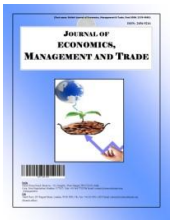

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Socio-Economic Development and Mental Health Connection in China: Evidence from China Family Panel Study

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Authors' contributions

Authors FX and XZ are the joint first authors who made equal contributions. Author Xu found the data and performed the statistical analysis (section 3,4). Author XZ reviewed the literature and edited the manuscript (section 1,2,5). Both authors read and approved the final manuscript.

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ABSTRACT

With the growing public awareness and attention towards mental health issues, policymakers and researchers are constantly increasing their efforts. The purpose of this study is to explore the relationship between socio-economic factors and mental health in China. The data used in this study is from a large scale nationally representative survey (the 2016 China Family Panel Studies). The CFPS is funded by the Chinese government through Peking University and conducted by the Institute of Social Science Survey (ISSS), which covers 16,000 households in 25 provinces in China using various questionnaires. Participants included in the survey are aged 16 and above. An Ordered Probit model is applied in this study. Life satisfaction is the dependent variable, and independent variables are total annual income for all jobs, sleeping hours per day, age, gender, currently registered residence, the highest academic background, and current marital status in this study. The results indicated that there is a positive relationship between independent variables such as total income, sleeping hours per day and age with the dependent variable life satisfaction. Compared to people whose educational attainment is equal or below Primary School, people who have finished Junior High and Senior High have worse mental health but people whose degree is

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above Senior High have better mental health. Furthermore, the results indicated that if people get divorced, they have a much higher probability to have mental health problems. In addition, males are more vulnerable than females overall, especially when both females and males get divorced.

Keywords: Mental health problem; socio-economic development; mental health and socio-economic development connection; national mental health conditions.

1. INTRODUCTION

1.1 Background Information

The growing attention toward the problems of mental health has surged in the past several years, both from the societal perspective and the individual's standpoint, asserted by the World Health Organization (WHO). Mental disorders, severe forms that transfer unhealthy mental status into symptoms affecting daily life, unlike physical disorders, are typically difficult to capture in terms of their in-transparency. For instance, people with mild depression would encounter some difficulties in normal social life, while severe depressive disorder would likely affect the patient to stop participating in regular social, work, or family activities [1]. The prevalence number for people to get mental health issues was about 1 in 7 [2]. However, government support is lacking in many developing countries [1]. In a rapidly growing world today, both economic growth and people's mental health are important to provide development in the country.

1.2 Statement of the Research Problem

When taking a closer look at one of the largest fast-growing countries, China is experiencing the boom of demand for mental health support. According to the first national mental health report, "Report on National Mental Health Development in China (2017-2018)", published in 2019, the majority of people's mental health states fall into good conditions. The Institute of Psychology at the Chinese Academy of Sciences reported that urban citizens have better mental health conditions than rural people. Meanwhile, the report raised that 11 to 15 percent of people have poor mental health and may have mild to moderate psychological problems. Besides, about 2 to 3 percent of participants have poor mental health issues with moderate to severe problems. There is a hidden tendency towards getting more severe issues with maintaining people's healthy mental states, other than getting physical health. Thus, to fulfill the gap between the population's need for mental health services and the actual condition, this study intends to look into the correlation between the socio-economic development in China and people's status of mental health.

1.3 Significance of the Study

The population in China accounts for 18.47 percent of the overall global population [26]. In terms of the rapid socio-economic development and largest population density, analyzing the mental health problems would be necessary. Nevertheless, the number of studies done in China that focused on the relationship between mental health conditions and socio-economic development was limited in the past several years [3].

Researchers realize that the people's demand for getting more exposed to the knowledge and basic education needs is huge. As for the potential groups under threat, the "Report on National Mental Health Development in China (2017-2018)" indicated that more than half of the employees working in the banking industry suffer from intensive pressure resulting in problems of working overload, staying up late, irregular dining hours, and lack of sports and fitness practices. Among people aged between 30 to 35, engaged in service sectors also face critical unhealthy mental health conditions of anxiety, sleeping disorders, or depression, as well as those joining high-level management teams. People dealing with family-related problems face mental health problems. However, social support is lacking in most of the cities as well. Therefore, besides the part wish of improving the GRoss Domestic Product, how to enhance a good living condition and maintain a positive mindset rises in demand in China.

1.4 Research Objectives

The overall objective of this study is to determine the relationship between socio-economic development and mental health conditions in China using the China Family Panel Studies (CFPS).

The hypothesis falls into an improvement in socio-economic development correlated with a better state of mental health of people of China. This study tested if income remained a crucial role in the connection. Other variables including age, gender, Hukou status, educational level, marital status, and sleeping hours are included. Some of the factors related to regulating people's mental health conditions, while others might generate negative impacts on the connection between socio-economics development and mental health conditions.

2. LITERATURE REVIEW

2.1 Prevalence of Mental Health Issues

The relationship between socio-economic development and people's mental health condition is complex as it was observed from previous studies [3]. Mental health issues are becoming severe but the studies addressing them are lacking in China. The prevalence rate of mental health disorders declined in the past decades when China experienced sustained economic growth [4]. Moreover, the number of mental health hospitals increased to 1.2 million in 2012, and the number of outpatients' visits increased to 27 million in 2011, and the daily increment rate was about 12 percent per year for both [5]. However, these numbers do not tell the truth about Chinese' mental health, because though more and more people have symptoms related to mental health they refuse to acknowledge that they have mental health problems because they are suffering social pressure from others [6].

2.2 Factors influencing Mental Health Conditions

Mental health itself is difficult to be measured, especially when analyzing the mental health problems at a nationwide level. According to Fergusson et al. [7], mental health plays a significant role in shaping people's views on life satisfaction [7]. Moreover, the degree of life satisfaction is likely to be lower when people are suffering from mental health problems [7]. Many other studies focusing on mental health adopted the life satisfaction approach, showing that life satisfaction is a good measure to evaluate mental health [8-10].

Previous studies show economic factors are important in daily life, and many studies have discussed their effect on mental health. For example, both negative economic growth and economic expansion can make people's mental health worse, and uncertainty or job insecurity is known to bring out a higher probability of psychological distress, along with anxiety, depressive symptoms, or other serious mental health disorders [11,12]. Besides, Wang and Tapia show that people had worse mental health during the economic recession [3], which is contrary to one study conducted in Europe [13]. Buffel et al. [13] report that people had stable mental health conditions when the economic recession appeared in Europe [13]. While discussing how economic factors affect mental health, income is a significant indicator [14,15]. People's income represents people's wealth, and it makes an influence on people's living standards. Then, changes in the standard of living can affect people's life satisfaction, showing that income affects people's mental health [16,17,18].

Researchers also found that gender is a significant factor causing mental health in Europe. For example, the study reports that males had deterioration in mental health while females did not have such change during the economic recession in England [19]. Moreover, Edwards shows that the impacts made by economic development on people's mental health are different for people who have different characteristics in the U.S., such as age, gender, ethnicity, and educational level [20].

Some studies have focused on some specific groups to analyze mental health. Husky et al. [21] pointed out adolescents faced a higher risk for suicide attempts, and schools located in urban areas can be sociodemographic risk factors for suicidal behaviors [21]. These variations in age and places for school enrollment would create differences in people's mental health. Also, McInerney and Mellor found that senior people got worse mental health from 1994 to 2008 [22]. Hukou, the system of household registration, was used in mainland China. It serves as the registration of an individual in the system where a household registration record would then officially identify a person as a resident of that area and includes identifying information such as name, parents, spouse, and date of birth [23]. Getting back to the discussion of the impact of economic recession on psychological health conditions, the quantity and quality of health services tend to deteriorate in the process of recessions [3]. Combining a variety of factors impacting mental

health conditions, this study would be generated from a different scope.

3. DATA AND METHODOLOGY

3.1 Methods

The study aimed to determine the factors causing people's mental health problems in China. Life satisfaction was the variable used to measure the level of mental health problems. Total annual income for all jobs, sleeping hours per day, age, gender, currently registered residence (residence), academic background (educational attainment), current marital status (marital status) were major factors related to people's mental health conditions. Data on life satisfaction were ordinal numbers without numerical meaning. Therefore, the Ordered Probit Model was used in this study. Moreover, data on gender, residence, educational attainment, and marital status would be dealt with dummy variables.

$$Y^1 = \begin{cases} 1\ (Not\ satisfied\ at\ all) & \text{if } y_i \le \mu_1 \\ 2\ (Unsatisfied) & \text{if } \mu_1 < y_i \le \mu_2 \\ 3\ (Neutral) & \text{if } \mu_2 < y_i \le \mu_3 \\ 4\ (Satisfied) & \text{if } \mu_3 < y_i \le \mu_4 \\ 5\ (Very\ satisfied) & \text{if } y_i > \mu_4 \end{cases}$$

In the Ordered Probit Model, a latent measure was underlying the ordinal responses. The study used yi as the unobserved latent variable and thresholds (i.e.μ_1, μ_2, μ_3, μ_4) divided the real line into various regions corresponding to the five ordinal categories. The latent variable y_i was a combination of the explanatory variables with an error term e_i having the standard normal distribution, N (0,1): $y_i = \beta * x_i + e_i$. Moreover, this model was an index model but not the regression model since the dependent variable y_i was not observed.

When interpreting the results of the Ordered Probit Model, this study focused on how explanatory variables affect the probability of each five ordinal categories chosen by respondents, and the rationale behind was:

$$P(Y = 1) = P(y_i\ \mu_1) = P(\beta * x_i + e_i\ \mu_1)$$
$$= P(e_i\ \mu_1 - \beta * x_i)$$
$$= \Phi\ (\mu_1 - \beta * x_i)$$

The study used the same way for the other four categories:

$$P(Y = 2) = \Phi\ (\mu_2 - \beta * x_i) - \Phi\ (\mu_1 - \beta * x_i)$$
$$P(Y = 3) = \Phi\ (\mu_3 - \beta * x_i) - \Phi\ (\mu_2 - \beta * x_i)$$
$$P(Y = 4) = \Phi\ (\mu_4 - \beta * x_i) - \Phi\ (\mu_3 - \beta * x_i)$$
$$P(Y = 5) = 1 - \Phi\ (\mu_4 - \beta * x_i)$$

The software used to run regressions showed the thresholds as cut points. The current study used the notation for the cut points as "cut1", "cut2", "cut3", "cut4", and "cut5" to indicate the thresholds.

As for the explanatory variables used in the Ordered Probit Model, this study had three continuous variables, total income, sleeping hours, and age, and they all had different scales. For instance, the scale of total income was from 0 to infinite while the scale of sleeping hours was from 0 to 24, thus, the study would standardize them before running regressions:

$\frac{Income - \underline{Income}}{SD(Income)}$, $\frac{Sleeping\ hours - \underline{Sleeping\ hours}}{SD\ (Sleeping\ hours)}$ and $\frac{Age - \underline{Age}}{SD(Age)}$,

With standardization, this study made all of them kept the same scale with the average of 0 and the standard deviation of 1. Therefore, how they impacted life satisfaction across these three continuous variables could be compared.

Other variables would be dummy variables. The dummy variable gender would be dealt with female and male, and residence would be dealt with "agricultural residence" and "non-agricultural residence". As for the educational attainment, the study made all people whose degrees were below or equal to Primary School as one group, people who had degrees above Senior High as one different group, and people who had degrees between these two would be set as a different group according to their degrees. Then the study would set one dummy variable for each group of educational attainment. Meanwhile, people with different marital statuses were in different groups and each group would be one dummy variable. How the data was conducted would be discussed in the following section.

3.2 Description of Data

The main questionnaire used by CFPS consists of five categories, including village residence questionnaire, family member questionnaire, family questionnaire, children's questionnaire, and adult questionnaire. These surveys were conducted at the levels of community, family, and

individual. The communities' questionnaire helps to provide an overall understanding of the village, as well as people living in the village, mainly from getting information on infrastructure, population structure, policy implementation, economic situation, and social services accessibility. The family questionnaire was designed for better understanding the overall situation of the family while the family members' questionnaire aimed to gather information about family members and their relationships. The individual questionnaire was conducted by asking to answer the children's questionnaire among those under the age of 16. Adults' questionnaire is used among people aged 16 above. There are two sections in the children's questionnaire. For children under 10 years old, their guardians will answer for them. For children aged from 10 to 15, they need to complete some parts of the questions by themselves, aside from the guardian's answers.

The secondary data used in this study obtained from the China Family Panel Studies (CFPS), a nationally representative and annual longitudinal survey. The CFPS was funded by the Chinese government and conducted by the Institute of Social Science Survey (ISSS) through Peking University. This CFPS provided the community questionnaire, family questionnaire, adult questionnaire, and children questionnaire covering 16,000 households in 25 provinces, municipalities, and autonomous regions in China operating in 2010, 2011, 2012, 2014, 2016, and 2018.

The data for CFPS done in 2018 was not updated completely; therefore, the major data sources used in this study were extracted from the CFPS done in 2016. One thing to notice was that after dropping the adult population with age equal or above 16,36,892 observations were remaining in the dataset.

The CFPS was used since it was nationally representative, which allowed the researchers to grasp the broader picture of the population's mental health conditions. In the meantime, CFPS contained data on the individual level, providing precise information on each respondent by answering various questions revealing economic and non-economic well-being. These all served as the required information needed in this study to arrive at a reasonable conclusion. Though some respondents refused to answer some questions causing a proportion of the dataset lost, 8,270 observations remained after removing all the missing values.

3.2.1 Mental health

Life satisfaction in this study was used as the dependent variable to measure the mental health condition in China. According to the study done by Zhang et al. [10], life satisfaction was the estimation of the individual's happiness and overall valuation of life [10]. These data about respondents' life satisfaction were directly selected from one question in CFPS 2016; "Overall, how satisfied are you with your life?" with answers on a scale from 1 (not satisfied at all) to 5 (very satisfied). Since the data collected scaled from 1 to 5, as ordinal numbers without numerical meaning, the study used life satisfaction as the dependent variable in the regressions and applied the Ordered Probit model.

3.2.2 Income

There were various types of data linked to income in the CFPS 2016. This study selected the total income for all jobs to cover all the revenue streams for each respondent made annually. Data on the total income for all jobs (total income) were calculated by the CFPS research institution. They analyzed and integrated all sources of earning that respondents had to obtain the overall income using the unit for the Chinese currency, Yuan. The major problem with the data on total income was that many participants did not answer the questions related to income. There are 27,176 participants left blank, leaving no information about their real income.

3.2.3 Sleeping hours

During the period of economic expansion, stress-related problems would occur along with overtime work [3]. Lack of sleeping hours would form pressure and generate mental health-related issues. In the CFPS 2016, the data on sleeping hours was collected as the average sleeping hours per day (shown as sleeping hours in data); there were three questions related to the means of calculating it. Participants were divided into two groups, one group was employed and the other group was unemployed. If the participants did not have jobs, they were asked for their time of estimation on sleeping hours per day. If the participants were employed, they were asked to answer two questions, one was for the approximate sleeping hours per day during weekdays, and the other was for sleeping hours on weekends. This study applied an average of

two sleeping hours per day for the employed participants. The unemployed participants' answers were used directly.

3.2.4 Age and gender

Age and gender were common and essential factors reflecting some proportion of people's mental health conditions in China. Data on age and gender were obtained directly from the CFPS 2016. Since the study focused on adult population questionnaires, all the respondents aged equal or above 16 were selected. As for the data on gender, the CFPS 2016 offers "1" representing "male" and "0" representing "female". Therefore, this study used these data directly by treating gender as a dummy variable to identify how the impact made on mental health conditions changes between male and female.

3.2.5 Registered residence

Under the influence of traditional history and culture, whether having a registered residence played a vital role in Chinese people's daily life. Thus, the study included the factor of currently registered residence into the model to examine if this made an impact on people's mental health conditions. In the CFPS 2016, there were two options available on the questions of registered residence, one was for people with agricultural registered residence and the other was for people with the non-agricultural registered residence. This study established a dummy variable to observe the different impacts made by two types of registered residence, letting "1" represent the value of "agricultural registered residence" and "0" represent the value of "non-agricultural registered residence".

3.2.6 Educational attainment

Some recent studies revealed that educational attainment was an essential factor to analyze mental health problems in China. According to the study done in South Korea by Kim et al. [24] and done in India by Patel et al. [25], the correlation between educational attainment and mental health condition always existed [24,25]. Therefore, it would be reasonable to add educational attainment as an explanatory variable into the model.

The data on the participants' highest academic qualifications came from the CFPS 2016 and aimed to cover all educational backgrounds, but not specific educational levels. In CFPS 2016, there were 8 choices provided for respondents to answer: 1-Illiterate/Semiliterate (respondents who do not finish primary school), 2-Primary School, 3-Junior High, 4-Senior High, 5-Three year college, 6-Four year college, 7-Master, and 8-Ph.D degree. It was worth noting that there was no data contained related to respondents with Ph.D. degrees after removing all the missing income values. The study combined people with educational attainment below or equal to the primary school level and treated people with Senior High as one category. Thus, four groups of showing educational attainment remained: 1-Below or equal to Primary School, 2-Junior High, 3-Senior High, and 4-College and above.

This study the data of participants' highest academic background obtained from the CFPS 2016 aiming to cover all educational backgrounds but not specific levels of educational attainment. In CFPS 2016, there were 8 choices provided for respondents to answer: 1-Illiterate/Semiliterate (respondents who do not finish primary school), 2-Primary School, 3-Junior High, 4-Senior High, 5-Three year college, 6-Four year college, 7-Master, and 8-Ph.D degree. It was worth noting that there was no data contained related to respondents with Ph.D. degrees after removing all the missing income values. The study combined people with educational attainment below or equal to the primary school level and treated people with Senior High as one category. Thus, four groups of showing educational attainment remained: 1-Below or equal to Primary School, 2-Junior High, 3-Senior High, and 4-College and above.

In this regression, this study would have 4 dummy variables related to educational attainment by setting one dummy variable for each group and using the first group as the reference group.

3.2.7 Marital status

Chinese people value family life essentially and life satisfaction (i.e. mental health) would somehow be influenced by the family situation. Thus, marital status could be a key factor in determining the causes of mental health problems.

Data obtained from the CFPS 2016 on participants' marital status were shown from 1 to 5: 1-Never Married, 2-Married and have a wife/husband, 3- Cohabitation, 4- Divorced, 5-Widowed. This study assigned each category a dummy variable and left the "Never Married"

Table 1. Demographic characteristics of independent variables used in the regression model

Variables	N	Proportion/Mean	SD	Min	Max
Total Annual Income (Yuan)	8270	21978.76	118305.59	0	1.03×10^7
Sleeping hours/day	8270	7.97	1.46	0.5	17
Age	8270	40.08	14.91	16	91
Gender (%)			0.50	0	1
Male	4502	0.54			
Female	3768	0.46			
Registered Residence (%)			0.42	0	1
Agricultural	6415	0.78			
Non-agricultural	1855	0.22			
Educational Attainment (%)			1.00	1	4
Below or equal to Primary School	3400	0.41			
Junior High	2667	0.32			
Senior High	1292	0.16			
College and above	911	0.11			
Marital Status (%)			0.76	1	5
Never Married	1689	0.20			
Married	6091	0.74			
Cohabitation	47	0.01			
Divorced	185	0.02			
Widowed	258	0.03			

group as the reference group; ended up getting 5 dummy variables related to marital status. After removing all the missing data on educational attainment, 8,270 observations remained. The summary statistics of variables used in the regression model except the dependent variable was shown in Table 1.

4. RESULTS

The regression results of the Ordered Probit Model were reported in Table 2.

Firstly, the study focused on the effect made by three continuous variables, Total income, Sleeping hours per day, and Age. The results reported in Table 1 clearly showed that these continuous variables all had a positive relationship with the dependent variables respectively. Both sleeping hours and age played highly significant roles in impacting people's choice of life satisfaction. Since this was an Ordered Probit Model, the thresholds would be identified to report how the variables made an effect on the dependent variable, and the estimates of thresholds were shown in Table 3.

The statistics of each threshold and the information getting from Table 1 indicated that when the increase of one-unit total income made the value of the latent variable [1]changed from -3.547 to -1.737, the participants' response would change from "Not satisfied at all" to "Unsatisfied". What's more, if it changed the value from the scale of cut1 to cut 5, it showed that participants would report their life satisfaction as "Very satisfied" rather than "Not satisfied at all" with a one-unit total income increase. The results showed that people who had low income were more likely to have mental health issues.

This type of deduction to the other two continuous variables could be applied as well. For example, keeping other variables unchanged, if the participants who had one more sleeping hour per day made the value of the latent variable changed from cut1 to cut 3, then participants would regard their life satisfaction as "Neutral" instead of "Not satisfied at all".

Moreover, among these three continuous variables, since the estimated coefficient of age was the largest, it could be suggesting that age had the greatest effect on life satisfaction. Therefore, when all other variables were constant, one-unit age increasing (i.e. people become one-year older) would make the greatest

[1] $y_i = * x_i + e_i$, *See "Method" part for more specific explanation.*

effect compared with total income and sleeping hours per day. Summarizing the effects made by these continuous variables, low-income persons, sleep-deprived persons, and younger persons were vulnerable to mental health issues could be concluded.

Dummy variables would be discussed separately. First, gender. Gender was very significant with a p-value smaller than 0.001, and it had a negative relationship with life satisfaction, having "1" for the value of "males" and "0" for "females". Also, the estimated coefficient of -0.126 would decrease the latent variable by 0.126. If this kind of decrement made the value of the latent variable change from cut5 to cut4, it showed that male participants would consider their life satisfaction as "Satisfied" instead of "Very satisfied". If this kind of decrement changed the latent variable from cut5 to cut3, the male's choice would be "Neutral" and so on. Therefore, it could be considered that males were more vulnerable to mental health problems than females.

Second, registered residence. Though the currently registered residence showed a positive relationship with life satisfaction, the estimation made in the model was not significant, thus; the impact on life satisfaction would not be discussed.

Third, educational attainment. How the highest educational attainment affected life satisfaction would be measured. There were 4 groups, and group 1 (i.e. people whose educational attainment was below or equal to Primary School) was the baseline. Compared to group 1, both group 2[2] and group 3[3] had a negative relationship with life satisfaction respectively, while group 4[4] had a positive relationship with life satisfaction. Also, among these 3 groups, group 2 made the greatest impact on life satisfaction with the estimated coefficient of -0.061. Therefore, compared to group 1, if the participant was in group 2, it would make the latent variable change by negative 0.061. Overall, the results reported that using group 1 as the baseline, people who had finished Junior High and Senior High were more likely to have mental health issues but people who got the degree above Senior High would be more satisfied with their lives.

Last, marital status. Comparing with group 1[5], the results reported that all other 4 groups had a negative relationship with life satisfaction. In other words, compared to people who had never married, other groups of people were more likely to become unhappy and unsatisfied with their lives. Moreover, group 4[6] was a highly significant factor here, and it had an important effect on people's rate of their lives with the estimated coefficient of -0.414. It illustrated that compared to people who had never married, people who had divorced would make the value of the latent variable decrease by 0.414. Then, it was more likely to change the thresholds from a high scale to a low scale, thus, there was a greater possibility for people who had divorced to regard their lives as less satisfied. It revealed that people who had divorced were much more likely to be unhappy in their daily life, in other words, they were more emotionally vulnerable to mental health problems.

Fig. 1. shows the effects made by highly significant variables on respondents' life satisfaction. In particular, compared to "Never Married" people, "Divorce" played an important role here. It would be worth exploring to a deeper level such influence to see if it has the same effect on males and females.

When analyzing how "Divorce" affected life satisfaction based on gender, one problem raised here was how to deal with "Cohabitation" since people in this group included both people who experienced marriage before and people who had never married. Therefore, the study ran regression twice, having one group "Cohabitate" to "Divorced" and the other excluding it using the equation:

$$Life\ Satisfaction = \alpha + \beta_1 Gender + \beta_2 Divorce + \beta_3\ Gender \times Divorce + e$$

To run the Ordered Probit Model. Before interpreting the regression results, the demographic characteristics of variables in these two regressions were shown in Table 4 [1[7]].

[2] *People whose educational attainment was Junior High.*

[3] *people whose educational attainment was Senior High.*

[4] *People whose educational attainment was College and above.*

[5] *People who had never married.*

[6] *People who had divorced and did not have any girlfriend or boyfriend when they filled out the survey.*

[7] *Table 4 did not contain the dependent variable, life satisfaction.*

As shown in Table 4, different ways were used to group "Divorced" people to see if gender would make an impact on participants' mental health. The regression results were reported in Table 5, showing how "Divorce" affected males' and females' life satisfaction differently, compared to "Never married" people.

Table 5 shows that there was always a negative relationship between these three variables and life satisfaction respectively, no matter including "Cohabitation" or not. The results also confirmed the idea that males and divorced people were more susceptible to mental health issues. To compare how "Divorce" influenced males and females separately, Table 6 was used to understand such differences.

Table 2. Summary statistics

Variables	Est. coefficient	St. error
Life Satisfaction[8]		
Total Annual Income	0.099**	0.042
Sleeping hours/day	0.076***	0.012
Age	0.138***	0.015
Gender	-0.126***	0.024
Registered Residence	0.004	0.031
Educational Attainment[9]		
Junior High	-0.061**	0.029
Senior High	-0.031*	0.037
College and above	0.051*	0.045
Marital Status[10]		
Married	-0.043*	0.034
Cohabitation	-0.075	0.156
Divorced	-0.414***	0.084
Widowed	-0.106*	0.081

*Notes: N= 8,270. Prob > chi2 = 0.0000 in the regression model. ***p<0.001, **p<0.05, *p<0.5*

[8] *Life satisfaction was the dependent variable in the regression*

[9] *There were 4 dummy variables related to educational attainment. The first one was "Below or equal to Primary School" and it was the baseline of educational attainment.*

[10] *There were 5 dummy variables related to marital status. The first one was "Never Married" which was the baseline here.*

Table 3. Statistics of thresholds

Cut points	Est. coefficient	St. error
Cut1	-3.547	0.166
Cut2	-1.737	0.050
Cut3	-1.108	0.047
Cut4	-0.067	0.046
Cut5	0.675	0.047

Note: N=8,270. Cut 1 relates to "Not satisfied at all", cut 2 is "Unsatisfied", cut3 is "Neutral", cut4 is "Satisfied" and cut5 is "Very satisfied"

The above information could be concluded that when both a male and a female had experienced a divorce, males were always more likely to become unhappier in daily life, referring to a low degree of life satisfaction. Moreover, females who had never married had the highest degree of life satisfaction, indicating that they were groups of people who were least likely to have mental health issues among these four groups .

5. DISCUSSION AND CONCLUSION

This study focused on the relationship between socio-economic development and the population's mental health conditions in China. The main finding of the study suggested a positive relationship between total income, sleeping hours per day, age, and life satisfaction. Using the data from the CFPS 2016, the study found that having higher income and longer sleeping hours could help people with mental health. Compared to older people, young people were more vulnerable to mental health. Moreover, people who had finished Junior High and Senior High had worse mental health but people whose degree was above Senior High group had better mental health. The current study found that if people get divorced, they would have a much higher probability to have mental health problems. In addition, Males were more vulnerable than females overall, especially when both females and males get a divorce.

Under the new epidemic of COVID-19, people's mental health conditions had been greatly affected. Factors used to explain mental health might be different in current pandemic times. Therefore, future studies may take into account the changing climates and possible solutions to limitations when analyzing mental health issues in China and other countries around the world.

The research had some advantages. First, the data were extracted on the individual level, so

the individual's mental health conditions could be analyzed. Second, this study showed what socio-economic factors affect mental health in China properly by considering a lot of factors that could be used to explain mental health problems. In particular, the research considered registered residence which was one variable that served special meaning for Chinese society, though the result was not significant. Third, much of the regression results were reliable, significant, and they explained the problems of mental health in China well. Fourth, the study analyzed how being in a divorced family would influence male's and female's mental health conditions.

Table 4. Demographic characteristics of variables

Regression without "Cohabitation" group			Regression with "Cohabitation" group		
Variables	**N**	**Proportion/Mean (SD)**	**Variables**	**N**	**Proportion/Mean (SD)**
Marital Status (%)			Marital Status (%)		
Never Married	1689	0.90	Never Married	1689	0.88
Divorced	185	0.10	Divorced	232	0.12
Gender (%)			Gender (%)		
Male	1177	0.63	Male	1205	0.63
Female	697	0.37	Female	716	0.37
Marital*Gender	1874	0.07 (0.25)	Marital*Gender	1921	0.08 (0.27)

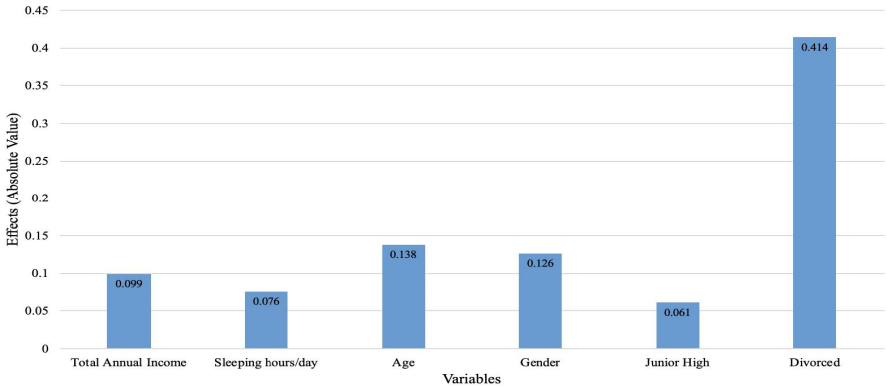

Fig. 1. Effects made by highly significant variables on life satisfaction

Table 5. Statistic information

Information from the model excluding "cohabitation"			Information from the model including "cohabitation"		
Variables	**Est. coefficient**	**St. error**	**Variables**	**Est. coefficient**	**St. error**
Marital Status, Divorced = 1	-0.190*	0.144	Marital Status, Divorced = 1	-0.202*	0.127
Gender, Male =1	-0.149***	0.053	Gender, Male =1	-0.149***	0.053
Marital * Gender	-0.202*	0.175	Marital * Gender	-0.010	0.156

*Notes: N=1,874 in the left three columns, and N=1,921 in the right three columns. Prob > chi2 = 0.0000 in both two regression models. ***p<0.005, **p<0.05, *p<0.5*

Table 6. Effects on life satisfaction based on gender and divorce

The model excludes "Cohabitation			The model includes "Cohabitation		
	Divorced	**Never Married**		**Divorced**	**Never Married**
Male	-0.541	-0.149	**Male**	-0.361	-0.149
Female	-0.190	0	**Female**	-0.202	0

There were some limitations to this study and some suggestions for future research. First, this study may not be representative enough to speak for the entire population in China, since the initial number of data gained was around thirty thousand, however, the data dropped to around eight thousand due to the existence of missing values. Besides, the study used the data collected in 2016, which could have discrepancies compared to the current situation in China. Second, most of the missing values were related to income, therefore, further research could pay more attention to this problem. Third, since all the data were collected by conducting surveys, participants may not be sincere during the data collection. Fourth, this study got the chance for unobserved heterogeneity in the model since each respondents' traits were unknown. They may have some unobserved characteristics affecting mental health conditions that were uncontrollable, for instance, participants may have a pet who could make them happier in daily life. Lastly, there might be reciprocal causality between income and life satisfaction. In other words, total income impacted mental health and mental health made an influence on total income. Therefore, it would be worthwhile for future studies to address the reciprocal causality issues.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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