BMJ Open

Different Predictors of Pain Severity across Ages and Genders of General Population in Rural China

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-020938
Article Type:	Research
Date Submitted by the Author:	06-Dec-2017
Complete List of Authors:	Liu, Xiao-kun Xiao, Shuiyuan; Xiangya Hospital, Mental Health Center Zhou, Liang; Guangzhou Huiai Hospital, ; Hu, Mi; School of Public Health, Central South University, Department of Social Medicine and Health Management Liu, Hui-ming
Keywords:	Pain management < ANAESTHETICS, Public health < INFECTIOUS DISEASES, Adult anaesthesia < ANAESTHETICS

Different Predictors of Pain Severity across Ages and Genders of General Population in Rural China

Xiao-kun Liu[1]

Shui-yuan Xiao*, [1]

Liang Zhou[2]

Mi Hu[3]

Hui-ming Liu[4]

21-pages

1 figure and 8 tables

1: Mental Health Center, Xiangya Hospital, Central South University, Changsha, Hunan 410008, China;

* Corresponding Author: Shui-yuan Xiao; Xiangya Hospital, Central South University, 87 Xiangya Road, Changsha, 410087, Hunan, China. E-mail address: xiaosy@csu.edu.cn; Tel: +86-13907494509; Fax: +86-84805459.

2: Affiliated Brain Hospital of Guangzhou Medical University, Guangzhou, China.

3: Department of Social Medicine and Health Management, School of Public Health, Central South University, China;

4: Shenzhen Kangning Hospital, Shenzhen, China.

Abstract

Objectives: This study investigated the following problems: (1) the pain prevalence among general adult population in rural China over the course of 4 weeks; (2) the risk factors of experiencing pain among the participants; (3) the different predictors of pain severity across ages and genders among general population.

Methods: Data were collected from a random multistage sample of 2,052 participants (response rate = 95%) in rural areas of Liuyang, China. We used visual analogue scale to assess participants' pain experienced and a series of internationally validated instruments to assess their self-reported health status, depression symptoms, anxiety symptoms, sleep quality, self-efficacy and perceived stress.

Results: The pain prevalence over the 4-week period in rural China was 66.18% (62.84% for males and 68.82% for females). A logistic regression model revealed that being female (OR = 1.41, 95%CI: 1.13 – 1.75), age (OR = 1.55, 95%CI: 1.31 – 1.84) and depressive symptoms (OR = 1.06, 95%CI: 1.02 – 1.10) were risk factors of experiencing pain. Multivariate analyses revealed that 1) pain severity of young people was related to psychosocial factors, while the pain severity of middle aged and old people was mainly related to their physical conditions; 2) males' pain severity was related to their socioeconomic status and perceived physical health and females' pain severity was related to their self-efficacy and perceived physical health.

Conclusions: The predictors of pain severity across different ages and genders were different, which suggests that pain treatment for the general population should be designed with consideration to different ages and genders.

Strengths and limitations of this study

This study established the prevalence of pain among general population in rural China over a 4-week period.

To our knowledge, this is the first study to reveal the different predictors of pain severity across ages and genders among general population.

The cross-sectional design of this study prevented us from determining the causes of pain experienced.

Key words: Pain prevalence; pain severity; gender; cross-sectional study.

Different Predictors of Pain Severity across Ages and Genders of General Population in Rural China

Introduction

Pain is a public and clinical health concern. The prevalence of pain and chronic pain has been estimated to be 20% and 10% annually among the general population[1, 2]. To date, most studies on pain prevalence have been conducted in developed areas such as in the United States[3-7], Canada[8-11], Australia[12-14], Britain[15] and European countries[16-19]. The few studies on pain prevalence in China have mainly focused on the residents of large cities. For example, Jackson et al. (2014)[20] reported that the pain and chronic prevalence was 42.2% and 25.8% respectively, during the past 6 months in Chongqing, China. Chen et al (2016) studied a mix of urban and rural Chinese and found that the chronic pain prevalence among women and men in China was 39.92% and 32.17 % respectively[21]. Rural Chinese comprises over half of China's total population and they have significantly lower income[22] and poorer medical health services[23, 24] than urban citizens. However little is known about the pain prevalence of the rural population in China.

Experiencing pain is a biopsychosocial process[1]. The potential risk factors of experiencing pain among the general population include physiological factors and psychosocial factors. The former include genes, injury, and health status. The latter include early life factors[25], being female[21, 26], poor sleep[27-31], distressed mood (depression, anxiety)[32], psychosocial environment (social suffering setting[33]), perceived stress[34], religion and self-efficacy (SE)[35, 36]. Reliable analysis of the risk factors of pain in the rural population is needed for targeting people at higher risk among this specific population and facilitating treatment planning in China.

The exploration of differences in pain across age and gender has been recommended by the International Association for the Study of Pain[37]. Most epidemiological and experimental studies have indicated that older people[12, 38, 39] and females[40, 41 42] are at greater risk of experiencing pain. However, the differences in the predictors of pain severity across different ages and genders have not received enough attention. The potentially different impacts of health conditions (physical, mental and social health), socioeconomic status and psychological factors (emotion, cognition,

sleep) on pain severity across ages and genders remained to be explored.

Our team conducted a large-scale, population-based survey in the rural areas of Liuyang City, China. This study aimed to determine the pain prevalence among rural Chinese over the course of 4 weeks, and to investigate the risk factors of experiencing pain among this population as well as the different predictors of pain severity across ages and genders. We hypothesized that there would be significant psychosocial differences related to pain severity across ages and genders.

2. Methods

2.1 Survey methods

The Ethics Review Committee of the Public Health School of Central South University approved the study protocol. Sample size was calculated using the basic estimation formula for a cross-sectional study: N = 400*(Q/P), a = 0.05, Q = 1-P. According to Wang et al.'s study in China[43], P was defined as 20%, which produced a sample size of 1,600. The estimated response rate would be 80%, and we further expanded our sample size to 2,000.

Liuyang County, located in south central China，has a total population of 1.4235 million including people of the Han nationality and 34 ethnic minorities. Liuyang is a representative rural city of China and classified as one of its national development and reform pilot cities[44]. Liuyang not only has advantages in grain production, and raising pigs and black goats, but has also always been the center of fireworks production in China, with a history of fireworks production more than 1,400 years long[45]. Administratively, Liuyang contained 4 districts in urban areas and 33 towns in rural areas. The 33 towns in rural areas are with similar characteristics. The population sizes, age and gender distributions in these rural towns are comparable.

We conducted a cross-sectional survey of people who have lived in the rural areas of Liuyang City, Hunan Province from November 2010 through August 2011. As Figure 1 showed, a three-stage stratified sample was used, consisting of (1) random sampling to select 2 towns from the 33 towns of Liuyang City according to the list of villages; (2) random sampling of 2 villages from each town; (3) random sampling of 2 geographically natural blocks. Natural blocks were used to identify subjects. The target sample for this study comprised residents from 8 geographically natural blocks. All adults in all households of the 8 natural blocks were included as our final sample, with 2,158 residents in total.

The target population was residents aged above 18 who had lived in the rural areas of Liuyang County for over 6 months. We excluded subjects: (1) who could not be contacted after 3 attempts by the local investigators sent by the research team; or (2) had serious physical or mental illness that influenced the experience of pain. A total of 2,377 participants were initially included as subjects, of whom 219 were excluded. 78 people (2.8%) refused to be investigated, and 28 (1.3%) quit the survey before its completion. Therefore, 2,052 valid responses (response rate = 95%) were analyzed.

Quality control

Interviewers included 12 graduate students and 3 undergraduates from Central South University, all of whom underwent centralized and unified training, which lasted for 2 days. The training included the content of the questionnaire, public health knowledge, and psychiatry and communication skills. The investigation team visited each household and conducted face-to-face interviews with all eligible respondents in their house after they signed consent forms. Each interview comprised an initial interview and self-report survey, and lasted approximately 1 hour for each participant. At the end of the survey, each participant was reimbursed with a thank-you gift, such as a kitchen utensil. At the end of each interviewing day, a meeting was held to review the interviewing process, to check the quality of the questionnaires, and to discuss any problems that emerged during the interviews. All questionnaires were double-checked by two quality control specialists to ensure that there were no inconsistencies, missing items, or logic errors, and then handed to one quality control specialist for final checking.

2.2 Survey questions

2.2.1 Initial interview

A short interview lasted for approximately 15 minutes and consisted of the following two parts.

(1) Socio-demographic status

The participant was interviewed about his/her gender, age, the highest level of education completed, employment condition (unemployment denoted with 1, employment with 2), income and religion. Education was divided into 1 = primary school or lower, 2 = middle school, 3 = high school and above. Employment was divided into two conditions : engaged in agriculture and engaged in non-agriculture work (still registered as a rural resident)。Income was measured monthly. Religion was defined as 1 = religious, 2 = unreligious.

(2) Pain

Participants were first asked by the interviewer whether they had experienced an episode of pain within the past 4 weeks (yes/no). If they were pain free, the interviewer recorded "0". If they experienced pain, their pain intensity was assessed by a visual analogue scale (VAS), with ratings from 0 (no pain at all) to 10 (the worst pain imaginable) along a straight line. The VAS is a widely used measurement for pain severity and subjective experience[46, 47] and its reliability and validity have been evaluated and verified[48-50].

2.2.2 Self-report survey

After the interview, each participant filled out the following questionnaires.

(1) Perceived health status

The Self-Rated Health Measurement Scale (SRHMS), developed and revised by Xu et al.[51], includes 48 items, with a Cronbach's α coefficient of 0.93[52]. The SRHMS assesses three dimensions of health: physical, mental and social. Physical health indicates one's physical function. Mental health denotes emotional and cognitive health. Social health refers to social relationships and social nets, such as one's level of communication with family members or the availability of a support network in times of need. The highest possible scores for Physical Health, Mental Health and Social Health are 170, 150 and 120 respectively, for a maximum overall score of 440 [53]. The higher the score obtained by a subject, the better his or her health is concluded to be.

(2) Psychological variables

Depression symptoms were assessed by the Patient Health Questionnaire Depression Module (PHQ-9), a 9-item scale, with each item based on the criteria for depressive disorders listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V)[54, 55]. Each item is rated on a scale from 0 ("not at all"), to 3 ("nearly every day") [56] and the total score ranges from 0 to 27. The Chinese version of the PHQ-9 has a Cronbach's alpha of 0.86[57].

Anxious symptoms were assessed by the Generalized Anxiety Disorder scale (GAD), a 7-item scale developed by Spitzer et al[58]. Each item is rated on a scale from 0 ("not at all") to 3 ("nearly every day")[58]. The scale was found to have excellent internal consistency, with a Cronbach's α coefficient of 0.92[58]. The GAD-7 has been used widely and validated well in general populations[59] as well as psychiatric settings[60].

Global sleep quality was assessed by the VAS. The participant selected the point along a 10cm horizontal line that best represented his/her overall sleep quality with "0" (indicating the worst sleep quality) and "10" (indicating the best sleep quality). The distance is measured from the left edge to the participant's mark to reflect the subjective sleep quality. We divided sleep quality into 3 categories based on the ratings: 0 – 3.33 was defined as group 1 (poor sleep quality); 3.34 – 6.67 was defined as group 2 (medium sleep quality) ; 6.68 – 10 (high sleep quality) was defined as group 3.

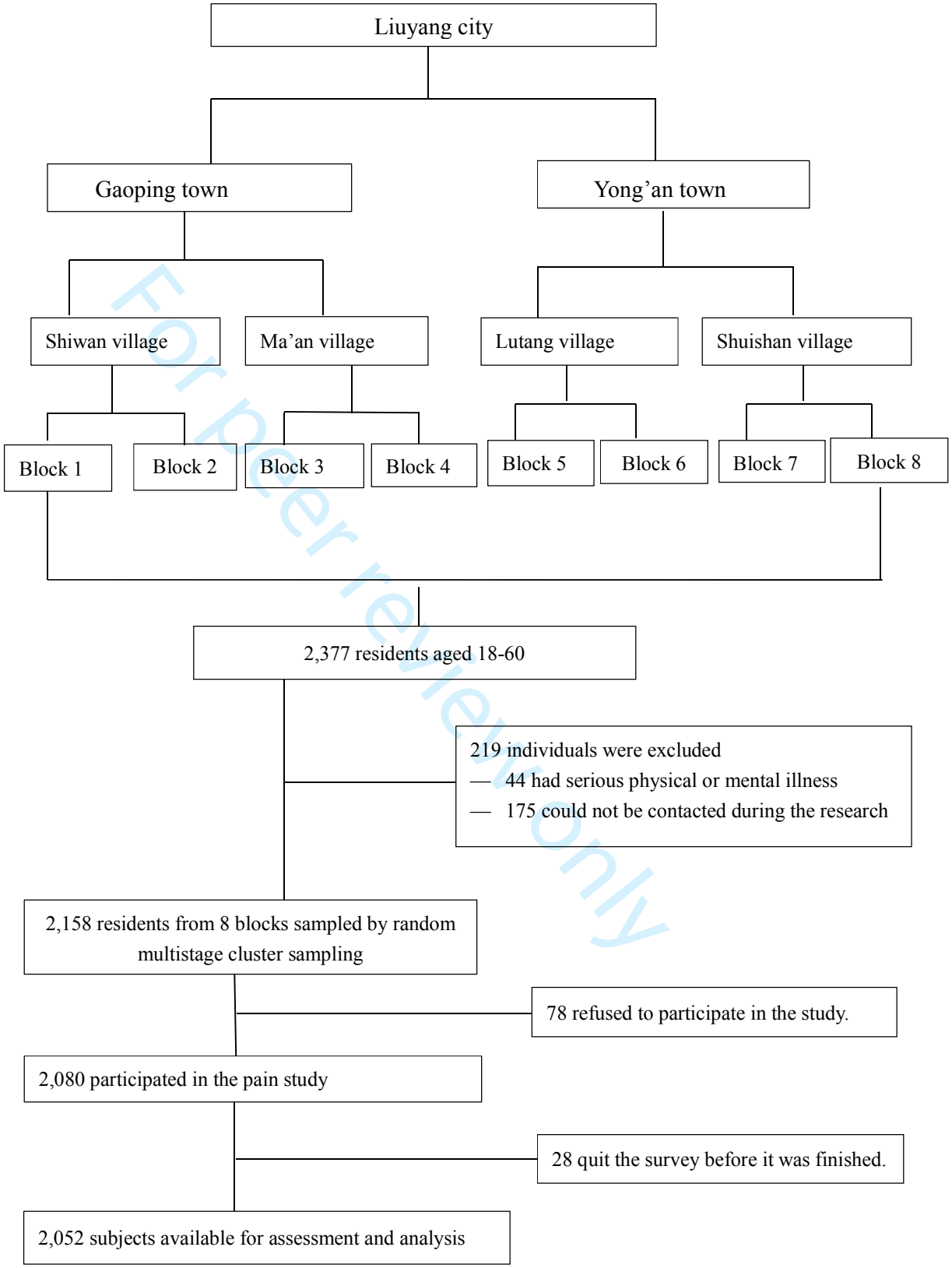
Self-efficacy was assessed by the General Self-Efficacy Scale (GSES), originally developed in German by Schwarzer and Jerusalem in 1979[61]. The scale consists of 10 statements, and the Cronbach's α coefficient of the Chinese GSES was found to be between 0.89 and 0.92[62].

Perceived stress was assessed by the Chinese edition of the Perceived Stress Scale (CPSS). Cohen et al (1983) developed the Perceived Stress Scale as a stress measure. Originally, this self-report scale comprised 14 items. Later the authors reported the shortened 10-item version (PSS-10) as psychometrically superior to the original 14-item version (Cohen & Williamson, 1988), as it had higher validity and internal reliability than the PSS-14[63]. The Chinese PSS-10 was found to have a stable 2-factor structure of satisfactory internal consistency and construct validity, with a Cronbach's α coefficient of 0.70[64].

Statistical analysis

Sample characteristics were detailed by basic descriptive statistics. Logistic regression analysis was utilized to identify the risk factors of experiencing pain. The dependent variable was having pain (y = 1) versus being pain-free (y = 0). P-values lower than 0.05 were considered significant. Analyses were performed using SPSS v 18.0. Independent variables included: (1) sociodemographic variables gender, age, income, degree of education, religious belief and unemployment; (2) health condition status: physical health, mental health and social health; (3) psychological variables: PHQ-9 score, GAD-7 score, self-efficacy, perceived stress and sleep quality. Forward logistic regression was employed to explore the factors related to experiencing pain. Employment condition and sleep quality were set as the category variables. Stepwise multiple linear regression was used to explore the predictors of pain severity across ages and genders. The dependent variable was pain severity (y = 1 – 10). The independent variables were the same as in the logistic regression model.

Figure1. Recruitment and follow-up of study participants



3. Results

3.1 Sample characteristics

A total of 2,052 participants (987 males, 1,065 females) completed the interviews and the overall response rate was 95.09%. The demographic characteristics of the sample are presented in Table 1. There were more female (51.90%) subjects than male subjects (48.10%). In terms of age group, 38.79% were young, 47.61% were middle aged, and 13.60% were old. Most of the sample was of Han ethnicity (99.51%), married (90.98%), and non-religious (90.01%), while 90.9% were married/cohabiting; 84.75% of the sample were of low education (middle school and below) and 61.11% were employed full-time (43.42% employed in agriculture, 17.69% in non-agriculture). In 2009, the national rural poverty line was defined as below 1,992 yuan/year. In Hunan province in 2010, the average income of per farmer was 5,523 yuan/per year. We divided income level into three groups: low (1,992 yuan/year or less), medium (1,993 – 5,523 yuan/year), and high (above 5,524 yuan /year). A total of 241 participants (0.25%) were below the poverty level, 513 participants (25%) had medium income, and 1,298 (63.26%) had high income.

Table 1. Socio-demographics characteristics of the sample (N=2,052)

Characteristics		n	%
Gender	Male	987	48.10
	Female	1,065	51.90
Age (years)	18 – 44	796	38.79
	45 – 59	977	47.61
	60 and above	279	13.60
Ethnicity	Han	2,042	99.51
	Non-Han	10	0.49
Education	Illiterate	47	2.30
	Primary school or lower	767	37.40
	Middle school	925	45.10
	High school	268	13.10
	College or above	45	2.20
Employment	Unemployed	797	38.84
	Employed	1,254	61.11
	Agriculture	891	43.42
	Non-agriculture	363	17.69
Income	1,992 or less	241	11.74
(person /Year/(RMB)	1,993 – 5,523	513	25
	5,524 or greater	1,298	63.26
Marital Status	Never married	145	7.07
	Married/cohabiting	1,867	90.98
	Divorced/separated/widowed	40	1.95
Religion	Yes	205	9.99
	No	1,847	90.01

Abbreviation: RMB, Ren Ming Bi

3.2 Pain prevalence over the past 4 weeks in rural China

As the Table 2 illustrated, the overall 4-week prevalence of experiencing pain was 66.18%, 62.84% for males, and 68.82% for females. The prevalence peaked at 81.00% in the oldest age group (60 years and above) with 71.30% for males and 87.80% for females. In all age groups, females had higher pain prevalence than males, while males reported higher pain severity than females. The average pain severity for males was 5.10, with a standard deviation of 2.47. The average pain severity for females was 4.82, with a standard deviation of 2.45. The oldest groups of both genders had the most intense pain severity.

Table 2. Pain prevalence over the past 4 weeks according to different ages

Age	Gender	Pain free	Experienced pain	4-week prevalence rate	Pain severity	
					Mean	SD
18-44	Male	157	170	51.99	5.08	2.70
(n=796)	Female	182	287	61.19	4.51	2.46
	Sum	339	457	57.41	4.72	2.57
45-59	Male	147	318	68.39	5.06	2.33
(n=977)	Female	155	357	69.73	4.99	2.37
	Sum	302	675	69.09	5.02	2.35
60 and above	Male	33	82	71.30	5.29	2.53
(n=279)	Female	20	144	87.80	5.00	2.60
	Sum	53	226	81.00	5.11	2.57
All ages	Male	337	570	62.84	5.10	2.47
	Female	357	788	68.82	4.82	2.45
N=2052	Total	694	1358	66.18	4.94	2.47

3.3 Risk factors of experiencing pain

The dependent variable was pain free versus experiencing pain. As shown in Table 3, gender (OR = 1.41, 95% CI: 1.13 – 1.75), age (OR = 1.55, 95% CI: 1.31 – 1.84) and depressive symptoms (OR = 1.06, 95% CI: 1.02 – 1.10) were risk factors of experiencing pain. Physical health (OR = 0.92, 95%CI: 0.91 – 0.93), and better sleep quality (OR_1 = 0.48, 95% CI_1:0.28 – 0.81; OR_2 = 0.70, 95%CI_2: 0.52 – 0.94) were protective factors of experiencing pain.

Table 3. Risk factors of experiencing pain

Variables	B	Exp (B) OR	95% CI of Exp (B) Lower	Upper	SE	P
Constant	12.42				0.91	0.00
Gender	0.44	1.41	1.13	1.75	0.11	0.00
Age	0.03	1.55	1.31	1.84	0.09	0.00
Physical health	-0.09	0.92	0.91	0.93	0.01	0.00
Depressive symptoms	0.06	1.06	1.02	1.10	0.20	0.00
Employment condition	-0.25	0.78	0.61	1.00	0.13	0.05
Sleep quality						
High sleep quality	-0.74	0.48	0.28	0.81	-0.74	0.01
Medium sleep quality	-0.36	0.70	0.52	0.94	-0.36	0.02

3.4 Predictors of pain severity across different age groups and genders

The divisions of age groups were made according to the WHO report from World Health Day 2012: Ageing and Health[66]. Participants were divided into 3 groups: the youth group (18-44 years old), the middle-age group (45-59 years old) and the old group (60 and above years old). Stepwise multiple linear regression was used to explore the predictors of pain severity across different age groups and genders. As Table 4 showed, in the young group, gender, physical health, social health and sleep quality were found to be related to pain severity.

Table 4. Related factors of pain severity among the youth

Variables	B	Std. Error	Beta	t	P
(Constant)	15.21	1.10		13.85	0.00
Gender	-0.54	0.23	-0.10	-2.35	0.02
Physical health	-0.07	0.01	-0.43	-9.34	0.00
Social health	0.02	0.01	0.11	2.37	0.02
Sleep quality	-0.36	0.14	-0.12	-2.55	0.01

As Table 5 and Table 6 showed, in the middle-aged group and the old group, pain severity was associated solely with physical health.

Table 5. Related factors of pain severity among the middle aged

	B	Std. Error	Beta	t	*p*
(Constant)	13.02	0.58		22.36	0.00
Physical health	-0.06	0.00	-0.48	-13.88	0.00

Table 6. Related factors of pain severity among the old

	B	Std. Error	Beta	t	*p*
(Constant)	14.54	1.03		14.11	0.00
Physical health	-0.07	0.01	-0.54	-9.30	0.00

As seen in Tables 7 and 8, males' pain severity was related to their socioeconomic status, including employment and income in addition to physical health, while females' pain severity was related to physical health and self-efficacy.

Table 7. Related factors of pain severity among males

Variables	B	Std. Error	Beta	t	*p*
(Constant)	13.65	0.78		17.62	0.00
Physical health	-0.05	0.01	-0.38	-9.68	0.00
Employment	-0.66	0.24	-0.11	-2.75	0.01
Income	-0.26	0.11	-0.10	-2.41	0.02

Table 8. Related factors of pain severity among females

	B	Std. Error	Beta	t	*p*
(Constant)	15.71	0.80		19.55	0.00
Physical health	-0.07	0.00	-0.52	-16.42	0.00
Self-efficacy	-0.04	0.02	-0.08	-2.41	0.02

4. Discussion

4.1 Pain prevalence in rural China

This study established the pain prevalence among rural Chinese over a 4-week period to be 66.18%, or 62.84% for males and 68.82% for females. The prevalence for both genders peaked in the oldest group (60 years and above). The pain prevalence of rural Chinese was higher than that previously found for urban Chinese[20, 21], and higher than the pain prevalence of adults in the United States[7], Canada[11], and Britain [15]. The higher pain prevalence among rural Chinese is probably due to their poorer socioeconomic status and medical conditions relative to urban Chinese and other residents of developed countries. The adverse effect of low economic status on health condition was reported previously[3, 67]. Additionally, the lower education level (only 2.2% participants had college education or above) of rural Chinese is probably associated with less medical knowledge on pain management and treatment, which may be linked to higher pain prevalence.

4.2 Risk factors of experiencing pain

We found that gender, age and depressive symptoms were risk factors of experiencing pain. In our study, females were much more likely to report experiencing pain，which is consistent with most previous studies[3, 14, 40, 68-77]. From social psychology and culture psychology perspectives, most men have internalized a pressure to invoke stereotypical masculine behaviors to maintain a sense of power and control when they encounter actual or perceived threats to their masculine status[78-80]; therefore, they may underreport their pain experiences compared to women. Older participants were also more likely to experience pain, probably because they were in worse physical condition[81] than younger participants and suggesting that more attention should be focused on pain treatment for older people. Depressive symptoms were also a risk factor of experiencing pain, which is consistent with previous studies[82, 83] and suggests that more concern should be given to the risk of experiencing pain among rural Chinese with depression symptoms.

4.3 The different factors related to pain severity across ages and genders.

Age differences

The related factors of pain severity differed significantly among the young, middle-aged and old groups. Pain severity among young people was much more entangled with psychosocial factors, while the pain severity of the middle aged and the old was solely related to physical conditions. Deteriorating bodily functions probably make physical conditions much more relevant to the elderly's severity of pain. Meanwhile, young people may be more affected by social expectations and pressures to develop their careers and take on social responsibilities, leading to a greater effect of psychosocial factors on their pain severity.

Among young people, gender was a significant factor related to pain severity. Females experienced significantly less intense pain severity than males. From a medical perspective, oxytocin probably has an effect on modulating the severity of pain during the peak reproductive years[84]. Some research has addressed the analgesic agent function of oxytocin[84, 85]. Young females secrete much more oxytocin during reproductive periods providing a possible physiological buffer against pain experience. Further, young men are encouraged by culture and society to take economic responsibility for their families and to participate in social competition to gain success, which may result in more intense psychological pain for males than for females. In

the young group, sleep quality was a predictor of pain severity, as well as physical health and social health. It has been suggested by many studies that poor sleep increases the risk of experiencing pain[31, 86, 87]. Young people are prone to insufficient sleep and better sleep likely helps young people decrease pain severity.

Gender differences

Our results showed that males' pain severity was related to their social economic status, while females' pain severity was related to self-efficacy other than physical health. Unemployed and lower income male participants experienced more intense pain, which probably due to their mental pain from psychosocial pressure in cultural. Thus having stable employment and higher income is important for decreasing males' pain severity. Females' pain severity was related to self-efficacy and perceived physical condition. Self-efficacy likely influences females' pain management process.

4.4 Clinical implications

Because the factors related to pain severity differed significantly in different age groups and genders, pain treatment for the general population should be designed with consideration to different ages and genders. For the elderly, it is essential to improve their physical functioning to reduce their pain severity. This could be achieved by way of sports and exercise. For young people, improving sleep quality could be helpful for decreasing pain severity. Sleep hygiene education on strategies such as turning off the lights and going to bed punctually could help young people to establish a conditioned reflex to fall asleep.

For males, improving their socioeconomic status could be suggested to decrease their pain severity, for example, they could be provided with pre-job training to enhance their employability or supplied with more employment information. For women, improving self-efficacy could be a viable method for decreasing pain severity. Self-efficacy is the confidence in one's own ability to achieve intended results; according to Bandura's theory, it could be achieved by way of making positive progress in one's own life or through the observation of others' progress. Therefore, observation of other successful pain management examples could be helpful for managing females' pain severity. Whether clinical pain treatments and analgesics should be customized for different genders and ages needs further experimental study.

5. Conclusion

In conclusion, our study revealed that about two‐thirds of adults in rural China experience pain over the course of 4 weeks and the predictors of pain severity differ significantly across ages and genders.

Contributors: Xiao-kun Liu, Shui-yuan Xiao，Liang Zhou, Mi Hu and Huiming Liu contributed to this article. Shui-yuan Xiao and Liang Zhou designed this cross-sectional survey. Mi Hu and Huiming Liu contributed to data collection. Xiao-kun Liu drafted the manuscript and conducted data analyses. All the authors gave final approval to the version submitted for publication.

Competing interests: No competing interests.

Funding: This study was funded by the National Science and Technology Support Program, China (Number 2009BAI77B01; Number 2009BAI77B08).

Competing interests: None declared.

Ethics approval: The ethics approval was obtained from the Institutional Review Board of the School of Public Health, Central South University.

Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing statement: Relevant data in our study are available upon request for the information might compromise participants' privacy. Please contact xiaosy@csu.edu.cn for the dataset and analysis commands.

References

1. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: scientific advances and future directions. *Psychol Bull* 2007; **133**(4): 581-624.
2. Goldberg DS, McGee SJ. Pain as a global public health priority. *BMC public health* 2011; **11**: 1471-2458.
3. Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. *The journal of pain : official journal of the American Pain Society* 2010; **11**(11): 1230-9.
4. Riskowski JL. Associations of socioeconomic position and pain prevalence in the United States: findings from the National Health and Nutrition Examination Survey. *Pain medicine* 2014; **15**(9): 1508-21.
5. Taneja I, So S, Stewart JM, Evans M, Jason LA. Prevalence and Severity of Symptoms in a Sample of African Americans and White Participants. *Journal of cultural diversity* 2015; **22**(2): 50-8.
6. Mansfield KE, Sim J, Jordan JL, Jordan KP. A systematic review and meta-analysis of the prevalence of chronic widespread pain in the general population. *Pain* 2016; **157**(1): 55-64.
7. Nahin RL. Estimates of pain prevalence and severity in adults: United States, 2012. *The journal of pain : official journal of the American Pain Society* 2015; **16**(8): 769-80.
8. Schopflocher D, Taenzer P, Jovey R. The prevalence of chronic pain in Canada. *Pain research & management* 2011; **16**(6): 445-50.
9. Van Den Kerkhof EG, Hopman WM, Towheed TE, Anastassiades TP, Goldstein DH, Canadian Multicentre Osteoporosis Study Research G. The impact of sampling and measurement on the prevalence of self-reported pain in Canada. *Pain research & management* 2003; **8**(3): 157-63.
10. Moulin DE, Clark AJ, Speechley M, Morley-Forster PK. Chronic pain in Canada--prevalence, treatment, impact and the role of opioid analgesia. *Pain research & management* 2002; **7**(4): 179-84.
11. Schopflocher D, Taenzer P, Jovey R. The Prevalence of Chronic Pain in Canada. *Pain Research and Management* 2011; **16**(6): 445-50.
12. Currow DC, Agar M, Plummer JL, Blyth FM, Abernethy AP. Chronic pain in South Australia - population levels that interfere extremely with activities of daily living. *Australian and New Zealand journal of public health* 2010; **34**(3): 232-9.
13. Chen J, Devine A, Dick IM, Dhaliwal SS, Prince RL. Prevalence of lower extremity pain and its association with functionality and quality of life in elderly women in Australia. *The Journal of rheumatology* 2003; **30**(12): 2689-93.
14. Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain* 2001; **89**(2-3): 127-34.
15. Fayaz A, Croft P, Langford RM, Donaldson LJ, Jones GT. Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. *BMJ open* 2016; **6**(6): e010364.
16. Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *European journal of pain* 2006; **10**(4): 287-333.
17. Branco JC, Bannwarth B, Failde I, et al. Prevalence of fibromyalgia: a survey in five European countries. *Seminars in arthritis and rheumatism* 2010; **39**(6): 448-53.
18. Langley PC. The prevalence, correlates and treatment of pain in the European Union. *Current medical research and opinion* 2011; **27**(2): 463-80.
19. Macfarlane GJ, Pye SR, Finn JD, et al. Investigating the determinants of international differences in the prevalence of chronic widespread pain: evidence from the European Male Ageing Study. *Annals*

of the rheumatic diseases 2009; **68**(5): 690-5.

20. Jackson T, Chen H, Iezzi T, Yee M, Chen F. Prevalence and correlates of chronic pain in a random population study of adults in Chongqing, China. *The Clinical journal of pain* 2014; **30**(4): 346-52.

21. Chen B, Li L, Donovan C, et al. Prevalence and characteristics of chronic body pain in China: a national study. *SpringerPlus* 2016; **5**(1): 938.

22. Molero-Simarro R. Inequality in China revisited. The effect of functional distribution of income on urban top incomes, the urban-rural gap and the Gini index, 1978–2015. *China Economic Review* 2017; **42**: 101-17.

23. Xu H, Zhang W, Gu L, et al. Aging village doctors in five counties in rural China: situation and implications. *Human resources for health* 2014; **12**: 36.

24. Zhou XD, Li L, Hesketh T. Health system reform in rural China: voices of healthworkers and service-users. *Social science & medicine* 2014; **117**: 134-41.

25. Macfarlane GJ. The epidemiology of chronic pain. *Pain* 2016; **157**(10): 2158-9.

26. Coggon D, Ntani G, Palmer KT, et al. Patterns of multisite pain and associations with risk factors. *Pain* 2013; **154**(9): 1769-77.

27. Sivertsen B, Petrie KJ, Skogen JC, Hysing M, Eberhard-Gran M. Insomnia before and after childbirth: The risk of developing postpartum pain-A longitudinal population-based study. *European journal of obstetrics, gynecology, and reproductive biology* 2017; **210**: 348-54.

28. Mork PJ, Nilsen TI. Sleep problems and risk of fibromyalgia: longitudinal data on an adult female population in Norway. *Arthritis and rheumatism* 2012; **64**(1): 281-4.

29. Boardman HF, Thomas E, Millson DS, Croft PR. The natural history of headache: predictors of onset and recovery. *Cephalalgia : an international journal of headache* 2006; **26**(9): 1080-8.

30. Odegard SS, Sand T, Engstrom M, Stovner LJ, Zwart JA, Hagen K. The long-term effect of insomnia on primary headaches: a prospective population-based cohort study (HUNT-2 and HUNT-3). *Headache* 2011; **51**(4): 570-80.

31. Choy EH. The role of sleep in pain and fibromyalgia. *Nature reviews Rheumatology* 2015; **11**(9): 513-20.

32. Lerman SF, Rudich Z, Brill S, Shalev H, Shahar G. Longitudinal associations between depression, anxiety, pain, and pain-related disability in chronic pain patients. *Psychosomatic medicine* 2015; **77**(3): 333-41.

33. Nordgren LF, Banas K, MacDonald G. Empathy gaps for social pain: why people underestimate the pain of social suffering. *Journal of personality and social psychology* 2011; **100**(1): 120-8.

34. White RS, Jiang J, Hall CB, et al. Higher Perceived Stress Scale scores are associated with higher pain intensity and pain interference levels in older adults. *Journal of the American Geriatrics Society* 2014; **62**(12): 2350-6.

35. Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *Journal of consulting and clinical psychology* 2002; **70**(3): 678-90.

36. Jackson T, Wang Y, Wang Y, Fan H. Self-efficacy and chronic pain outcomes: a meta-analytic review. *The journal of pain : official journal of the American Pain Society* 2014; **15**(8): 800-14.

37. Racine M, Castarlenas E, de la Vega R, et al. Sex differences in psychological response to pain in patients with fibromyalgia syndrome. *The Clinical journal of pain* 2015; **31**(5): 425-32.

38. Thomas E, Peat G, Harris L, Wilkie R, Croft PR. The prevalence of pain and pain interference in a general population of older adults: cross-sectional findings from the North Staffordshire Osteoarthritis Project (NorStOP). *Pain* 2004; **110**(1-2): 361-8.

39. Wong WS, Fielding R. Prevalence and characteristics of chronic pain in the general population of Hong Kong. *The journal of pain : official journal of the American Pain Society* 2011; **12**(2): 236-45.
40. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL, 3rd. Sex, gender, and pain: a review of recent clinical and experimental findings. *The journal of pain : official journal of the American Pain Society* 2009; **10**(5): 447-85.
41. Myers CD, Tsao JC, Glover DA, Kim SC, Turk N, Zeltzer LK. Sex, gender, and age: contributions to laboratory pain responding in children and adolescents. *The journal of pain : official journal of the American Pain Society* 2006; **7**(8): 556-64.
42. Robinson ME, Riley JL, 3rd, Myers CD, et al. Gender role expectations of pain: relationship to sex differences in pain. *The journal of pain : official journal of the American Pain Society* 2001; **2**(5): 251-7.
43. J W, Y H, Q J, J C, W W, Q Z. Mental health literacy among residents in Shanghai *Shanghai Arch Psychiatry* 2013; **25**(4): 224-35.
44. Baidu. Liuyang. 2017. http://baike.baidu.com/link?url=sGeotSfR1sfKtjAmcZ0x5Lx34TN_wS3icZTPOSkY5UsgTYjxOpx1x2aFFk9B-IKGJCXmKn3XzOSc5KW0oonJRb5ox9IqxIyNzyP5MEyImO3.
45. Wikepedia. Liuyang. 2017. https://en.wikipedia.org/wiki/Liuyang.
46. Myles PS, Troedel S, Boquest M, Reeves M. The Pain Visual Analog Scale: Is It Linear or Nonlinear? *Anesthesia & Analgesia* 1999; **89**(6): 1517.
47. Phan NQ, Blome C, Fritz F, et al. Assessment of pruritus intensity: prospective study on validity and reliability of the visual analogue scale, numerical rating scale and verbal rating scale in 471 patients with chronic pruritus. *Acta dermato-venereologica* 2012; **92**(5): 502-7.
48. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. *Pain* 1983; **17**: 45-56.
49. Dimitriadis Z, Strimpakos N, Kapreli E, Oldham J. Validity of Visual Analog Scales for Assessing Psychological States in Patients with Chronic Neck Pain. *Journal of Musculoskeletal Pain* 2014; **22**(3): 242-6.
50. Appukuttan D, Vinayagavel M, Tadepalli A. Utility and validity of a single-item visual analog scale for measuring dental anxiety in clinical practice. *Journal of Oral Science* 2014; **56**(2): 151-6.
51. Yu Z, Jingfang W. The Comparative Research on SRHMS and SCL-90 Applied in College Students' Mental Health. *Medical Research and Education* 2013; **30**: 55-8.
52. Xu J, Tan J, Wang Y, Hu M. Evaluation of the Self-rated Health Measurement Scale-the Revised Version 1.0. *Chinese Mental Health Journal* 2003; **17**: 301-5.
53. Xu J, Xie Y, Li B, Hu M. The study of validity on Self-Rated Health Measurement Scale-the revised version 1.0. *Chinese Journal of Clinical Rehabilitation* 2002; **6**(14): 2082-5.
54. Fried EI, Nesse RM, Zivin K, Guille C, Sen S. Depression is more than the sum score of its parts: individual DSM symptoms have different risk factors. *Psychological medicine* 2014; **44**(10): 2067-76.
55. Zimmerman M. Symptom severity and guideline-based treatment recommendations for depressed patients: implications of DSM-5's potential recommendation of the PHQ-9 as the measure of choice for depression severity. *Psychotherapy and psychosomatics* 2012; **81**(6): 329-32.
56. Teddy M. Chen PD, M.S.S.W., Frederick Y. Huang MD, Christine Chang BS, Henry Chung MD. Using the PHQ-9 for Depression Screening and Treatment Monitoring for Chinese Americans in Primary Care. *Psychiatric Services* 2006; **57**: 976-81.
57. Wang W, Bian Q, Zhao Y, et al. Reliability and validity of the Chinese version of the Patient Health Questionnaire (PHQ-9) in the general population. *General hospital psychiatry* 2014; **36**(5): 539-44.

58. Spitzer RL, Kroenke K, Williams JB, Lowe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine* 2006; **166**(10): 1092-7.

59. Lowe B, Decker O, Muller S, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical care* 2008; **46**(3): 266-74.

60. Beard C, Bjorgvinsson T. Beyond generalized anxiety disorder: psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. *Journal of anxiety disorders* 2014; **28**(6): 547-52.

61. Franckowiak BA, Glick DF. The effect of self-efficacy on treatment. *Journal of addictions nursing* 2015; **26**(2): 62-70.

62. Leung DY, Leung AY. Factor structure and gender invariance of the chinese general self-efficacy scale among soon-to-be-aged adults. *Journal of advanced nursing* 2011; **67**(6): 1383-92.

63. Chaaya M, Osman H, Naassan G, Mahfoud Z. Validation of the Arabic version of the Cohen Perceived Stress Scale (PSS-10) among pregnant and postpartum women. *BMC psychiatry* 2010; **10**: 111.

64. Ng S-m. Validation of the 10-item Chinese perceived stress scale in elderly service workers: one-factor versus two-factor structure. *BMC psychology* 2013; **1**(1): 9.

65. Mary E Lynch M, FRCPC1. What Is the Latest in Pain Mechanisms and Management? *The Canadian Journal of Psychiatry* 2015; **4**.

66. WHO. World Health Day 2012 - Ageing and health 2012.

67. Hu HY, Chen L, Wu CY, Chou YJ, Chen RC, Huang N. Associations among low back pain, income, and body mass index in Taiwan. *The spine journal : official journal of the North American Spine Society* 2013; **13**(11): 1521-6.

68. Hashmi JA, Davis KD. Deconstructing sex differences in pain sensitivity. *Pain* 2014; **155**(1): 10-3.

69. Hardt J, Jacobsen C, Goldberg J, Nickel R, Buchwald D. Prevalence of chronic pain in a representative sample in the United States. *Pain medicine* 2008; **9**(7): 803-12.

70. Cabral DM, Bracher ES, Depintor JD, Eluf-Neto J. Chronic pain prevalence and associated factors in a segment of the population of Sao Paulo City. *The journal of pain : official journal of the American Pain Society* 2014; **15**(11): 1081-91.

71. Cho NH, Jung YO, Lim SH, Chung CK, Kim HA. The prevalence and risk factors of low back pain in rural community residents of Korea. *Spine* 2012; **37**(24): 2001-10.

72. Jackson T, Thomas S, Stabile V, Han X, Shotwell M, McQueen K. Prevalence of chronic pain in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet* 2015; **385 Suppl 2**: S10.

73. Schneider S, Randoll D, Buchner M. Why do women have back pain more than men? A representative prevalence study in the federal republic of Germany. *The Clinical journal of pain* 2006; **22**(8): 738-47.

74. Son KM, Cho NH, Lim SH, Kim HA. Prevalence and risk factor of neck pain in elderly Korean community residents. *Journal of Korean medical science* 2013; **28**(5): 680-6.

75. Mapplebeck JC, Beggs S, Salter MW. Sex differences in pain: a tale of two immune cells. *Pain* 2016; **157 Suppl 1**: S2-6.

76. Bouhassira D, Lanteri-Minet M, Attal N, Laurent B, Touboul C. Prevalence of chronic pain with neuropathic characteristics in the general population. *Pain* 2008; **136**(3): 380-7.

77. Torrance N, Smith BH, Bennett MI, Lee AJ. The epidemiology of chronic pain of predominantly neuropathic origin. Results from a general population survey. *The journal of pain : official journal of the American Pain Society* 2006; **7**(4): 281-9.

78. Berke DS, Reidy DE, Miller JD, Zeichner A. Take it like a man: gender-threatened men's experience of gender role discrepancy, emotion activation, and pain tolerance. *Psychology of Men & Masculinity* 2016.

79. Moore TM, Stuart GL. A Review of the Literature on Masculinity and Partner Violence. *Psychology of Men & Masculinity* 2005; **6**(1): 46-61.

80. Vandello JA, Bosson JK. Hard won and easily lost: a review and synthesis of theory and research on precarious manhood. *Psychology of Men & Masculinity* 2013; **14**(2): 101-13.

81. Landmark BT, Gran SV, Kim HS. Pain and persistent pain in nursing home residents in Norway. *Research in gerontological nursing* 2013; **6**(1): 47-56.

82. Han C, Pae CU. Pain and depression: a neurobiological perspective of their relationship. *Psychiatry investigation* 2015; **12**(1): 1-8.

83. Wiech K, Tracey I. The influence of negative emotions on pain: behavioral effects and neural mechanisms. *NeuroImage* 2009; **47**(3): 987-94.

84. Tracy LM, Georgiou-Karistianis N, Gibson SJ, Giummarra MJ. Oxytocin and the modulation of pain experience: Implications for chronic pain management. *Neuroscience and biobehavioral reviews* 2015; **55**: 53-67.

85. Gong L, Gao F, Li J, et al. Oxytocin-induced membrane hyperpolarization in pain-sensitive dorsal root ganglia neurons mediated by Ca(2+)/nNOS/NO/KATP pathway. *Neuroscience* 2015; **289**: 417-28.

86. Ayeni GO, Olaniyi O, Ayeni OA. Sleep habits and occurrence of lowback pain among craftsmen. *International Journal of Public Health Science* 2014; **3**: 101-6.

87. Edwards RR, Almeida DM, Klick B, Haythornthwaite JA, Smith MT. Duration of sleep contributes to next-day pain report in the general population. *Pain* 2008; **137**(1): 202-7.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	5-6
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	No
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	4
		(*e*) Describe any sensitivity analyses	No
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	8
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-12
		(*b*) Report category boundaries when continuous variables were categorized	No
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	No
Discussion			
Key results	18	Summarise key results with reference to study objectives	No
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	No
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Different predictors of pain severity across age and gender of a Chinese rural population : a cross-sectional survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-020938.R1
Article Type:	Research
Date Submitted by the Author:	27-Mar-2018
Complete List of Authors:	Liu, Xiao-kun; Xiangya Hospital, Central South University, Mental Health Center Xiao, Shuiyuan; Xiangya Hospital, Central South University, Mental Health Center; School of Public Health, Central South University, Department of Social Medicine and Health Management Zhou, Liang; Affiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huiai Hospital) Hu, Mi; School of Public Health, Central South University, Department of Social Medicine and Health Management Liu, Hui-ming ; Shenzhen Kangning Hospital
Primary Subject Heading:	Anaesthesia
Secondary Subject Heading:	Medical management, Complementary medicine, Sexual health
Keywords:	Pain management < ANAESTHETICS, Adult anaesthesia < ANAESTHETICS, gender

Different predictors of pain severity across age and gender of a Chinese rural population：a cross-sectional survey

Xiao-kun Liu[1]

Shui-yuan Xiao*[1, 2]

Liang Zhou[3]

Mi Hu[2]

Hui-ming Liu[4]

27-pages

17 tables and 10 figures

1: Mental Health Center, Xiangya Hospital, Central South University, Changsha, Hunan, China;

2: Department of Social Medicine and Health Management, School of Public Health, Central South University, Changsha, Hunan, China;

3: Affiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huiai Hospital), Guangzhou, Guangdong, China;

4: Shenzhen Kangning Hospital, Shenzhen, Guangdong, China.

* Corresponding Author: Shui-yuan Xiao; Xiangya Hospital, Central South University, 87 Xiangya Road, Changsha, Hunan, China. Zip code: 410008. E-mail address: xiaosy@csu.edu.cn; Tel: +86-13907494509; Fax: +86-84805459.

Abstract

Objectives: To investigate a 4-week period of pain prevalence and the risk factors of experiencing pain among a rural Chinese population sample. To explore the psychosocial and health-condition predictors of pain severity and the interactions of age and gender with these factors in real life situations among the general adult population in China.

Methods: Data was collected from a random multistage sample of 2,052 participants (response rate = 95%) in the rural areas of Liuyang, China. Visual analogue scale was used to assess participants' pain experienced and a series of internationally validated instruments to assess their socio-demographics characteristics, self-reported health status, depression symptoms, anxiety symptoms, sleep quality, self-efficacy and perceived stress.

Results: The pain prevalence over the 4-week period in rural China was 66.18% (62.84% for males and 68.82% for females). A logistic regression model revealed that being female (adjusted OR = 1.58, 95%CI: 1.24-2.02), age (adjusted OR = 1.03, 95% CI: 1.02-1.05), depressive symptoms (adjusted OR = 1.07, 95% CI: 1.02-1.13) and medium-quality sleep (adjusted OR = 2.14, 95% CI: 1.26-3.64) were significant risk factors for experiencing pain. General linear model analyses revealed that 1) pain severity of rural Chinese was related to self-rated physical health and social health; 2) the interactions of age, gender with employment status, depression symptoms, perceived stress and physical health were significant. Simple effect testing revealed that in different age groups, gender interacted with employment status, depression symptoms, perceived stress and physical health differently.

Conclusions: Improving physical and social health could be effective in reducing the severity of pain and the treatment of pain should be designed specifically for different ages and genders among the general population.

Strengths and limitations of this study

This study established the 4-week prevalence of pain among a Chinese rural population.

To the best of our knowledge, this is the first study reported which describes the psychosocial and health-condition predictors on pain severity and the interactions of ages and genders in real life situations among the general adult population.

The cross-sectional design of this study prevented the causes of pain to be determined.

Key words: Pain prevalence; pain severity; gender; cross-sectional study.

Introduction

Pain is a public and clinical health concern. The annual prevalence of pain and chronic pain has been estimated to be 20% and 10% of the general population respectively.[1,2] To date, most studies on the prevalence of pain have been conducted in developed countries such as the United States,[3-7] Canada,[8-11] Australia,[12-14] Britain[15] and European countries.[16-19] A few studies on the prevalence of pain in the Chinese population have primarily focused on residents in the large cities. For example, Jackson et al. (2014)[20] reported that the prevalence of pain and chronic pain were 42.2% and 25.8% respectively, during a 6 month study period of the residents in Chongqing, China. Chen et al (2016) studied Chinses from both urban and rural areas and found that the prevalence of chronic pain over the past six months among women and men in China was 39.92% and 32.17 % respectively.[21] The Rural population in China comprises about half of China's total population and have significantly lower income[22] and inferior medical health services[23,24] compared to the population living in urban areas. However little is reported regarding the prevalence of pain experienced by the rural population in China.

Experiencing pain is a biopsychosocial process.[1] The risk factors of experiencing pain throughout the general population include physiological and psychosocial factors. The physiological factors include genetics, injury, and health status. The psychosocial factors include early life factors,[25] female in gender,[21,26] poor sleep,[27-31] distressed mood (depression, anxiety),[32] psychosocial environment (social suffering setting[33]), perceived stress,[34] religion and self-efficacy (SE).[35,36] The analysis of risk factors of pain among the rural residents in China is required for target people that are at a greater risk and planning and facilitating treatment across rural areas in China.

The exploration of differences in pain experienced across age groups and gender has been recommended by the International Association for the Study of Pain.[37] However, different predictors of pain severity across age groups and genders have received little attention. Most epidemiological and experimental studies have indicated that older people[12,38,39] and females[40,41 42] are at greater risk of experiencing pain. However, the potentially different interactions of ages and genders with psychosocial status and health conditions on the severity of pain in real life situation have not been adequately studied. To the best of our knowledge, few studies have been reported that consider the socioeconomic status (for example, employment

versus unemployment) and mental health (such as depression symptoms, perceived stress) may interact differently across ages and genders, contributing to the severity of pain experienced.

This study reports a population-based survey across the rural areas of Liuyang City, Hunan province, China. The prevalence of pain among rural Chinese over a 4 week period was explored, and the risk factors of experiencing pain among this population were investigated. Further, the main effects and interactions of gender and age with psychosocial variables and three-dimensional health conditions on the severity of pain in real life situation were explored. Significant differences of pain severity across ages and genders were hypothesized.

Methods

Ethics statement

The Ethics Review Committee of the Public Health School of Central South University approved the study protocol (No.CSU-GW-2010-01).

Patient and public involvement

No specific kinds of patients were involved. All the participants were general adult population in the rural areas of Liuyang. The informed consent was interpreted to the rural participants by the local guide and the survey was conducted with their agreement of the informed consent orally. The participants agreed that results of this study will be published in the form of essays or articles, and no personal information will be disclosed in any report.

Study design

Liuyang is a representative rural city of the Hunan province, China and classified as one of the national development and reform pilot cities.[43] Liuyang County, located in the center of Hunan province, has a total population of 1.4235 million including people of Han nationality and 34 ethnic minorities. Liuyang has industries in grain production, raising pigs and black goats, and is the center of fireworks production in China, with a history of fireworks production greater than 1,400 years.[44] Administratively, Liuyang is divided into 4 districts in the urban areas and 33 towns in the rural areas. Rural towns in Liuyang are similar to each other in respect of geography, population sizes, gender and age distributions, social structure, public health and health care services, making residents in these rural towns comparable.

A cross-sectional survey of rural residents in Liuyang City was conducted from November 2010 to August 2011. As Figure 1 showed, a three-stage stratified sample was used, consisting of (1) random sampling to select 2 towns from the 33 towns of Liuyang City according to the list of villages; (2) random sampling of 2 villages from each town; (3) random sampling of 2 geographically natural blocks. Natural blocks were used to identify subjects. The target sample for this study comprised of residents from 8 geographically natural blocks. All adults in all households of the 8 natural blocks were included in the final sample, with 2,158 residents in total. The sample size is representative of the rural counties in Liuyang.

Participants

The current household registration system (known as the Hukou System) implemented in China divides the residents into agricultural and non-agricultural residencies and established a rural-urban division.[45] A household registration record officially identifies a person as a resident to be rural or urban according to the inheritance and geographic location. Rural areas are less developed in many ways, compared with urban areas, such as infrastructure, education and health care.

The target population in this study was rural residents aged above 18 years who had lived in the Liuyang County for over 6 months. We excluded subjects (1) they could not be contacted after 3 attempts by the local investigators sent by the research team; or (2) had a serious physical or mental illness that influenced the experience of pain. A total of 2,377 participants were initially included in the study, of whom 219 were excluded. Seventy eight people (2.8%) refused to participate, and 28 (1.3%) dropped out of the survey before it was completed. Therefore, 2,052 valid responses (response rate = 95%) were analyzed.

Quality control

Interviewers included 12 graduate and 3 undergraduates from Central South University, all of whom underwent 2 days of centralized and unified training. The training included the content of the questionnaire, public health knowledge, and psychiatry and communication skills. All interviewers received this training so that they could administer the interview to the same standards.

Procedure

The investigation team visited each household and conducted face-to-face interviews. Each interview was comprised of an initial interview and self-reported survey, and lasted approximately 1 hour for each participant. At the end of the survey,

each participant received a thank-you gift, such as a kitchen utensil. At the end of each day of interviews, a meeting was held to review the process, to check the quality of the questionnaires, and to discuss any problems that had emerged during the interviews. All questionnaires were double-checked by 2 quality control specialists to ensure that there were no inconsistencies, missing items, or errors, and then handed to 1 quality control specialist for a final check.

The survey

Initial interview

A short interview conducted for approximately 15 minutes consisted of the 2 parts:

(1) Socio-demographic status

The participant was interviewed about his/her gender, age, highest level of education completed, employment status (unemployment denoted with 1, employment with 2), income and religion. Education was divided into 1 = primary school or lower, 2 = middle school, 3 = high school and above. Employment was divided into 2 categories: employed and unemployed. Income was measured annually. Religion was defined as 1 = religious, 2 = nonreligious.

(2) Pain

Participants were asked by the interviewer whether they had experienced an episode of pain within the past 4 weeks (yes/no). If they were pain free, the interviewer recorded "0". If they had experienced pain, their pain intensity over the past 4 weeks was assessed using a visual analogue scale (VAS), with ratings from 0 (no pain at all) to 10 (the worst pain imaginable) along a straight line. The VAS is a widely used measurement for the severity of pain and subjective experience[46,47] and its reliability and validity have been tested and verified.[48-50] The participant recalled the mean level of their pain severity during the past four weeks and selected the level that could best represent his/her pain severity on VAS. It has been reported in the literature that when recalled over a period of 1 or 4 weeks, the outcome was well correlated with daily momentary assessments.[51-53] Long-term recall is significantly influenced by recall bias.[54,55] Therefore, the participants were not asked to recall the severity of pain over a 4-week period. The recollection of pain across a 4-week period is an indicator of acute pain, which indicates the demands of public health concern

and clinical health treatment.

Self-administrated assessment

After the interview, each participant filled out the following questionnaires.

(1) Perceived health status

The Self-Rated Health Measurement Scale (SRHMS), developed and revised by Xu et al.,[56] includes 48 items, and has a Cronbach's α coefficient of 0.93.[57] The SRHMS assesses 3 dimensions of health: physical, mental and social. Physical health indicates one's physical function. Mental health denotes emotional and cognitive health. Social health refers to social relationships and social networks, such as the level of communication between family members or the availability of a support network during times of need. The highest possible scores for physical, mental and social health are 170, 150 and 120 respectively, and a maximum overall score of 440.[58] The higher the score obtained by a participant, the better his or her health was concluded to be. The SRHMS is not a diagnostic instrument, and there are no cut-points for delineating the different levels of health conditions.

(2) Psychological variables

Depression symptoms were assessed using the Patient Health Questionnaire Depression Module (PHQ-9), a 9-item scale, with each item based on the criteria for depressive disorders listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V).[59,60] Each item is rated on a scale from 0 ("not at all"), to 3 ("nearly every day") [61] and the total score ranges from 0 to 27. The Chinese version of the PHQ-9 has a Cronbach's alpha of 0.86.[62] The results of the PHQ-9 may be used for the screening of depression severity with the scores of 0-4, 5-9, 10-14, 15-19 and 20-27 indicating none-minimal, slight, moderate, moderately severe and severe depression according to DSM-IV.

Anxious symptoms were assessed using the Generalized Anxiety Disorder scale (GAD), a 7-item scale developed by Spitzer et al.[63] Each item is rated on a scale from 0 ("not at all") to 3 ("nearly every day").[63] The scale was found to have excellent internal consistency, with a Cronbach's α coefficient of 0.92.[63] The GAD-7 has been used widely and well validated in general populations[64] as well as psychiatric settings.[65] Scores of 0-4, 5-9, 10-14 and ⩾15 indicate none, slight, moderate and severe anxiety symptoms according to DSM-IV.

Global sleep quality was assessed by the VAS. The participant selected the point

along a 10cm horizontal line that best represented his/her overall sleep quality with "0" (indicating the worst sleep quality) and "10" (indicating the best sleep quality). The distance is measured from the left edge to the participant's mark to reflect the subjective quality of sleep. We divided sleep quality into 3 categories based on the ratings: 0 – 3.33 defined as group 1 (poor sleep quality); 3.34-6.67 defined as group 2 (medium sleep quality); 6.68-10 (high sleep quality) defined as group 3.

Self-efficacy was assessed using the General Self-Efficacy Scale (GSES), originally developed in German by Schwarzer and Jerusalem in 1979 and has been confirmed validated in multicultural settings.[66,67] The scale consists of 10 statements, and the Cronbach's α coefficient of the Chinese GSES was found to be between 0.89 and 0.92.[68]

Perceived stress was assessed using the Chinese edition of the Perceived Stress Scale (CPSS). Cohen et al (1983) developed the Perceived Stress Scale as a stress measure.[69] Originally, this self-reported scale comprised of 14 items. A shortened 10-item version (PSS-10) is reported which is psychometrically superior to the original 14-item version, as it had higher validity and internal reliability compared to the PSS-14.[70] The CPSS-10 was found to have a stable 2-factor structure of satisfactory internal consistency and construct validity, with a Cronbach's α coefficient of 0.70.[71] Each item of the CPSS was rated on a 5-point scale, ranging from 1-5. The total scores of the CPSS were calculated by adding 4 reverse items and another six items. The possible total scores ranged from 10 to 50 (higher score indicating greater stress). There are no cut-points of the CPSS that indicate different levels of perceived stress.

Statistical analysis

Sample characteristics were described using basic descriptive statistics. Logistic regression analysis was used to identify the risk factors of experiencing pain. The dependent variable was experiencing pain versus being pain-free. P-values smaller than 0.05 were considered significant. Analyses were performed using SPSS v 18.0. Independent variables included : (1) socio-demographic variables, gender, age, income, degree of education, religious belief and employment status; (2) health condition status: physical, mental and social health; (3) psychological variables: PHQ-9 score, GAD-7 score, self-efficacy, perceived stress and sleep quality. Logistic regression was used to explore the factors related to experiencing pain. Sleep quality was set as the category variable.

A general linear model was used to explore the main effects and interactions of

age and gender with other predictors on the severity of pain. The dependent variable was pain severity (y = 1-10). The independent variables were the same as those in the logistic regression model. Any interactions found between age, gender and another predictor was further studied using simple effect tests. Age was divided into 3 groups (youth, middle aged and elderly). In each age group, the interactions between gender and other predictors were tested using pairwise comparisons.

Results

Sample characteristics

A total of 2,052 participants (987 males, 1,065 females) completed the interview process, with an overall response rate of 95.09%. The demographic characteristics of the sample are shown in Table 1. There were more female (51.90%) participants than male participants (48.10%). In terms of age groups, 38.79% were young, 47.61% were middle aged, and 13.60% were elderly. Most of the sample was of Han ethnicity (99.51%), married (90.98%), and non-religious (90.01%), while 90.9% were married/cohabiting; 84.75% of the sample were of low education (middle school and below) and 61.11% were employed full-time (43.42% employed in agriculture, 17.69% in non-agriculture). In 2009, the national rural poverty line was defined as below 1,992 yuan/year. In the Hunan province in 2010, the average income of per farmer was 5,523 yuan/year. Income level was divided into three groups: low (1,992 yuan/year or less), medium (1,993-5,523 yuan/year), and high (above 5,524 yuan /year). A total of 241 participants (0.25%) were below the poverty level, 513 participants (25%) had medium income, and 1,298 (63.26%) had high incomes.

Table 1. Socio-demographics characteristics of the sample (N=2,052)

Characteristics		n	%
Gender	Male	987	48.10
	Female	1,065	51.90
Age (years)	18-44	796	38.79
	45-59	977	47.61
	60 and above	279	13.60
Ethnicity	Han	2,042	99.51
	Non-Han	10	0.49
Education	Illiterate	47	2.30
	Primary school or lower	767	37.40
	Middle school	925	45.10

	High school	268	13.10
	College or above	45	2.20
Employment	Unemployed	797	38.84
	Employed	1,254	61.11
	Agriculture	891	43.42
	Non-agriculture	363	17.69
Annual Income	1,992 or less	241	11.74
(person /(RMB)	1,993-5,523	513	25
	5,524 or greater	1,298	63.26
Marital Status	Never married	145	7.07
	Married/cohabiting	1,867	90.98
	Divorced/separated/widowed	40	1.95
Religion	Yes	205	9.99
	No	1,847	90.01

Abbreviation: RMB, Ren Ming Bi

The psychological characteristics of the 2052 participants are presented in Table 2. The participants' mean score of sleep quality s was 7.28 ± 2.55. Their mean score for depression symptoms was 3.64 ± 3.92, and a mean score of anxiety symptoms was 2.73 ± 3.56. The mean±SD scores for physical, mental and social health were 142.58 ± 18.68, 117.17 ± 21.44 and 85.12 ± 18.76 respectively. The mean scores for self-efficacy and perceived stress were 27.09 ± 4.36 and 18.33 ± 6.47 respectively.

Table 2 Psychological characteristics of the participants (N=2052)

Variable	Mean	Standard deviation
Sleep quality	7. 28	2.55
PHQ-9	3.64	3.92
GAD-7	2.73	3.56
Health status		
Physical health	142.58	18.68
Mental health	117.17	21.44
Social health	85.12	18.76
Self-efficacy	27.09	4.36
Perceived stress	18.33	6.47

Abbreviations: PHQ-9 = Patient Health Questionnaire Depression Module;
GAD-7 = 7-item Generalized Anxiety Disorder scale.

Pain prevalence over the past 4 weeks in rural China

As the Table 3 illustrated, the prevalence of experiencing pain across the 4 week

period was 66.18% overall, 62.84% for males, and 68.82% for females. The prevalence peaked at 81.00% in the oldest age group (60 years and above) with 71.30% for males and 87.80% for females. The average pain severity for males was 5.10, with a standard deviation of 2.47. The average pain severity for females was 4.82, with a standard deviation of 2.45. The oldest groups of both genders had the most intense pain severity.

Table3. Pain prevalence over the past 4 weeks according to different ages

Age	Gender	Pain free	Experienced pain	4-week prevalence rate	Pain severity	
					Mean	SD
18-44	Male	157	170	51.99	5.08	2.70
(n=796)	Female	182	287	61.19	4.51	2.46
	Sum	339	457	57.41	4.72	2.57
45-59	Male	147	318	68.39	5.06	2.33
(n=977)	Female	155	357	69.73	4.99	2.37
	Sum	302	675	69.09	5.02	2.35
60 and above	Male	33	82	71.30	5.29	2.53
(n=279)	Female	20	144	87.80	5.00	2.60
	Sum	53	226	81.00	5.11	2.57
All ages	Male	337	570	62.84	5.10	2.47
	Female	357	788	68.82	4.82	2.45
N=2052	Total	694	1358	66.18	4.94	2.47

Risk factors for experiencing pain

The independent variable was pain free versus experiencing pain. The dependent variables include: health status (physical, mental and social health); socio-demographic cofounders and psychological cofounders. Crude odds ratios and adjusted odds ratios for experiencing pain were calculated. Sleep has been divided into a categorical variable, included as a dummy variable and high-quality sleep was set as the reference group. As shown in Table 4, gender (adjusted OR = 1.58, 95% CI: 1.24-2.02), age (adjusted OR = 1.03, 95% CI: 1.02-1.05), depressive symptoms (adjusted OR = 1.07, 95% CI: 1.02-1.13) and medium-quality sleep (adjusted OR = 2.14, 95% CI: 1.26-3.64) were significant risk factors for experiencing pain. Physical health (adjusted OR = 0.92, 95%CI: 0.90-0.93) was a protective factor against experiencing pain.

Table 4. Risk factors of experiencing pain

Variables	OR	OR[a]	OR[a] (95% CI)		P
Gender	1.31	1.58	1.24	2.02	0.00

Age	1.03	1.03	1.02	1.05	0.00
Education	0.77	1.14	0.95	1.37	0.15
Employment condition	0.87	1.26	0.98	1.62	0.08
Annual income	1.00	1.00	1.00	1.00	0.65
Religion	0.59	0.93	0.62	1.38	0.71
Physical health	0.92	0.92	0.90	0.93	0.00
Mental health	0.96	0.99	0.99	1.00	0.16
Social health	0.98	1.01	1.00	1.01	0.08
Depressive symptoms	1.21	1.07	1.02	1.13	0.01
Anxiety symptoms	1.18	0.99	0.94	1.05	0.77
Self-efficacy	1.02	1.02	0.99	1.04	0.28
Perceived stress	1.06	0.99	0.97	1.02	0.56
Sleep quality					0.00
Poor-quality sleep	4.04	1.49	0.87	2.53	0.15
Medium-quality sleep	2.25	2.14	1.26	3.64	0.01

Note: OR= Crude OR, OR[a]= Adjusted OR

Predictors of pain severity across different age groups and genders

A general linear model was used to explore the main effects and interactions of age and gender with other predictors on the severity of pain. The dependent variable was pain intensity. The independent variables were the same as those used in the above logistic models. The results suggest that physical health and social health significantly influenced pain severity (Table 5), while age, gender with employment status, depression symptoms, physical health and perceived stress interacted significantly. As figure 2 showed, physical health and social health related with pain severity negatively in the overall condition.

Table 5. Tests of between-subjects effects

Source	Type III of Squares	Sum df	Mean Square	F	Sig.
Corrected Model	2451.13	117	20.95	4.57	0.00
Intercept	772.01	1	772.01	168.31	0.00
Gender	7.87	1	7.87	1.72	0.19
Age	14.79	2	7.40	1.61	0.20
Education	0.49	2	0.24	0.05	0.95
Employment	3.56	1	3.56	0.78	0.38
Annual income	10.29	2	5.15	1.12	0.33
Religion	2.14	1	2.14	0.47	0.49
Depression	8.99	3	3.00	0.65	0.58

Anxiety	3. 90	3	1.30	0.28	0.84
Sleep	14.44	2	7.22	1.57	0.21
P-Health	684.25	1	684.25	149.18	0.00
M-Health	14.54	1	14.54	3.17	0.08
S-Health	31.94	1	31.94	6.96	0.01
Stress	0.01	1	0.01	0.00	0.97
SE	3.07	1	3.07	0.67	0.42
Age * Gender * Education	36.39	10	3.64	0.80	0.64
Age * Gender * Employment	53.72	5	10.75	2.34	0.04
Age * Gender * Income	63.99	10	6.40	1.40	0.18
Age * Gender * Religion	1.65	5	0.33	0.07	0.99
Age * Gender * Depression	131.14	14	9.37	2.04	0.01
Age * Gender * Anxiety	53.80	14	3.84	0.84	0.63
Age * Gender * Sleep	37.94	10	3.79	0.83	0.60
Age * Gender * P-Health	65.66	5	13.13	2.86	0.01
Age * Gender * M-Health	44.62	5	8.92	1.95	0.08
Age * Gender * S-Health	10.06	5	2.01	0.44	0.82
Age r *Gende * Stress	52.68	5	10.54	2.30	0.04
Age * Gender * SE	22.68	5	4.54	0.98	0.42
Error	5472.09	1193	4.59		
Total	39696.00	1311			
Corrected Total	b7923.22	1310			

Note: P-health= physical health; M-health=mental health; S-health=social health; income=annual income;SE=self-efficacy

The three-factor interactions present were age*gender*employment, age*gender* depression, age*gender*p-health, and age*gender*stress. The age was split into 3 groups and the simple effects of gender within each significant interaction of the other variables were explored in each age group. These tests are based on the estimable independent, linear pairwise comparisons between the estimated marginal means.

The divisions of age groups were made according to the WHO report from World Health Day 2012: Ageing and Health.[72] Participants were divided into 3 groups: youth group (18-44 years old), middle-age group (45-59 years old) and elderly group (60 and above years old). Depression symptoms were coded from y=1-4, based on moderate and above moderately severe, mild, slight and no depression symptoms. Anxiety symptoms were divided into y=1-4, based on moderate and above severe, mild, slight and no anxiety severity. Physical health was divided into 3 categories based on the scores: (1) 0-56 were defined as 1 denoting poor physical health; (2)

scores of 57-113 were defined as 2 denoting average physical health; (3) scores of 114-160 was defined as 3 denoting good physical health. Perceived stress was divided into 3 groups and scores of 10-22 represented lower stress, scores of 23-37 represented average stress and scores of 38-50 represented high stress.

Among the youth group, pairwise comparisons revealed: 1) unemployment influenced men and women differently, as showed in Table 6 and Figure 3, which increased male's pain intensity significantly; 2) the absence of depression could significantly decrease the pain severity in the young females, compared to males, as presented in Table 7 and Figure 4; 3) good physical-health influenced female's pain severity negatively, greater effect than that seen in male's, which is showed in Table 8 and Figure 5; 4) average level stress increased young male's pain intensity more dramatically than in female's as showed in Table 9 and Figure 6.

Pairwise Comparisons

Table 6. Dependent Variable: Pain severity

Employment	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Employed	1	2	0.49	0.32	0.12
Unemployed	1	2	0.95*	0.43	0.03

Based on estimated marginal means

Pairwise Comparisons

Table 7. Dependent Variable: Pain severity

Depression	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Severe	1	2	0.21	1.56	0.89
Moderate	1	2	0.31	0.77	0.69
Slight	1	2	-0.36	0.42	0.43
None	1	2	1.21*	0.32	0.00

Based on estimated marginal means

Pairwise Comparisons

Table 8. Dependent Variable: Pain severity

P-health	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
57-113	1	2	-0.49	1.07	0.65
114-170	1	2	0.61*	0.25	0.02

Based on estimated marginal means

Pairwise Comparisons

Table 9. Dependent Variable: Pain severity

Perceived stress	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
10-22	1	2	0.35	0.42	0.40
23-37	1	2	0.67*	0.31	0.03
38-50	1	2	b	.	.

Based on estimated marginal means

b. The level combination of factors in (I) is not observed.

Among the middle aged group, pairwise comparisons revealed: 1) unemployment influenced men and women differently, as Table 10 and Figure 7 showed, which significantly increased male's pain severity; 2) severe depression symptoms could significantly increase the pain severity of the mid-aged female, compared to the male as showed in Table 11 and Figure 8; 3) the influence of physical-health on gender in the middle aged group was not significant as illustrated in Table 12; 4) high stress could significantly increase middle aged male's pain severity, compared to that in female's, which is shown in Table 13 and Figure 9.

Pairwise Comparisons

Table 10. Dependent Variable: Pain severity

Employment	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Employed	1	2	-0.19	0.23	0.39
Unemployed	1	2	1.32*	0.37	0.00

Based on estimated marginal means

Pairwise Comparisons

Table 11. Dependent Variable: Pain severity

Depression	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Severe	1	2	-2.52*	1.06	0.02
Moderate	1	2	0.55	0.62	0.38
Slight	1	2	-0.37	0.36	0.30
None	1	2	0.14	0.22	0.53

Based on estimated marginal means

Pairwise Comparisons

Table 12. Dependent Variable: Pain severity

P-health	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
0-56	1	2	b	.	.
57-113	1	2	-1.02	0.60	0.09
114-170	1	2	0.07	0.18	0.71

Based on estimated marginal means

b. The level combination of factors in (I) is not observed.

Pairwise Comparisons

Table 13. Dependent Variable: Pain severity

Perceived stress	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
10-22	1	2	0.06	0.25	.794
23-37	1	2	-0.11	0.26	.660
38-50	1	2	6.00*	2.29	.009

Based on estimated marginal means

Among the elderly group, pairwise comparisons revealed that unemployment influenced men and women differently, as showed in Table 14 and Figure 10, which significantly increased male's pain severity. The influence of depression symptoms,

physical-health and perceived stress on gender in the elderly group were not significant, that were showed in Table 15, Table 16, and Table 17 respectively.

Pairwise Comparisons

Table 14. Dependent Variable: Pain severity

Employment	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Employed	1	2	-0.35	0.47	0.46
Unemployed	1	2	1.66*	0.65	0.01

Based on estimated marginal means

Pairwise Comparisons

Table 15. Dependent Variable: Pain severity

Depression	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
Severe	1	2	.[a]	.	.
Moderate	1	2	-0.57	0.98	.561
Slight	1	2	0.63	0.64	.325
None	1	2	0.12	0.47	.806

Based on estimated marginal means

Pairwise Comparisons

Table 16. Dependent Variable: Pain severity

P-health	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
57-113	1	2	-.040	0.95	.966
114-170	1	2	0.51	0.36	.161

Based on estimated marginal means

Pairwise Comparisons

Table 17. Dependent Variable: Pain severity

Perceived stress	(I) Gender	(J) Gender	Mean Difference	Std. Error	Sig
10-22	1	2	0.30	0.48	.525
23-37	1	2	0.07	0.54	.906
38-50	1	2	3.00	2.75	.277

Based on estimated marginal means

Discussion

Pain prevalence in rural China

This study indicates that the pain prevalence among rural Chinese over a 4-week period was to be 66.18%, or 62.84% for males and 68.82% for females. The prevalence for both genders peaked in the oldest group (60 years and above). The pain prevalence of rural Chinese appeared to be higher than that previously reported for urban Chinese population,[20,21] and higher than the pain prevalence of adults in the

United States,[7] Canada,[11] and Britain.[15] However, the cited studies examined chronic pain (pain lasting ⩾ 3 months) and could produce substantially lower prevalence rates compared to pain over a 4-week period.

Risk factors of experiencing pain

Being female, older age, reported depression symptoms and medium-quality sleep were found to be risk factors for experiencing pain. In this study, females were more likely to report experiencing pain，which is agreement with the majority of reported studies.[3,14,40,73-82] From social psychology and culture psychology perspectives, most men have internalized a pressure to invoke stereotypical masculine behaviors to maintain a sense of power and control when they encounter actual or perceived threats to their masculine status.[83-85] Therefore, they may underreport their pain experiences when compared to women. Older participants were also more likely to experience pain, which may be due to their worse physical condition[86] than younger participants. The result suggested that more attention should be focused on the treatment of pain in the elderly. Depressive symptoms were also a risk factor for experiencing pain, which is consistent with previous studies[87,88] and suggests that more focus should be given to rural Chinses with depression symptoms. Medium-quality sleep improved the risk of experiencing pain, which suggest having sufficient and efficient sleep would be helpful of decreasing the risk of experiencing pain.

Factors related to pain severity across ages and genders

In this study, physical health and social health significantly impacted pain severity among the general population in rural China. Physical health significantly influenced pain intensity, which is in agreement with previous studies[1,89,90] and common sense. The predictive role of social health on pain severity has not attracted attention by clinicians and scholars. In this study, social health referred to social ties and social support. The findings presented here indicated that enlarging social networks and improving social support could be an effective social approach to decreasing pain severity in adults.

There are significant interactions between age, gender and employment status, depression symptoms, psychical health and perceived stress. The simple test effects indicated that unemployed male participants experienced more intense pain across all age groups, compared to females. Men are encouraged by culture and society to take

economic responsibility to feed their families and to participate in social competition to gain success, which may result in more intense psychological pain for males when they are unemployed. Thus having stable employment is important for decreasing males' pain severity. Providing multiple job-skills training to enhance males' employability across all age groups and offering more employment information and opportunities for them may be a useful social approach to mitigate the severity of their mental pain and psycho-ache from unemployment. Average level stress increased young male's pain severity more dramatically than female's. High-level stress could increase middle aged male's pain severity significantly compared to females. Reducing perceived stress may be helpful for the pain management and treatment of males, which could be achieved by reducing-stress therapy.[91]

It has been reported that depression symptoms influenced pain experienced.[87,92-94] Our study revealed that female adults' pain severity was much more entangled with depression symptoms in real life situation. The absence of depression significantly decreased the pain severity in the young females, and severe depression symptoms significantly increased the pain severity in the middle aged females. Treatment for depression symptoms may be effective for decreasing female's pain severity, which could be achieved using medication or psychotherapy (such as Cognitive Behavior Therapy[95]), or complementary therapy such as exercises or meditation. Good physical-health condition could significantly decrease young female's pain severity. For young women, improving their physical functioning could be a viable method for decreasing pain severity. This could be achieved by way of sports and exercise.

The factors related to pain severity differed across ages and genders, and therefore the treatment of pain across the general population should be designed with consideration for different ages and genders. Whether clinical pain treatments and analgesics should be customized for different genders and ages needs to be further explored.

Strengths and limitations

This study reported a 4-week prevalence of pain in rural China and the risk factors of experiencing pain of a rural Chinese sample. To our knowledge, this is the first study to explore the psychosocial and health-condition predictors on pain severity and the interactions of gender, age with those variables in real life situations. However, the study has a few limitations. First, our measurements of pain were not precise: we

did not detail the site of pain, nor did we distinguish chronic pain from acute pain or physical pain from psychological pain. And the frequency of the pain experienced was not included in the study design, so how often the study subjects had experienced pain over the 4 weeks preceding the survey was not determined. Subjects could have experienced pain as frequently as every day or as rarely as just once in the span of 4 weeks. In future research, more detailed information (e.g. pain duration, the frequency of pain and the pain sites) would be useful to refine the understanding of the various dimensions of pain. Another limitation is the cross-sectional design of the study, which precludes the induction of cause and effect and a potential causal relationship between independent variables and pain severity is inferred. In addition, the sample size only reflected the rural population of Liuyang, Hunan province and the findings of this study cannot be generalized to other rural counties in China. Future multi-centers research is required to reflect the pain conditions of the rural population in China.

Conclusions

In conclusion, our study revealed that about two-thirds of adults in a rural Chinese sample experience pain over the course of 4 weeks and the predictors of pain severity differ significantly across ages and genders. Improving physical and social health could be effective in reducing the severity of pain, and the treatment of pain should be designed specifically for different ages and genders.

Acknowledgements: The authors would like to thank the local guides for guiding us to visit each household in the rural areas of Liuyang, Hunan province, China.

Contributors: Xiao-kun Liu, Shui-yuan Xiao，Liang Zhou, Mi Hu and Huiming Liu contributed to this article. Shui-yuan Xiao and Liang Zhou designed this cross-sectional survey. Mi Hu and Huiming Liu contributed to data collection. Xiao-kun Liu drafted the manuscript conducting data analyses and Shui-yuan Xiao gave guidance on the paper. All the authors gave final approval to the version submitted for publication.

Funding: This study was funded by the National Science and Technology Support Program, China (Number 2009BAI77B01; Number 2009BAI77B08) and China Medical Board (CMB Number 14-188).

Competing interests: None declared.

Patient consent: Not required.

Ethics approval: The ethics approval was obtained from the Institutional Review Board of the School of Public Health, Central South University.

Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing statement: Extra data are available from the corresponding author on reasonable request.

References

1. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: scientific advances and future directions. *Psychol Bull.* Jul 2007;133(4):581-624.
2. Goldberg DS, McGee SJ. Pain as a global public health priority. *BMC public health.* Oct 6 2011;11(770):1471-2458.
3. Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. *The journal of pain : official journal of the American Pain Society.* Nov 2010;11(11):1230-1239.
4. Riskowski JL. Associations of socioeconomic position and pain prevalence in the United States: findings from the National Health and Nutrition Examination Survey. *Pain medicine.* Sep 2014;15(9):1508-1521.
5. Taneja I, So S, Stewart JM, Evans M, Jason LA. Prevalence and Severity of Symptoms in a Sample of African Americans and White Participants. *Journal of cultural diversity.* Summer 2015;22(2):50-58.
6. Mansfield KE, Sim J, Jordan JL, Jordan KP. A systematic review and meta-analysis of the prevalence of chronic widespread pain in the general population. *Pain.* Jan 2016;157(1):55-64.
7. Nahin RL. Estimates of pain prevalence and severity in adults: United States, 2012. *The journal of pain : official journal of the American Pain Society.* Aug 2015;16(8):769-780.
8. Schopflocher D, Taenzer P, Jovey R. The prevalence of chronic pain in Canada. *Pain research & management.* Nov-Dec 2011;16(6):445-450.
9. Van Den Kerkhof EG, Hopman WM, Towheed TE, Anastassiades TP, Goldstein DH, Canadian Multicentre Osteoporosis Study Research G. The impact of sampling and measurement on the prevalence of self-reported pain in Canada. *Pain research & management.* Fall 2003;8(3):157-163.
10. Moulin DE, Clark AJ, Speechley M, Morley-Forster PK. Chronic pain in Canada--prevalence, treatment, impact and the role of opioid analgesia. *Pain research & management.* Winter 2002;7(4):179-184.
11. Schopflocher D, Taenzer P, Jovey R. The Prevalence of Chronic Pain in Canada. *Pain Research and Management.* 2011;16(6):445-450.
12. Currow DC, Agar M, Plummer JL, Blyth FM, Abernethy AP. Chronic pain in South Australia - population levels that interfere extremely with activities of daily living. *Australian and New Zealand journal of public health.* Jun 2010;34(3):232-239.
13. Chen J, Devine A, Dick IM, Dhaliwal SS, Prince RL. Prevalence of lower extremity pain and its association with functionality and quality of life in elderly women in Australia. *The Journal of rheumatology.* Dec 2003;30(12):2689-2693.
14. Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain.* Jan 2001;89(2-3):127-134.
15. Fayaz A, Croft P, Langford RM, Donaldson LJ, Jones GT. Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. *BMJ open.* Jun 20 2016;6(6):e010364.
16. Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *European journal of pain.* May 2006;10(4):287-333.

17. Branco JC, Bannwarth B, Failde I, et al. Prevalence of fibromyalgia: a survey in five European countries. *Seminars in arthritis and rheumatism.* Jun 2010;39(6):448-453.
18. Langley PC. The prevalence, correlates and treatment of pain in the European Union. *Current medical research and opinion.* Feb 2011;27(2):463-480.
19. Macfarlane GJ, Pye SR, Finn JD, et al. Investigating the determinants of international differences in the prevalence of chronic widespread pain: evidence from the European Male Ageing Study. *Annals of the rheumatic diseases.* May 2009;68(5):690-695.
20. Jackson T, Chen H, Iezzi T, Yee M, Chen F. Prevalence and correlates of chronic pain in a random population study of adults in Chongqing, China. *The Clinical journal of pain.* Apr 2014;30(4):346-352.
21. Chen B, Li L, Donovan C, et al. Prevalence and characteristics of chronic body pain in China: a national study. *SpringerPlus.* 2016;5(1):938.
22. Molero-Simarro R. Inequality in China revisited. The effect of functional distribution of income on urban top incomes, the urban-rural gap and the Gini index, 1978–2015. *China Economic Review.* 2017;42:101-117.
23. Xu H, Zhang W, Gu L, et al. Aging village doctors in five counties in rural China: situation and implications. *Human resources for health.* Jun 28 2014;12:36.
24. Zhou XD, Li L, Hesketh T. Health system reform in rural China: voices of healthworkers and service-users. *Social science & medicine.* Sep 2014;117:134-141.
25. Macfarlane GJ. The epidemiology of chronic pain. *Pain.* Oct 2016;157(10):2158-2159.
26. Coggon D, Ntani G, Palmer KT, et al. Patterns of multisite pain and associations with risk factors. *Pain.* Sep 2013;154(9):1769-1777.
27. Sivertsen B, Petrie KJ, Skogen JC, Hysing M, Eberhard-Gran M. Insomnia before and after childbirth: The risk of developing postpartum pain-A longitudinal population-based study. *European journal of obstetrics, gynecology, and reproductive biology.* Jan 19 2017;210:348-354.
28. Mork PJ, Nilsen TI. Sleep problems and risk of fibromyalgia: longitudinal data on an adult female population in Norway. *Arthritis and rheumatism.* Jan 2012;64(1):281-284.
29. Boardman HF, Thomas E, Millson DS, Croft PR. The natural history of headache: predictors of onset and recovery. *Cephalalgia : an international journal of headache.* Sep 2006;26(9):1080-1088.
30. Odegard SS, Sand T, Engstrom M, Stovner LJ, Zwart JA, Hagen K. The long-term effect of insomnia on primary headaches: a prospective population-based cohort study (HUNT-2 and HUNT-3). *Headache.* Apr 2011;51(4):570-580.
31. Choy EH. The role of sleep in pain and fibromyalgia. *Nature reviews. Rheumatology.* Sep 2015;11(9):513-520.
32. Lerman SF, Rudich Z, Brill S, Shalev H, Shahar G. Longitudinal associations between depression, anxiety, pain, and pain-related disability in chronic pain patients. *Psychosomatic medicine.* Apr 2015;77(3):333-341.
33. Nordgren LF, Banas K, MacDonald G. Empathy gaps for social pain: why people underestimate the pain of social suffering. *Journal of personality and social psychology.* Jan 2011;100(1):120-128.
34. White RS, Jiang J, Hall CB, et al. Higher Perceived Stress Scale scores are associated with higher pain intensity and pain interference levels in older adults. *Journal of the American*

Geriatrics Society. Dec 2014;62(12):2350-2356.

35. Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *Journal of consulting and clinical psychology.* Jun 2002;70(3):678-690.
36. Jackson T, Wang Y, Wang Y, Fan H. Self-efficacy and chronic pain outcomes: a meta-analytic review. *The journal of pain : official journal of the American Pain Society.* Aug 2014;15(8):800-814.
37. Racine M, Castarlenas E, de la Vega R, et al. Sex differences in psychological response to pain in patients with fibromyalgia syndrome. *The Clinical journal of pain.* May 2015;31(5):425-432.
38. Thomas E, Peat G, Harris L, Wilkie R, Croft PR. The prevalence of pain and pain interference in a general population of older adults: cross-sectional findings from the North Staffordshire Osteoarthritis Project (NorStOP). *Pain.* Jul 2004;110(1-2):361-368.
39. Wong WS, Fielding R. Prevalence and characteristics of chronic pain in the general population of Hong Kong. *The journal of pain : official journal of the American Pain Society.* Feb 2011;12(2):236-245.
40. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL, 3rd. Sex, gender, and pain: a review of recent clinical and experimental findings. *The journal of pain : official journal of the American Pain Society.* May 2009;10(5):447-485.
41. Myers CD, Tsao JC, Glover DA, Kim SC, Turk N, Zeltzer LK. Sex, gender, and age: contributions to laboratory pain responding in children and adolescents. *The journal of pain : official journal of the American Pain Society.* Aug 2006;7(8):556-564.
42. Robinson ME, Riley JL, 3rd, Myers CD, et al. Gender role expectations of pain: relationship to sex differences in pain. *The journal of pain : official journal of the American Pain Society.* Oct 2001;2(5):251-257.
43. Baidu. Liuyang. 2017; http://baike.baidu.com/link?url=sGeotSfR1sfKtjAmcZ0x5Lx34TN_wS3icZTPOSkY5UsgTYjxOpx1x2aFFk9B-IKGJCXmKn3XzOSc5KW0oonJRb5ox9lqxlyNzyP5MEyImO3.
44. Wikipedia. Liuyang. 2017; https://en.wikipedia.org/wiki/Liuyang.
45. Wikipedia. Hukou system. 2018; https://en.wikipedia.org/wiki/Hukou_system.
46. Myles PS, Troedel S, Boquest M, Reeves M. The Pain Visual Analog Scale: Is It Linear or Nonlinear? *Anesthesia & Analgesia.* 1999;89(6):1517.
47. Phan NQ, Blome C, Fritz F, et al. Assessment of pruritus intensity: prospective study on validity and reliability of the visual analogue scale, numerical rating scale and verbal rating scale in 471 patients with chronic pruritus. *Acta dermato-venereologica.* Sep 2012;92(5):502-507.
48. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. *Pain.* 1983;17:45-56.
49. Dimitriadis Z, Strimpakos N, Kapreli E, Oldham J. Validity of Visual Analog Scales for Assessing Psychological States in Patients with Chronic Neck Pain. *Journal of Musculoskeletal Pain.* 2014;22(3):242-246.
50. Appukuttan D, Vinayagavel M, Tadepalli A. Utility and validity of a single-item visual analog scale for measuring dental anxiety in clinical practice. *Journal of Oral Science.* 2014;56(2):151-156.
51. Perrot S, Rozenberg S, Moyse D, Legout V, Marty M, cercle d'etude de douleur en r. Comparison of daily, weekly or monthly pain assessments in hip and knee osteoarthritis. A

29-day prospective study. *Joint, bone, spine : revue du rhumatisme.* Oct 2011;78(5):510-515.

52. Jamison RN, Raymond SA, Slawsby EA, McHugo GJ, Baird JC. Pain assessment in patients with low back pain: comparison of weekly recall and momentary electronic data. *The journal of pain : official journal of the American Pain Society.* Mar 2006;7(3):192-199.
53. Mendoza TR, Dueck AC, Bennett AV, et al. Evaluation of different recall periods for the US National Cancer Institute's PRO-CTCAE. *Clinical trials.* Jun 2017;14(3):255-263.
54. Stull DE, Leidy NK, Parasuraman B, Chassany O. Optimal recall periods for patient-reported outcomes: challenges and potential solutions. *Current medical research and opinion.* Apr 2009;25(4):929-942.
55. Rasmussen CDN, Holtermann A, Jorgensen MB. Recall bias in Low Back Pain among workers: effects of recall period and individual and work-related factors. *Spine.* Oct 18 2017.
56. Jun X, Binhui W, Minyan H. The develoment and evaluation of self-rated health measurement scale-prior test version. *Chinese Journal of Behavioral Medical Science.* 2000;9(1):65-68.
57. Xu J, Tan J, Wang Y, Hu M. Evaluation of the Self-rated Health Measurement Scale-the Revised Version 1.0. *Chinese Mental Health Journal.* 2003;17:301-305.
58. Xu J, Xie Y, Li B, Hu M. The study of validity on Self-Rated Health Measurement Scale-the revised version 1.0. *Chinese Journal of Clinical Rehabilitation.* 2002;6(14):2082-2085.
59. Fried EI, Nesse RM, Zivin K, Guille C, Sen S. Depression is more than the sum score of its parts: individual DSM symptoms have different risk factors. *Psychological medicine.* Jul 2014;44(10):2067-2076.
60. Zimmerman M. Symptom severity and guideline-based treatment recommendations for depressed patients: implications of DSM-5's potential recommendation of the PHQ-9 as the measure of choice for depression severity. *Psychotherapy and psychosomatics.* 2012;81(6):329-332.
61. Teddy M. Chen PD, M.S.S.W., Frederick Y. Huang MD, Christine Chang BS, Henry Chung MD. Using the PHQ-9 for Depression Screening and Treatment Monitoring for Chinese Americans in Primary Care. *Psychiatric Services.* 2006;57:976-981.
62. Wang W, Bian Q, Zhao Y, et al. Reliability and validity of the Chinese version of the Patient Health Questionnaire (PHQ-9) in the general population. *General hospital psychiatry.* Sep-Oct 2014;36(5):539-544.
63. Spitzer RL, Kroenke K, Williams JB, Lowe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine.* May 22 2006;166(10):1092-1097.
64. Lowe B, Decker O, Muller S, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical care.* Mar 2008;46(3):266-274.
65. Beard C, Bjorgvinsson T. Beyond generalized anxiety disorder: psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. *Journal of anxiety disorders.* Aug 2014;28(6):547-552.
66. Franckowiak BA, Glick DF. The effect of self-efficacy on treatment. *Journal of addictions nursing.* Apr-Jun 2015;26(2):62-70.
67. Luszczynska A, Scholz U, Schwarzer R. The general self-efficacy scale multicultural validationstudies. *The Journal of Psychology.* 2005;139(5):439-457.
68. Leung DY, Leung AY. Factor structure and gender invariance of the chinese general self-efficacy scale among soon-to-be-aged adults. *Journal of advanced nursing.* Jun 2011;67(6):1383-1392.

69. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior,.* 1983;24(4):385-396.
70. Chaaya M, Osman H, Naassan G, Mahfoud Z. Validation of the Arabic version of the Cohen Perceived Stress Scale (PSS-10) among pregnant and postpartum women. *BMC psychiatry.* Dec 15 2010;10(111):1471-1244.
71. Ng S-m. Validation of the 10-item Chinese perceived stress scale in elderly service workers: one-factor versus two-factor structure. *BMC psychology.* 2013;1(1):9.
72. WHO. *World Health Day 2012 - Ageing and health* 2012.
73. Hashmi JA, Davis KD. Deconstructing sex differences in pain sensitivity. *Pain.* 2014;155(1):10-13.
74. Hardt J, Jacobsen C, Goldberg J, Nickel R, Buchwald D. Prevalence of chronic pain in a representative sample in the United States. *Pain medicine.* Oct 2008;9(7):803-812.
75. Cabral DM, Bracher ES, Depintor JD, Eluf-Neto J. Chronic pain prevalence and associated factors in a segment of the population of Sao Paulo City. *The journal of pain : official journal of the American Pain Society.* Nov 2014;15(11):1081-1091.
76. Cho NH, Jung YO, Lim SH, Chung CK, Kim HA. The prevalence and risk factors of low back pain in rural community residents of Korea. *Spine.* Nov 15 2012;37(24):2001-2010.
77. Jackson T, Thomas S, Stabile V, Han X, Shotwell M, McQueen K. Prevalence of chronic pain in low-income and middle-income countries: a systematic review and meta-analysis. *The Lancet.* Apr 27 2015;385 (Suppl 2):S10.
78. Schneider S, Randoll D, Buchner M. Why do women have back pain more than men? A representative prevalence study in the federal republic of Germany. *The Clinical journal of pain.* Oct 2006;22(8):738-747.
79. Son KM, Cho NH, Lim SH, Kim HA. Prevalence and risk factor of neck pain in elderly Korean community residents. *Journal of Korean medical science.* May 2013;28(5):680-686.
80. Mapplebeck JC, Beggs S, Salter MW. Sex differences in pain: a tale of two immune cells. *Pain.* Feb 2016;157 Suppl 1:S2-6.
81. Bouhassira D, Lanteri-Minet M, Attal N, Laurent B, Touboul C. Prevalence of chronic pain with neuropathic characteristics in the general population. *Pain.* Jun 2008;136(3):380-387.
82. Torrance N, Smith BH, Bennett MI, Lee AJ. The epidemiology of chronic pain of predominantly neuropathic origin. Results from a general population survey. *The journal of pain : official journal of the American Pain Society.* Apr 2006;7(4):281-289.
83. Berke DS, Reidy DE, Miller JD, Zeichner A. Take it like a man: gender-threatened men's experience of gender role discrepancy, emotion activation, and pain tolerance. *Psychology of Men & Masculinity.* 2016.
84. Moore TM, Stuart GL. A Review of the Literature on Masculinity and Partner Violence. *Psychology of Men & Masculinity.* 2005;6(1):46-61.
85. Vandello JA, Bosson JK. Hard won and easily lost: a review and synthesis of theory and research on precarious manhood. *Psychology of Men & Masculinity.* Apr 2013;14(2):101-113.
86. Landmark BT, Gran SV, Kim HS. Pain and persistent pain in nursing home residents in Norway. *Research in gerontological nursing.* Jan 2013;6(1):47-56.
87. Han C, Pae CU. Pain and depression: a neurobiological perspective of their relationship. *Psychiatry investigation.* Jan 2015;12(1):1-8.
88. Wiech K, Tracey I. The influence of negative emotions on pain: behavioral effects and neural

mechanisms. *NeuroImage.* Sep 2009;47(3):987-994.

89. Do Carmo Silva Parreira P, Maher CG, Latimer J, et al. Can patients identify what triggers their back pain? Secondary analysis of a case-crossover study. *Pain.* Oct 2015;156(10):1913-1919.
90. Bernfort L, Gerdle B, Rahmqvist M, Husberg M, Levin LA. Severity of chronic pain in an elderly population in Sweden--impact on costs and quality of life. *Pain.* Mar 2015;156(3):521-527.
91. Johnson AC, Greenwood-Van Meerveld B. Stress-induced pain: a target for the development of novel therapeutics. *The Journal of pharmacology and experimental therapeutics.* Nov 2014;351(2):327-335.
92. Keefe FJ, Wilkins RH, Cook WA, Jr. JEC, Muhlbaier LH. Depression, pain, and pain behavior. *Journal of consulting and clinical psychology.* 1986;54(5):665-669.
93. Li J-X. Pain and depression comorbidity: A preclinical perspective. *Behavioural Brain Research.* Jan 1 2015;276:92-98.
94. Pinheiro MB, Ferreira ML, Refshauge K, et al. Genetics and the environment affect the relationship between depression and low back pain: a co-twin control study of Spanish twins. *Pain.* Mar 2015;156(3):496-503.
95. Burns JW, Nielson WR, Jensen MP, Heapy A, Czlapinski R, Kerns RD. Specific and general therapeutic mechanisms in cognitive behavioral treatment of chronic pain. *Journal of consulting and clinical psychology.* Feb 2015;83(1):1-11.

Figure legends

Figure 1. Recruitment and follow-up of study participants

Figure 2. The relationship between physical, social health and pain severity

Figure 3. Gender-employment effects on pain severity in youth

Figure 4. Gender and depression symptoms effects on pain severity in youth

Figure 5. Gender and physical health effects on pain severity in youth

Figure 6. Gender and perceived stress effects on pain severity in youth

Figure 7. Gender-employment effects on pain severity in the middle aged

Figure 8. Gender and depression symptoms effects on pain severity in the middle aged

Figure 9. Gender and perceived stress effects on pain severity in the middle aged

Figure 10. Gender-employment effects on pain severity in the elderly

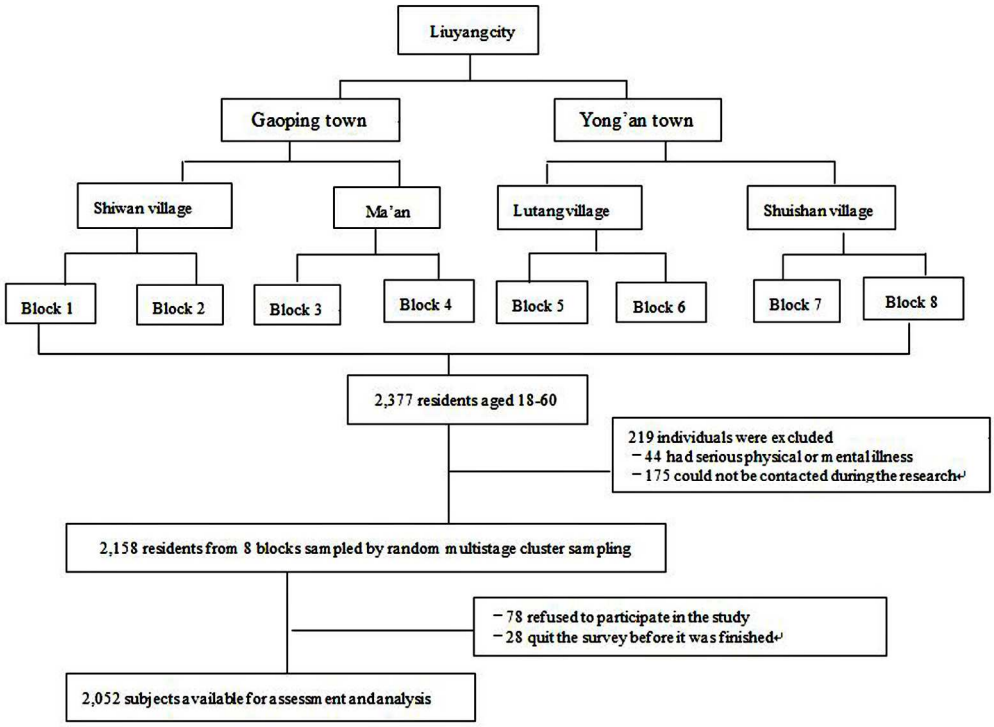


Figure1. Recruitment and follow-up of study participants

210x163mm (300 x 300 DPI)

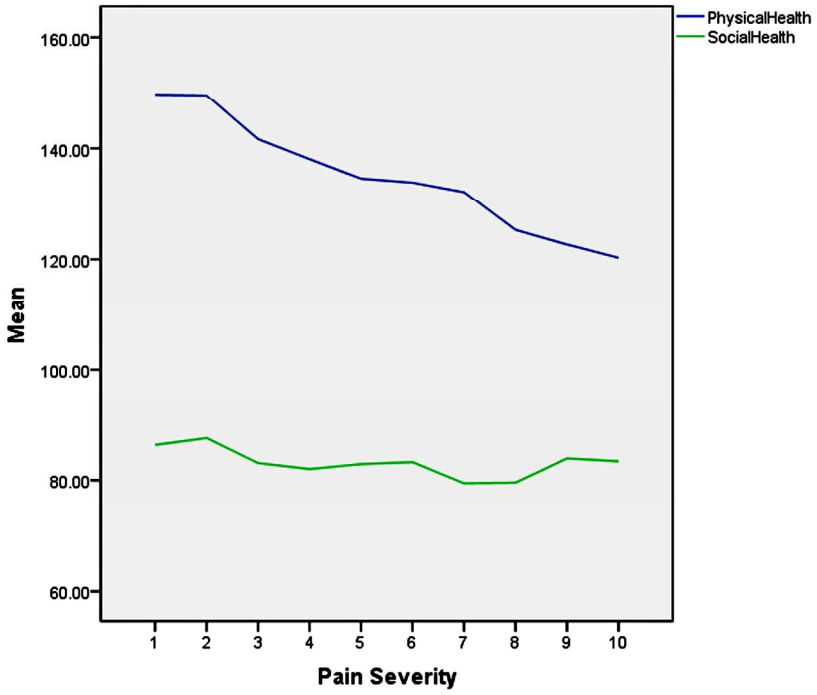


Figure 2. The relationship between physical, social health and pain severity

598x481mm (300 x 300 DPI)

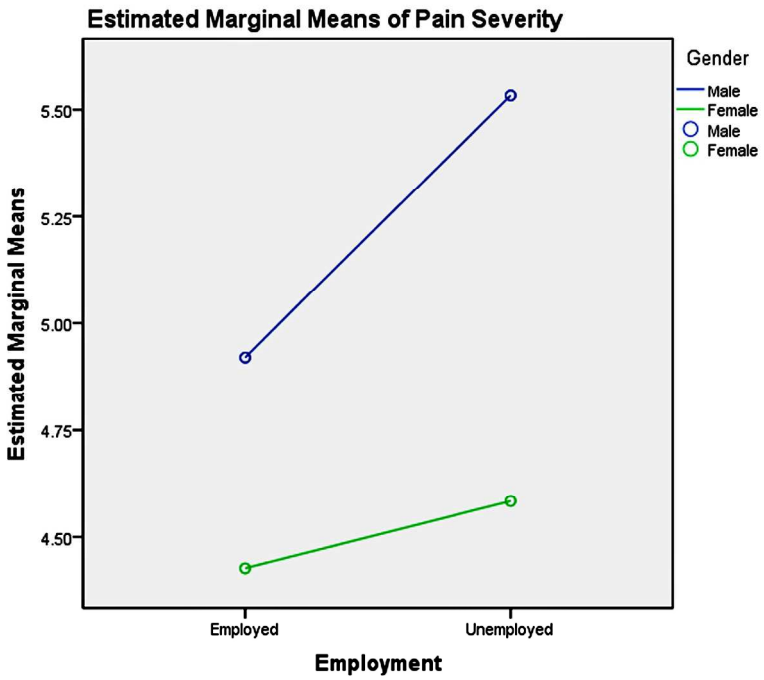


Figure 3. Gender-employment effects on pain severity in youth

598x489mm (300 x 300 DPI)

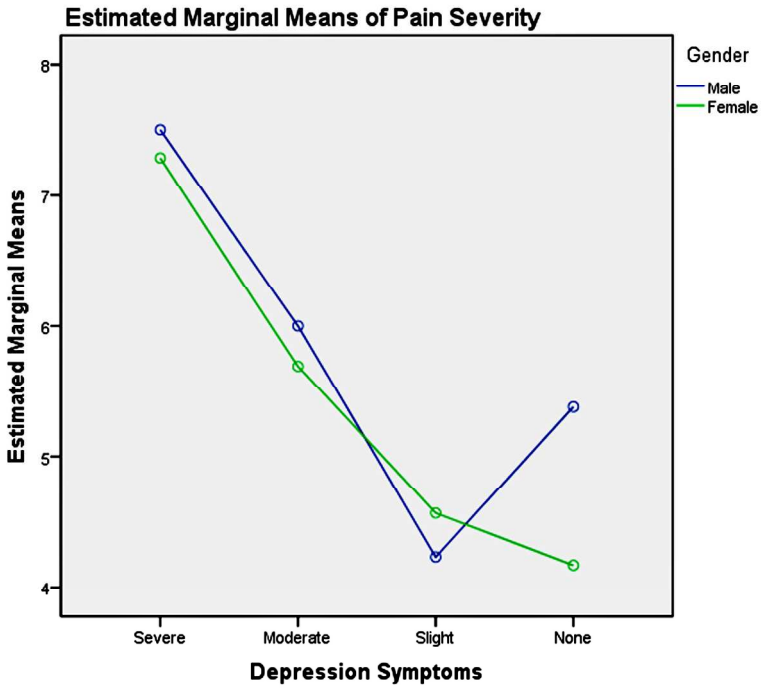


Figure 4. Gender and depression symptoms effects on pain severity in youth

598x481mm (300 x 300 DPI)

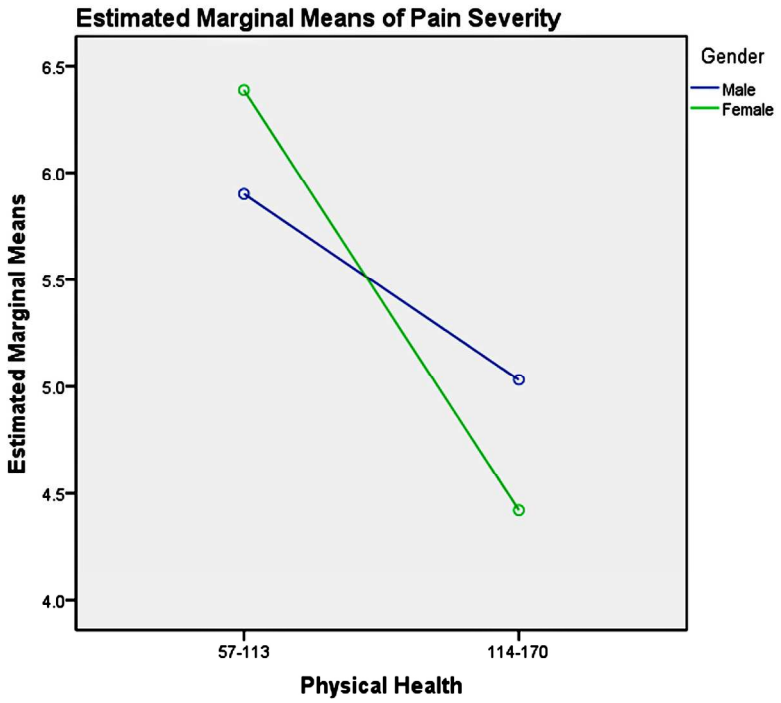


Figure 5. Gender and physical health effects on pain severity in youth

585x458mm (300 x 300 DPI)

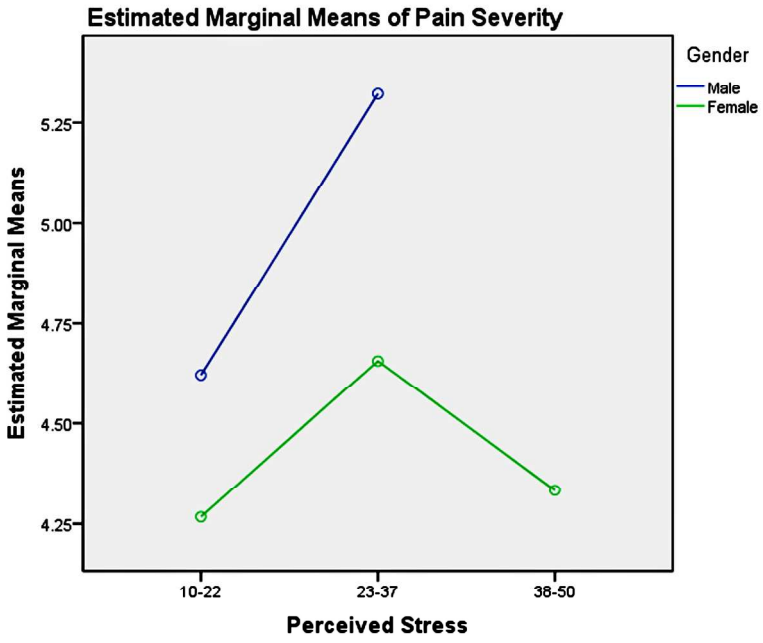


Figure 6. Gender and perceived stress effects on pain severity in youth

598x481mm (300 x 300 DPI)

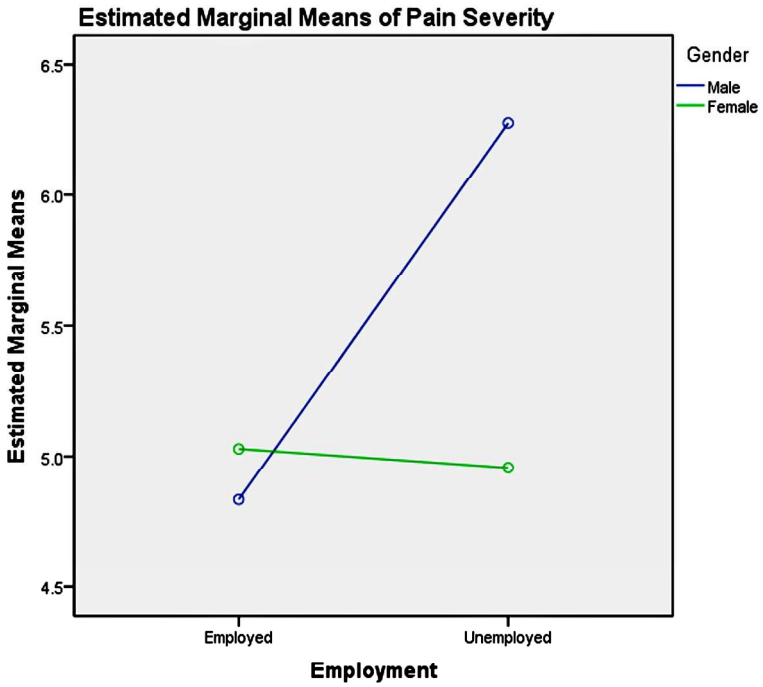


Figure 7. Gender-employment effects on pain severity in the middle aged

598x463mm (300 x 300 DPI)

Unable to Convert Image

The dimensions of this image (in pixels) are too large to be converted. For this image to convert, the total number of pixels (height x width) must be less than 40,000,000 (40 megapixels).

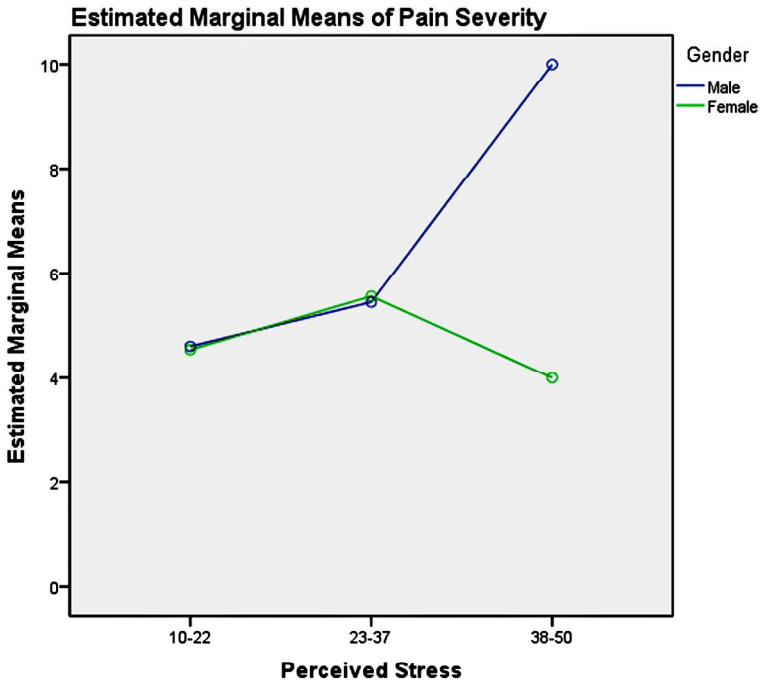


Figure 9. Gender and perceived stress effects on pain severity in the middle aged

598x463mm (300 x 300 DPI)

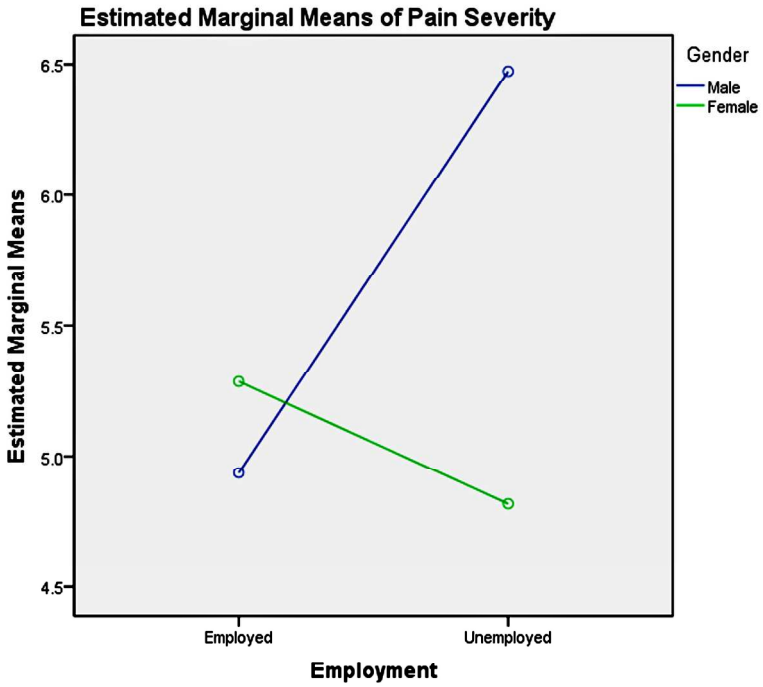


Figure 10. Gender and employment effects on pain severity in the elderly

598x463mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	No
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	No
		(*e*) Describe any sensitivity analyses	No
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	Attached file
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-16
		(*b*) Report category boundaries when continuous variables were categorized	No
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	No
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13-16
Discussion			
Key results	18	Summarise key results with reference to study objectives	17-19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	No
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.