



# Short working hours and perceived stress: Findings from a population-based nationwide study

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## ABSTRACT

**Background:** Evidence on the potential negative health effects of short working hours remains limited. This study aimed to investigate the association between short working hours and perceived stress in a population-based sample from China.

**Methods:** This cross-sectional study included 4368 participants aged 18–65 years from the China Health and Nutrition Surveys (CHNS) 2015. Working hours were categorized into <35, 35–40, 41–54, and ≥55 h/week. Perceived stress was assessed using the Perceived Stress Scale-14 (PSS-14).

**Results:** Of the 4368 participants, 817 (18.7 %) reported short working hours (<35 h/week) and 1817 (41.6 %) reported perceived stress. Short working hours were associated with higher perceived stress compared to standard working hours (35–40 h/week) (Adjusted odds ratios (AOR) = 1.25, 95 % confidential intervals (CI): 1.04–1.51). Stratified analysis showed that short working hours were significantly associated with more perceived stress in subjects aged 36–50 years (AOR = 1.43, 95 % CI: 1.16–1.70), while long working hours (≥55 h/week) were significantly related to less perceived stress among low-income subjects (AOR = 0.56, 95 % CI: 0.33–0.94). Reduced income partially mediated the effects of short working hours on perceived stress (indirect effects = –0.002, 95 % CI: –0.007~–0.001).

**Conclusion:** Reduced working hours may be associated with increased risk of perceived stress in China, particularly among people aged 36–50 years and those with low income. Reduced income may be a possible reason for the increased perceived stress caused by short working hours. Future longitudinal studies are needed to examine these relationships and to explore mechanisms.

## 1. Introduction

Short working hours referred to a work schedule in which an employee works less than the standard full-time schedule (typically less than 35 h/week), often resulting in reduced income and benefits [1,2]. This concept can be viewed within the broader framework of “underemployment”, which encompasses various forms of inadequate employment conditions, such as involuntary part-time work, overqualification, and underutilization of skills. While short working hours could be desirable for achieving a better work-life balance, the assumption may vary across countries and socioeconomic settings. In developing countries, short working hours may lead to

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financial insecurity and reduced access to benefits such as health insurance and retirement savings plans [3–5]. Additionally, short working hours may lead to reduced job satisfaction and limited opportunities for career development [6,7], resulting in stress and potential health problems for workers.

Short working hours can be considered a facet of underemployment, particularly when workers are willing but unable to secure additional hours. Existing literature has extensively explored the relationship between underemployment and mental health, revealing meaningful findings across various dimensions. For instance, longitudinal studies have identified specific forms of underemployment, such as involuntary temporary work, as particularly detrimental to mental health over time [8,9]. Moreover, epidemiological evidence suggested that underemployment was a significant driver of suicide rates [10]. Research also indicated that the negative mental health implications of underemployment were more pronounced among certain demographic groups, including women and younger workers [11]. Despite this comprehensive understanding, there remains a notable gap in the literature concerning the specific impact of short working hours on mental health. Short working hours may lead to psychological distress due to factors such as unstable income, job dissatisfaction, and a decline in social status.

Previous research has explored the relationship between various work types and perceived stress, including studies on part-time work that offer valuable insights into the effects of short working hours. Both part-time work and short working hours share key characteristics that make them relevant to our study. Specifically, they both involve reduced working hours compared to standard full-time employment, which can have similar outcomes in terms of mental health and economic impact. For example, a Danish study found that individuals working part-time experienced a poorer psychosocial work environment and safety, higher job insecurity, and poorer health compared to those who worked full-time [12]. Similarly, a study from the European Working Conditions Survey showed that low job satisfaction and poorer health status were more common in part-time employment than in full-time employment, with differences related to working conditions and influenced by gender and welfare systems [13]. Given these similarities, findings from studies on part-time work can be extrapolated to understand the impact of short working hours. Other studies have highlighted the potential for part-time employment to exacerbate stress and well-being disparities in vulnerable populations, such as pregnant women in Johannesburg who faced unemployment and financial insecurity [3] and people in caregiving and part-time jobs who reported lower well-being scores and life satisfaction [6].

China presents a unique context for examining the relationship between working hours and stress due to several interrelated factors. The country's rapid economic growth and industrial transformation have led to intensified work expectations, including longer working hours across various sectors, particularly in key industries. This has resulted in increased income in these sectors, widening the income gap with more marginal industries. This is further complicated by a broader widening of income inequality [14], which produces varying levels of financial stress that interact with working hours to yield distinct stress outcomes. Additionally, the increasing psychological problems associated with China's economic development [15,16] suggest that broader economic and psychological factors may influence the effects of working hours on stress. Moreover, the vast geographical and industrial landscape of China introduces significant regional and industrial variations in work culture and expectations, adding another layer of complexity. Given these contextual considerations, it is essential to build on prior research to better understand the intricate relationship between working hours and stress in China.

Based on current research evidence, we hypothesize that short working hours may be associated with lower income, which in turn could lead to higher levels of perceived stress. This study aimed to investigate the associations between short working hours and perceived stress in a population-based sample in China. We hypothesized that short working hours were a risk factor for perceived stress, independent of other factors. To explore potential modifiers of this relationship, we conducted stratified analyses by age group, income level, work type, and gender. Additionally, we examined whether reduced income mediated the relationships between short working hours and perceived stress. This study contributed to a better understanding of the complex relationship between working hours, perceived stress, and socioeconomic context in China.

## 2. Material and methods

### 2.1. Study design and sample

Data for this study was sourced from the China Health and Nutrition Surveys (CHNS), an ongoing longitudinal survey initiated by the University of North Carolina at Chapel Hill and Chinese Center for Disease Control and Prevention in 1989. CHNS data collection was conducted every 2–4 years using a multistage, cluster random sampling design in 15 provinces of China, including 12 representative provinces (Heilongjiang, Liaoning, Shaanxi, Guizhou, Henan, Hubei, Shandong, Jiangsu, Zhejiang, Hunan, Yunnan, Guangxi), and three centrally-administered municipalities (Beijing, Shanghai, Chongqing). The CHNS survey aimed to provide data on health, nutrition, and socioeconomic trends in China. Detailed information about the survey can be found on the official website (<https://www.cpc.unc.edu/projects/china>).

The latest data set available for the CHNS was from 2015, as the 2019 data collection was ongoing. Perceived stress was evaluated in CHNS 2015, leading to a cross-sectional study design for the present investigation. A total of 44,800 participants were included in the CHNS 2015 dataset, out of which 4916 were within the legal working age range of 18–65 years and had been assessed for both working hours and perceived stress. After excluding participants with missing values and extreme values (mean  $\pm$  3 standard deviation) of covariates, the final sample for analysis comprised 4368 participants. All enrolled survey data were self-reported by the participants under the supervision of trained investigators using a face-to-face approach, ensuring the accuracy and reliability of the collected information. A detailed flowchart of the participant selection process is shown in Fig. 1.

## 2.2. Working hours

The participants' working hours were self-reported by responding to an open-end question: "How many hours do you usually work per week?" To comply with Chinese labor law regulations, the standard working hour system in China is 8 h per day and 40 h per week [17,18]. Based on the WHO and ILO classification standards, the study categorized the working hours into four groups: <35, 35–40, 41–54, and  $\geq 55$  h/week [19,20]. In this study, working hours <35 h/week were considered as short working hours.

## 2.3. Perceived stress

Perceived stress was assessed using the Chinese version of the Perceived Stress Scale-14 (PSS-14) [21,22], a widely used tool for measuring perceived stress [23]. The PSS-14 comprises 14 questions that capture participants' feelings and thoughts over the preceding month. Participants rated their responses on a 5-point Likert scale ranging from "never" (score = 0) to "very often" (score = 4), with higher scores indicating greater perceived stress. The total score ranged from 0 to 56. In this study, perceived stress scores were dichotomized into two categories: no stress ( $\leq 21$  scores) and stress ( $\geq 22$  scores) [24].

## 2.4. Covariates

Covariates included demographic, socioeconomic, and unhealthy behavior of the participants. Demographic variables included gender (male or female) and age (18–35, 36–50, 51–65 years). Socioeconomic variables included marital status (unmarried, married, divorced/separated/widowed), residence (urban or rural), work type (non-manual: professional and technical workers, managers, and office workers; or manual: agricultural workers, unskilled workers, service workers, athletes, and firefighters), and contract type (full-time workers or part-time workers). Income was categorized as high (>75th median), medium (25–75th median), or low (<25th median) by interquartile. Unhealthy behavior variables included smoking (no or yes), alcohol drinking (no or yes).

## 2.5. Statistical analysis

First, the distribution differences of perceived stress levels among different working hours were compared using the Chi-square test. Paired comparisons were used for comparisons between specific two groups. Second, univariate logistic regression models were performed to explore the associations between working hours and perceived stress with no adjustment for any covariate (**Model 1** of Table 3). Additional multivariable models were sequentially adjusted for demographic characteristics and individual indicators (**Model 2**), unhealthy behavior (**Model 3**), work type and contract type (**Model 4**), and income (**Model 5**) to explore the changes in the effect size of covariates on the associations between short working hours and perceived stress. Third, stratified analysis was used to examine the independent associations between short working hours and perceived stress in different age groups, income levels, work types, and gender based on the results of multivariable logistic regression and the characteristics of career development in Chinese society. Logistic regression models were used to obtain odds ratios (OR), adjusted odds ratios (AOR), and 95 % confidence intervals (CI). Fourth, structural equation modeling (SEM) models were utilized to examine the potential mediating role of reduced income in the associations between short working hours and perceived stress (Fig. 2). The maximum likelihood (ML) method was used to

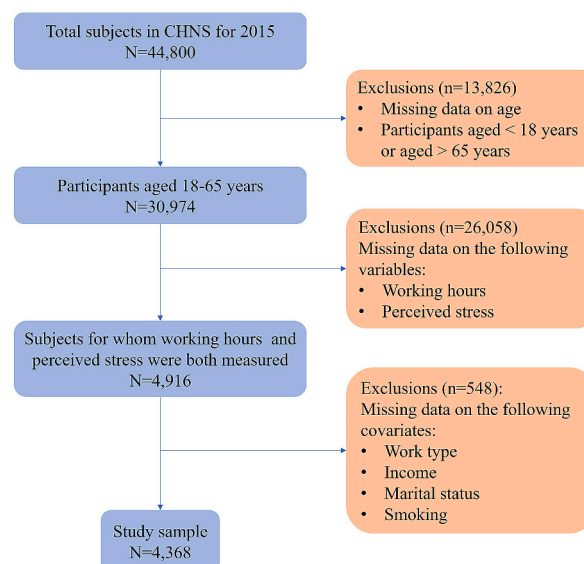


Fig. 1. Flow chart for sample selection.

estimate the parameters of the model. Beta coefficients, standardized indirect effects, and total effects were reported, and the bias-corrected 95 % CI was estimated using 1000 bootstrap samples. Statistical significance was determined by a  $P$ -value  $<0.05$ , and the alpha level for paired comparison was set using the Bonferroni correction. All descriptive analyses and logistic regression analyses were conducted using IBM Statistics SPSS version 26.0 (IBM Corp, Armonk, NY, USA), and mediation analyses were performed using the “bruceR” and “mediation” package in R version 4.2.2 (R Foundation for Statistical Computing, Vienna, Austria).

### 3. Results

#### 3.1. Demographic characteristics of participants

Table 1 displays the demographics of the study participants, which included 4368 individuals. Of these participants, 54.9 % were male, while nearly half (45.2 %) of the participants were between 36 and 50 years old. Furthermore, approximately 2/3 of the participants were engaged in manual labor jobs, most (90.6 %) of the participants were full-time workers, and 14.7 % of the participants had low income.

#### 3.2. Perceived stress in participants with different working hours

Based on Table 2, 41.6 % of participants reported to experience perceived stress. Among all participants, those who worked less than 35 h per week reported a higher proportion of perceived stress compared to those who worked between 35 and 40 h per week (47.7 % vs. 39.6 %,  $\chi^2 = 15.67$ ,  $P < 0.001$ ). No significant difference in perceived stress was observed between those who worked 41–54 h or more than 55 h per week and those who worked 35–40 h per week.

#### 3.3. Associations between short working hours and perceived stress

Table 3 presents the results of univariable and multivariable logistic regression analysis of the association between short working hours and perceived stress. Working less than 35 h per week was associated with a greater risk of perceived stress than working 35–40 h per week in univariate analyses (Model 1: OR = 1.40, 95 % CI = 1.18–1.65). Further analysis using stepwise regression revealed that the associations were attenuated but remained statistically significant after adjustment for age, gender, marital status, and residence (Model 2: AOR = 1.34, 95 % CI = 1.12–1.59), smoking, and alcohol drinking (Model 3: AOR = 1.33, 95 % CI = 1.12–1.59). When work type, contract type, and income was incorporated into the logistic regression model separately, the strength of associations in Model 4 (AOR = 1.33, 95 % CI = 1.12–1.58) and Model 5 (AOR = 1.33, 95 % CI = 1.12–1.58) did not change compared to Model 2 and Model 3, respectively. The associations were weakened when these three variables were incorporated into the model simultaneously (Model 6: AOR = 1.25, 95 % CI = 1.04–1.51).

#### 3.4. Associations between short working hours and perceived stress stratified by age group, income level, work type, or gender

To investigate the potential effects of work type and income level on the relationships between short working hours and perceived stress, we conducted further analyses stratified by these factors. Additionally, given that age and gender are important determinants of career development in Chinese society, we also stratified our analysis by these variables.

Stratification by age group revealed that the associations between short working hours and perceived stress were significant only in the 36–50 age group (Table 4). Among this group, those who worked less than 35 h per week were more likely to report experiencing stress than those who worked 35–40 h per week (AOR = 1.43, 95 % CI = 1.16–1.70).

When stratifying by income level (Table 4), we observed a significant association between short working hours and perceived stress in the middle-income and low-income groups. After adjusting for covariates, the association was only found in the low-income group, and those who worked more than 55 h per week were less likely to report experiencing stress than those who worked 35–40 h per week (AOR = 0.56, 95 % CI = 0.33–0.94).

After stratifying by work type (Supplementary Table S1) or gender (Supplementary Table S2), we found no significant association

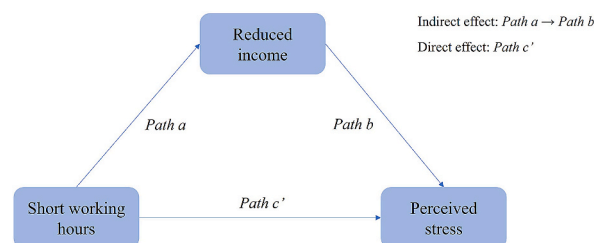


Fig. 2. Hypothesis of the role of reduced income in associations between short working hours and perceived stress. Path a: short working hours (independent variable) significantly predicted reduced income (mediator); Path b: reduced income (mediator) significantly predicted perceived stress (dependent variable); Path c': short working hours (independent variable) significantly predicted perceived stress (dependent variable).

**Table 1**  
Demographic characteristics of participants (N = 4368).

Variables	n (%)
<b>Gender</b>	
Male	2399 (54.9)
Female	1969 (45.1)
<b>Age (years)</b>	
18–35	1003 (23.0)
36–50	1976 (45.2)
51–65	1389 (31.8)
<b>Work type</b>	
Non-manual	1456 (33.3)
Manual	2912 (66.7)
<b>Contract type</b>	
Full-time workers	3958 (90.6)
Part-time workers	410 (9.4)
<b>Income</b>	
High (>75th median)	1460 (33.4)
Medium (25–75th median)	2266 (51.9)
Low (<25th median)	642 (14.7)
<b>Marital status</b>	
Unmarried	296 (6.8)
Married	3912 (89.6)
Divorced/separated/widowed	160 (3.6)
<b>Residence</b>	
Urban	1667 (38.2)
Rural	2701 (61.8)
<b>Smoking</b>	
No	3012 (69.0)
Yes	1356 (31.0)
<b>Alcohol drinking</b>	
No	2868 (65.7)
Yes	1500 (34.3)

**Table 2**  
Comparisons of perceived stress in participants with different working hours (N = 4368).

Variables	Total, n (%)	Working hours (hours/week)				$\chi^2$	P
		35–40	<35 <sup>a</sup>	41–54 <sup>b</sup>	≥55 <sup>c</sup>		
<b>Perceived stress</b>							
No	2551 (58.4)	1143 (60.4)	427 (52.3)	475 (60.4)	506 (57.9)	17.34	0.001
Yes	1817 (41.6)	748 (39.6)	390 (47.7)	311 (39.6)	368 (42.1)		
<b>Total, n (%)</b>	4368 (100.0)	1891 (43.3)	817 (18.7)	786 (18.0)	874 (20.0)		

<sup>a</sup> Compared with working 35–40 h per week, there was a statistically significant difference ( $\chi^2 = 15.67, P < 0.001$ ) after Bonferroni correction (alpha level for paired comparison was set at  $P = 0.0083$ ).

<sup>b</sup> Compared with working 35–40 h per week, there was no statistically significant difference ( $\chi^2 = 0.01, P = 0.996$ ).

<sup>c</sup> Compared with working 35–40 h per week, there was no statistically significant difference ( $\chi^2 = 1.61, P = 0.204$ ).

between short working hours and perceived stress, regardless of the type of work or gender, after adjusting for covariates.

### 3.5. Mediating effects of reduced income on the associations between short working hours and perceived stress

Based on the study hypothesis and logistic regression results, we performed a mediation analysis using reduced income as the mediator variable (Table 5). Our findings suggested that reduced income partially mediated the associations between short working hours and perceived stress, with a standardized beta estimate of  $-0.002$  (95 % CI:  $-0.007 \sim -0.001$ ). The total standardized effect of short working hours on perceived stress was  $-0.013$  (95 % CI:  $-0.023 \sim -0.003$ ). Therefore, the mediating effect of reduced income accounted for approximately 15.4 % of the total effect. These results were consistent with the hypothesis that reduced income played a mediating role in the relationship between short working hours and perceived stress.

## 4. Discussion

Our study investigated the relationship between short working hours and perceived stress in a population-based sample, in the context of China. We found that short working hours were independent factors associated with higher perceived stress levels. Furthermore, we observed that short working hours were significantly associated with increased perceived stress in the 36–50 years old group, whereas long working hours were significantly related to decreased perceived stress in the low-income group. These

**Table 3**  
Associations between short working hours and perceived stress (N = 4368).

Variables	Perceived stress					
	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 3 <sup>c</sup>	Model 4 <sup>d</sup>	Model 5 <sup>e</sup>	Model 6 <sup>f</sup>
Working hours (hours/week)	OR (95 % CI)	AOR (95 % CI)	AOR (95 % CI)	AOR (95 % CI)	AOR (95 % CI)	AOR (95 % CI)
35–40	1.00	1.00	1.00	1.00	1.00	1.00
<35	1.40 (1.18–1.65) ***	1.34 (1.12–1.59) **	1.33 (1.12–1.59) **	1.33 (1.12–1.58) **	1.33 (1.12–1.58) ***	1.25 (1.04–1.51) *
41–54	1.00 (0.84–1.19)	0.98 (0.82–1.16)	0.97 (0.82–1.16)	0.98 (0.83–1.16)	0.96 (0.81–1.14)	0.93 (0.78–1.11)
≥55	1.11 (0.94–1.31)	1.07 (0.91–1.27)	1.07 (0.91–1.27)	1.07 (0.90–1.26)	1.05 (0.89–1.24)	1.02 (0.86–1.21)

\*\*\*P<0.001, \*\*P<0.01, \*P<0.05.

Abbreviations: AOR, adjusted odds ratios; CI, confidence intervals.

<sup>a</sup> Model 1: univariable logistic regression analysis.

<sup>b</sup> Model 2: Adjusted for Model 1 + age, gender, marital status, residence.

<sup>c</sup> Model 3: Adjusted for Model 2 + smoking and alcohol drinking.

<sup>d</sup> Model 4: Adjusted for model 3 + work type and contract type.

<sup>e</sup> Model 5: Adjusted for model 3 + income.

<sup>f</sup> Model 6: Full model, adjusted for model 3 + work type + contract type + income.

**Table 4**  
Associations between short working hours and perceived stress by age group or income level (N = 4368).

Variables	Perceived stress					
	Age: 18–35 years		Age: 36–50 years		Age: 51–65 years	
Working hours (hours/week)	OR (95 % CI)	AOR (95 % CI) <sup>a</sup>	OR (95 % CI)	AOR (95 % CI) <sup>a</sup>	OR (95 % CI)	AOR (95 % CI) <sup>a</sup>
35–40	1.00	1.00	1.00	1.00	1.00	1.00
<35	1.20 (0.79–1.82)	1.00 (0.62–1.61)	1.46 (1.13–1.88) ***	1.43 (1.16–1.70) **	1.44 (1.10–1.88) **	1.29 (0.95–1.75)
41–54	1.11 (0.81–1.53)	0.99 (0.70–1.40)	0.89 (0.68–1.15)	0.78 (0.59–1.04)	1.09 (0.79–1.51)	1.04 (0.74–1.45)
≥55	1.19 (0.84–1.68)	1.10 (0.75–1.61)	1.10 (0.87–1.39)	0.97 (0.73–1.25)	1.09 (0.81–1.46)	0.98 (0.71–1.36)
Working hours (hours/week)	Income: High OR (95 % CI)	AOR (95 % CI) <sup>b</sup>	Income: Medium OR (95 % CI)	AOR (95 % CI) <sup>b</sup>	Income: Low OR (95 % CI)	AOR (95 % CI) <sup>b</sup>
35–40	1.00	1.00	1.00	1.00	1.00	1.00
<35	1.22 (0.83–1.79)	1.27 (0.84–1.91)	1.41 (1.11–1.79) **	1.28 (0.98–1.65)	0.99 (0.63–1.54)	0.89 (0.55–1.42)
41–54	0.74 (0.53–1.03)	0.74 (0.52–1.05)	1.09 (0.87–1.36)	1.00 (0.79–1.27)	0.85 (0.48–1.50)	0.81 (0.45–1.46)
≥55	0.97 (0.72–1.30)	0.95 (0.69–1.32)	1.29 (1.03–1.61) *	1.17 (0.92–1.49)	0.61 (0.37–1.02)	0.56 (0.33–0.94) *

\*\*\*P<0.001, \*\*P<0.01, \*P<0.05.

Abbreviations: AOR, adjusted odds ratios; CI, confidence intervals.

<sup>a</sup> Adjusted for gender, marital status, residence, work type, contract type, smoking, alcohol drinking and income.

<sup>b</sup> Adjusted for age, gender, marital status, residence, work type, contract type, smoking and alcohol drinking.

findings differed from previous studies conducted in other countries and highlight the importance of prioritizing the mental health of workers with short working hours, including part-time workers and the unemployed, particularly among those in middle age and with low income. Our results provided further evidence of the negative impact of short working hours on perceived stress in the Chinese social context.

Recent systematic review focusing on the Chinese population have shown that extended working hours are associated with an increased risk of mental disorders [25]. This effect is particularly pronounced among women, white-collar workers, and employees in micro-companies. Importantly, most of the research on the relationship between long working hours and both physical and mental health (for example, depressive symptoms and anxiety) in China has been conducted in the context of the COVID-19 pandemic [26–29]. These studies primarily target frontline healthcare workers [27], nurses [29], and delivery drivers [28], occupational groups that are often subject to work overload during this period. Therefore, these findings may not be generalizable to the relationship between working hours and mental health under normal conditions. Additionally, the temporal scope of our study, which utilizes the CHNS dataset from 2015, differs from that of many recent studies. This temporal discrepancy could also account for the differences observed between our findings and current research. Another potential explanation for this relationship is that worker on short hours

**Table 5**  
Mediating effects of reduced income on the associations between short working hours and perceived stress (N = 4368).

Variables	Perceived stress
	Beta (95 % CI) <sup>a</sup>
<b>Path</b>	
Short working hours → reduced income	0.038 (0.022–0.054)*
Reduced income → Perceived stress	−0.004 (−0.008~−0.001)*
Short working hours → Perceived stress	−0.012 (−0.024~−0.003)*
<b>Standardized effects</b>	
Indirect effects	−0.002 (−0.007~−0.001)*
Total effects	−0.013 (−0.023~−0.003)*

\* $P < 0.05$ .

Abbreviations: CI, confidence intervals.

<sup>a</sup> Adjusting for age, gender, marital status, residence, work type, contract type, smoking, alcohol drinking.

may experience financial insecurity or difficulty balancing work and personal responsibilities, leading to increased stress levels [3,12]. Moreover, workers on short hours may feel undervalued or have limited opportunities for career growth, resulting in lower job satisfaction and increased stress [6,13]. This association may be more pronounced in developing countries like China, where the wealth gap is notably widening, as evidenced by a Gini coefficient that has risen from 0.29 in 1980 to 0.47 in 2021, according to the National Bureau of Statistics of China [30]. For comparison, the Gini coefficient in many developed Western countries ranges from 0.25 to 0.35. Additionally, the social insurance system in China offers less comprehensive unemployment benefits, with the average monthly unemployment benefit being less than 1000 RMB, considerably lower than in developed countries.

In order to examine the influence of individual characteristics on the relationship between short working hours and perceived stress, we conducted stratification analyses. Our findings indicated that among participants aged 36–50 years old, there was a significant association between short working hours and perceived stress. This could potentially be attributed to the tendency of employers in Chinese society to recruit younger applicants who are willing to work long hours for less pay, as well as older experienced applicants who are viewed as more stable and reliable [31,32]. It is possible that middle-aged workers may be more susceptible to stress due to reduced work hours, such as unemployment, part-time work, or caregiving responsibilities, when compared to their younger or older counterparts [33]. Interestingly, our analysis also revealed a significant association between long working hours and lower perceived stress levels among low-income individuals. Our mediation analysis further suggested that the increased perceived stress associated with short working hours may be attributed to reduced income. This may be related to the fierce competition and large income gap that exists in current Chinese society [34,35]. In some cultures, there may be a strong emphasis on working long hours as a means of achieving success or providing for one's family, especially in societies where there is significant income inequality or a lack of social safety net programs. In these cases, working long hours may be viewed as necessary for financial stability or social mobility, and may even be considered a source of pride instead of stress [36]. It is important to note that these interpretations may not be universally applicable and may only be relevant in certain social settings or countries. Caution is necessary when interpreting our results, as further research is needed to fully understand the complex relationship between working hours and perceived stress.

Work is an essential aspect of a fulfilling life as it provides financial stability and a sense of purpose [37,38]. Career satisfaction has been linked to higher self-esteem and lower levels of psychosocial stress [39,40]. A recent trial of a four-day workweek, the largest of its kind in the world, has shown promising early results in countries such as the UK, where over 70.0 % of workers reported a reduction in burnout and almost 40.0 % reported a reduction in stress [41]. However, it is important to note that the feasibility of this working hours system may vary across countries, and replicating these results may require careful consideration of factors such as ensuring that workers are not paid less or have an increased workload. In developed Western nations, standard workweeks range from 29 to 40 h, underpinned by strong labor laws [42]. These countries manage to maintain work-life balance without compromising income, owing to robust social safety nets and labor protections [43]. It's worth noting that cultural norms and expectations around work in China may differ from those in other countries, potentially influencing how working hours are perceived. In some work environments in China, long working hours may even be seen as a symbol of diligence, capability, and an opportunity for increased income. This could be one reason why our study did not find a significant association between long working hours and perceived stress. Short working hours may indicate part-time, unstable, or even unemployment status, leading to income instability and reduced career development opportunities that can contribute to high levels of psychological stress.

The current study has several limitations that should be considered when interpreting the findings. One limitation is the cross-sectional design, which preclude any causal inferences regarding the relationship between short working hours and perceived stress. Future longitudinal studies are needed to clarify whether the observed association is bidirectional, with increased perceived stress also leading to reduced working hours. Another limitation is the use of self-reported data, which may be subject to reporting bias. To better understand the internal mechanisms underlying the relationship between working hours and psychological stress, future studies should assess the sources and categories of stressors, such as stress related to finances, career, or self-worth. Additionally, potential confounders such as shift work and biomarkers were not measured or analyzed in this study, highlighting the need for further research to examine the impact of these factors on the relationship between working hours and perceived stress. Despite these

limitations, our findings contribute to the growing body of literature on the association between working hours and psychological stress, and underscore the importance of addressing this issue in the workplace.

Overall, the impact of working short hours on perceived stress is influenced by individual characteristics and economic circumstances. Policymakers and labor organizations should prioritize developing targeted policies to support disadvantaged workers and those with low income. Additionally, employers can play a crucial role in mitigating the potential negative effects of short working hours by providing competitive compensation and benefits packages, promoting career development opportunities, and prioritizing work-life balance and employee well-being. Therefore, a comprehensive approach that addresses the needs of both workers and employers is necessary to create a healthy and productive work environment.

## 5. Conclusion

Our study found that individuals working short hours reported higher levels of perceived stress compared to those who worked standard hours. This association was particularly evident in individuals aged 36–50 years and those with lower income, suggesting that reduced income may be a possible explanation for the increased stress associated with short working hours. Future research is needed to validate these findings across different countries and socioeconomic backgrounds. Additionally, more longitudinal studies are required to investigate the causal relationship between short working hours and perceived stress, as well as the underlying mechanisms involved.

**Ethics approval:** As all data were completely deidentified, this study did not require human participants review by the Southern University of Science and Technology institutional review board. Consent was waived because all data were deidentified.

**Declaration of competing interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Data availability statement

The CHNS data are publicly available at <https://www.cpc.unc.edu/projects/china/data/datasets/index.html>. Dissemination to study participants is not possible/applicable given the nature of public use and deidentified CHNS data.

## CRedit authorship contribution statement

**Yeen Huang:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **Yingping Xiang:** Data curation, Formal analysis. **Wei Zhou:** Data curation, Formal analysis. **Yonghong Jiang:** Data curation, Software. **Zeshi Wang:** Data curation, Software. **Shenyang Fang:** Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Validation, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e21919>.



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