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Review article

Burnout among doctors in China through 2020: A systematic review and meta-analysis

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ABSTRACT

Objective: To analyze surveys measuring the prevalence of burnout among Chinese doctors and reveal the overall prevalence, characteristics, timeline, and factors related to burnout.

Methods: A comprehensive search was conducted on China National Knowledge Infrastructure, WANFANG, PubMed, EMBASE, PsycINFO and Cochrane Library databases from their inception to 28 February 2021. Random-effects meta-analyses, meta-regression and planned subgroup analyses were performed, and the standardized mean difference was adopted for comparisons between subgroups. Egger's and Begg's tests were performed to evaluate publication bias. Heterogeneity across the studies was tested using the I^2 statistic. The study protocol was registered on PROSPERO (CRD42018104249).

Results: In total, 3,210 records were reviewed; 64 studies including 48,638 Chinese doctors were eligible for meta-analysis. The prevalence of burnout increased continuously from 2008 to 2017 and decreased significantly from 2018 to 2020, a little increase from 2020 to 2021. The overall prevalence of burnout was 75.48% (95% CI, 69.20 to 81.26; $I^2 = 99.23\%$, $P < 0.001$), and high burnout was 9.37% (95% CI, 4.91 to 15.05, $I^2 = 98.88\%$, $P < 0.001$). The prevalence of emotional exhaustion was 48.64% (95% CI, 38.73 to 58.59; $I^2 = 99.53\%$, $P < 0.001$), depersonalization was 54.67% (95% CI, 46.95 to 62.27; $I^2 = 99.20\%$, $P < 0.001$), and reduced personal accomplishment was 66.53% (95% CI, 58.13 to 74.44; $I^2 = 99.37\%$, $P < 0.001$). Gender, marriage, professional title and specialty all influenced burnout.

Conclusions: The results showed that the total prevalence of doctor burnout in China is very high. The prevalence of burnout varies by location. Gender, marital status and professional title all affect burnout scores.

1. Introduction

Burnout is a syndrome resulting from overload and stress during work (Peters and Rajasingam, 2019). Maslach characterized burnout according to 3 dimensions, namely, emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (PA) (Maslach et al., 2001), and developed the Maslach Burnout Inventory (MBI) to measure these dimensions. Health care providers are highly prone to burnout, with burnout prevalence being twice as high as that of other professions (Coombs et al., 2019), and the burnout of doctors has become a focus of public health (Chemali et al., 2019; Kopacz et al., 2019). In the United States, 54.4% of physicians had at least one symptom of burnout (Shanafelt et al., 2015), and the burnout prevalence among doctors was as high as 50% (Chambers et al., 2016) in New Zealand, 49% (Kansoun et al., 2019) in France. While in China, 53.2% of neurologists and 69% of anesthesiologists experienced burnout (Zhou et al., 2017) (Li et al.,

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2018), and 85.1% of surgeons met criteria of burnout (Zheng et al., 2018). The prevalence was markedly higher than that in Western countries.

In China, for every 1000 people, there are only 1.2 doctors to provide health care services, while these values were 2.5 and 3.9 in the United States and Germany, respectively (Organization, 2015). Over the past decades, the increasing health care demand driven by the improving economy has led to an excessive burden on Chinese doctors (Li et al., 2018; Wang et al., 2012). Meanwhile, the health budget from the government has been decreasing (X et al., 2000), and violence against doctors has been increasing in recent decades. Among Chinese doctors, one-third had experienced conflict with patients, and thousands have been injured; the scale, frequency, and viciousness of attacks have shocked the world (L.E, 2014). All these factors might induce job burnout. Burnout not only negatively affects the well-being of health care practitioners but also elevates the risk of major medical errors (Kivimaki et al., 2015; Shanafelt et al., 2002; Tawfik et al., 2018), deteriorates the relationship between doctors and patients and ultimately forms a vicious circle of burnout and suboptimal health care.

Though high rates of doctor burnout in different Chinese regions or groups of doctors have been reported for decades, most data are derived only from regional annual surveys, particular subtypes of doctors (neurologists, anesthesiologists, etc.), or limited samples (Li et al., 2018; Wen et al., 2016; Zheng et al., 2018; Zhou et al., 2017). However, no comprehensive analysis in studies surveying Chinese doctor's burnout has been conducted to reflect the nationwide status and the dynamic annual trend on which the changing of public attitude and government policies might influence (Bo et al., 2020; Ma et al., 2020). To the best of our knowledge, only one systematic review including 11 studies reported in English was published, and no meta-analysis has been conducted (Lo et al., 2018). In view of this situation, we conducted a systematic review and meta-analysis to analyze studies measuring the prevalence of burnout among Chinese doctors using the Maslach burnout scales and to reveal the overall prevalence, characteristics, timeline, and factors related to burnout. Analyzing the overall burnout rate is of great importance for establishing strategies or policies to reduce burnout among Chinese doctors and improve the quality of medical services.

2. Methods

The protocol was registered on PROSPERO (CRD42018104249) in advance and was published (Zheng et al., 2019). This systematic review and meta-analysis is reported according to the Meta-analyses of Observational Studies in Epidemiology (MOOSE) guidelines and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2015; Stroup et al., 2000).

2.1. Search strategy

QZ (an author) conducted a comprehensive search without data limits in the China National Knowledge Infrastructure, WANFANG, PubMed, EMBASE, PsycINFO and Cochrane Library databases from their inception to 28 February 2021. An information professional (XW, an author) developed search terms and combined overlapping areas with key words such as Chinese doctor or physician and burnout or job burnout. The MeSH terms and related keywords are shown in Appendix 1. We reduced publication bias by searching conference records and unpublished literature and using forward and backward citation tracking for included records.

2.2. Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) studies involving Chinese doctors; (2) observational studies; (3) studies published in English or Chinese; (4) studies that used the following 3 validated scales: Maslach Burnout Inventory-General Survey (MBI-GS), Maslach Burnout Inventory-Human Services Survey (MBI-HSS), or Chinese Maslach Burnout Inventory (CMBI); (5) studies that provided the necessary data. Studies were included if they met all 5 of the above conditions.

The exclusion criteria were as follows: (1) studies including medical technicians and paramedics; (2) duplicate publications; (3) studies without sufficient data for the meta-analysis. Records were excluded if they met any of the above criteria.

2.3. Job burnout scale

The MBI-HSS scale includes 22 items scored from 0 to 6 (Maslach et al., 1996). The MBI-GS scale includes 15 items scored from 0 to 6 (Maslach et al., 2001). The CMBI scale includes 15 items scored from 1 to 7 (Yongxin, 2003). In the analysis, we respectively analyzed data from studies using the MBI-HSS, CMBI, and MBI-GS. According different assessment standards applied in studies, we further classified the MBI-GS scale as either MBI-GS-A or MBI-GS-B or MBI-GS-C, and the MBI-HSS scale as either MBI–HSS–A or MBI–HSS–B. Detailed descriptions of the scales and the assessment standards are shown in Appendix 2.1-2.3.

2.4. Identification and data extraction

The selected studies were screened in four stages. QZ imported the title and abstracts of identified records into EndNote Software (version X8, Thomson Scientific, USA) and screened them to exclude duplicates and irrelevant studies. In the next stage, QZ and XP S (two authors) independently reviewed the full text of the selected articles for eligibility assessment and examined them according to the inclusion and exclusion criteria.

The data from the included studies were extracted by QZ and added to an Excel table containing the following variables: author name, publication year, research design, region, number of participants, number of doctors exhibiting burnout, burnout score, burnout scale, gender, marital status, professional title, speciality and methodological quality. The discrepancies were resolved through a consensus discussion with a third author (PP). The level of consistency between QZ and XP S was 90%. When the presented data were not clear, one author (XW) contacted the authors by email or telephone. In 7 instances (Hongyan et al., 2016; Hui and Ning, 2008; Li et al., 2013; Lingyun, 2015; Nengzhi et al., 2010; Xiuzhen et al., 2009; Yun, 2011), clarification was obtained from the corresponding author. A random subsample of 20% of the data used for the meta-analysis was examined by ZH O (an author).

2.5. Quality assessment

Because all studies were observational, the quality of the included studies was evaluated with reference to the quality evaluation standard for observational studies proposed by Hoy et al. (2012). The scale includes 11 items. The answer "yes" is scored 1 point, and "no" or "not clear" is scored as 0 points. In this study, the articles were classified as having "excellent" (10–11 points), "good" (7–9 points), "weak" (4–6 points) or "poor" (0–3 points) methodological quality. QZ completed the full quality assessment, and ZH O independently double-checked the accuracy.

2.6. Statistical analysis

2.6.1. Assessment of heterogeneity

The heterogeneity across the studies was assessed by determining the I^2 statistic (Huedo-Medina et al., 2006) and the underlying theoretical model and whether study-to-study variability, to quantitatively measure the inconsistency across studies. Exploratory subgroup and meta-regression analyses were conducted to examine the possible sources of heterogeneity, and sensitivity analyses were performed to assess the robustness and stability of the results. We choice the random-effects

because the expectation of study effects is unlikely identical and the variability across the studies is expected.

2.6.2. Assessment of reporting biases

Reporting biases were assessed by scrutinizing the protocols of the included studies. Potential publication bias was assessed by visually inspecting the funnel plots and quantified by Egger's and Begg's tests.

2.6.3. Data synthesis

The pooled estimates of the outcomes are expressed as percentages with 95% confidence intervals (CIs). Meta-regression analysis was performed to explore the time trend based on the publication year.

The standardized mean difference (SMD) was calculated through the estimated mean difference between the two groups divided by the mean standard deviation (SD) because it can eliminate the influence of the magnitude caused by the different burnout scales (Takeshima et al., 2014).

All analyses were performed with Stata Statistical Software (version 14.0, Stata Corp, College Station, Texas, USA). Visualization was performed with R software (R Foundation for Statistical Computing, Vienna, Austria, version 3.6.1). All analyses were 2-tailed, and a P value < 0.05 was considered statistically significant. The details of the whole meta-analysis procedure are shown in the Appendix 3.

3. Results

3.1. Literature search

We identified 3,210 records through database searches and 64 studies were eventually included in the meta-analysis (Chenliang, 2019; Dianzhen, 2013; Diwen et al., 2019; Enfang and Yan, 2017; Fuyingcong, 2012; Gang and Lijun, 2020; Hao, 2012; Haoyun et al., 2019; Hongyan et al., 2016; Hongyao, 2017; Houyuan, 2014; Huang et al., 2020; Huaqing and Zuomiao, 2011; Hui and Ning, 2008; Huimin et al., 2019; Jing and Yujian, 2017; Jingquan and Wenxiu, 2018; Lei et al., 2015; Li et al., 2013, 2018; Lianhong et al., 2015; Limei and Congying, 2020; Lingyun, 2015; Liqun and Lin, 2020; Lu et al., 2016; Ma et al., 2020; Meng, 2016; Meng et al., 2018; Mengying et al., 2019; Miao et al., 2012; Mingke et al., 2011; Nengzhi et al., 2010; Pu et al., 2017; Qiuyu, 2020; Shanshan and Li, 2020; Sun et al., 2012; Suqiu, 2019; Tieshuang, 2010; Tingmei, 2016; Wang et al., 2012, 2020a, 2020b, 2021; Weiye et al., 2018; Wen et al., 2016; Wencheng, 2011; Wenxuan et al., 2016; Xi et al., 2020; Xia et al., 2007; Xiao et al., 2014; Xiaojuan and Fuzhong, 2015; Xiaoyan et al., 2019; Xiuzhen et al., 2009; Yanli, 2012; Yanling et al., 2019a; Ye et al., 2019; Yiyi and Liping, 2016; Yu, 2015; Yuan, 2009; Yuanbin, 2005; Yun, 2011, 2017; Zheng et al., 2018; Zhou et al., 2020). The detailed procedure is presented in Figure 1.

The descriptive characteristics of the included studies are presented in Table 1. 50 studies (78%) were published in Chinese, with 14 studies (22%) in English. The studies were published from 2005 to 2021, and included cities throughout China. The included studies involved a total of 48,638 Chinese doctors, and the median number of samples was 760 (range, 68–5,558). Of the 64 studies, 63 were cross-sectional studies, and 1 was a prospective study. Twenty-three studies used the MBI-HSS scale, 23 studies used the MBI-GS scale, and 18 studies used the CMBI scale. The mean quality score was 7.92 (range, 7–9).

3.2. Prevalence estimates

3.2.1. Total prevalence of burnout

Thirty-two studies including 27,130 Chinese doctors reported the prevalence of burnout as dichotomous data (Diwen et al., 2019; Enfang and Yan, 2017; Hao, 2012; Haoyun et al., 2019; Hongyan et al., 2016; Hongyao, 2017; Houyuan, 2014; Huang et al., 2020; Hui and Ning, 2008; Huimin et al., 2019; Jingquan and Wenxiu, 2018; Lei et al., 2015; Li et al., 2013; Lingyun, 2015; Ma et al., 2020; Meng, 2016; Miao et al., 2012; Mingke et al., 2011; Nengzhi et al., 2010; Pu et al., 2017; Shanshan and Li, 2020; Wang et al., 2020a, 2021; Wen et al., 2016; Xi et al., 2020; Xiaoyan et al., 2019; Xiuzhen et al., 2009; Ye et al., 2019; Yun, 2011, 2017; Zheng et al., 2018; Zhou et al., 2020) (Table 2 and Appendix 4.1). Based on the use of different burnout scales and evaluation criteria, we divided the total burnout rate into 4 subgroups. The prevalence of burnout was 67.25% (95% CI, 51.60 to 81.17; $I^2 = 99.16\%$, $P < 0.001$) in studies with the MBI-HSS scale, 82.02% (95% CI, 68.62 to 92.31; $I^2 = 99.16\%$, $P < 0.001$) in studies with the MBI-GS-A scale, 63.01% (95% CI, 40.60 to 82.83; $I^2 = 99.32\%$, $P < 0.001$) in studies with the MBI-GS-B scale, and 80.12% (95% CI, 72.55 to 86.74; $I^2 = 98.78\%$, $P < 0.001$) in studies with the CMBI scale. The total prevalence of burnout among Chinese doctors was 75.48% (95% CI, 69.20 to 81.26; $I^2 = 99.23\%$, $P < 0.001$).

Of the 32 studies, 19 studies including 12,056 Chinese doctors reported the prevalence of different degrees of burnout as dichotomous data (Diwen et al., 2019; Enfang and Yan, 2017; Hao, 2012; Haoyun et al., 2019; Hongyan et al., 2016; Houyuan, 2014; Hui and Ning, 2008; Lei et al., 2015; Lingyun, 2015; Meng, 2016; Miao et al., 2012; Mingke et al., 2011; Nengzhi et al., 2010; Shanshan and Li, 2020; Xi et al., 2020; Xiaoyan et al., 2019; Ye et al., 2019; Yun, 2011, 2017). The prevalence of low and moderate burnout was 62.01% (95% CI, 54.59 to 69.15, $I^2 = 98.51\%$, $P < 0.001$), and the prevalence of high burnout was 9.37% (95% CI,4. 91 to 15.05, $I^2 = 98.88\%$, $P < 0.001$). The specific content is shown in Table 2 and Appendix 4.2-4.3.

3.2.2. Prevalence of EE\DP\reduced PA

Twenty-nine studies (Diwen et al., 2019; Enfang and Yan, 2017; Fuyingcong, 2012; Gang and Lijun, 2020; Hao, 2012; Haoyun et al., 2019; Houyuan, 2014; Huang et al., 2020; Huaqing and Zuomiao, 2011; Hui and Ning, 2008; Lei et al., 2015; Li et al., 2018; Limei and Congying, 2020; Liqun and Lin, 2020; Lu et al., 2016; Meng et al., 2018; Mengying et al., 2019; Miao et al., 2012; Tieshuang, 2010; Wang et al., 2021; Wencheng, 2011; Xia et al., 2007; Xiaojuan and Fuzhong, 2015; Yanling et al., 2019a; Yiyi and Liping, 2016; Yuanbin, 2005; Yun, 2011, 2017; Zhou et al., 2020) including 21,501 Chinese doctors provided data about the prevalence of the 3 dimensions of burnout. The overall prevalence of EE was 48.64% (95% CI, 38.73 to 58.59; $I^2 = 99.53\%$, $P < 0.001$), the overall prevalence of DP was 54.67% (95% CI, 46.95 to 62.27; $I^2 = 99.20\%$, $P < 0.001$), and the overall prevalence of reduced PA was 66.53% (95% CI, 58.13 to 74.44; $I^2 = 99.37\%$, $P < 0.001$). The details are shown in Table 2 and Appendix 4.4-4.6.

3.2.3. Subgroup, sensitivity and meta regression analyses

We explored the heterogeneity among different scales, which suggested that the different burnout scales used in studies were the source of the following heterogeneity of burnout prevalence: for reduced PA prevalence with regards to burnout, P for heterogeneity = 0.01, for low and moderate prevalence of burnout, high prevalence of burnout, the prevalence of EE with regards to burnout, and the prevalence of DP with regards to burnout, all P for heterogeneity <0.001. Only the assessment of heterogeneity of the total prevalence of burnout showed no statistical significance (P for heterogeneity = 0.18). The specific results are shown in Appendix 4.1-4.6.

Subgroup analysis was conducted according to the quality scores of the studies. There were few studies with quality scores of 9 or greater. However, the literature quality score was not a source of heterogeneity for the total prevalence of burnout (P for heterogeneity = 0.13), the prevalence of low and moderate burnout (P for heterogeneity = 0.40), the prevalence of high burnout (P for heterogeneity = 0.72), the prevalence of burnout with regard to DP (P for heterogeneity = 0.36), or the prevalence of decreased PA with regard to burnout (P for heterogeneity = 0.99), but was a source of heterogeneity for the prevalence of burnout with regard to EE (P for heterogeneity = 0.02). We also performed a meta regression with the quality score as an independent variable. The results showed that the quality score did not affect the total, low and moderate,

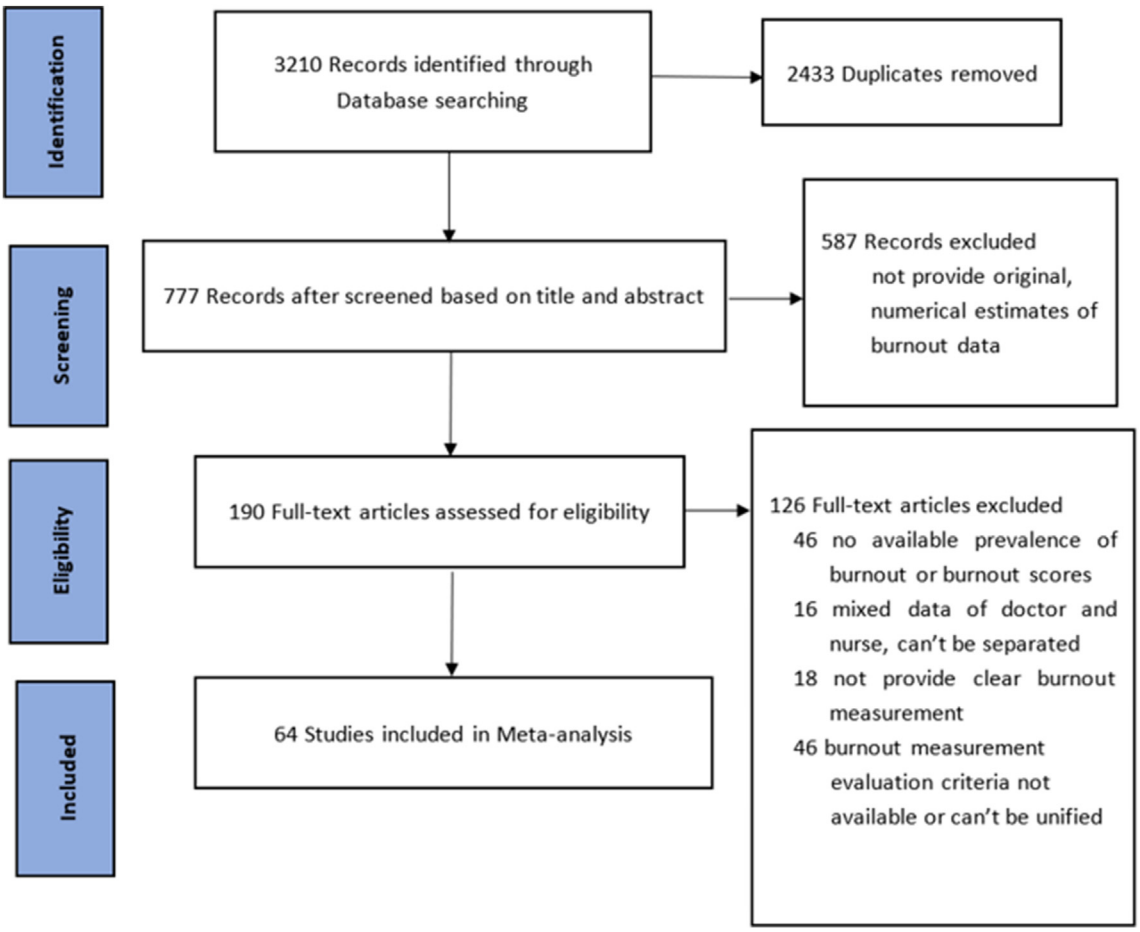

Figure 1. Flow diagram of study selection. 3210 records were identified through database searching and removed 2433 duplicates. After screening 777 records based on the titles and abstracts, 190 full-text articles were assessed for eligibility, and 126 of them were excluded. Eventually, 64 studies were included in the meta-analysis.

high, DP, and decreased PA dimensions (all $P > 0.05$) of burnout prevalence. The detailed results are shown in Appendix 5.1-5.6.

3.2.4. Prevalence of burnout over time

The burnout prevalence over time is shown in Figure 2. The total prevalence of burnout increased continuously from 2008 to 2017 and decreased significantly from 2018 to 2020, a little increase from 2020 to 2021. Furthermore, we analyzed the prevalence based on different scales and 3 dimensions. The prevalence of EE gradually decreased from 2005 to 2014, and gradually increased from 2015 to 2021. The prevalence of DP decreased gradually from 2005 to 2014, increased gradually from 2015 to 2016, and decreased significantly from 2017 to 2021. The prevalence of reduced PA increased gradually from 2005 to 2016, decreased significantly from 2017 to 2019, but increased slightly from 2020 to 2021. All the detailed time trends are shown in Appendix 6.1-6.7.

3.2.5. The influence of individual factors on burnout

In this study, we compared burnout prevalence among different genders, marital statuses, title, and specialty. Twenty-five studies (Chenliang, 2019; Dianzhen, 2013; Fuyingcong, 2012; Hao, 2012; Huang et al., 2020; Hui and Ning, 2008; Lianhong et al., 2015; Ma et al., 2020; Qiuyu, 2020; Sun et al., 2012; Suqiu, 2019; Tieshuang, 2010; Tingmei, 2016; Wang et al., 2012, 2020b; Weiye et al., 2018; Wencheng, 2011; Wenxuan et al., 2016; Xia et al., 2007; Xiao et al., 2014; Xiaojuan and Fuzhong, 2015; Ye et al., 2019; Yu, 2015; Yun, 2011, 2017) including 17,894 doctors provided gender data, and 15 studies (Chenliang, 2019; Dianzhen, 2013; Hao, 2012; Huang et al., 2020; Lianhong et al., 2015; Ma et al., 2020; Qiuyu, 2020; Tieshuang, 2010; Tingmei, 2016; Wencheng, 2011; Xia et al., 2007; Xiaojuan and Fuzhong, 2015; Ye et al., 2019; Yu, 2015; Yun, 2011) involving 12,223 doctors provided marital data. Twelve studies (Chenliang, 2019; Fuyingcong, 2012; Hao, 2012; Hui and Ning, 2008; Lianhong et al., 2015; Qiuyu, 2020; Tingmei, 2016; Xia et al., 2007; Yanli, 2012; Yu, 2015; Yun, 2011, 2017) including 6,320 doctors provided data pertaining to professional title. Eight studies (Chenliang, 2019; Fuyingcong, 2012; Hao, 2012; Hui and Ning, 2008; Jing and Yujian, 2017; Wenxuan et al., 2016; Xiaojuan and Fuzhong, 2015; Yuan, 2009) involving 1,431 physicians, 980 surgeons, 105 obstetricians, 79 pediatricians and 256 psychiatrists provided data of specialties.

We compared the 3 dimensions of burnout using the SMD according to sex, marital status, professional title and specialty of doctors. All detailed results, values of SMD and I^2 are shown in Table 3.

The results showed that in terms of gender, the EE and DP scores of male doctors were significantly higher than those of female doctors. The PA score of male doctors was also significantly lower than that of female doctors. In terms of marital status, the DP score of single doctors was higher than that of married doctors.

Doctors with primary professional title scored lower than those with intermediate and advance professional title on the DP dimension. Additionally, doctors with primary professional title scored lower than those with advanced professional title on the PA dimension.

In terms of specialty, no significant difference was observed between the scores of physicians and surgeons, they all had higher EE scores and lower PA scores than psychiatrists and pediatricians.

The subgroup analyses also showed that the scores of the 3 dimensions were affected by the individual factors, such as gender, marital

Table 1. Descriptive characteristics of the included studies.

Lead author	Publication year	Research design	Number	Region	Burnout measurement	Quality score
Li Yuanbin	2005	Cross-sectional	281	Chengdu City	MBI-HSS[1]	8
Ren Xia et al.	2007	Cross-sectional	256	Beijing City	MBI-HSS[1]	7
Wang Hui et al.	2008	Cross-sectional	646	Nanjing, Wuxi and Lianyungang City	CMBI[2]	8
Chen Xiuzhen et al.	2009	Prospective study	108	Haikou City	MBI-HSS[1]	7
Zhang Yuan	2009	Cross-sectional	364	Inner Mongolia	MBI-GS[3]	7
Chi Tieshuang	2010	Cross-sectional	1105	Liaoning Province	MBI-GS[3]	7
Jiang Nengzhi et al.	2010	Cross-sectional	461	Shandong, Hebei Province and Beijing City	CMBI[2]	7
Yu Mingke et al.	2011	Cross-sectional	230	Nanning City	CMBI[2]	8
Huang Yun	2011	Cross-sectional	692	Jiangsu, Anhui and Guizhou Province	CMBI[2]	8
Yang Wencheng	2011	Cross-sectional	1007	Liaoning Province	MBI-GS[3]	7
Zhong Huaqing et al.	2011	Cross-sectional	68	Ganzhou City	CMBI[2]	7
Liu Fuyingcong	2012	Cross-sectional	266	Shenzhen City	MBI-HSS[1]	7
Cheng Hao	2012	Cross-sectional	653	Western China	CMBI[2]	8
Liu Miao et al.	2012	Cross-sectional	1569	Eastern, western and central China	CMBI[2]	8
Yang Wang et al.	2012	Cross-sectional	1011	Liaoning Province	MBI-GS[3]	9
Wei Sun et al.	2012	Cross-sectional	1034	Liaoning Province	MBI-GS[3]	9
Li Yanli	2012	Cross-sectional	219	Sichuan Province	MBI-GS[3]	8
Tang Dianzhen	2013	Cross-sectional	902	12 Provinces of China	CMBI[2]	7
Huang Li	2013	Cross-sectional	735	Shanghai City	MBI-GS[3]	7
Yunbei XIAO et al.	2014	Cross-sectional	205	Beijing City	MBI-GS[3]	8
Luo Houyuan	2014	Cross-sectional	2404	Eastern, western and central China	CMBI[2]	8
Shi Lingyun	2015	Cross-sectional	435	Xinjiang Province	CMBI[2]	7
Zhou Lianhong et al.	2015	Cross-sectional	1611	Beijing City	MBI-HSS[1]	8
Zhang Yu	2015	Cross-sectional	160	Beijing City	MBI-HSS[1]	7
Liu Xiaojuan et al.	2015	Cross-sectional	415	Jinan City	MBI-HSS[1]	8
Huang Lei et al.	2015	Cross-sectional	775	Zhenzhou City	MBI-GS[3]	7
Juncai Pu et al.	2016	Cross-sectional	5558	China	MBI-HSS[1]	8
Wang Lu et al.	2016	Cross-sectional	78	Taiyuan City	MBI-HSS[1]	8
Jin Wen et al.	2016	Cross-sectional	1537	10 Provinces of China	MBI-GS[3]	9
Zhu Hongyan et al.	2016	Cross-sectional	414	Shanghai City	MBI-GS[3]	8
Lv Meng	2016	Cross-sectional	312	Xinjiang Province	CMBI[2]	7
Zhang Wenxuan et al.	2016	Cross-sectional	1098	12 Provinces of China	CMBI[2]	7
Li Yiyi et al.	2016	Cross-sectional	292	Shenzhen City	MBI-HSS[1]	7
Yan Tingmei	2016	Cross-sectional	1863	Liaoning Province	MBI-GS[3]	7
Fan Enfang et al.	2017	Cross-sectional	85	Shanghai City	CMBI[2]	7
Li Hongyao	2017	Cross-sectional	1047	Chongqing City	MBI-GS[3]	7
Hanlong Zheng et al.	2017	Cross-sectional	202	China	MBI-HSS[1]	7
Sun Yun	2017	Cross-sectional	379	Wuhu City	MBI-GS[3]	7
Yang Jing et al.	2017	Cross-sectional	560	Xinjiang Province	MBI-GS[3]	7
Cai Jingquan et al.	2018	Cross-sectional	475	Beijing City	MBI-GS[3]	7
Hange Li et al.	2018	Cross-sectional	2873	Beijing, Tianjin City and Hebei Province	MBI-HSS[1]	9
Yang Meng et al.	2018	Cross-sectional	227	Guangdong Province	MBI-HSS[1]	7
Liang Weiye et al.	2018	Cross-sectional	225	Beijing, Tianjin City and Hebei Province	MBI-HSS[1]	8
Zhai Chenliang	2019	Cross-sectional	245	Wuhu City	MBI-HSS[1]	8
Lu Huimin et al.	2019	Cross-sectional	568	Xuzhou City	MBI-GS[3]	8
Qi Xiaoyan et al.	2019	Cross-sectional	217	Shanghai City	MBI-GS[3]	8
Zhang Haoyun et al.	2019	Cross-sectional	131	Guangzhou Province	MBI-GS[3]	8
Wu Ye et al.	2019	Cross-sectional	499	Jilin Province	MBI-GS[3]	9
Hui Ma et al.	2019	Cross-sectional	2530	China	CMBI[2]	9
Shen Diwen et al.	2019	Cross-sectional	602	China	CMBI[2]	9
Zheng	019	Cross-sectional	3236	China	MBI-HSS[1]	8
Cao Suqiu	2019	Cross-sectional	110	Guangzhou Province	CMBI[2]	8
Li Mengying et al.	2019	Cross-sectional	265	Henan Province	MBI-GS[3]	9
Gu Shanshan et al.	2020	Cross-sectional	244	Chongqing City	CMBI[2]	9
Ying Zhou et al.	2020	Cross-sectional	125	Shanghai City	MBI-HSS[1]	9
Lei Huang et al.	2020	Cross-sectional	318	Shanghai City	MBI-HSS[1]	9
Jing Wang et al.	2020	Cross-sectional	58	4 Provinces of China	MBI-HSS[1]	9
Zhang Xi et al.	2020	Cross-sectional	1308	Jiangsu Province	MBI-GS[3]	9

(*continued on next page*)

Table 1 (*continued*)

Lead author	Publication year	Research design	Number	Region	Burnout measurement	Quality score
Sun Gang et al.	2020	Cross-sectional	584	China	MBI-HSS[1]	9
Han Limei et al.	2020	Cross-sectional	174	Xingjiang Province	MBI-HSS[1]	9
Yu Liqun et al.	2020	Cross-sectional	182	Beijing City	CMBI[2]	9
Meng Qiuyu	2020	Cross-sectional	366	Chongqing City	MBI-HSS[1]	9
Wang Liping	2020	Cross-sectional	226	Yantai City	MBI-GS[3]	9
Jing Wang et al.	2021	Cross-sectional	1813	China	MBI-HSS[1]	9

NOTE: MBI-HSS; CMBI; MBI-GS
[1] MBI-HSS scale includes 22 items, with a score of 0–6.
[2] CMBI scale includes 15 items, with a score of 1–7.
[3] MBI-GS scale includes 15 items, with a score of 0–6.

Table 2. Total, degree and dimensions of burnout prevalence specified by scale and quality score in Chinese doctors.

Total		Degree		Dimension		
		Low and moderate	High	EE	DP	PA
Overall (%)	75.48 (69.20, 81.26)	62.01 (54.59, 69.15)	9.37 (4.91, 15.05)	48.64 (38.73, 58.59)	54.67 (46.95, 62.27)	66.53 (58.13, 74.44)
Scale						
MBI-HSS (%)	67.25 (51.60, 81.17)					
MBI-GS-A (%)	82.02 (68.62, 92.31)	46.98 (43.09, 50.89)	20.20 (17.14, 23.43)			
MBI-GS-B (%)	63.01 (40.60, 82.83)	53.36 (42.16, 64.38)	5.31 (0.00, 26.07)	15.03 (1.13, 40.02)	34.88 (3.23, 77.83)	42.44 (22.44, 63.82)
MBI-GS-C (%)				60.16 (53.03, 67.09)	65.16 (55.68, 74.08)	62.97 (49.48, 75.51)
CMBI-MBI (%)	80.12 (72.55, 86.74)	69.16 (62.59, 75.36)	9.27 (5.63, 13.69)			
MBI–HSS–A (%)				65.84 (50.75, 79.46)	68.44 (59.38, 76.84)	73.62 (58.13, 86.60)
MBI–HSS–B (%)				67.82 (65.33, 70.26)	55.99 (34.86, 76.01)	82.68 (70.35, 92.24)
CMBI (%)				27.58 (22.26, 33.24)	45.07 (42.15, 48.00)	56.83 (37.24, 75.39)
Quality						
Score 7	84.81 (70.04, 95.22)	63.10 (48.06, 76.95)	12.19 (2.65, 27.13)	54.60 (36.70, 71.91)	59.64 (44.05, 74.29)	66.49 (52.24, 79.36)
Score 8	72.23 (62.04, 81.38)	64.75 (55.00, 73.91)	7.44 (4.21, 11.47)	32.65 (19.57, 47.26)	48.82 (42.36, 55.30)	65.79 (50.64, 79.47)
Score 9	67.82 (59.45, 75.66)	54.34 (42.18, 66.24)	9.90 (4.91, 15.05)	60.12 (45.68, 73.72)	55.45 (42.70, 67.84)	67.40 (51.69, 81.34)

NOTE: EE = emotional exhaustion; DP = depersonalization; PA = personal accomplishment; MBI = Maslach Burnout Inventory; MBI-GS = Maslach Burnout Inventory-General Survey; MBI-HSS = Maslach Burnout Inventory-Human Services Survey; CMBI = Chinese Maslach Burnout Inventory.

status, title, and specialty. Furthermore, through a visual inspection of the funnel plots and Egger's and Beggs's tests, we qualitatively and quantitatively evaluated the publication bias of the analysis of individual factors. The results showed that 52 of the 60 studies had no publication bias ($P > 0.05$). Eight studies that reported data for specialty had biases because the sample size was limited. Therefore, the results for specialty should be considered with caution. The forest plots of the subgroup studies and funnel plots of publication bias are shown in Appendix 7.1-7.4.

4. Discussion

The results of our study showed that the total prevalence of burnout in doctors in China was 75.48%, and the prevalence of high burnout was 9.37%, suggesting that the burnout situation in Chinese doctors might be very serious, since the total prevalence of burnout of doctors was 49% in France (Kansoun et al., 2019) and 51.64% in United State (Low et al., 2019) This result is consistent with a previous study reporting that the prevalence of doctor burnout was higher in Asian countries than in Western countries (De Simone et al., 2019). We also found the prevalence of EE was 48.64%, the prevalence of DP was 54.67%, and the prevalence of reduced PA was 66.53% among Chinese doctors. The results were obviously higher than those among doctors in France (EE 21%, DP 29% and reduced PA 21%) (Kansoun et al., 2019) and consistent with a previous study reporting that Chinese doctors had the highest EE scores among 37 middle-income countries worldwide (Sabitova et al., 2020). The reasons for the high prevalence of burnout in Chinese doctors might be as follows.

First, heavy workload could lead to severe burnout. According to the Fifth Survey of Doctors' Clinical Conditions by the Chinese Medical Doctors Association, 52.72% of doctors worked more than 40 h per week, and 32.69% of doctors worked more than 60 h per week (Association, 2015). Although the Chinese healthcare system is structured into three tiers (primary clinics, secondary hospitals and tertiary hospitals), the payment for consultation and tests in different tiers of hospitals is regulated by the government and is approximately same price. Chinese patients are free to visit any higher-tier hospital without referral by a primary doctor (Bo et al., 2020); thus, doctors in top-tier hospitals are overloaded due to an increased number of patients and forced to reduce the consultation time for all patients.

Second, government health care policies might contribute to burnout. In China, the government spends only 3% of the total world health expenditure on 20% of the world's population (L.E, 2014). The national investment in medical services has been neglected since 1979, with the total medical expenditure less than 7% of the annual state fiscal expenditure each year (China), and the proportion of the medical insurance expenditure of the total medical expenditure has decreased from 36% to 16% (X et al., 2000). Meanwhile, medical insurance payments for services have been strictly controlled (D et al., 2014). Therefore, in order to sustain themselves, Chinese doctors are encouraged by hospitals to prescribe more medicines and expensive tests for patients. The conversion from a doctor to businessman not only causes doctors to experience severe burnout but also leads patients to mistrust doctors (J et al., 2014; Lancet, 2010).

Third, violence against doctors might lead to burnout as well. Due to the situations mentioned above, patients' dissatisfaction with and

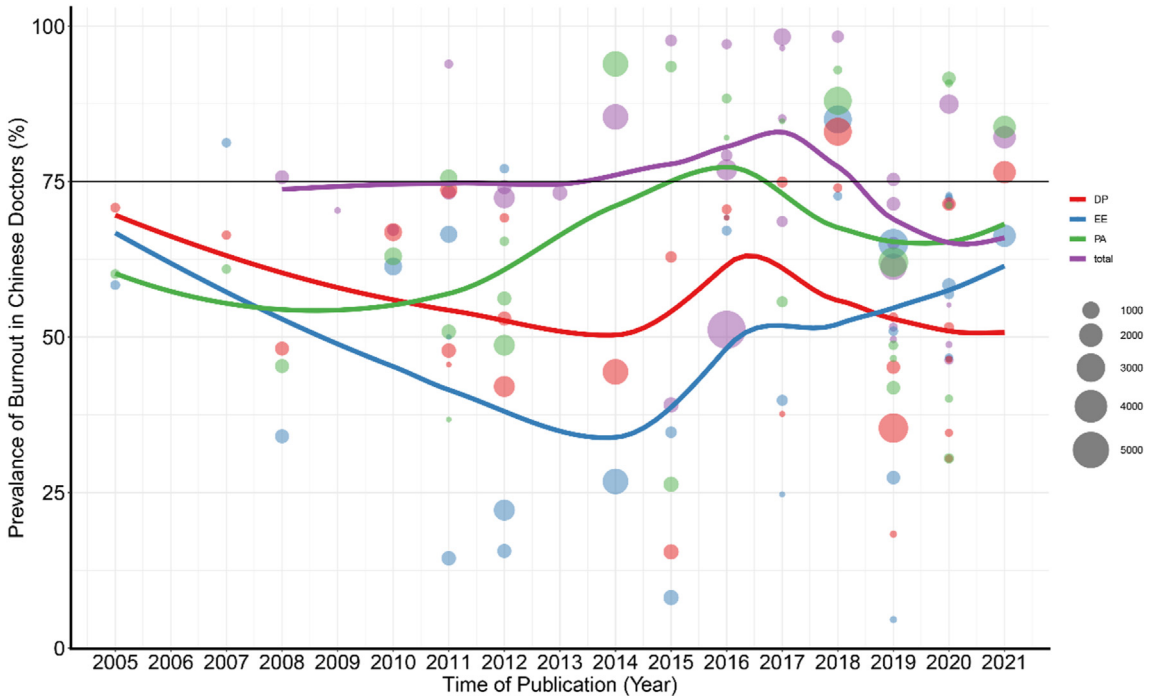

Figure 2. Prevalence of burnout in Chinese doctors through 2020. The total prevalence of burnout increased from 2008 to 2017 and decreased significantly from 2018 to 2020, a little increase from 2020 to 2021. The prevalence of EE gradually decreased from 2005 to 2014, and gradually increased from 2015 to 2021. The prevalence of DP decreased gradually from 2005 to 2014, increased gradually from 2015 to 2016, and decreased significantly from 2017 to 2021. The prevalence of reduced PA increased gradually from 2005 to 2016, decreased significantly from 2017 to 2019, but increased slightly from 2020 to 2021.

Table 3. Comparison of related factors according to the three dimension.

	EE			DP			PA		
	SMD[a]	*P*	*I*-squared	SMD	P	*I*-squared	SMD	*P*	*I*-squared
Gender									
Male vs Female	0.094 (0.064, 0.124)	<.001	74.90%	0.117 (0.087, 0.147)	<.001	52.20%	-0.079 (-0.109, -0.049)	<.001	74.70%
Marriage stage									
Single vs Married	0.017 (-0.029, 0.062)	0.473	42.40%	0.133 (0.088, 0.179)	<.001	74.20%	0.002 (-0.044, 0.048)	0.933	77.90%
Title									
Primary vs Intermediate	-0.038 (-0.091, 0.015)	0.164	0.00%	-0.072 (-0.125, -0.019)	0.008	59.30%	0.011 (-0.042, 0.064)	0.682	39.80%
Primary vs Advance	0.042 (-0.044, 0.128)	0.336	76.90%	-0.109 (-0.195, -0.023)	0.013	87.60%	-0.086 (-0.173, 0)	0.05	92.80%
Department									
Physician vs Surgeon	0.052 (-0.030, 0.134)	0.211	7.10%	-0.058 (-0.140, 0.024)	0.165	32.30%	0.078 (-0.004, 0.160)	0.062	51.80%
Physician vs Psychiatrist	0.216 (0.072, 0.361)	0.003	0	-0.029 (-0.173, 0.115)	0.695	0	-0.202 (-0.346, -0.057)	0.006	21.80%
Surgical vs Psychiatry	0.179 (0.029, 0.330)	0.019	51.40%	0.052 (-0.098, 0.202)	0.5	0	-0.366 (-0.517, -0.214)	<.001	61.90%
Physician vs Obstetrician	-0.012 (-0.238, 0.215)	0.92	75.40%	0.017 (-0.213, 0.247)	0.885	92.20%	0.320 (0.094, 0.546)	0.006	40.80%
Surgeon vs Obstetrician	0.023 (-0.206, 0.252)	0.844	75.50%	0.083 (-0.148, 0.314)	0.479	85.80%	0.417 (0.185, 0.648)	<.001	80.70%
Physician vs Pediatrician	0.352 (0.080, 0.623)	0.011	0	0.387 (0.114, 0.659)	0.005	63.10%	0.087 (-0.185, 0.358)	0.532	79.90%
Surgeon vs Pediatrician	0.375 (0.104, 0.645)	0.007	0	0.385 (0.113, 0.656)	0.005	32.30%	0.120 (-0.150, 0.390)	0.383	61.20%

SMD

[a] I–V pooled SMD; I-squared: variation in SMD attributable to heterogeneity; P: Test of SMD = 0.

distrust of doctors has triggered violence against doctors. The incidence of violence increased abruptly after 2010 (Bo et al., 2020; L.E, 2014; Paper, 2017). Among Chinese doctors, one-third had experienced conflict with patients, and thousands had been injured (L.E, 2014).

These three reasons have not only caused and exacerbated burnout but also negatively influenced the recruitment and retention of Chinese doctors. More than 60% of physicians have expressed an unwillingness to advise their children to go into the medical profession (Association, 2015). Additionally, 35.2% of general practitioners (Yanling et al., 2019b) and 34.03% of primary care doctors (Binjie et al., 2018) have admitted to having thoughts of altering career. From 2005 to 2015, all medical collages in China enrolled 4.7 million medical students, but the total number of doctors increased by only 0.75 million (Paper, 2017). The quantity and quality of Chinese doctors has been negatively impacted (Bo et al., 2020).

We also found that, although the burnout prevalence was significantly high, starting from 2018, the total burnout prevalence of Chinese doctors and the scores of the 3 dimensions had started to obviously decline. The decreasing trend might mainly be caused by alteration of regulations and laws. For example, the Regulations on Prevention and

Treatment of Medical Disputes was approved by Chinese State council in June 2018, to protect doctors from violence (PRC, 2018). Meanwhile, a series of policies and projects was applied in 2018 to improve the health care system, referral regulation and insurance coverage of low-income people. New regulation of the network was also applied in 2018 to restrict vicious and insulting information against doctors on websites. All these reformative policies and regulations might contribute to the decrease in burnout of Chinese doctors. However, there was a slight upward trend from 2020 to 2021, which may be due to the impact of the COVID-19.

Meanwhile, our results also suggested that gender, marital status, professional title, and specialty were all related to occupational burnout. Male doctors were more prone to emotional failure, disintegration of personality, and having a lower sense of achievement than female doctors. These results are different from previous studies in Western countries. One survey in Australia suggested that female doctors were more likely to suffer from burnout (Clough et al., 2020). One study in the United States observed that the burnout prevalence of female doctors was 1.6 times higher than that of male doctors (Mcmurray et al., 2000). The reason for this inconsistency might be due to the different context and culture by which Chinese males are required to bear more life responsibilities (Wei, 2006). In the present study, single doctors were more likely to be depersonalized than married doctors. Due to the lack of support from partners, they often retreat when encountering difficulties in work and life (Ma et al., 2020). This was consistent with the results of previous studies in the United States and European countries (Banerjee et al., 2017; Halbesleben, 2006; Shanafelt et al., 2014). Meanwhile, possibly due to the enthusiasm of junior doctors, in our study, they had a lower DP score than doctors with intermediate and advanced professional titles. We also found that physicians and surgeons were more likely to suffer from EE and reduced PA, which was consistent with a previous study conducted in the United States (Shanafelt et al., 2019). However, this result was tentative due to the high heterogeneity and publication biases in studies included in the specialty analysis.

4.1. Strengths and limitations

This study has some strengths worth mentioning. To the best of our knowledge, this is the first comprehensive meta-analysis of studies surveying burnout among Chinese doctors. We applied a holistic strategy to search the literature and conducted a robust statistical procedure in the analysis. Studies in both the English and Chinese languages were included. Because 3 different burnout scales were applied in 64 studies and the quality of studies was uneven, sensitivity and subgroup analyses were conducted to evaluate the potential heterogeneity and bias in the analysis.

Several limitations still exist. First, the quality of literature included in this study was not excellent, with a mean quality score of 7.92. However, the sensitivity analysis showed that the main results of our study were not significantly impacted by the factor of quality. Second, although we conducted a subgroup exploration based on different scales, the heterogeneity of the included studies was still high. Nevertheless, this approach is wildly accepted and applied, and heterogeneity is an inevitable and primary characteristic in meta-analyses of prevalence rates. The heterogeneity has been shown high in previous meta-analysis studies of burnout prevalence (Kansoun et al., 2019; Low et al., 2019; Sabitova et al., 2020). Third, we used the publication year instead of the research year to analyze time trends; therefore, a delay effect might be present, but it did not affect the overall result. Forth, when measuring the effects of individual factors on burnout, the sample size was limited, thus caution is needed when interpreting this result.

5. Conclusions

The total prevalence of doctor burnout in China was higher than that in developed countries. Gender, marital status, professional title and specialty all might affect burnout scores. The prevalence of burnout in Chinese doctors has decreased since 2018, which suggests that transformative policies and government regulations might affect burnout in Chinese doctors, although longitudinal research is needed to provide evidence supporting this conclusion. Because of the high heterogeneity and limited quality of the included studies, the conclusions are tentative. In the future, more effective policies will be continuously needed to improve burnout. Meanwhile, a unified standard and normative scale of burnout should be developed and applied in high quality studies with large sample sizes. The results would help to establish a theoretical basis for developing strategies to alleviate burnout in doctors, increase the recruitment and retention of doctors, improve the quality of medical services, and eventually optimize the health care system.

Declarations

Author contribution statement

All authors listed have significantly contributed to the development and the writing of this article.

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Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

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