Original Article

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Workload, burnout, and medical mistakes among physicians in China: A cross-sectional study

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Summary **The purpose of this study is to determine the prevalence of burnout among different grade hospitals and to examine if a relation exists between burnout and medical mistakes. A multi-center cross-sectional survey was conducted. Physicians were interviewed in hospitals from 10 provinces in China. Burnout was measured using the Chinese version of the Maslach Burnout Inventory-General Survey. Overall, 1,537 physicians were included in this study. Of these, 76.9% reported some burnout symptoms or serious burnout symptoms and 54.8% reported committing medical mistakes during the last year. 39.6%, 50.0%, and 59.5% of the respondents in primary, secondary, and tertiary hospitals respectively reported having made mistakes over the course of the previous year. Multivariate analysis demonstrated that being female was protective against medical mistakes (OR = 0.72, 95% CI: 0.58-0.89), whereas physician-reported 60 or more work hours per week (OR = 1.65, 95% CI: 1.22-2.22), and physicians who reported serious burnout (OR = 2.28, 95% CI: 1.63-3.17) were independently associated with higher incidence of medical mistakes. In conclusion, Chinese physicians reported high workloads, high rates of burnout and high medical mistakes. Physicians in tertiary hospitals were especially overworked and suffered the most serious burnout. Longer work hours per week, and burnout were the independent risk factors for medical mistakes.**

Keywords: Workload, burnout, medical mistakes, physicians, cross-sectional study

1. Introduction

China is facing great pressure in providing quality care for patients in a landscape where available healthcare resources are limited. However, resource waste is not uncommon in the Chinese healthcare system. According to the 2012 Health Statistical Report made by Ministry of Health in China, bed utilization rate was 58.9% in primary hospitals while the rate was 104.5% in tertiary hospitals. One of the reasons why bed utilization rates are low in primary hospitals is that some patients do not trust the community or township hospital (*1,2*), resulting in everyday overcrowding in Chinese secondary or tertiary hospitals with relatively few patients seeking treatment in primary hospitals. The gap between healthcare demand and supply has caused Chinese healthcare providers in the secondary and tertiary setting to become overworked (*3*), and leads to an intensive relationship between physicians and patients. The last decade has been witness to a number of doctors in China being killed by their patients.

One common consequence of long hours is physician burnout. This term was originally coined by Freudenberger and Richelson based on psychoanalytical case studies, with burnout manifesting itself as extreme physical and emotional exhaustion, often unrecognized by the individual (*4*). Maslach (*5,6*) provided a more detailed account of burnout syndrome based upon qualitative and quantitative research, suggesting that the components of burnout are exhaustion, cynicism, and inefficacy.

During the last two decades, several studies have

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characterized the prevalence of healthcare provider burnout and its associated risk factors (*7-9*). However, few studies have examined the impact of physician burnout on healthcare practice and no studies have examined differential burnout rates by hospital characteristics. The purpose of this study is to reveal the severity of burnout among physicians in different grades of hospitals in China, and the impact physician burnout has on the occurrence of medical mistakes.

2. Methods

The Institutional Review Board (IRB) of West China Hospital in Sichuan University approved this study. As the survey was anonymous it is impossible to adopt written informed consent. Oral informed consent was approved by the IRB and obtained from each subject. An informed consent form was presented on the cover of the questionnaire. Once a questionnaire was completed we consider that the participant has orally agreed to participate in the survey.

2.1. *Study design and participants*

A multi-center cross-sectional survey was conducted in China from November to December 2013. Physicians in hospitals from 10 provinces (Sichuan, Chongqing, Gansu, Guizhou, Guangdong, Shanxi, Hu'nan, Zhejiang, Yunnan, and Ningxia) were selected. Overall 12 tertiary, 9 secondary, and 25 primary hospitals were included in this study. For any secondary or tertiary hospital, we required selecting physicians from at least 10 clinical departments and no less than 10 persons in each age group (across a total of 4 age groups). For primary hospitals, all on-duty physicians were included in the survey.

2.2. *Measures*

Workload was measured by two indicators. The first was work hours per week, and the second was number of daily service patients. Medical mistakes include self-report of any of the following: *i*) patient was harmed, *ii*) medication errors, *iii*) treatment delayed, and *iv*) incomplete or incorrect item in the patient's record.

Burnout was measured with the Chinese version of Maslach Burnout Inventory-General Scale (MBI-GS) (*10*) which includes 15 items for measuring the three dimensions of burnout: exhaustion (5 items), cynicism (4 items), and reduced professional efficacy (6 items). The 6 items of reduced professional efficacy were reverse scored (Supplement Table 1). The following equation was used to produce the weighted sum score of the scale (*11*):

$$0.40 \times exhaustion + 0.30 \times cynicism + 0.30 \times reduced\ professional\ efficacy$$

Physician participants were then divided into three groups on the basis of their syndrome score (range 0-6). Group 1: No burnout symptoms (scores 0-1.49); group 2: Some burnout symptoms (scores 1.50-3.49), and group 3: Serious burnout symptoms (scores 3.50-6). The categorization means that the symptoms in group 1 were experienced on average a few times per year or never, in group 2 a few times per month or nearly weekly, and in group 3 several times per week or daily.

2.3. *Data Collection*

We took several precautions to address potential sources of bias and ensure the quality of this study. When developing the questionnaire, we organized an inter-disciplinary group to review the questions in order to ensure the items were easily understandable. The self-reported questionnaire with instructions was developed to collect information on demographic characteristics, workload, burnout, and medical mistakes of each participant. Investigators at each center received critical training prior to the formal investigation, and were responsible for the completeness of the questionnaires. Participant physicians were ineligible if he/she was an intern. Informed consent was obtained from each subject. The eligible questionnaire should have been completed with no errors of logic, otherwise it was excluded.

2.4. *Statistical Analysis*

Missing data, if it existed, would be described as the number and proportion. We did not use imputation technique for addressing the missing data because participants may differ dramatically in characteristics given our experience. Frequencies, percentages, means and standard deviations were calculated for descriptive data, ANOVA were used to evaluate differences in continuous variables, and Chi-square tests were used to test for significance in categorical data. Forward stepwise multivariate logistic regression was used to identify risk factors for medical mistakes. A p-value of < 0.05 was considered to be statistically significant. Data were analyzed using SPSS version 17.0 (SPSS Inc, Chicago, Ill).

3. Results

One thousand eight hundred questionnaires were issued in total, and 1,607 were collected (response rate, 89.3%). The reason for non-responders was that they were too busy to fill out the questionnaires. Of the 1,607 respondent questionnaires, 70 did not meet the eligible criteria and were excluded. Overall, 1,537 physicians were included in this study. Of them, 57.3% were male, 73.4% were married, 14.7% reported either some college or lower education. Of the physicians who responded, 46.9% were junior professional title;

Table 1. Physician's characteristics among different grade hospitals in China

Items	Primary (n = 192)	Secondary (n = 354)	Tertiary (n = 991)	p
Age (mean ± SD)	36.5 ± 9.9	35.9 ± 9.4	35.5 ± 8.0	0.299
Age group, n (%)				0.057
< 30	50 (26.0)	90 (25.4)	252 (25.4)	
30-39	81 (42.2)	161 (45.5)	439 (44.3)	
40-49	35 (18.2)	69 (19.5)	232 (23.4)	
≥ 50	26 (13.5)	34 (9.6)	68 (6.9)	
Gender, n (%)				0.025
Male	104 (54.2)	189 (53.4)	603 (60.8)	
Female	88 (45.8)	165 (46.6)	388 (39.2)	
Marriage, n (%)				0.250
Unmarried/divorced/widowed	42 (21.9)	93 (26.3)	274 (27.6)	
Married	150 (78.1)	261 (73.7)	717 (72.4)	
Education, n (%)				< 0.001
High school or lower	33 (17.2)	13 (3.7)	7 (0.7)	
Some college	90 (46.9)	59 (16.7)	25 (2.5)	
Bachelor's degree	67 (34.9)	260 (73.4)	455 (45.9)	
Master's degree or higher	2 (1.0)	22 (6.2)	504 (50.9)	
Professional title, n (%)				< 0.001
Junior	135 (70.3)	169 (47.7)	417 (42.1)	
Middle	47 (24.5)	126 (35.6)	296 (29.9)	
Senior	10 (5.2)	59 (16.7)	278 (28.0)	

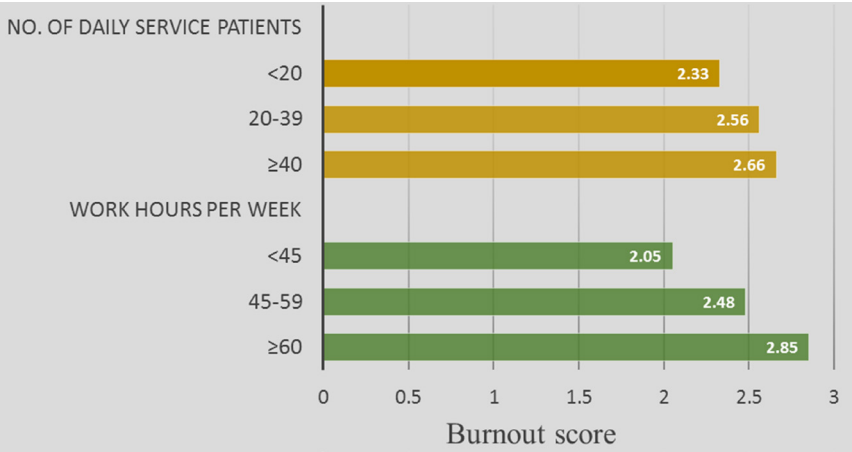

Figure 1. Burnout score distribution in number of daily service patients and work hours per week.

and their mean (SD) age was 35.8 (8.6) years (range, 20-73 years). More detailed information on participants' characteristics among the different grade hospitals in China has been presented in Table 1.

Overall, 76.9% of all physicians reported either some burnout symptoms or serious burnout and 54.8% of physicians reported committing medical mistakes over the course of the previous year. The average work hours per week (mean ± SD) were 54.1 ± 10.7 and the average number of daily service patients (mean ± SD) was 27.8 ± 25.1. In addition, Figure 1 revealed that work hours per week and number of patients for daily service were positively correlated with burnout score (both $p < 0.001$).

Table 2 shows physician reported workload, burnout, and mistakes among different hospital grades in China. The average work hours per week (mean ± SD) were 46.6 ± 9.1, 52.2 ± 11.5, and 56.2 ± 9.9 ($p < 0.001$), and the average number of daily service patients (mean ± SD) were 15.3 ± 13.2, 22.8 ± 18.3, and 32.1 ± 27.7 ($p < 0.001$) in primary, secondary, and tertiary hospitals, respectively. When categorized for work hours per week, the percentage of no less than 60 work hours a week average for a physician in a tertiary hospital (31.8%) was the highest; and when grouped with the patient number for daily service, that was no less than a 40 patient number a day average for a physician in a tertiary hospital (29.8%) also appeared the greatest workload. Meanwhile, proportions of physicians with some burnout symptoms were 52.6%, 59.0%, and 56.0%; and those of physicians with serious burnout were 10.9%, 17.3%, and 23.7% ($p < 0.001$) in primary, secondary, and tertiary hospitals, respectively. Similarly, the burnout score was highest in tertiary hospitals (2.6 ± 1.1), followed by secondary (2.4 ± 1.1) and primary (2.0 ± 1.2) hospitals. In regard

Table 2. Physician's workload, burnout, and mistakes among different grade hospitals in China

Items	Primary (n = 192)	Secondary (n = 354)	Tertiary (n = 991)	p^*
Workload				
Work hours per week (mean ± SD)	46.6 ± 9.1	52.2 ± 11.5	56.2 ± 9.9	< 0.001
Work hour group per week, n (%)				< 0.001
< 45	139 (72.4)	132 (37.3)	206 (20.8)	
45-59	37 (19.5)	148 (41.7)	470 (47.4)	
≥ 60	16 (8.1)	74 (21.0)	315 (31.8)	
Patient number of daily service (mean ± SD)	15.3 ± 13.2	22.8 ± 18.3	32.1 ± 27.7	< 0.001
Patient number group of daily service, n (%)				< 0.001
< 20	132 (68.5)	176 (49.7)	367 (37.0)	
20-39	46 (23.9)	114 (32.2)	329 (33.2)	
≥ 40	14 (7.6)	64 (18.1)	295 (29.8)	
Burnout score (mean ± SD)	2.0 ± 1.2	2.4 ± 1.1	2.6 ± 1.1	< 0.001
Burnout category, n (%)				< 0.001
No burnout	70 (36.5)	84 (23.7)	201 (20.3)	
Some burnout symptoms	101 (52.6)	209 (59.0)	555 (56.0)	
Serious burnout	21 (10.9)	61 (17.3)	235 (23.7)	
Mistakes, n (%)				< 0.001
No	116 (60.4)	177 (50.0)	401 (40.5)	
Yes	76 (39.6)	177 (50.0)	590 (59.5)	
Mistakes by subtypes, n (%)				
Patient was harmed	21 (10.9)	35 (9.9)	121 (12.2)	0.484
Medication errors	5 (2.6)	18 (5.1)	77 (7.8)	0.014
Treatment delayed	23 (12.0)	38 (10.7)	155 (15.6)	0.050
Incomplete or incorrect item in patient's records	64 (33.3)	163 (46.0)	530 (53.5)	< 0.001

*The p value means the statistical difference among the three grade hospitals.

to self-reported medical mistakes, 39.6%, 50.0%, and 59.5% of the respondents in primary, secondary, and tertiary hospitals reported having made mistakes over the course of the last year. For subtypes of mistakes, incomplete or incorrect items in patient's records are the most common mistakes (occurrence rates were 33.3%, 46.0%, and 53.5% in primary, secondary, and tertiary hospitals, respectively, $p < 0.001$). Meanwhile, the proportion of medication errors and delayed treatments were higher in tertiary hospitals ($p = 0.014$ and 0.050, separately).

The results of univariate analysis for risk factors associated with medical mistakes are shown in Table 3. Medical mistakes were significantly lower among females (OR = 0.68, 95% CI: 0.55-0.83) and higher among those with a Bachelor's degree (OR = 2.43, 95% CI: 1.35-4.38) and Master's degree or higher (OR = 2.68, 95% CI: 1.48-4.85), those with longer work hours per week, those who reported suffering some burnout symptoms (OR = 1.57, 95% CI: 1.23-2.02), those reporting suffering serious burnout symptoms (OR = 2.79, 95% CI: 2.03-3.83), and those who worked at secondary hospitals (OR = 2.25, 95% CI: 1.63-3.08) and tertiary hospitals (OR = 1.53, 95% CI: 1.07 -2.18).

In the multivariate analysis, being female was protective against medical mistakes (OR = 0.72, 95% CI: 0.58- 0.89), whereas physician -reported 45 to 59 work hours per week (OR = 1.40, 95% CI: 1.08-1.81), physcician-reported 60 or more work hours per week (OR = 1.65, 95% CI: 1.22-2.22), physicians who reported some burnout symptoms (OR = 1.46, 95% CI: 1.13-1.89) and physicians who reported serious burnout (OR = 2.28, 95% CI: 1.63-3.17) and physician who worked at secondary hospitals (OR = 1.58, 95% CI: 1.12-2.23) were independently associated with a higher incidence of medical mistakes (Table 3).

4. Discussion

Physician burnout is not only a critical issue involving physician health, but also that of patient safety. This multicenter cross sectional survey revealed that being male, longer work hours per week, and increased burnout symptoms were all risk factors for medical mistakes. Meanwhile, doctors in tertiary hospitals were most overworked, suffered the most serious burnout, and made the most mistakes, while those in primary hospitals were least overworked, with least burnout symptoms, and made the least mistakes. However, overall, the absolute workload, prevalence of burnout, and medical mistakes among physicians in China were consistently high.

The heavy workload of hospital physicians is a major problem for the Chinese health care system. This study showed that physicians' mean work hours per week were 54.1, similar to another report (*12*). However, the mean work hours reflected the fact that many doctors work long hours each day, and this could potentially impact many components of healthcare such as patient satisfaction, outcomes of disease, prescribing practice, physician satisfaction, and risk of malpractice claims (*13*). Unfortunately, most decision makers and hospital administrators are unaware or have potentially ignored the impact of over-worked healthcare

Table 3. Risk factors of medical mistakes by logistic stepwise regression

Items	Univariate analysis			Adjusted analysis		
	OR	95% CI	*p*	OR	95% CI	*p*
Gender						
Male						
Female	0.68	0.55-0.83	< 0.001	0.72	0.58-0.89	0.003
Age (year)						
< 30						
30-39	1.06	0.83-1.36	0.647			
40-49	0.93	0.70-1.25	0.648			
≥ 50	0.68	0.46-1.01	0.056			
Marital status						
Unmarried/divorced/widowed						
Married	0.91	0.73-1.15	0.439			
Education						
High school or lower						
Some college	1.81	0.95-3.45	0.069			
Bachelor's degree	2.43	1.35-4.38	0.003			
Master's degree or higher	2.68	1.48-4.85	0.001			
Professional title						
Junior						
Middle	1.03	0.82-1.31	0.750			
Senior	0.93	0.72-1.21	0.621			
Work hours per week						
< 45						
45-59	1.70	1.35-2.16	< 0.001	1.40	1.08-1.81	0.010
≥ 60	2.29	1.75-3.00	< 0.001	1.65	1.22-2.22	0.001
No. of daily service patients						
< 20						
20-39	1.10	0.87-1.39	0.411			
≥ 40	0.98	0.75-1.26	0.867			
Burnout						
No burnout						
Some burnout symptoms	1.57	1.23-2.02	< 0.001	1.46	1.13-1.89	0.004
Serious burnout	2.79	2.03-3.83	< 0.001	2.28	1.63-3.17	< 0.001
Hospital level						
Primary						
Secondary	2.25	1.63-3.08	< 0.001	1.58	1.12-2.23	0.010
Tertiary	1.53	1.07-2.18	0.020	1.19	0.82-1.74	0.345

Abbreviations: CI, confidence interval; OR, odds ratio.

providers in China, which has potentially contributed to highly intense doctor-patient relationships and might partially explain why attacks on medical personnel by dissatisfied patients has become more common in China (*14*).

Meanwhile, the number of patients one doctor can manage is another concern. Our research revealed that the average number of patients managed per shift was 27.8. Currently, there are no standard recommendations that address the daily maximum number of patients one doctor should manage per shift. Using data from the online physician network QuantiaMD, Johns Hopkins researchers found physicians said they could safely see 15 patients per shift (*15*). Healthcare providers and administrators need to keep in mind that the goal of healthcare is not just to see patients, but to make the right decisions and management.

Burnout is also common among physicians internationally. In the United States, it is estimated 30% to 40% of clinicians experienced burnout (*16*). Shanafelt and colleagues (*17*) reported that more than 75% of their study participants met the criteria for burnout. Another review presented that there are reports of burnout in 25-60% of doctors (*18*). This empirical study found that overall 76.9% of participants suffered from some burnout symptoms or serious burnout symptoms, demonstrating that burnout among Chinese doctors is an area of concern.

Medical errors or mistakes are another common concern internationally. The IOM revealed that up to 98 000 patients die each year in the hospital as a result of preventable medical errors (*19*). Many aspects of patient care may be compromised by burnout. Physicians who have burnout are more likely to report making recent medical errors or mistakes, and burnout has been associated with reduced patient satisfaction with medical care and patient adherence to treatment plans (*16,20-23*). However, few empirical studies provide solid evidence for the relationship between burnout and medical errors. Our paper revealed that over half of physicians admitted that they had made mistakes over the course of the last year, and

the logistic regression analysis showed that being male, working greater than 45 hours per week, and burnout symptoms were independently associated with increased physician-reported mistakes. The above evidence suggests that medical facility decision makers should consider interventions to reduce clinician workload and associated burnout for the safety of their patients and physicians.

Some of the findings deserve to be discussed here. Logistic regression revealed that medical mistakes were significantly lower among females, which possibly relates to an important female characteristic-carefulness. Though univariate analysis showed that medical mistakes were higher among those with a Bachelor's degree and Master's degree or higher, multivariate analysis denied the relation. Another interesting finding is that after multivariate analysis, physicians who worked at a tertiary hospital were not indicated as an independent risk factor associated with higher incidence of medical mistakes while those who worked at a secondary hospital were identified as a risk factor. Although the physician working at a tertiary hospital showed the highest average workload and burnout symptoms, heavy workload and serious burnout do not necessarily result in medical mistakes. Furthermore, this finding was also potentially associated with the fact that in China tertiary hospitals usually have a higher management capability which could prevent the occurrence of mistakes.

Though several studies have examined physician burnout, no previous work has analyzed the reported burnout prevalence among different hospital levels. A significant finding of this paper is that there were statistical differences in workload, burnout, and mistakes among primary, secondary, and tertiary hospitals in China. The bigger or more advanced hospitals were found to be associated with increased workload, reported burnout, and reported mistakes. There are several factors that might contribute to this finding. On the one hand, China does not have a policy to encourage patients to initially see a doctor in community clinics or a primary hospital, which means a patient can choose any level hospital in which to seek care. Many people in China do not trust the care quality in community clinics or primary hospitals (*1,2*). In some cases, self-treatment is still the first choice for patients, especially in remote rural areas. If self-treatment fails, then a patient might then choose to go to the best hospital (usually a tertiary hospital), if it is accessible and affordable, to see a doctor. These factors have led to shorter available management time for patients at larger hospitals, which can result in inadequate physician-patient communication. The current doctor-patient relationship in China is highly volatile. Doctors have been abused, injured, and even murdered by patients or relatives of patients in hospitals and clinics across the country (*14*). Evidence showed that about 80% of the physical attacks occurred in tertiary hospitals (*24*).

One limitation of this study was that the medical mistakes were self-reported, which might lead to unreliable findings. However, participants are more likely to underestimate rather than overestimate the number of mistakes they made in the past year. Another limitation is that the study design was not random and consisted of a convenient sample which could potentially impact the findings of this paper in that participants were biased in their responses by their inclusion in the study. Nevertheless, our study is a multi-center design and we developed sampling requirements before implementing the formal investigation and thus believe the sample in this paper should be a fair representation of the general population of Chinese physicians.

Currently, patient-centered care is the primary goal of each hospital. The reality of this model will require healthcare providers taking more time to communicate with patients. However, our findings revealed that more work hours were associated with an increase in the incidence of medical mistakes. Therefore, reducing individual clinician work hours is an urgent issue in China. To date, no regulations have been implemented or formally called for regarding the capping of physician work hours in China. Considering the large healthcare demand in China, it will be difficult to take measures to reduce physician workload and burnout within a single hospital. Policy makers and health insurance companies should work in collaboration with hospitals and healthcare provider professional groups to determine optimal workloads, and develop some national guidelines or policies to encourage patients to see doctors in different level hospitals according to their own illness severity. Doing so could finally promote quality of care, prevent burnout, and achieve patient safety.

To better manage physicians, it should be born in mind that heavy workload could be a risk factor for burnout, and both heavy workload and burnout could result in medical mistakes.

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Supplement Data

Supplement Table 1. Original scores of MBI-GS 15 items in different grade hospitals in China (mean ± SD)

Items	Primary (*n* = 192)	Secondary (*n* = 354)	Tertiary (*n* = 991)	Total (*n* = 1,537)
1. I feel emotionally drained from my work	2.50 ± 1.68	3.26 ± 1.65	3.66 ± 1.59	3.42 ± 1.66
2. I feel used up at the end of the day	2.46 ± 1.77	3.50 ± 1.69	3.93 ± 1.59	3.64 ± 1.71
3. I feel tired when I get up in the morning and have to face another day at work	2.45 ± 1.82	3.23 ± 1.79	3.63 ± 1.77	3.38 ± 1.82
4. Working with people all day is a real strain for me	2.37 ± 1.79	3.09 ± 1.81	3.57 ± 1.73	3.31 ± 1.80
5. I feel burned out from my work	1.70 ± 1.79	2.24 ± 1.78	2.63 ± 1.81	2.42 ± 1.82
6. I have become more callous toward work since I took this job	1.83 ± 1.87	2.20 ± 1.76	2.51 ± 1.83	2.35 ± 1.84
7. I have become less enthusiastic about my work	1.60 ± 1.67	2.10 ± 1.81	2.42 ± 1.82	2.25 ± 1.82
8. I doubt the significance of my work	1.63 ± 1.79	2.10 ± 1.86	2.24 ± 1.89	2.13 ± 1.88
9. I have become more and more indifferent in the contribution of my job	1.49 ± 1.68	2.09 ± 1.93	2.31 ± 1.99	2.16 ± 1.96
10. I deal effectively with the problems of clients	3.77 ± 2.11	4.29 ± 1.88	4.50 ± 1.57	4.36 ± 1.73
11. I feel that I am contributing to my company	4.00 ± 2.11	4.32 ± 1.87	4.31 ± 1.81	4.27 ± 1.87
12. In my opinion, I am good at my job	4.06 ± 2.11	4.34 ± 1.79	4.41 ± 1.61	4.35 ± 1.72
13. I feel very happy when I accomplish some tasks of my job	4.00 ± 2.14	4.24 ± 1.83	4.33 ± 1.62	4.27 ± 1.74
14. I have accomplished many worthwhile things in this job	3.71 ± 2.13	4.20 ± 1.82	4.28 ± 1.60	4.19 ± 1.73
15. I am confident that I can accomplish all tasks effectively	4.04 ± 2.05	4.48 ± 1.65	4.35 ± 1.54	4.34 ± 1.64

Items 1 to 5 reflect exhaustion, 6 to 9 refer to cynicism, and 10 to 15 relate to reduced professional efficacy.