The Impact of a Natural Disaster on Individuals' Health-Related Behaviors in China

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Abstract

This paper aims to investigate the impact of natural disasters on 3 individuals' health-related behaviours: drinking, sleeping and smoking. We estimate this impact by comparing the health-related behaviours between individuals who were and were not living in the provinces that were affected by the 2011 summer floods in China. We study this effect by using data drawn from the China Health and Nutrition Survey(CHNS) in 2009 and 2011 while restricting individuals' from the age of 18 to 75. We find that individuals living in the affected provinces tend to strongly engage in less sleep time, mainly driven by those living in rural areas. We also find individuals tended to decrease their cigarette consumption marginally overall, but women tended to increase their cigarette consumption after the floods. Furthermore, the floods had no significant effect on drinking behaviour for the overall sample.

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1.Introduction

As the world is increasingly affected by climate change and overexploitation of natural resources, we are all increasingly exposed to natural disasters. According to Aon Empower Result's Weather, Climate & Catastrophe Insight: 2019 Annual Report (2020), not only was 2019 the second warmest year on record since 1851, but there were also a total of 409 natural disasters in 2019, costing an estimated 232 billion USD in economic losses.

There recently has been an increasing number of studies examining how natural disasters, as a negative exogenous shock, change individuals' risk preferences and behaviours. Studies in economics literature observe changes in individuals' risk preferences by testing their risk attitudes when making financial decisions. Most studies show that individuals demonstrate that natural disasters induce greater risk aversion (Said et al.,2015; Cameron and Shah,2011). Some medically-related studies also examine whether individuals would change their alcohol or medical consumption after being exposed to natural disasters (Vetter et al.,2008; Cerda et al.,2010).

One of the more recent cases that relate to this topic is COVID-19. The virus is still spreading across the world. Millions of people have had confirmed cases and more than 0.3 million people have died because of it. With a worldwide lockdown and travel restrictions, the international financial and trade systems have shocked even more than in the financial crisis in 2008. The U.S. stock market triggered a circuit breaker four times in ten days in March (Funakoshi and Hartman,2020,para1&2).In Canada, an increasing number of people have chosen to work from home, and only essential businesses are allowed to remain open. This pandemic has profoundly threatened income and employment. Also, because of the pandemic, people have started to stay home longer, do groceries less frequently, and take more care more of their health conditions to prevent the virus. This natural disaster has a unique impact on individuals' daily routines, and people have started to change their behaviours. Even though, as a pandemic, it has not produced the same type of shocks that we discuss in this paper, there are still some similarities between them, which has motivated us to take a closer look at how natural disasters impact individuals' health-related behaviour.

This paper analyzes the effects of natural disasters on individual's health-related behaviours in China, focusing mainly on smoking, drinking, and sleeping related behaviours. China, as the most populous country in the world, has experienced a lot of natural disasters since ancient times. Therefore, China is also a suitable research object in investigating the impact of natural disasters on individual behaviour. To be more specific, we examine the impact of the June to September 2011 floods, caused by a 56-year record the most torrential rainfall in the past 56 years. The floods occurred in central and southern China, affecting 12 provinces and regions. It resulted in 256 deaths, 72 missing, and over 42 million people were affected with over 48 billion yuan in direct economic losses (NDRC, 2013). We examined whether individuals tend to drink or smoke more frequently or report sleeplessness after experiencing those floods by using a difference-in-difference strategy.

To further identify which factors might bring about variation in the impact of natural disasters, we will also introduce the heterogeneity of its impact along with gender and urban/rural differences.

To measure the change in individuals' behaviours, we are using panel data from the China Health and Nutrition Survey (CHNS). This survey was conducted every two to four years from 1989 to 2015 in all household, individual, and community levels. It includes both demographic and health-related data, and around 4400 households and 19000 individuals are covered.

We find that individuals tended to reduce their sleeping time after the floods, mainly driven by rural residents. As well, urban residents tended to smoke less, but we do not observe a similar pattern for rural residents. Only females tended to consume more cigarettes, and the females who were already drinkers would drink more frequently after the floods.

This paper will be structured as follows: Section 2 reviews the current related literature. Section 3 introduces the data, our sample and health outcome of interest. The identification strategy is in Section 4, Section 5 presents the main results, and the last part provides the concluding remarks and discusses the limitations of this study.

2.Literature review

There are two types of research related to this paper: literature that has studied the impacts of natural disasters on individuals' risk perception and the effects of other exogenous shocks on risk perception and health-related behaviours.

For the first type of literature, the authors usually launch a lottery experiment asking whether residents would choose a more risky option with a higher payoff or a safer but lower payoff after their neighbourhood had exposure to any recent natural disasters. Then the authors compare these results with the neighbourhood that had no exposure to the same natural disasters. For example, in Cameron and Shah's paper (2011), they conducted a risk game to measure risk perception in rural Indonesia. Then, they compared the results between the villages which had and had not been exposed to earthquakes or floods in the past three years. The result shows that residents with exposure to natural disasters are more risk averse than those without exposure to natural disasters. Similar results are introduced in a study about floods in Pakistan (Said et al.,2015)

Some studies have focused on how different levels of shock caused by natural disasters, such as financial losses and earthquake intensity, can change personal risk preferences. For instance, Page et al. (2011) did risk perception research about the 2011 Australia flood: they interviewed homeowners who had or not had damage to their property due to the floods. They noticed that the homeowners with a substantial loss on their property caused by the floods would prefer a riskier option than their unaffected counterparts. Cameron and Shah(2011) also find that those who experienced higher losses by natural disasters become more risk averse. A similar result comes from Said et al. (2015), who find that individuals who had substantial losses on their house structures would become more risk-loving, but this behaviour cannot be observed with other types of losses. They explain that it might be because the financial losses on house structure are higher than the other types of losses and the availability of possible future assistance from the government or a non-government organization (NGO). The authors also observed that seeing neighbours' damage due to the floods on house structures could lower individuals' risk aversion. Hanaoka et al. (2018) similarly examine the relationship between risk preference and the intensity of the earthquake and find there is no significant effect on the whole sample. However, men who experienced a higher intensity of earthquake would be more risk-tolerant even five years after this earthquake versus women where there was no significant effect.

Another important factor that affects risk preference is previous experiences on natural disasters in individuals' lifetime Said et al. (2015) uses the 2010 flood in Pakistan to take a closer look at the impact of past experiences on floods. Since most of the people in their sample have experienced floods in their lifetimes, past experiences only impact risk-taking behaviour for those living in the flooded areas in 2010. To the residents in 2010 flooded villages, the individuals who had experienced floods before are less risk averse than those who have not experienced floods. However, those residents with a greater number of past experiences would be more likely to make more risk averse choice than those had fewer. Using a different method in their research in Indonesia, Cameron and Shah (2011) did not focus on one specific natural disaster. Instead, they collected the number of floods and earthquakes over the past three years and loss caused by those natural disasters. Their results are statistically significant and demonstrate that the greater the damage from natural disasters, the more risk averse the game players would be. Their survey shows that those who had exposure to floods or earthquakes were more likely to expect another one in the future. This result can partly explain these changes in risk preference. However, this expectation would decrease as the effects of those experiences diminish over time.

Other factors, such as gender and education, can also influence changes in risk preference due to natural disasters. In a study based on the experience of natural disasters in Indonesia (Cameron and Shah,2011), females and older players are more risk averse in a risk game. Education and wealth also influence differences in risk perception. The more educated and wealthier individuals' are more risk loving. Given that the households with the larger loss in natural disasters are more risk averse, and that having insurance can indicate less risk aversion, the change of income can partly explain the changes in individuals' risk preference (Cameron and Shah,2011).

However, Said et al. (2015) find the opposite results. In this study, women marginally make riskier options, and older players would be more risk loving. The part of the labour force with uncertain income is also more risk loving, while those who had insurance products were more risk averse. In Said et al. (2015)' s risk experiment, there are three rounds. The payoff increases with rounds. Players who won in the previous round were more risk seeking in the next round. Conversely, those who lost in the previous round became more risk averse. These changes in behaviours demonstrate that players were more guided by their results in the previous rounds – in other words, they are correcting their risk-taking behaviour.

The second type of literature focuses on different types of exogenous shocks, such as an increase in cigarette prices or health information about themselves or those nearby, or spouse's health shocks, to health-related behaviour. Some of them are medically and psychologically related.

We begin by discussing smoking behaviour. Khwaja et al. (2006) examine how information about health shock affects individuals' beliefs and decisions to smoke. They collected information on smokers' spouses and their health shocks and found out that individuals tend to more risk averse due to their health shocks, but not of their spouses'. They also noticed that public health suggestions would not change individuals' decision to smoke. Similar results can be found in a study about males' smoking behaviour in China. Wang et al. (2018) found that male smokers would only change their smoking behaviour as a result of their own short- and long-term health experiences instead of their spouses' health or public information. Lin and Solan (2014) use the health shock of smoking neighbours as an exogenous shock-specifically, lung cancer - and find a significant effect on individuals' smoking behaviour. This shock resulted in smokers consuming fewer cigarettes, or increasing intentions to quit, which can be taken to represent being more risk-averse.

When it comes to sleeping behaviour, most changes in sleeping patterns are related to mental health, such as stress. According to Linton (2004), stress at the workplace is the main reason for sleeping problems, not general health conditions or irregular working hours. Linton found 816 employees working in various industries who had no sleeping problem at the initial self-reported assessment and felt gainful for their job as their sample. The author looked again at whether they had sleeping problems based on another set of self-reports after one year. In the follow-up assessment, 14.3% had experienced sleeping problems in the last three months.

Work-related stress from a “poor”psycho-social work environment was the most relevant even after controlling for gender and age.

Many papers are examining how natural disasters negatively affect individuals’ mental health conditions. For instance, Frankenberg et al. (2008) assess the post-traumatic stress reactions (PTSR) after individuals had exposure to the 2004 Indonesia tsunami. According to this research, levels of damage and property loss are positively related to PTSR. Women had higher PTSR scores than men. Surprisingly, socioeconomic indicators, such as education, were not correlated to PTSR level. Thus, in combination with the effects of natural disasters on mental health, there may be more populations with sleeping problems due to mental stress after natural disasters. Especially as most of the people in our paper are of working age, stress from a “poor” psycho-social work environment after a natural disaster could change their sleeping behaviours by a larger magnitude.

Some studies use natural disasters such as earthquakes and hurricanes as shocks to measure their impacts on changing individuals’ drinking behaviour. For instance, Shimizu et al. (2000) use the 1995 Great Hanshin earthquake in Japan to specifically assess the change of alcohol consumption related to this unpredictable shock. This earthquake happened in the first quarter of 1995, with a maximum intensity of 7. They compared the alcohol consumption per adult from official alcohol sale data in the heavily damaged area, the moderately damaged area, and the unaffected area, at three points: before, immediately after, and in the following year after the earthquake. The trend of change in alcohol consumption was slightly decreasing but varied on the level of damage. In the heavily damaged area, alcohol consumption per person decreased right after the earthquake as compared to the same quarter in the previous year.
Moreover, one year later, alcohol consumption for the whole year was even lower than in the same quarter in 1995. However, the trends in the moderately affected and unaffected areas were slightly different. Compared to average consumption in the past five years by quarters, consumption had an initial increase right after the earthquake in both areas but then a decreasing trend afterward. The authors suggested cultural context as a possible explanation for this decreasing trend in alcohol consumption. According to the Japanese drinking culture, Japanese people prefer drinking socially than drinking alone. As well, in Japanese society,

people tend to stop drinking instead of increasing alcohol consumption after tragic events. On the other hand, Vetter et al. 's (2008) study of Swiss survivors from the tsunami disaster in the Indian Ocean basin finds an increase in substance use, including alcohol and tobacco, after traumatic events. Related to these findings, Cerda et al. (2010) compare alcohol use before and after hurricanes. They find that alcohol consumption of individuals with light or moderate lifetime trauma is not correlated to the effect of hurricanes. Instead, with the impact of hurricanes, individuals with high lifetime trauma had higher alcohol consumption than before hurricanes.

Hanaoka et al. (2018) use a more recent earthquake- the Great East Japan Earthquake -to examine whether the intensity of earthquake affects risk taking behaviours such as gambling, drinking, and smoking (Hanaoka et al.,2018). Unlike Shimizu et al. (2000), Hanaoka et al. only find some statistically significant results in the areas with an intensity higher than 4. It is worth mentioning that Hanaoka et al. control for the change in employment status. However, they only investigate the most frequent consumers, including those who were drinking almost every day, gambling at least once a week, or smoking more than 40 cigarettes daily. As a result, drinking had a positive, but minor no statistically significant result on men only. Also, Hanaoka et al. (2018) find that in men, gambling has a statistically significant positive result when the intensity is equal to or higher than 4. Because of the nature of gambling, men would, therefore, be more risk-loving with a higher intensity of the earthquake. Hanaoka et al. also demonstrated that natural disasters still cause negative shocks to people in a developed country that had a long history of coping with frequent natural disasters.

From the above literature, we can see that the impact of natural disasters on health-related behaviours and risk perception varies by the influence of different factors. It also varies with the initial financial, psychological, and even cultural context. This paper focuses on three different health-related behaviours to demonstrate the change in health-related behaviours resulting from the 2011 floods in China. Due to the data constraints, we will only investigate whether urban/rural and gender differences will demonstrate different results.

3.Data

3.1. The CHNS data

The data of this study are from the China Health and Nutrition Survey (CHNS). This longitudinal data has been gathered every two to four years since 1989 in all household, individual, and community levels. This survey not only collects the health and nutrition-related data, but also contains various economic, demographic, and social-related variables(CHNS). The questionnaire is divided into five categories: Household, Adult, Child, Nutrition, and community survey with demographic information.

There have been more provinces added to the survey over the years, and the latest survey in 2015 has 15 provinces. There were 9 provinces in the 2009 survey and 12 provinces in the 2011 survey. The survey covers around 4400 households and 19000 individuals. In this paper, we only use the 2009 and 2011 surveys, and nine of those provinces are included.

We use survey data in 2009 and 2011, which was collected before, during and after the summer 2011 floods. The interview dates in the 2011 survey range from June to December. Therefore, all the data was collected during or after the flooding. Based on the surveys we use and the information about the different provinces' exposure to the floods, we determined subsets of individuals living in seven of the affected provinces as the treatment group and individuals living in the two unaffected provinces as the control group. The observations are from the individuals who participate in both 2009 and 2011 surveys, with the complete health-related behaviour information that we required. Moreover, to take into consideration that China's legal drinking and smoking age is 18, and to make our sample to be more representative, we restrict our observations to an age range of 18 to 75, leaving a final sample of 14,238 observations.

3.2. Health outcomes of interest

This paper includes 3 different health-related behaviours: drinking, sleeping and smoking and uses 5 different health-related outcomes, including time in bed, frequency of drinking per month, number of cigarettes per day, and whether or not currently drinking or smoking. All the health-related behaviour data are from the Adult Survey, which includes physical examination and physical activity information at the individual level.

In terms of the drinking behaviour, our information is drawn from answers to two questions asked in the survey: first, whether the respondent drinks alcohol, and second, a "frequency of alcohol consumption" question. In terms of frequency, the questionnaire asks options including "Almost every day", "3-4 times a week", "1-2 times a week", "1-2 times a month", and "No more than once a month". In order to more clearly observe any changes, we transform those options into a monthly-based definitive numerical value. For example, a response of "Almost every day" would be marked as "Drinks 28 times a month".

We measure smoking behaviours and daily cigarette consumption from the related questions on the survey, which include the questions "Ever smoked cigarettes", "Still smokes cigarettes" and "How many cigarettes do you smoke per day".

Finally, for sleeping behaviour, the outcome of time in bed per day is directly measured by the question of "Time in bed per day".

3.3. Independent variables

The independent variables include education, occupation, income per capita, age, marital status, and location. To be more specific, education is based on years in school from 0 to 18 years maximum, and occupation is categorized into 6 categories based on Liu et al. 's paper (2008). The income per capita in thousand is calculated by the household gross income that converts to 2015 Chinese yuan by using the Consumer Price Index and then divided by the number of people in each household.

4.Identification Strategy

This paper will measure the impact of floods on 3 health-related behaviours: sleeping, drinking, and smoking. We will be using panel data in 2009 and 2011, which tracks information before and after this natural disaster. We use a difference-in-difference strategy by controlling for ~~the~~ time-invariant individual fixed effects. Similar to Hanaoka et al. (2018), we capture this impact by comparing the health-related behaviour of individuals in the unaffected provinces(control group) and the affected provinces (treatment group). The treatment is the floods in the summer of 2011(the year of the floods). Following Cameron and Shah(2011), we assume that this flood is unanticipated. The common-trend assumption of our difference-in-difference strategy is that the change in health-related behaviour would be the same in both the control group and the treated group over the course of time in the absence of treatment (the floods).

The basic equation in this paper can be written as follow.

$$H_{it} = \beta_0+\beta_1 G_i + \beta_2 Year_t + \beta_3 T_{it}+\beta_4 X_{it} + \alpha_i + \varepsilon_{it} \qquad (1)^{1}$$

H_{it} indicates the outcomes of health-related behaviour for individual i at time t. G_i is the treatment group variable. It is equal to 0 if the individual i is in the control group and is equal to 1 if the person is in the treatment group. $Year_t$ is a dummy variable for the time of the floods. $Year_t$ is equal to 0 when individual i is before the floods and equals to 1 after the floods. T_{it} is the interaction term of the treatment dummy variable and time dummy variable which is equal to $G_i \times Year_t$.This term equals 1 if the individuals are in the treatment group after the floods and 0 otherwise. Following Hanaoka et al. (2018), α_i is the unobserved individual fixed effect that might affect health-related behaviours. For instance, the number of severe natural disasters individuals have experienced in the past, which is unobservable in this paper, might affect health-related behaviours after a natural disaster, (Cameron and Shah,2011; Said et al. ,2015).X_{it} is a vector of the control variables such as education, occupation, marital status, and income per capita. The gender and location variables such as urban/rural and province will be omitted, which represents that no move changes their location status in our sample. Lastly, ε_{it} is the error term.

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[1]In the estimate, the G_i will be omitted since the individuals remain in the same province in both survey years in our sample

5.Result

5.1. Descriptive Data

All the data were collected from 7,119 individuals and evenly distributed across all 9 provinces in the survey.

To verify that the control is a proper counterfactual for the treatment group, table 1 shows the essential individual characterization and health-related behaviours of our sample and displays the differences between the treatment and control groups. Since the floods affected most of the regions in our sample, the number of observations is relatively larger in the treatment group. In particular, there is no significant individual difference between the two groups. Table 1 shows that the average respondent is around 50-years-old with an annual income of approximately 20 thousand yuan, around 8 years of education, and usually married and living in a rural area.

It is worth mentioning that the gender and geographical location factors that might vary the impact of this flood on health-related behaviours: almost half of the individuals are male, and nearly 70% of our sample are from rural areas. Those characterizations explain why urban/rural is a necessary stratification for our paper.

Regarding health-related behaviour, the control and treatment groups have similar levels in all three behaviours and similar percentages of individuals who are currently drinking or smoking. The percentages of those current drinking and smoking are both around 30%, and the averages for drinking consumption is approximately 4 times a month, alongside 4 -5 cigarettes per day. The average sleeping time is around 7 hours per day.

Table 1 Descriptive statistics(N=14,238, population age:18-75)

Variables	Full Sample		Treatment Group		Control Group	
	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Panel A: Individual Characteristics						
Household Income per capita (thousand)	21.31	29.15	22.22	30.64	18.54	23.82
Age group	50.20	12.87	50.76	12.87	48.51	12.75
Gender						
Male	0.47	0.50	0.46	0.50	0.48	0.50
Education(schooling year)	7.88	4.37	7.78	4.48	8.21	4.02
Marital status						
Married	0.88	0.32	0.89	0.32	0.87	0.34
Primary occupation						
No job	0.37	0.48	0.39	0.49	0.33	0.47
Farmer	0.29	0.45	0.27	0.44	0.34	0.47
Technical worker	0.05	0.22	0.05	0.22	0.06	0.23
Other job	0.05	0.22	0.05	0.21	0.06	0.23
Officer	0.03	0.16	0.03	0.17	0.02	0.14
worker	0.12	0.32	0.13	0.33	0.12	0.32
Urban/Rural						
Urban	0.31	0.46	0.32	0.46	0.29	0.45
Province						
Heilongjiang(Control)	0.11	0.39	-	-	-	-
Guangxi(control)	0.13	0.34	-	-	-	-
Liaoning	0.11	0.31	-	-	-	-
Jiangsu	0.11	0.31	-	-	-	-
Shandong	0.11	0.31	-	-	-	-
Henan	0.12	0.32	-	-	-	-
Hubei	0.10	0.30	-	-	-	-
Hunan	0.10	0.30	-	-	-	-
Guizhou	0.10	0.30	-	-	-	-
Panel B: Health-Related Behavior						
Currently Drinking(1 = yes, 0 = no)	0.33	0.47	0.33	0.47	0.32	0.49
Frequency of drinking per month	4.33	8.64	4.44	8.89	3.55	7.82
Sleeping(Time in bed per day, hourly)	7.89	1.21	7.87	1.22	7.95	1.19
Currently smoke(1 = yes, 0 = no)	0.31	0.46	0.31	0.46	0.31	0.46
Number of cigarettes per day	4.62	8.99	4.61	9.08	4.67	8.72
Number of Observations	14,238		10,718		3,520	

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

5.2. The overall sample

Table 2 shows the result for equation 1 for all 5 health outcomes in drinking, smoking, and sleeping, for the overall sample. Two of the health outcomes (i.e. currently drinking and currently smoking) are binary variables and take a value of 1 if individuals were respectively smoking or drinking during the survey year or 0 if they were not. Since those are binary variables, technically, we can choose the discrete choice model, but it is for the random effect. Therefore, the linear probability(LMP) model is the only option because we are using the individual fixed effect model with panel data to compare the utility of each choice on aggregate. Furthermore, the LMP model produces good approximations for the average. In **Table 2** (column 1 and column 5), the averages of currently drinking and currently smoking are both at approximately 0.32. Sleeping is measured by the number of hours the individuals spent in bed per day. The frequency of drinking per month is a count of drinking frequency per month for each drinker (detail can be found in section 3). The number of cigarettes per day reflects the number of cigarettes each smoker consumes per day.

As we can see from **Table 2**, for most of the outcomes, floods do not appear to have any significant effect on drinking, except for smoking behaviours (marginally significant, see column 6) and a negative statistically significant effect on sleeping (column 4). The floods seem to decrease sleeping by 0.082 hours per day for the overall sample, which is 1.04% of the average sleeping hours. While this effect is relatively small, it is still statistically significant. This reduction in sleeping time could be explained by increased stress due to the occurrence of a natural disaster. As for smoking, the number of cigarettes per day decreases by 0.3122 cigarettes, which is 6.8 % of their average cigarette consumption as a result of the floods, but this effect is only marginally statistically significant (p-value=0.081).

Given that the people who do not smoke are also included in the frequency variable, these results could be driven by the mass at zero. The situation could be similar to drinking behaviours, where over 60% of respondents who do not drink. To investigate whether the absence of results is driven by those who do not smoke (or drink), we run a regression that only uses the drinking frequency and cigarette consumption conditional on individuals who are currently drinking or smoking (column 3 and column 7). Comparing column 2 to column 3 and column 6 to column 7, we notice that there are similar patterns in the frequency of drinking and cigarette consumption with a noticeable increase in the magnitude of their coefficient after excluding individuals who do not smoke(or drink). For drinking, the change in drinking frequency per month changes from an increase of 0.0656 times to an increase of 0.6320 times. As regards smoking, the change in cigarette consumption per day changes from a decrease of 0.3122 cigarettes to a decrease of 0.7823 cigarettes. However, the floods still do not seem to have a statistically significant impact on the frequency of drinking and smoking.

Table 2 Change in health-related behaviours (Overall sample)

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	0.0122	0.0656	0.6320	-0.0820**	0.0011	-0.3122*	-0.7823
	(0.0119)	(0.1973)	(0.6080)	(0.0417)	(0.0090)	(0.1787)	(0.4875)
Constant	0.6071	12.2892	40.8077	10.0556	-0.2693	0.3402	6.2421
	(0.8813)	(13.9687)	(41.6220)	(3.3250)	(0.6084)	(12.4594)	(35.7448)
Control mean	0.3241	3.5491	10.9492	7.9506	0.3122	4.6665	14.9463
Number of observation	14,238	14,238	4,699	14,238	14,238	14,238	4,399

Note: Robust standard errors adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

5.3. Male and female

In our sample, around 60 % of males smoke, but only 4 % of females smoke. Given that smokers are predominantly males in China, and given that drinking behaviour is different between males and females, We will stratify the regressions by gender.

Table 3 indicates the result of health-related behaviours for males and females, respectively. As we can see, with this stratification, cigarette consumption in the male group is significantly affected by the floods. Looking at Panel A of **Table 3** (column 6) with males only, the floods seem to have a negative statistically significant effect on cigarette consumption. Males who are exposed to the floods tend to decrease their cigarette consumption by 0.86 cigarettes per day, which is 9.9% of the control group's average cigarette consumption. Moreover, in Panel A of **Table 3**, the floods had a positive but not statistically significant effect for males in drinking frequency (column 2) and choosing whether to smoke or not (column 5). There is also no statically significant effect on sleeping behaviour in the male sample (column 4).

On the other hand, results from Panel B of **Table 5** (column 6) show that the floods had a negative and marginally statistically significant effect on cigarette consumption for women (p-value=0.079). Women who are exposed to the floods tend to increase their cigarette consumption by 0.1818 cigarettes per day, which is 3.9% of the average consumption. Also, even though none of the effects are statistically significant in this panel, evidence shows that females tend to drink more frequently (column 2), and more of them might start to smoke (column 5) after the floods. Even though the floods brought a negative effect on sleeping (column 4), it is not statistically significant.

To examine if the significant effect on men's drinking and smoking frequency are driven by the individuals who do not smoke or drink, we run a regression in which we focus on those who are currently drinking or smoking. We present these results in column 3 and column 7 in Panel A**.** Results in column 3 reveal that the negative and statistically significant effect on cigarette consumption in the male sample decreases to an only marginally statistically significant effect (p-value=0.06). This result suggests that being exposed to the floods would decrease men's cigarette consumption by 0.9698 cigarettes per day, which is 20.8% of the entire control group. This change in the significance level of the estimates might be due to loss of efficiency in the estimation as a result of the reduction in the sample size.

After excluding the non-drinkers or non-smokers in column 3 and column 7, the floods seem to have a positive and statistically significant effect on women's drinking frequency (Panel B). Therefore, exposure to floods increases females drinkers' drinking frequency by 3.45 times more per month, which represents 97.5% of the average frequency of the entire control group. In this case, an absence of the result in drinking frequency is driven by the non-drinking females. Besides drinking, the floods do not seem to have an effect on cigarette consumption for females.

Comparing the result from both Panel A and Panel B, we can say that overall there are different (sometimes opposite) results on the frequency variables of drinking and smoking when we stratify by genders. Males have a statistically significant negative effect on cigarette consumption at the 5 percent level, whereas females have a positive and only marginally statically significant (p-value=0.079) effect. This means females tend to increase their cigarette consumption after being exposed to the floods, and males have the opposite reaction. Additionally, female drinkers tend to drink more frequently after being exposed to the floods, but those reactions are not observed in the male group.

These differences can be explained in several ways. Firstly, it might be because of the change in their risk preferences. Females are reacting in a way that suggests that they are less risk-averse after the floods. Some studies suggest that individuals become more risk averse after natural disasters (Said and al, 2015; Cameron and Shah, 2011) but Said et al. (2015) also notice that female respondents tend to marginally make riskier choices in the risk games than male respondents after the floods in Pakistan. Hence, in our study, women tend to smoke more, which constitutes a risk on their health since cigarette consumption results in negative health outcomes(such as cardiovascular and respiratory systems diseases) (Maritz and Mutemwa, 2012)

Secondly, males and females might have different reactions to the floods. Frankenberg et al. (2008) found that women had a higher score in post-traumatic stress disorder (PTSD) exams compared to men after the 2004 Indonesia Tsunami. This means that when faced with the same natural disaster or shock, women are more traumatized than men. Further, Vetter et al. (2008) show that, in general, people tend to increase tobacco consumption after traumatic events. Therefore, combining evidence on how women process traumatic events differently with information about how traumatic events affect cigarette consumption provides us with insights regarding the results we observed for women. As for the decrease in cigarette consumption for men, this might be interpreted as an increase in their risk aversion.

Thus, the absence of overall effects for cigarette consumption is observed because the decrease in men's cigarette consumption was counterbalanced by the positive effect on women. Similarly, the positive effect on women's drinking frequency was diluted by the absence of the effect on men.

Table 3 Change in health-related behaviours (stratification by gender)

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Male only							
T_{it}	0.0162	-0.015	0.4313	-0.0941	-0.0077	-0.8556**	-0.9698*
	(0.0206)	(0.3852)	(0.6350)	(0.0607)	(0.0172)	(0.3565)	(0.5147)
Constant	0.9924	35.3785	45.4794	12.8965	-1.2198	-3.5530	8.1323
	(1.6291)	(29.6525)	(43.0714)	(4.4770)	(1.3531)	(28.7896)	(36.9781)
Control mean	0.5878	6.894	11.7295	7.9812	0.573	8.7226	15.222
Number of observation	6,636	6,636	4,037	6,636	6,636	6,636	4,100
Panel B: Female only							
T_{it}	0.0075	0.1462	3.4535**	-0.07450	0.0090	0.1818*	0.8926
	(0.0128)	(0.1346)	(1.3392)	(0.0575)	(0.0067)	(0.1033)	(1.6554)
Constant	0.1747	-4.5394	-214.2511	7.4843	0.4041	3.1984	-30.9449
	(0.9352)	(10.0583)	(135.3691)	(4.7441)	(0.3098)	(3.2897)	(132.3126)
Control mean	0.0785	0.4319	5.5035	7.0221	0.0692	0.8864	12.8175
Number of observation	7,602	7,602	662	7,602	7,602	7,602	299

Note: Robust standard errors adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.
*0.1>p>0.05 ,**p< 0.05.
Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

5.4. Urban and rural areas

Residents of urban and rural areas may behave differently in reaction to natural disasters. This is perhaps due to the financial loss and facility damage caused by natural disasters which might influence individuals' change in risk perceptions in rural areas (Cameron and Shah, 2011; Said et al., 2015; Page et al., 2011), which was mentioned in section 2. Most of these papers focus on the neighbourhoods in rural areas and some similar losses that mainly occurred in rural China in our study, such as agriculture-related loss. Furthermore, Kirsch et al. (2012) show that in Pakistan, the population in rural areas were more affected than those in urban areas, in terms of income and access to the services following the 2010 floods and these areas also had a slower recovery than urban areas. Over 70% of the observation in our sample is from the rural areas where farming has the largest (40.68%) share in all 5 occupation categories. Also, over 70% of the farmers were living in the provinces that had exposure to the floods in our study. Therefore, it is also necessary to stratify our regressions by region. The results of this urban/rural stratification are presented in **Table 4**. With this stratification, only cigarette consumption in urban areas and sleeping behaviours in rural areas were significantly affected by the floods.

In Panel A of **Table 4**, we can see the floods seem only to have a negative and statistically significant impact on cigarette consumption in urban areas(column 7). Indeed, the residents in urban areas were smoking 0.63 cigarettes less after being exposed to the floods, which is 8.1% of the average cigarette consumption. These results are in line with results in other studies that argue that generally, individuals became more risk averse as a result of natural disasters (Said et al.,2015; Cameron and Shah, 2011). For sleeping and drinking, there is no statistically significant effect for residents in urban areas.

As for rural areas, results in Panel B of **Table 8** (column 3) indicate that the floods have a significant negative effect on sleeping only. This result suggests that the effect on sleeping behaviour in the overall sample is driven by people living in rural areas. Specifically, for residents in the rural areas, being exposed to the floods decreased sleep by 0.1 hours per day, which 1.3 % of the average sleeping time. While this is a small effect, it is still statistically significant. In the context of Pakistan, Kirsch et al. (2012) find that households living in rural areas who were exposed to the floods were more commonly financially affected by the 2010 Pakistan flood. They also recovered at a slower pace to their previous living standards and were slower to regain access to essential services such as clear water and electricity when compared to those who were living in urban areas. Hence, it is possible that in our study, the residents in rural areas lost sleep because they were more stressed as a result of this slower recovery from financial loss and access to the utilities after the floods. Apart from sleeping, there is no significant effect on smoking or drinking behaviours for people living in rural areas (Panel B). However, results seem to suggest that floods decrease the frequency of drinking and smoking.

To account for the fact that the absence of results may be driven by those who do not drink or smoke, we focus on those who are currently smoking and drinking in both panels (column 3 and column 7). As a result, the effect on cigarettes is less precisely estimated are thus is not statistically significant anymore (Panel A, column 7). However, the results remain in the same order of magnitude.

By comparing cigarette consumption in Panel A (column 6 and column 7), the impact on urban areas could point towards more risk aversion than people living in urban areas because they tend to decrease their cigarette consumption. The patterns in rural areas reflect a higher stress level and less sleep. Based on the result from Pakistan floods in Kirsch et al. (2012), there is a higher percentage of people in the rural area who lost their income, and they recovered from their financial loss at a slower pace than urban residents. Hence, they feel more stressed. Therefore, if the financial loss hypothesis and slow recovery scenario are true, then in our study, the decrease in residents in rural areas' budget may explain the absence of an effect on drinking and a negative effect on smoking.

Table 4 Change in health-related behaviours (stratification by region)

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Urban only							
T_{it}	0.0323	0.4546	1.2020	-0.0191	-0.0219	-0.6349**	-0.9973
	(0.0222)	(0.3527)	(1.0803)	(0.0732)	(0.0156)	(0.2756)	(0.8559)
Constant	1.7294	-3.6244	-39.1146	4.4864	-0.2979	1.2078	7.0954
	(1.5771)	(24.4023)	(93.9198)	(5.8879)	(0.9376)	(14.6797)	(80.7586)
Control mean	0.329	3.1988	9.7221	7.9105	0.2485	3.4911	14.048
Number of observation	4,394	4,394	1,417	4,394	4,394	4,394	1,245
Panel B: Rural only							
T_{it}	0.0019	-0.123	0.3542	-0.1075**	0.0113	-0.1829	-0.7783
	(0.0141)	(0.2383)	(0.7401)	(0.0508)	(0.0109)	(0.2264)	(0.5850)
Constant	0.1438	17.7945	65.2771	12.0532	-0.2250	0.3438	3.9587
	(1.0535)	(16.8271)	(46.4958)	(3.9890)	(0.7574)	(16.1541)	(39.4719)
Control mean	0.3222	3.6893	11.4506	7.9666	0.3377	5.1368	15.2108
Number of observation	9,844	9,844	3,282	9,844	9,844	9,844	3,164

Note: Robust standard errors, adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

5.5. Robustness check

One possible concern arising from the results obtained earlier is an age restriction for our sample, which includes adults over 65 who may have different health-related behaviour as a result of their age. Indeed, chronic conditions are more common as one ages. While these conditions may arise in later years as well, many preventative lifestyle changes may be triggered around the age of 65, as it is the usual age of retirement. To investigate whether our results may be affected by the inclusion of this age group, we re-estimated our regression model by excluding data from above the age of 65 from the sample. With the new restriction, we lost 2,072 and retained 12,166 observations in our new regressions.

To further examine whether this age restriction is the reason we did not obtain a robust result, we also run a regression with individuals who are older than 65 but younger than 75. The results are in **Table 7** and **Appendix,** and 2,072 observations are involved in this regression.

Table 5 shows that the results obtained in the overall sample are robust. According to the result in column 4, the floods still have a negative impact on sleeping behaviour. However, this result is only marginally statistically significant (p-value=0.077). The precision has changed because the sample size is smaller with the new age restriction.

Table 5 Change in health-related behaviours (Overall sample)until age 65

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	0.0115	0.1145	0.6702	-0.077*	-0.0009	-0.2698	-0.5849
	(0.0128)	(0.2097)	(0.6213)	(0.0437)	(0.0093)	(0.1937)	(0.5216)
Constant	0.9877	16.0346	41..3129	7.2127	-0.5132	-2.2734	2.5116
	(0.9171)	(14.9293)	(42.8286)	(3.2429)	(0.6557)	(13.0310)	(37.8377)
Control mean	0.3340	3.6584	10.7609	7.9441	0.3127	4.8393	15.4779
Number of observation	12,166	12,166	4,266	12,166	12,166	12,166	3,727

Note: Robust standard errors, adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

The results with stratification by gender (**Table 6**) are all robust. The cigarette consumption for males is robust, with the exclusion of individuals above the age of 65. However, Panel A of **Table 6** (column 4) reveals that the floods have a negative and marginally significant (p-value=0.094) impact on sleeping among men below the age of 65. According to Panel B of **Table 7** (column 4), the floods had a positive but not statistically significant effect on men who are between 65-75 years old. It indicates that the negative effect on individuals who were under the age of 65 was counterbalanced by the positive effect on men in the 65-75 age range. Similarly, the cigarette consumption for females (Panel B of **Table 6**, column 6) still has a positive and marginally not statistically significant effect (p-value==0.057). However, the margin decreases with the new age restriction, which means the impact of floods on cigarette consumption increases in strength among younger female groups. Panel B of **Table 6** (Column 2) demonstrates that the frequency of drinking among female drinkers is still robust without individuals above the age of 65.

Table 6 Change in health-related behaviours (stratification by gender)until age 65

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Male only							
T_{it}	0.0162	0.1398	0.4889	-0.1061*	-0.0135	-0.7893**	-0.7933
	(0.0221)	(0.4126)	(0.6496)	0.0634	(0.0182)	(0.3871)	(0.5502)
Constant	2.4487	47.7777	46.4979	11.9430	-1.6330	-11.8958	0.6660
	(1.6294)	(30.6186)	(44.4678)	(4.2994)	(1.4167)	(29.4839)	(38.7167)
Control mean	0.6155	7.1129	11.5556	7.0714	0.5777	9.0903	15.7356
Number of observation	5,692	5,692	3,637	5,692	5,692	5,692	3,517
Panel B: Female only							
T_{it}	0.0062	0.0155	2.9801**	-0.0538	0.0105*	0.2042*	1.7719
	(0.0139)	(0.1335)	(1.4033)	(0.0605)	(0.0062)	(0.1072)	(1.8417)
Constant	-0.2747	-7.9751	-172.967	3.3056	0.3728	4.1542	94.5235
	(1.0107)	(11.1888)	(141.031)	(4.6654)	(0.3397)	(1.9992)	(70.5688)
Control mean	0.0816	0.4191	5.1374	7.9184	0.0641	0.8531	13.301
Number of observation	6,474	6,474	589	6,474	6,474	6,474	210

Note: Robust standard errors, adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

Table 7 Change in health-related behaviours (stratification by gender)from age 65 to age 75

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Male only							
T_{it}	0.0240	-0.9585	0.1213	0.0389	0.0427	-1.3481	0.7397
	(0.0586)	(1.1029)	(2.9390)	(0.1934)	(0.0518)	(0.8837)	(1.7478)
Constant	-13.2490	-76.6638	-10.2456	20.8458	3.2874	77.5964	124.1883
	(5.4910)	(65.3406)	(28.1934)	(21.8827)	(2.8532)	(86.7503)	(84.8488)
Control mean	0.3698	5.1771	14	8.0573	0.5365	5.8385	10.8835
Number of observation	944	944	400	944	944	944	400
Panel B: Female only							
T_{it}	0.0242	0.6624	-	-0.2308	0.0014	0.0291	-7.4299
	(0.0350)	(0.5417)	-	(0.1760)	(0.0332)	(0.3485)	(4.7505)
Constant	3.2423	15.2378	-	41.2195	0.0952	-3.8854	-196.3109
	(2.0882)	(15.0977)	-	(17.5008)	(0.8432)	(24.1890)	(319.5091)
Control mean	0.0556	0.5278	9.5	7.9491	0.1065	1.1343	10.6522
Number of observation	1,128	1,128	73	1,128	1,128	1,128	89

Note: Robust standard errors adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

Also, when we stratified the regression by geographical location in **Table 8**, the results are all robust. The cigarette consumption in the urban area (column 5, Panel A of **Table 8**) is robust and still negative but only marginally statistically significant (p-value=0.067) with the smaller sample size. The result of overall sleeping behaviours appears to be driven by the rural areas is robust(column 4, Panel B). Based on Panel B of **Table 8** (column 3), the floods still had a negative effect but only marginally statistically(p-value=0.064) in rural areas because of the decrease in sample size.

Table 8 Change in health-related behaviours (stratification by region)until age 65

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Urban only							
T_{it}	0.0207	0.4449	1.0399	-0.0173	-0.0182	-0.5660*	-0.5857
	(0.0239)	(0.3721)	(1.0847)	(0.0770)	(0.0167)	(0.3092)	(0.9001)
Constant	1.7361	6.5683	-33.1576	-1.2760	-0.2829	-0.1868	9.2009
	(1.5871)	(23.7592)	(93.8621)	(5.5824)	(0.9884)	(15.4107)	(80.6057)
Control mean	0.3530	3.3877	9.5967	7.9225	0.2685	3.8854	14.4698
Number of observation	3,696	3,696	1,299	3,696	3,696	3,696	1,063
Panel B: Rural only							
T_{it}	0.0065	-0.0382	0.4792	-0.0986*	0.0075	-0.1572	-0.6656
	(0.0152)	(0.2539)	(0.7616)	(0.0532)	(0.0112)	(0.2426)	(0.6294)
Constant	0.6529	19.6780	65.4521	10.6471	-0.5573	-3.4972	-1.9915
	(1.1120)	(18.6136)	(48.2039)	(3.9174)	(0.8264)	(17.0499)	(42.5760)
Control mean	0.3350	3.7625	11.2324	7.9524	0.3296	5.2060	15.7935
Number of observation	8,470	8,470	2,927	8,470	8,470	8,470	2,664

Note: Robust standard errors adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

6.Conclusion

Many studies have investigated the impact of natural disasters on changes in risk perception. However, there is limited research on the impact on individuals' health-related behaviours. Thus, we chose 6 health outcomes in three behaviours to test the influence of the summer 2011 floods that occurred in China.

Our findings suggest that the floods have a negative effect on individuals' sleeping time overall. After stratifying by gender and geographical location, the data shows that rural residents may be more sensitive to sleeping time and tend to sleep less after the floods. Meanwhile, residents in urban areas decreased their cigarette consumption. We find that, after the floods, women engaged in heavier cigarette consumption, and female drinkers tended to drink more often.

As a traditionally agriculture-based society, using Chinese data to analyze the impacts of natural disasters on health-related behaviours would be good supporting evidence for any future research on related topics in other developing countries with similar economic structures.

This paper has several limitations. Firstly, because the CHNS survey is not conducted annually, the data is not collected immediately before and after natural disasters. Hence, many other possible variables might influence health-related behaviours in the two years between the survey datasets we are using. Secondly, even though these datasets have a series of detailed variable options with a large number of observations, the information is only available at the provincial level, and we can only divide the affected and unaffected areas at the provincial level. Therefore, we could not capture more precise geographical variation that may underestimate the influence of natural disasters on health-related behaviours in our results. Finally, since this survey focuses on health and nutrition, there are fewer variables directly related to the consequences of natural disasters such as financial loss due to the floods. These questions are beyond the scope of our research but remain as a suggestion for further study.

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Appendix

Table 9 Change in health-related behaviours (Overall sample) from age 65 to age 75

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	0.0229	-0.0791	0.5724	-0.1004	0.0217	-0.6035	-8.2489**
	(0.0334)	(0.5947)	(2.9194)	(0.1313)	(0.0297)	(0.4501)	(1.3748)
Constant	-2.1173	-10.7068	-9.4409	35.2169	1.6399	14.5488	10.1438
	(2.5569)	(26.9799)	(24.6269)	(13.7500)	(1.0716)	(35.5484)	(98.9128)
Control mean	0.2034	2.7157	13.3494	8	0.3088	3.3480	10.8413
Number of observation	2,072	2,072	473	2,072	2,072	2,072	672

Note: Robust standard errors adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)

Table 10 Change in health-related behaviours (stratification by region)from age 65 to age 75

Outcomes	Drinking			Sleeping	Smoking		
	Currently drinking(Yes = 1)	Frequency of drinking per month		Time in bed per day	Currently smoking(Yes=1)	Number of cigarettes per day	
	Total	Total	Drinker only	Total	Total	Total	Smoker only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Urban only							
T_{it}	0.1122	0.7885	5.8672	-0.021	-0.0376	-0.9593*	-6.169**
	(0.0600)	(1.0488)	(5.5372)	(0.2080)	(0.0434)	(0.5260)	(2.5386)
Constant	2.3244	-105.2407	-603.1792	54.9091	-1.1735	8.1437	81.1133
	(5.6021)	(83.0871)	(765.4363)	(25.1740)	(1.8319)	(29.9579)	(64.2752)
Control mean	0.3276	3.8448	11.1923	7.8448	0.2241	1.8966	8.6111
Number of observation	698	698	118	698	698	698	172
Panel B: Rural only							
T_{it}	-0.0194	-0.3649	0.0156	-0.1935	0.0475	-0.4063	-2.2079
	(0.0396)	(0.7023)	(3.4552)	(0.1649)	(0.0369)	(0.6282)	(1.5203)
Constant	-3.5868	13.0314	-37.6780	25.4976	3.0388	34.5196	-8.2803
	(2.9198)	(18.7973)	(33.6657)	(16.0339)	(3.4500)	(46.061)	(102.6532)
Control mean	0.3881	14.3333	5.7537	8.1493	0.6716	7.5448	11.213
Number of observation	1,374	1,374	355	1,374	1,374	1,374	500

Note: Robust standard errors, adjusted for clustering on individuals. All columns control for individual characteristics, including age, education, occupation, marital status, and income per capita, and time-invariant individual fixed effect.

*0.1>p>0.05 ,**p< 0.05.

Source: China Health and Nutrition Survey(CHNS,2009 and 2011)