidimensional perspective, including physiological, psychological, and work-related dimensions, going beyond simple burnout. Second, we identified significant factors associated with well-being, specifically quantifying the adverse association of heavy workload factors such as extended working hours, night shift frequency, and high outpatient visit volume. Third, we confirmed the critical importance of physician well-being by demonstrating its strong and independent association with turnover intention.

Our study revealed significant variations in physician workload metrics across institutional types (hospitals, PHC facilities, and CDCs), reflecting the imbalanced roles within China's hospital-centric healthcare system[34]. This non-uniform strain is fundamentally rooted in the implementation gap of the national

hierarchical medical system policy. Although the government has committed to strengthening PHC since the 2009 reform, the system remains predominantly hospital-centric, resulting in persistent structural workload imbalances[19].

Our study found that extended weekly working hours emerged as the most pervasive and impactful common factor influencing physician well-being. Specifically, working 57 hours or more per week was negatively associated with every dimension of well-being measured in this study. This finding is consistent with prior literature[35,36] and can be explained through the Job Demand-Resources (JD-R) theory[37]. Within this framework, excessively long hours constitute a persistent and intense job demand that continuously depletes the physician's mental and physical resources. The sustained cognitive load and physical exertion not only induce chronic fatigue but also manifest as emotional issues, thereby eroding overall well-being[38]. Furthermore, this pattern severely curtails time for critical recovery and social activities, leading to a significant opportunity cost that prevents the replenishment of personal resources through adequate rest, family life, and leisure[39]. This resource depletion ultimately results in a vicious cycle where recovery is consistently suppressed, creating a state of chronic imbalance.

This study found that across hospitals and primary healthcare facilities, weekly night shift frequency consistently demonstrated a pervasive negative influence, significantly impacting well-being across almost all dimensions, consistent with prior studies[40]. The core mechanism involves the forced disruption of the human circadian rhythm, leading to severe sleep disorders characterized by reduced sleep duration and poor sleep quality[41,42]. This chronic sleep deprivation is the central driver of declining well-being, directly manifesting in the physiological dimension through sustained physical fatigue and increased risks for chronic conditions, which is reflected in lower self-rated health scores[43]. Crucially, the negative spiral of night shifts extends profoundly into the psychological dimension, directly contributing to heightened emotional exhaustion, anxiety, and depressive symptoms[44]. Furthermore, night shifts impose a substantial social and opportunity cost that severely disrupts the work-related dimension. This schedule hinders participation in family activities and social gatherings, leading to phenomena like “social jetlag”, strained familial relationships, and a reduced social support network[45]. The long-term lack of social connection and support is a critical factor that erodes psychological resilience and translates directly into lower job satisfaction and a marked decline in work-life balance[46].

In this study, weekly outpatient visits were significantly associated with lower odds of achieving good psychological well-being across both primary healthcare facilities and hospitals. This highlights that the high volume of patient encounters imposes a distinct and profound strain on the physician's mental and emotional resources. The primary challenge in the outpatient setting stems from the high frequency, rapid pace, and intensive communication demands of the work. Short consultation times combined with high patient loads necessitate high levels of sustained cognitive and attentional resources for rapid diagnosis and decision-making, leading to a high mental workload[47]. Concurrently, the direct, constant interface with patients and their families subjects physicians to immediate feedback and high expectations, significantly increasing their emotional labor and susceptibility to interpersonal stress[48]. This combination of intense cognitive demand and emotional pressure leads to the depletion of psychological resources, manifesting

as elevated anxiety and depressive symptoms. Furthermore, the typical lack of a strict shift system or dedicated, team-based support structure, often found in inpatient units, can blur work-life boundaries for outpatient physicians, diminishing recovery opportunities and making administrative follow-up an independent source of stress[47].

Our research revealed a distinct finding that the standardized weekly surgical hours significantly predicted a decrease in well-being specifically for primary healthcare physicians, an effect not observed in hospital settings. This is noteworthy as surgical activity in PHC facilities is generally infrequent. This negative association stems from China's highly fragmented, hospital-centric health delivery system[49]. The absence of a strict "gatekeeper" mechanism and the concentration of resources in large hospitals erode patient trust, causing them to commonly bypass PHC for surgical procedures and seek care in higher-level hospitals[50]. This systemic diversion results in a severe low volume of surgical cases at the primary level, which creates a dual professional and institutional barrier detrimental through two mechanisms. First, infrequency of practice hinders competence maintenance, leading to skill decay and heightened anxiety associated with rare, high-risk tasks[51]. Second, this low volume prevents the necessary scale effect, making medical income insufficient to cover the expense of maintaining dedicated teams and advanced equipment. This financial tension reduces institutional motivation to invest, intensifying the existing resource deficit[34]. Ultimately, PHC physicians must perform these procedures with severely limited resources and inadequate support, creating a deep tension between professional responsibility and systemic limitations (capacity erosion and resource deficit). This generates significant psychological distress, uniquely linked to the surgical workload in this setting.

Our findings indicated a negative association between all three dimensions of physician well-being and the odds of expressing a definite intention to leave their job. This finding aligns with established literature that identifies physician well-being as a critical, multi-faceted determinant of workforce stability[52]. Furthermore, the inclusion of physiological well-being highlights the long-term impact of work, as a decline in personal health and sustained physical fatigue can ultimately drive a physician to seek a change in employment or organizational exit[53]. Compromised psychological well-being, characterized by high anxiety and depressive tendencies, increases the perception of a heavy workload as an unbearable burden, thereby exacerbating the propensity to leave[54].Conversely, work-related well-being, often reflected in high job satisfaction, serves as a key retention factor by fostering intrinsic motivation and reducing burnout[55].

This study raised the following recommendations. Firstly, policymakers should consider enforcing stricter labor regulations to cap total working time, such as defining maximum weekly working hours, and mandate mechanisms to ensure adequate physiological recovery, including non-negotiable short breaks and protected time after night shifts. Secondly, structural redesign is necessary to address the cognitive and emotional burden of high-volume outpatient care by implementing team-based models to decentralize administrative tasks and piloting flexible scheduling to mitigate high-intensity demands. Thirdly, the disproportionate strain observed from surgical work in primary healthcare facilities suggests the need for policy to define and enforce minimum resource and support benchmarks for all high-risk foundational services. Fourthly, institutional leaders are recommended to move beyond reactive measures to protect the

holistic health of the physician workforce. This involves proactively integrating well-being metrics, such as burnout and depression screenings, into organizational quality improvement projects, and formalizing work-life balance policies, including establishing clear shift boundaries and flexible scheduling[56].

This study possesses several key strengths. Firstly, we utilized a multi-dimensional framework to assess physician well-being, encompassing physiological, psychological, and work-related components. Secondly, the analysis utilized a fine-grained, decomposed approach to workload measurement, clearly distinguishing between specific work activities to precisely identify the distinct impact of each on physician outcomes. Thirdly, this research leveraged an analytical sample that covered three distinct professional settings: primary healthcare facilities, hospitals, and CDC systems, which significantly enhances the external validity of the findings.

This study had several limitations. Firstly, the use of a cross-sectional study design, while effective for identifying associations, precludes the definitive inference of causal relationships between workload, well-being, and turnover intention Secondly, the data collected via a self-administered questionnaire introduces the potential for information bias, including social desirability bias and underreporting bias, which may subtly influence the magnitude of the reported associations. Nevertheless, the findings retain significant practical value for informing organizational strategies and targeted interventions aimed at improving physician well-being and reducing attrition.

Conclusion

In conclusion, compromised multi-dimensional well-being is prevalent among Chinese physicians (physiological, psychological, and work-related), a status strongly associated with higher turnover intention. This study confirms that both excessive total weekly working hours and the disaggregated workload metrics are negatively associated with well-being. Furthermore, specific clinical demands like night shift frequency and outpatient volume exhibit distinct negative associations across the dimensions of well-being. Therefore, workforce stability strategies should move beyond simply capping total hours and instead implement targeted interventions that manage specific clinical demands, particularly addressing the outpatient burden and supporting primary care physicians. Prioritizing physician well-being through such refined workload management is essential for mitigating attrition and ensuring the long-term sustainability and quality of healthcare services.

Declarations

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Ethics approval and consent to participate

The Peking University Health Science Center's Institutional Review Board (PU IRB) (IRB00001052-24072) sanctioned the study, which adhered to the Declaration of Helsinki. Before administering the questionnaire,

we obtained written permission from all participants.

Consent for publication

Not applicable.

Availability of data and materials

Due to ethical restrictions related to personal data and anonymity, the datasets produced and/or examined in this study are not open to the public. However, they may be obtained from the corresponding author upon reasonable request.

Competing interests

None declare that they have competing interests.

Authors' contributions

HZ was responsible for drafting the manuscript, as well as analyzing and interpreting the data. ML took charge of the study's design, data analysis, and data management. HT and YZ were tasked with data collection and management. XL, who designed the study, provided essential interpretations and revised the article's intellectual contents significantly. All authors have read and given their approval to the final version of the manuscript.

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