Impact of long working hours on mental health in China

Xinxin Ma (xxma@hosei.ac.jp)
Hosei University

Research Article

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Abstract

Background. Although previous studies have examined the impact of long working hours on mental health in China, they have not addressed the initial value and reverse causality problems. To bridge this gap in the literature and address these problems, we conducted a dynamic longitudinal analysis to investigate the association between long working hours and mental illness nationwide.

Methods. Using three-wave longitudinal data from the China Family Panel Studies conducted in 2014, 2016, and 2018, we adopted dynamic regression models with lagged long working hours variables to examine their association with mental illness.

Results. Long working hours were positively associated with mental illness. The effect was more significant for women, highly-educated, white-collar, and younger-generation workers compared to their counterparts.

Conclusions. The results provided rich evidence of the adverse effects of long working hours on mental health in China. It is thus necessary to enforce the regulations regarding standard working hours and monitor regulatory compliance by companies, as these factors are expected to improve mental health in China.

Background

Mental illness (MI) and long working hours are two main problems that plague employees worldwide [1–3]. In 2017, 792 million people worldwide were reported to be living with an MI; they constituted 10.7% of the global population, a figure slightly higher than 1 in 10 people [1]. As medical care expenses for MI are high in most countries, public policies to address mental health have emerged as a critical issue in the public health field. With regard to the determinants of MI, some studies have pointed out that in addition to demography and family factors, social factors such as social participation and social capital significantly affect an individual's mental health [4–5]. Furthermore, two models were advocated to indicate that long working hours negatively affect mental health: first, according to the job demand–control model [6], involuntary long working hours may lead to MI because of the imbalance between work responsibility (the reality of long working hours) and authority (wherein employees lack authority to determine their own working hours); second, according to the effort–reward imbalance model [7], when the effort involved in involuntary long working hours is not rewarded (e.g., through unpaid overtime or low overtime premium), the probability of MI may become higher among those working long hours. Numerous studies focusing on developed countries have reported that long working hours negatively affect mental health [e.g., 8–20], however, equivalent studies for China are scarce [21, 22].

According to the World Health Organization, approximately 54 and 41 million people in China experienced depression and anxiety disorders, respectively; the nationwide proportion of people with MI was more than 12% of that worldwide [3]. Regarding overtime work, even though the Labor Law of the People's Republic of China regulates the standard working hours (around 40 h weekly), it was reported that the work hours were longer in China's private or informal sectors [23, 24].

To bridge the gap in the literature and address the issue of MI, this study empirically investigated the association between long working hours and mental health in the context of China. It makes three contributions to the related literature. First, based on three-wave longitudinal survey data from the China Family Panel Studies (CFPS), it addressed statistical issues such as the initial value effect (i.e., the effect of a variable's initial value on its current value) and reverse causality—problems that have remained largely unsolved in previous studies [21, 22]. Second, unlike previous studies that concentrated on one definition of long working hours, we used different long working hours variables to perform robustness checks. Third, although some studies for developed countries have reported that the effect of long working hours differs by sex, educational attainment, occupation, and age group [12–20], no study has analyzed these differences for China. This study compared these differences by groups for China, a first in the literature.

Methods

Study sample

We used the latest three-waves data obtained from the CFPS, a nationwide longitudinal survey conducted by Peking University in representative regions of China in 2014, 2016, and 2018. The CFPS was designed to collect individual, family, and community-level longitudinal data in contemporary China. The sample for the 2010 CFPS baseline survey was drawn through multi-stage probability with implicit stratification. In the 2010 baseline survey, the CFPS successfully interviewed approximately 15,000 families and 30,000 individuals within these families, with an approximate response rate of 79%. The respondents were tracked through annual follow-up surveys. The CFPS covered 25 provinces and municipalities in 2010 and 31 provinces in the current survey. The CFPS contains rich individual- and household-level information, such as a set of indices on mental health status, working hours, demographic characteristics, and family, workplace, and region, which have been used in this study. The sample sizes of the CFPS data for 2014, 2016, and 2018 were 37,147, 36,892, and 37,354, respectively. This study focused on individuals aged 16 years or older in the baseline survey who had committed to at least one of two follow-up surveys. After excluding respondents who were missing data on the key variables used in the statistical analysis, the data for 21,093 individuals were used in this study (6,328 in 2014; 6,117 in 2016; and 8,648 in 2018). The sample used in the regression differed slightly depending on the model. We used the nationwide weight (fswt_nat in original data) in this study.

Variables

The key independent variable was a binary variable of MI, which was constructed based on the following six types of mental health status: (i) I find nothing exciting; (ii) I feel nervous; (iii) I cannot concentrate on things; (iv) I feel depressed; (v) I find it difficult to do anything; and (vi) I feel that I cannot continue with my life. We categorized the answers to the question “How often do you feel about the mental health status?” as follows: 5–7 days weekly = 4; 3–4 days weekly = 3; 1–2 days weekly = 2; less than 1 day weekly or never = 1. The total score of MI ranged from 6 to 24. Mental health was part of the original CFPS questionnaire and was used for the first time in this study; a high value indicated a high probability of MI (becoming mentally ill). We constructed a binary variable of MI to take a value of 1 = when total mental health score$\geq$12 and 0 = when the score < 12.

The key independent variable was the long working hours dummy variable. Referring to most previous studies [8–20], based on the question item “How many hours did you spend at work each week?” we constructed the long working hours dummy variable with a value of 1 for weekly working hours$\geq$50 and 0 for weekly working hours < 50 for basic analysis. We also used two other types of long working hours variables to implement the robustness checks: (i) to change the cutoff value of long working hours as 1=weekly working hours$\geq$60 and 0 = weekly working hours $<$60; (ii) a set of dummy variables of working hours: weekly working hours $<$ 25; weekly working hours $\geq$35 and $<$ 40; weekly working hours $\geq$ 40 and$<$50; weekly working hours $\geq$ 50 and$<$60; and weekly working hours $\geq$60.

Based on previous studies [8–20, 25 – 26], we considered the following variables, all of which were likely to have affected mental health status and were available from the CFPS: (1) demographic factors including age, sex, years of education, ethnicity (han), Communist Party of China membership, urban residence; (2) family factors, including the presence of a spouse and number of family members; (3) large company size: number of employees$\geq$500; (4) occupation (manager and technician, staff and service, operation worker, and others); (5) industry sector (1=manufacturing industry, 0=other industry sector); (6) enrollment pension/medical insurance (1 = enrollment, 0 = otherwise); (7) regions (east, central, and west); and (7) survey years (2014, 2016, and 2018).

Analytic strategy

As the benchmark, we considered the logistic regression model to estimate the association between long working hours and MI, along with a set of covariates, *X*:

$$MI_i = a + \beta LWH_i + \sum\nolimits_n \delta_n X_{ni} + \epsilon_i,$$

1

where MI denotes the probability of MI; *i* and *n* denote the individual and number of covariates, respectively; LWH denotes the indicator of long working hours; X denotes the covariates; β and δ are the coefficients of LWH and X, respectively, a is a constant term; and ε is an error term.

We addressed the initial value problem [27–29]: mental health status at time *t* may be affected by mental health status at time *t* − 1. To resolve this problem, we considered a dynamic model that included health at time *t* − 1 as an explanatory variable. We further addressed the reverse causality issue using overtime work status at time *t* − 1 to mitigate the problem by allowing a one-wave (that is, two-year) lag between long working hours and mental health [30, 31]. Overall, we estimated the following dynamic model using balanced panel data:

$$MI_{it} = a + \rho MI_{it-1} + \beta LWH_{it-n} + \sum\nolimits_n \delta_n X_{nit} + u_{it},$$

2

where *t* and *t* − n denote combinations of survey years (2014 and 2016 or 2016 and 2018, respectively), and *u* is an error term.

We estimated these models using subsamples by sex (men and women), education (lower than university, university and higher), age (aged 16–29, 30–44, 45–60), and occupation to compare heterogeneous groups. Referring to existing studies [12, 13], we divided the sample into three occupational groups: white-collar (manager or technician), pink-collar (service or staff), and blue-collar (operation worker).

Results

Descriptive analysis

Table 1 summarizes the key features of the sample used for statistical analysis. We calculated the mean values by three groups: total, long working hours (working hours $\geq$50), and standard or lower working hours (working hours $<$50) groups. In general, for China, 46% of the respondents experienced long work hours from 2014 to 2018. The proportion of poor mental health status is higher for the long working hours group (33%) than for their counterpart (31%). The *t* test results indicate that the demographic, family, and workplace factors differ by two groups, suggesting these factors should be controlled for in the analysis.

Table 1
Key features of the study sample

	(a)Total	(b) WH≥50	(c) WH < 50	Difference	
				(b) − (c)	*t*-test
Weekly WH (hours)	46.15	64.95	29.83	35.12	$p < 0.000$
LWH	0.46				
MI	0.32	0.33	0.31	0.02	$p < 0.000$
Demographic factors					
Education (years)	8.13	8.01	8.24	-0.24	$p < 0.000$
Age (years)	42.04	41.17	42.79	-1.62	$p < 0.000$
Women	0.49	0.42	0.55	-0.12	$p < 0.000$
Urban	0.45	0.45	0.45	0.00	$p < 0.135$
Ethnicity (Han)	0.96	0.95	0.96	-0.01	$p < 0.051$
Party membership	0.05	0.04	0.06	-0.02	$p < 0.000$
Family factors					
Having a spouse	0.90	0.90	0.90	0.00	$p < 0.052$
Number of family members	4.44	4.47	4.42	0.06	$p < 0.000$
Large company size	0.09	0.08	0.09	0.00	$p < 0.006$
Occupation					
Manager and technician	0.07	0.05	0.09	-0.05	$p < 0.000$
Service	0.21	0.22	0.19	0.03	$p < 0.000$
Operation worker	0.26	0.35	0.19	0.15	$p < 0.000$
Others	0.46	0.38	0.52	-0.14	$p < 0.000$
Industry sector					
Manufactural	0.17	0.20	0.14	0.05	$p < 0.000$
Social insurance					
Pension	0.61	0.60	0.62	-0.02	$p < 0.002$
Medical insurance	0.92	0.92	0.93	-0.01	$p < 0.028$
Regions					
West	0.31	0.33	0.30	0.03	$p < 0.000$
Central	0.29	0.28	0.30	-0.02	$p < 0.000$
East	0.40	0.39	0.40	-0.01	$p < 0.061$
N	21093	9805	11288		

Note: WH: weekly working hours; LWH: long working hours; MI: mental illness.

Regression analysis

The results of the three logistic regression models (*t* time model, LVt_1, and LVt_2) are summarized in Table 2, which reports the odds ratios (ORs) of MI, along with the 95% confidence intervals (CIs), in response to long working hours, after controlling for all covariates. The table shows that long working hours have positive and significant ($p < 0.01$ or $p < 0.05$) associations with MI ([Model1] OR: 1.22, 95% CI: 1.11,1.33; [Model 2] OR: 1.12, 95% CI: 1.01,1.24; [Model 3] OR: 1.12, 95% CI: 1.01,1.24).

Table 2
Estimated associations between long working hours and MI

	(1) Logit				**(2) LVt_1_Logit**				**(2) LVt_2_Logit**			
	OR.		95% CI		OR.		95% CI		OR.		95% CI	
LWH(WH≥50)	1.22	**	(1.11,	1.33)	1.12	*	(1.01,	1.24)	1.12	*	(1.01,	1.24)
Covariates	Yes				Yes				Yes			
N	11010				11010				7060			
Log likelihood	-5994.556				-4552.136				-4403.115			
Pseudo R2	0.103				0.117				0.055			

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables. The covariates were controlled. ** $p < 0.01$, * $p < 0.05$.

Table 3 displays the results of the robustness checks. First, we changed the definition of long working hours to “weekly working hours≥60;” the results show that long working hours have positive and significant ($p < 0.01$, $p < 0.05$, or $p < 0.1$) associations with MI ([Model1] OR: 1.23, 95% CI: 1.12,1.36; [Model 2] OR: 1.11, 95% CI: 0.98,1.25; [Model 3] OR: 1.16, 95% CI: 1.03,1.30). Second, we replaced the binary variable of long working hours with a set of dummy variables; the results indicate that compared to the short working hours group (working hours <35), the probability of MI is significantly ($p < 0.01$, $p < 0.05$ or $p < 0.1$) higher for the long working hours group (working hours≥60) ([Model1] OR: 1.22, 95% CI: 1.08,1.37; [Model 2] OR: 1.03, 95% CI: 0.87,1.17; [Model 3] OR: 1.23, 95% CI: 1.07,1.42). Finally, considering the self-employed who can adjust working hours independently, thereby reducing the negative effect of long working hours, we estimated these models using only employee samples; the findings ([Model1] OR: 1.39, 95% CI: 1.20,1.60; [Model 2] OR: 1.17, 95% CI: 0.98,1.39; [Model 3] OR: 1.13, 95% CI: 0.96,1.34) are also similar to those in Table 2. These results confirmed the conclusion that there exists a positive association between long working hours and MI for China.

Table 3
Results of the robustness checks

	(1) Logit				(2) LVt_1_Logit				(2) LVt_2_Logit			
	OR.		95% CI		OR.		95% CI		OR.		95% CI	
(1) Change the definition of LWH (≥ 60)												
LWH(WH≥ 60)	1.23	**	(1.12,	1.36)	1.11	†	(0.98,	1.25)	1.16	*	(1.03,	1.30)
Covariates	Yes				Yes				Yes			
N	11010				11010				7060			
(2) Change to a set of dummy variables												
WH (Ref. WH < 35 hrs.)	1				1				1			
WH35–39	0.88	†	(0.76,	1.01)	0.79	**	(0.66,	0.95)	1.02		(0.86,	1.21)
WH40–49	0.97		(0.85,	1.11)	0.90		(0.76,	1.06)	1.09		(0.93,	1.27)
WH50–59	1.08		(0.95,	1.23)	0.99		(0.85,	1.15)	1.11		(0.95,	1.28)
WH≥60	1.22	**	(1.08,	1.37)	1.03	†	(0.87,	1.17)	1.23	**	(1.07,	1.42)
Covariates	Yes				Yes				Yes			
N	11010				11010				7060			
(3) Limit samples to only employees												
LWH(WH≥ 50)	1.39	**	(1.20,	1.61)	1.17	†	(0.98,	1.39)	1.13	†	(0.96,	1.34)
Covariates	Yes				Yes				Yes			
N	4993				4993				7060			

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables. The covariates were controlled. ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$.

Tables 4–7 summarize the results obtained from separate estimations by sex, education, occupation, and age group. Table 4 indicates that the positive effect of long working hours on MI is more significant for women than for men ($p < 0.1$ for women).

Table 5 compares the association between long working hours and MI in the educational attainment group. The results indicate that the positive effect of long working hours is significantly higher for the highly-educated group (university and higher) (OR: 1.28, $p < 0.05$) than for the middle- and low-education groups.

Table 6 compares the results of the three occupational groups. Notably, the positive effect of long working hours on MI is significantly higher for the white-collar group (OR: 1.65, $p < 0.05$) than for the pink- and blue-collar groups.

Table 7 compares the results by age group. The positive effect of long working hours on MI is significantly higher for the 16–29 age group (OR: 1.46, $p < 0.05$) than for the older generation groups.

Table 4
Estimated associations between long working hours and MI by sex

	(1) Men				(2) Women				
	OR.		95% CI		OR.		95% CI		
LWH(WH≥50)	1.11		(0.95,	1.30)	1.13	†	(0.98,	1.31)	
Covariates	Yes				Yes				
N	5756				5254				
Log likelihood	-2148.93				-2394.02				
Pseudo R2	0.11				0.10				

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables (dynamic LVt_1 model). The covariates were controlled. † $p < 0.10$.

Table 5
Estimated associations between long working hours and MI by education background

	(1) High_edu				(2) Middle and Low_edu			
	OR.		95% CI		OR.		95% CI	
LWH(WH≥50)	1.28	*	(1.02,	1.61)	1.08		(0.95,	1.22)
Covariates	Yes				Yes			
N	3207				7803			
Log likelihood	-1116.04				-3425.66			
Pseudo R2	0.13				0.10			

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables (dynamic LVt_1 model). The covariates were controlled. High_edu: years of education is more than 12 years (university and higher); Middle and Low_edu: years of education is less than 12 years (less than university). * $p < 0.05$.

Table 6
Estimated associations between long work hours and MI by occupational group

	(1) White collar				(2) Pink collar			(3) Blue collar		
	OR.		95% CI		OR.	95% CI		OR.	95% CI	
LWH(WH≥50)	1.65	*	(1.05,	2.59)	1.04	(0.82,	1.33)	1.09	(0.87,	1.36)
Covariates	Yes				Yes			Yes		
N	921				2287			2754		
Log likelihood	-297.83				-890.01			-1101.25		
Pseudo R2	0.14				0.10			0.16		

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables (dynamic LVt_1 model). The covariates were controlled. * $p < 0.05$.

Table 7
Estimated associations between long work hours and MI by age group

	(1) Age16-29				(2) Age30-44			(3) Age45-60		
	OR.		95% CI		OR.	95% CI		OR.	95% CI	
LWH(WH > = 50)	1.46	*	(1.17,	1.82)	1.01	(0.85,	1.19)	1.07	(0.94,	1.22)
Covariates	Yes				Yes			Yes		
N	2435				4524			6328		
Log likelihood	-1054.92				-1829.44			-2917.72		
Pseudo R2	0.12				0.12			0.11		

Note: Obtained the results from the dynamic logistic models with lagged explanatory variables (dynamic LVt_1 model). The covariates were controlled. * $p < 0.05$.

Discussion

We examined how long working hours were associated with MI in China for the period 2014–2018. Our regression analysis based on three-wave longitudinal data and dynamic models with the lagged working hours variable indicated that long working hours had a significant positive association with MI. The basic results are aligned with the findings of previous cross-sectional studies in the context of China [21, 22], which did not fully control for statistical biases; however, the OR values are higher in this study. These findings can contribute to the literature on the association between long working hours and mental health and provide richer and more robust conclusions. These estimation results shed light on the association between long working hours and mental health in-depth as follows:

First, the estimation results in this study confirmed that long working hours may increase the probability of MI. The magnitude of the OR ratio coefficients (1.12–1.22 in Table 2) is smaller than those in other studies for China (1.745) [12]. The differences may be attributable to the different data and models: we used the three-wave national longitudinal survey data from 2014–2018, and the dynamic lagged variable model to address the initial dependent and reverse causal problems, whereas previous studies used one-point cross-sectional survey data and did not address the bias in estimations. To compare the effects of long working hours on MI between China and other countries, according to a meta-analysis [12], the effect is smaller for China than for the other Asian countries, such as Japan (1.333) and Korea (1.237), and Italy (1.341), Spain (1.248), and the United States (1.274), but greater than that for Denmark (1.091), Finland (1.063) and the United Kingdom (1.083). The international comparison results indicated that the institutional and cultural differences among countries may affect the effects of long working hours on mental health, which should be analyzed in detail in the future.

Second, the results indicated that the negative effect of long working hours on mental health was modestly more significant for women than for men; it may be because of gender differences in familial responsibility. Although the Chinese government has promoted gender employment equality in the labor market, women typically bear higher family responsibility (e.g., childcare, parent care, housework) than men [31, 32]; the double shift (long working hours followed by long housework hours) may lead to more family–work conflict for women than men, thereby enhancing the negative effect of long working hours for women.

Third, a disparity existed in the effects of long working hours among various educational and occupational groups. The results indicated that the negative effect of long working hours on mental health was greater for the highly-educated or white-collar workers than their counterparts (middle-and low-education, pink- and blue-collar groups). This may be because of the differences in job content between these groups: highly-educated or white-collar workers may face challenges in terms of addressing changes in the environment or fostering innovation, thereby increasing their work stress, whereas their counterparts primarily work routine jobs [12, 13, 33, 34].

Based on the results of this study, we can argue that, in general, policies to reduce long working hours may improve the Chinese population's mental health status. First, although the Labor Law of the People's Republic of China mandates that the standard work hours be less than 40 hrs weekly, the proportion of workers who worked for 50 hrs or more was 46% based on the CFPS data from 2014 to 2018, suggesting that a compliance problem remains in most Chinese companies. Working hours were reported to be longer in China, especially for privately-owned companies [23–24]; therefore, first, monitoring the compliance of regulatory policies regarding working hours in companies (especially privately-owned) should be considered. Second, policies to reduce long working hours or provide more social services to reduce the housework burden for women (e.g., providing more public kindergartens) may contribute to improving their mental health status. Third, unlike in most developed countries (e.g., Japan), there is no mental health counseling branch in most Chinese companies; the policy to promote the establishment of a mental health counseling center at the workplace is expected to improve mental health status in China. Finally, as the negative effects of long working hours differ by group, these policies should be aimed more toward women, highly-educated, white-collar, and younger workers.

This study has several limitations. First, although we used dynamic models with lagged long working hours variables, we could not identify the underlying causality of long working hours affecting mental health, which should be investigated in a more in-depth analysis. Second, as no policy reform existed for working hours during 2014–2018, we could not investigate the policy effect on the association between long working hours and mental health based on a quasi-experimental method, which can be addressed in future research.

Conclusions

Based on an analysis of the three-wave longitudinal data from 2014 to 2018, we conclude that long working hours are negatively associated with the mental health of workers aged 16–60 years in China, and the negative effects of long working hours differ by sex, educational attainment, occupation, and age groups.

Despite its limitations, we believe that this study, which exploited longitudinal data, provided new insights for understanding the association between long working hours and mental health nationwide in China. Notwithstanding these, this study is the first to compare the effects of long working hours by education, occupation, and age groups for China. We expect the Chinese experience to provide valuable lessons for other countries looking to improve their nations' mental health.

Abbreviations

MI, mental illness; CFPS, China Family Panel Studies; LV, lagged variable; WH, working hour; LWH, long working hour; CI: confidence interval; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate

The dataset used in this study, the China Family Panel Studies (CFPS), is publicly available (http://opendata.pku.edu.cn/en), and the study protocol was approved by the Ethical Review Committee of Peking University, China. Hence, ethical approval was not required for this study. Survey data were obtained from Peking University with official permission; therefore, the current study did not require further ethical approval, and the need for written consent was waived by the committee.

Consent for publication

Not applicable.

Availability of data and materials

The dataset used in this study, the China Family Panel Studies (CFPS), is publicly available (http://opendata.pku.edu.cn/en).

Competing interests

The authors declare no competing interests.

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Authors' contributions

XM organized this research project, conceptualized, designed the study, collected the data, performed the formal analyses, prepared the manuscript.

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