Public Health 123 (2009) 694–698

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevierhealth.com/journals/pubh

Original Research

# Patterns and correlates of stress among rural Chinese males: A four-region study

T. Yang [a], I.R.H. Rockett [b], X. Yang [c,*], X. Xu [c]

[a] Center for Tobacco Control Research, Zhejiang University School of Medicine, Yuhangtang Road, Hangzhou 310058, PR China
[b] Injury Control Research Center and Department of Community Medicine, West Virginia University, Morgantown, WV 26506-9190, USA
[c] Department of Sociology, Zhejiang University School of Medicine, Yuhangtang Road, Hangzhou 310058, PR China

ARTICLE INFO

*Article history:*
Received 15 May 2009
Received in revised form
31 July 2009
Accepted 11 August 2009
Available online 3 November 2009

*Keywords:*
Stress
Epidemiology
Mental health
Health policy
Rural health
Health psychology

SUMMARY

*Objectives:* Prior research has revealed a high prevalence of stress among general urban populations in China. However, little is known about stress in rural Chinese counterparts. This research estimates the prevalence of severe stress among rural Chinese males and identifies sociodemographic and psychological correlates.
*Study design:* The study design was a cross-sectional survey with multistage sampling.
*Methods:* Subjects were male residents aged ≥15 years from four geographic regions of China ($N = 4414$), namely Jinbei, Jinnan, Guidongbei and Subei. Information was collected on perceived stress and potential sociodemographic and behavioural correlates as well as on perceived health status. Data were assessed by means of $\chi^2$ tests and unconditional logistic regression analysis.
*Results:* The mean score for the rural male resident sample on the Chinese Perceived Stress Scale (CPSS) was 24.8 (standard deviation = 7.7), and 44% of subjects reported severe stress. With Subei residents as the referent, respondents from Guidongbei region [adjusted odds ratio (OR) = 0.66; 95% confidence interval (CI) = 0.52–0.84] had a lower likelihood of reporting severe stress and those from Jinbei region (OR = 3.54; 95% CI = 2.85–4.39) and Jinnan region (OR = 2.73; 95% CI = 2.21–2.39) had higher likelihoods. Respondents aged 35–44 years (OR = 0.69; 95% CI = 0.55–0.85) and ≥45 years (OR = 0.67; 95% CI = 0.54–0.83) had a lower likelihood of reporting severe stress than those aged <25 years, and respondents in non-farming jobs (OR = 1.33; 95% CI = 1.09–1.62) had an excess likelihood relative to those in farming. An excess likelihood of reporting severe stress was manifest among the divorced and widowed relative to the unmarried, and a lower likelihood was observed among respondents with a higher education relative to the least educated. Hedonism seeking was positively associated with severe stress among rural Chinese males (OR = 2.43; 95% CI = 2.09–2.84) and social participation was negatively associated (OR = 0.62, 95% CI = 0.54–0.73).
*Conclusions:* This study found a high stress level among rural Chinese males. To ameliorate this problem, we recommend policy and prevention initiatives at national and local levels.


## Introduction

A global industrial force, China is also a major agricultural country, with 900 million rural residents out of a total population of 1.3 billion.[1] Reflecting policy, this country has recently experienced rapid socioeconomic development in urban areas with a much slower transformation occurring in rural areas. Thus, while living standards have risen across China, this regional lag in the modernisation process has generated 'agriculture, farmer and countryside' problems.[2] *Per capita* income for rural residents is only 4761 renminbi (RMB), compared with 15 781 RMB for urban residents.[3] Many rural Chinese dwell in cramped, dank and dilapidated mud-clay housing. They generally cannot access important benefits available to urban counterparts such as social welfare and a healthcare guarantee. Their poverty means that minor illness or injury has to be endured and that serious illness may well result in death or permanent disability. Pressure and fatigue are life constants for rural residents.[4]

During the past two decades, many rural residents migrated to urban areas in search of higher paying industrial employment. Estimated numbers increased from 50 million in 1990 to 121 million in the year 2000. By 2010 there will be a projected 160 million rural–urban migrants, representing approximately 25% of the active Chinese labour force.[5] Rural–urban migrant workers occupy low social status and must circumvent numerous barriers to

* Corresponding author. Center for Tobacco Control Research, Zhejiang University School of Medicine, Yuhangtang Road, Hangzhou 310058, PR China.
*E-mail address:* Ytingzhongyang@yahoo.com (X. Xu).

0033-3506/$ – see front matter 
doi:10.1016/j.puhe.2009.08.003

secure legitimate urban employment. Authorities typically only permit them to fill positions that city residents reject, such as construction and handling of corpses, sewage and chemical waste. This employment is characterised by inequitable terms and low remuneration. Migrants are frequently marginalised and are targets for discrimination.[6] Meanwhile, remaining rural residents are disproportionately children and female, and elderly, ill and disabled. They are usually limited to heavy agricultural jobs and suffer psychologically and socioeconomically through separation from their migratory head of household. Household heads remain the core of the Chinese family and disconnection can be catastrophic. Research indicates that rural–urban migrants[7–9] and detached family members manifest excess risk for stress and mental health disorders.[10,11]

Since rural residents emerge as a distinctly disadvantaged group, there is ample reason for scientific interest regarding their psychological pressures and related health issues. Such issues have been ignored in the literature. By contrast, stress among urban populations is well documented.[12,13] Thus, there is little information on patterns and correlates of stress among rural Chinese. Stimulated by their magnitude, it is a public health imperative for scientists to gather prevalence data on severe stress among rural residents in order to formulate policy and to design and implement effective intervention and prevention strategies. The rural population of China retains values and social bonds characteristic of a traditional society, with the core being emphasis upon family and kinship. Primary responsibility for maintaining this emphasis lies with adult males, since rural China remains a patriarchal and collectivist society. Traditional values firmly place an adult male as head of household and familial mainstay. He is obligated to assure the destiny and survival of his family. As head of household, he represents the principal line of resistance to the familial threats posed by external conflict and social challenge. Our study sought to investigate stress among household heads and potential household heads during a social transition which was devastating that social position. More specifically, we primarily sought to estimate the prevalence of severe stress among male rural residents in four geographic regions across China and to identify sociodemographic and psychological correlates of such stress.

Derived from the Chinese stress literature,[6–13] we anticipated that there would be a high stress level among rural Chinese males and also that region and other salient sociodemographic characteristics, such as age, education, marital status and occupation, would be associated with severe stress. We posit that stress is related to personal values and lifestyle. Accordingly, we evaluated the influence of hedonism seeking and social participation as potential determinants of stress. Neither relationship has previously been studied in rural males. Chinese society remains profoundly influenced by an agrarian culture, which reflects a strong hedonistic tradition.[14a] Hedonism promotes the pursuit of instant gratification—an ultimate societal value.[15] The highly hedonistic are more prone to work less and enjoy life more than opposites, and conflict between these tendencies could elevate their stress levels.[14a,15] On the other hand, their tendency to vocalise about the stress of traumatic events and to adopt an avoidant coping style could serve as mitigating forces.[16] There is research suggesting that social participation affects stress.[17–19] Unlike urban life, rural life is often mundane, lonely and stressful because of a lack of entertainment and social activities. As previously shown for Chinese urban residents, the presence of such opportunities might benefit rural participants by relieving their stress and maintaining or elevating their psychological well-being.[20]

## Methods

### *Geography*

The geographic area for this study covered four regions in China: southwest (Guidongbei region); southeast (Subei region); northwest (Jinnan region); and north (Jinbei region). The high degree of geographic dispersion meant that it was possible to examine rural resident stress levels between and within regions. The four regions were selected because of their agricultural commonality, long distance from metropolises and lack of large industries.

### *Study design and sampling*

Cross-sectional in design, this study utilised a multistage systematic sampling procedure to select participants. Stage 1 represented the a priori selection of the four geographic regions under review. In Stage 2, two counties from each of the four regions were respectively randomly selected, 20% of their rural villages and 20% of the local communities (the smallest rural areal units) in those villages. In Stage 3, a list of family households was first obtained through the local village government and administrative offices. From this list, 20% of the families were then randomly selected and contacted.[21] Eligible subjects were males aged $\geq$15 years. In families with two or more eligibles, the one with the birthday closest to the date of interview was selected as the subject.

Eligible subjects were interviewed at home by research assistants who were trained medical students from a local medical school. Written informed consent was obtained from each subject. Upon receiving their survey instructions, subjects were asked to complete a questionnaire of approximately 30 min duration. Each was given an opportunity to answer or clarify questions regarding the survey or constituent items. Upon questionnaire completion, subjects were given 2 RMB (equivalent to US$0.25) as a token of appreciation for their participation.

Possessing acceptable psychometric properties, the measures adopted for this study have been extensively used in prior research on stress involving Chinese populations.[6,12] Variables were organised within the questionnaire under the following categories.

- Sociodemographics: Age (date of birth); educational attainment; marital status; geographic region; job type; and personal income.
- Stress: Symptoms were tapped by the Perceived Stress Scale, Chinese version (CPSS). This scale comprises 14 items assessing perceptions of stress during the month prior to survey. Items were rated on a 5-point Likert-type scale ranging from 0 (never) to 4 (very often).[12,22] Item scores were summed to yield a total score—the higher the total, the greater the perceived stress level. Following previous practice, severe stress was operationalised as a score $\geq$25.[12] The internal reliability of the CPSS in this sample, measured by Cronbach's $\alpha$, was 0.83.
- Hedonism seeking: This behaviour was assessed by means of a validated Hedonism-Seeking Scale (HSS), which was developed by the senior author.[14a,15] The scale comprises four items: (i) I prefer spending my money on eating, drinking alcohol or pursuing other recreational activities; (ii) in order to enjoy life, I have a carefree attitude; (iii) I do not mind getting drunk if alcoholic drinks are available, since drinking is a way of enjoying life with sensation; and (iv) the purpose of life is to enjoy myself since fast living means that life disappears like a dream. There was a standard set of seven response alternatives for each item: (i) completely disagree; (ii) mostly disagree; (iii) somewhat disagree; (iv) neither agree nor disagree; (v) somewhat agree; (vi) mostly agree; and (vii) completely agree. A mean hedonism-seeking score was derived by aggregating the value for each

response and dividing it by the number of alternative responses (i.e. 7). Respondents with a mean score exceeding 4 were grouped as high hedonism-seekers and the remainder as low.[15] The internal reliability of the HSS for this sample was 0.82 (Cronbach's $\alpha$).

- Social participation: Based on the four items in our questionnaire, social participation was assessed using another indigenous Chinese scale created by the senior author.[14b] The internal reliability of the social participation scale was computed and its validity was estimated by exploratory factor analysis. The scale manifested high reliability in our sample (Cronbach's $\alpha = 0.76$). Exploratory factor analyses of the four scale items extracted one factor that explained 47.1% of the variance. Respective loading values were 0.76 (chatting with others), 0.58 (visiting relatives), 0.65 (participating in a ceremony) and 0.72 (having a meeting or going out for an activity with others). The total score was calculated for the scale by summing responses to these individual items. The higher the total, the greater the social participation. A total exceeding 12 equated to a higher (versus a lower) level of social participation.

### *Data analysis*

Subjects were profiled, their perceived health status was reported and prevalence estimates of severe stress were presented across sociodemographic and behavioural characteristics. An unconditional multiple logistic regression analysis was then performed to test the hypotheses regarding severe stress and its correlates. The dependent variable in this study was stress status, operationalised as a binary response variable (severe stress = 1 and no stress or low stress = 0). Independent variables were: geographic region; age; education; race; marital status; income; job type; hedonism seeking; and social participation. The respective referents were Subei for region, <25 years old for age, elementary or lower for education, never married for marital status, Han for ethnicity, farming for job, <¥1000 (US$1 = ¥7.6) for income, lower score for hedonism seeking and lower score for social participation. Adjusted point-estimated odds ratios were calculated together with their 95% confidence interval (CI). Data were analysed using Statistical Analysis Software version 6.12 (SAS Institute Inc., Cary, NC). Weighted analyses were reported since data were adjusted for clustering of subjects within regions.

## Results

A total of 5097 males was approached for study participation, with a response rate of 87%. Of the respondents, 4414 provided complete data that are reported on for this study. Their demographic characteristics were similar to those reported in the national population survey of the Chinese male rural population.[18] The mean age was 38.7 years (data not shown). The vast majority were Han Chinese, married, had less than a high school education and a very low mean annual per capita income; 42% reported that they held farm jobs, 41% of subjects scored high on hedonism seeking and 65% scored high on social participation. Regarding perceived health status, 22% of subjects felt very well, 39% felt well, 26% reported satisfactory health and the remainder felt that they were in poor or very poor health. The mean CPSS score was 24.8 (standard deviation 7.7), which closely approached the cut-off point of 25 for severe stress; 44% of respondents met the study's severe stress criterion. Table 1 shows estimates for the prevalence of severe stress in this sample, disaggregated by sociodemographic and behavioural characteristics.

**Table 1**
Sociodemographic and behavioural characteristics of the study sample ($N = 4414$), with prevalence estimates of severe stress.

| Variable | *n* | % of total | Stress (%) |
|---|---|---|---|
| Geographic region | | | |
| Subei | 958 | 21.7 | 36.1 |
| Jinnan | 1375 | 31.2 | 51.1 |
| Jinbei | 1259 | 18.6 | 57.1 |
| Guidongbei | 822 | 28.5 | 21.8 |
| | $\chi^2$ 305.58, d.f. = 3, $P < 0.01$ | | |
| Age (years) | | | |
| <25 | 759 | 17.2 | 48.4 |
| 25–34 | 981 | 22.2 | 46.3 |
| 35–44 | 1444 | 32.7 | 44.3 |
| ≥45 | 1230 | 27.9 | 39.5 |
| | $\chi^2$ 17.96, d.f. = 3, $P < 0.01$ | | |
| Residence | | | |
| Village | 3793 | 85.9 | 44.8 |
| Town | 621 | 14.1 | 39.6 |
| | $\chi^2$ 5.87, d.f. = 1, $P < 0.05$ | | |
| Education | | | |
| Elementary school | 1864 | 42.2 | 45.8 |
| Middle school | 1900 | 43.0 | 43.2 |
| High school | 516 | 11.7 | 45.2 |
| College or higher | 134 | 3.0 | 29.1 |
| | $\chi^2$ 15.37, d.f. = 3, $P < 0.01$ | | |
| Marital status | | | |
| Never married | 358 | 8.1 | 36.3 |
| Married | 3970 | 89.9 | 46.7 |
| Divorced/widowed | 86 | 1.9 | 48.8 |
| | $\chi^2$ 10.14, d.f. = 2, $P < 0.01$ | | |
| Ethnicity | | | |
| Han | 4320 | 97.9 | 44.2 |
| Minority | 94 | 2.1 | 38.3 |
| | $\chi^2$ 1.31, d.f. = 1, $P > 0.05$ | | |
| Job category | | | |
| Farming | 1871 | 42.4 | 39.3 |
| Rural–urban migrant | 1533 | 34.7 | 47.2 |
| Non-farming | 683 | 15.5 | 48.6 |
| Not working | 327 | 7.4 | 44.0 |
| | $\chi^2$ 24.70, d.f. = 3, $P < 0.01$ | | |
| Mean annual per capita income (¥) | | | |
| <1000 | 983 | 22.3 | 52.4 |
| 1000–1999 | 1808 | 41.0 | 40.4 |
| 2000–2999 | 891 | 20.2 | 42.8 |
| 3000–3999 | 377 | 8.5 | 49.1 |
| ≥4000 | 355 | 8.0 | 37.8 |
| | $\chi^2$ 47.52, d.f. = 4, $P < 0.01$ | | |
| Hedonism seeking | | | |
| Low | 2614 | 59.22 | 35.9 |
| High | 1800 | 40.78 | 56.1 |
| | $\chi^2$ 176.63, d.f. = 1, $P < 0.01$ | | |
| Social participation | | | |
| Low | 1526 | 34.57 | 60.9 |
| High | 2888 | 65.43 | 31.9 |
| | $\chi^2$ 266.70, d.f. = 1, $P < 0.01$ | | |

Table 2 shows the results of the multivariate analysis of severe stress. Subjects living in the Jinbei and Jinnan regions manifested a higher likelihood of being severely stressed than those living in the Subei region, whereas those living in the Guidongbei region manifested a lower likelihood. An excess likelihood was apparent for subjects aged ≥35 years compared with those aged <25 years. Subjects with a college degree or higher were less likely to be severely stressed than the least educated, and the divorced and widowed had a higher likelihood than the unmarried. The same was the case for those in non-farm jobs relative to farm workers. Compared with their opposites, a greater likelihood of severe stress

**Table 2**
Multiple logistic regression analysis of sociodemographic and behavioural correlates of severe stress in rural Chinese males ($N = 4414$).

| Correlate | OR | 95% CI |
|---|---|---|
| Region | | |
| Subei | 1.00 | — |
| Jinnan | 2.73** | 2.21–2.39 |
| Jinbei | 3.54** | 2.85–4.39 |
| Guidongbei | 0.66** | 0.52–0.84 |
| Age (years) | | |
| <25 | 1.00 | — |
| 25–34 | 0.95 | 0.76–1.87 |
| 35–44 | 0.69** | 0.55–0.85 |
| ≥45 | 0.67** | 0.54–0.83 |
| Education | | |
| Elementary school | 1.00 | — |
| Middle school | 0.88 | 0.76–1.01 |
| High school | 0.99 | 0.79–1.25 |
| College or higher | 0.55** | 0.35–0.85 |
| Marital status | | |
| Never been married | 1.00 | — |
| Married | 0.84** | 0.63–1.45 |
| Divorced/widowed | 1.29** | 1.36–3.89 |
| Job category | | |
| Farming | 1.00 | — |
| Rural–urban migrant | 0.89 | 0.76–1.04 |
| Non-farming | 1.33* | 1.09–1.62 |
| Other (no work capacity) | 1.10 | 0.83–1.45 |
| Hedonism seeking | 2.43** | 2.09–2.84 |
| Social participation | 0.62** | 0.54–0.73 |

OR, odds ratio, CI, confidence interval.
*$P < 0.05$; **$P < 0.001$.

was manifest among subjects scoring high on hedonism seeking and a lower likelihood among those scoring high on social participation.

## Discussion

In this study, perceived stress scores among Chinese rural males were calculated. The prevalence of severe stress was also estimated and its sociodemographic and behavioural correlates were identified. The mean score for subjects on the CPSS was 24.8 (95% CI 24.7–25.0), a marginally higher score than that previously estimated for male urban residents (23.8; 95% CI 23.5–24.0).[12] In addition, the estimated prevalence of severe stress (44.1%; 95% CI 43.3–44.9%) approximates an estimate of 44.5% (95% CI 42.9–46.1%) for urban counterparts. Although the prevalence of severe stress appears similar between Chinese rural and urban males, the relative sources of their stress may be quite different. Two main sources of stress have been identified in the Chinese population, social competition and day-to-day life stress.[12] Strongly implicating gross poverty and associated existential challenges, we suggest that the latter is relatively much more salient for rural than urban residents.[1–4] Traditional Chinese culture emphasises the obligation of the rural adult male to serve as household head and family leader, and poverty represents the major impediment for him being able to assure the survival of his family and its destiny.

We found that severe stress among rural male residents was associated with a number of sociodemographic characteristics. First, there were significant regional differences. This finding may reflect the substantial variation in both socioeconomic development and cultural norms across mainland China.[1,23] For example, rural male residents living in Subei region may be less likely to be severely stressed than those living in the Jinnan and Jinbei regions because Subei is the most developed of the three regions. On the other hand, Guidongbei region is less developed than Subei, yet its rural male residents manifested a lower likelihood of severe stress. This apparent anomaly may be culturally determined. Guidongbei is located in the southwest of the Chinese mainland and possesses a unique culture.[14c] It largely remains economically self-sufficient. Residents are unsophisticated and value and practice honesty in their personal and business interactions. They regard each event as determined by nature. They also subscribe heavily to the notion that people bring nothing to the world at birth and take nothing when they die. Their fatalism helps them keep stress levels low in the face of pressing problems.

Consistent with prior research,[8,23–25] we also found that age was another demographic correlate of severe stress. The older age groups, encompassing subjects ≥35 years, were less likely to manifest severe stress than the youngest subjects aged <25 years. Again, consistent with the literature,[8,23–25] rural males with a college degree or higher were less likely to manifest severe stress than the least educated. Also confirming prior findings, divorced and widowed males showed an excess of severe stress relative to the unmarried.[8,23,24] Similarly confirmatory,[25] we found a significant difference between married and unmarried males. Our finding that males in non-farm jobs showed an excess likelihood of severe stress compared with farm workers may stem from the former jobs being more transient in their nature than the latter jobs, i.e. more likely to generate instability in employment and residence.

A positive association was found between hedonism seeking and severe stress, likely stemming from a mix of personal values and poor coping styles.[14a,15,16,26] This finding has motivated us to argue for the importance of creating, implementing and evaluating evidence-based strategies to improve the mental and physical health of rural populations. Such strategies must be sensitive to social as well as psychological determinants of poor health. We also found that low social participation was inversely associated with stress, affirming previous findings.[18–20] Kindred to social participation, social networks and social support buffer both social and psychological stress.[27] Increasing both entertainment outlets and opportunities to participate in social activities should be integral to strategies aimed at alleviating and managing stress levels among Chinese rural male residents.

Another likely stressor for rural male residents is deprivation related to their low national socioeconomic status. Commencing in 1978, reform of China's policy for rural areas meant relaxation of agricultural controls and evolution towards a market economy. A consequence of this reform has been higher rural incomes. However, the Chinese countryside still typically lags far behind urban areas. There are substantial rural–urban disparities in income and services. Favouring urban areas, the distribution of healthcare resources has been disproportionate. Limited access to hospitals, health stations, trained counselling psychologists and psychiatrists has severely depressed the psychological welfare of the rural populace. We recommend that the government change the policy to achieve an equitable balance in economic development between rural and urban areas as well as to guarantee rural residents the same citizenship rights as urban residents. We acknowledge that rural–urban dualism is a persisting legacy of an ancient era. Historically, villages provided food and other necessities to cities without equal return because the cities arbitrarily served as the centre of political power. We find it most encouraging that the Central and regional governments in China now recognise the historical imbalance and are exploring ways to move towards equilibrium.

The highly stressed may not be more prone to mental disorders than other people. However, both government and local health authorities need to develop policies to prevent mental disorders and to reduce the high prevalence of severe stress now evident in the rural male population. A multifaceted approach to prevention should be incorporated into community healthcare programmes.

For example, local health authorities should offer mental health care and educational sessions. A health education curriculum should be provided that addresses such special topics as risk factors for severe stress and strategies for coping with life stressors. Currently there are few qualified psychological counsellors and few psychiatrists in rural areas. Thus, it is imperative to provide appropriate training to rural community health service staff and to recruit urban volunteers to work as mental health counsellors in the underserved areas. A special community-based mental health service centre should be established to provide rural residents with psychological counselling as needed. Support groups are particularly needed for rural 'left-behind' children and the elderly, i.e. for those vulnerable groups whose parents or offspring left home to pursue better economic opportunities in urban areas. These support groups could provide a forum where residents can express mental health concerns and learn stress management. Some rural areas still lack Internet access. The Internet might usefully be employed in China to offer psychological support rather than make this the responsibility of the village community centre. The reason for this suggestion is that Chinese culture emphasises emotional restraint and control, and the Chinese are wary about revealing their weaknesses and problems to others.

This study has at least three notable limitations. First, its cross-sectional design precludes us from drawing causal inferences. There is a crucial need to collect both cross-sectional and longitudinal data on stress in rural communities for surveillance, prevention and evaluation purposes. In addition, community health promotion and policy data are needed to facilitate understanding of how stress levels react to community-level health regulations and targeted campaigns. A second study limitation is that subjects were confined to males, thus limiting the generalisability of the findings. A third limitation is that this study only addressed current stress status. We need to specify better the type of stress or unhappiness that rural Chinese males are experiencing in order to understand the mechanisms and to design and implement effective preventive measures.

Our research possesses a number of strengths. This was the first study of stress with an exclusive focus on the Chinese rural population. Moreover, its large sample, derived from four large and distinct geographic regions, allowed broad rural representation to be attained. In addition, geographic regions rather than provinces were used for the sampling framework. Whilst this decision enabled a sample that was homogeneous within regions to be captured, it was possible simultaneously to maximise its geographic, cultural and socioeconomic heterogeneity across regions. The response rate of 87% is exceedingly high by contemporary survey research standards and enhances the generalisability of the results to the rural male population aged $\geq$15 years. Non-response was primarily due to absence from home at the time of survey. Refusal was extremely rare because subjects were given a financial incentive in appreciation for their participation. However, since we do not know the characteristics of the non-respondents, we cannot accurately assess the impact of the associated data gap.

This research contributes to the stress literature by documenting the high stress level among male residents from rural Chinese communities. Variable prevalence was apparent regionally, sociodemographically and behaviourally. Our findings indicate that it is vital for government and local health agencies to collaborate in developing and implementing a mix of policies and strategies aimed at markedly reducing the high prevalence of severe stress among the rural Chinese populace. These actions must address primary and secondary prevention. Stress is the common element in major mental illnesses[14b] for which there is a dearth of population-based research on rural Chinese. Future research needs to address females as well as males.

*Ethical approval*

The Ethics Committee of Zhejiang University School of Medicine (Hangzhou, PR China).

*Funding*

This study was funded by the World Health Organization (WP/2002/IC/TFI/2.2/001/03.02.AW.03).

*Competing interests*

The authors declare that they have no competing interests.

## References

1. National Bureau of Statistics of China. *China population statistics yearbook*. Beijing: China Statistics Press; 2004. pp. 13–9.
2. Zhang S. *Agriculture farmer and countryside problems in mainland China*. Beijing: China Financial and Economic Press; 2003. pp. 3–25.
3. Available from: http://www.china.com.cn/aboutchina/txt/2009-01/22/content_17169729.htm [accessed 10.08.09].
4. Guo J. Features and problems in increment of farmers' incomes in current stage in China with some countermeasures. *Chinese Rural Economy* 2001;**6**:26–9.
5. National Bureau of Statistics of China. Statistics of the fifth national census in 2000. Available from: http://www.china.org.cn [accessed 01.09.08].
6. Yang T, Li L, Wang W. *Study on the dissemination of human immunodeficiency virus risk behaviors*. Beijing: Chinese Sociology Publishing House; 2006. pp. 37–53.
7. Hu R, Gu M. Survey of mental health status among 408 rural–urban migrant workers. *China Health Management* 2008;**3**:196–8.
8. Shan J, Lu Z, Weihong W. The mental health of the migrant workers in Chongqing city. *Psychol Sci* 2007;**30**:216–8.
9. Sun C. Survey and analyses of mental health status among rural–urban migrant workers in east–north area. *Sichuan Mental Health* 2007;**20**:17–9.
10. Wang D, Lin H. Health among 284 left behind children in Fujian province. *Chinese Journal of School Health* 2003;**24**:521–2.
11. Pu Y, Ji R. Health education need of left behind women. *Chin J Health Educ* 2008;**24**:139–41.
12. Yang T, Huang H. Epidemiological study on stress of urban residents during social transition [*Chinese Epidemiology*]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2003;**24**:760–4.
13. Shen Z, Chen L, Pei H, Zhang N, Zhang B, Ma W. A survey of stress of state-owned enterprises. *Chin J Behav Med Sci* 2004;**6**:679–80.
14. Yang T. *Health behavior theory and research*. Beijing: People's Medical Publishing House; 2007. pp. 212–3 (a); 265–87(b); 175–9 (c).
15. Yang T, Abdullah AS, Mustafa J, Yang X, Chen B, Feng X. Factors associated with smoking cessation among Chinese adults in rural China. *Am J Health Behav* 2009;**33**:125–34.
16. Keough KA, Zimbardo PG, Boyd JN. Who's smoking, drinking, and using drugs? Time perspective as a predictor of substance use. *Basic Appl Soc Psych* 1999;**21**:149–67.
17. Heaney CA, Price RH, Rafferty J. Increasing coping resources at work: a field experiment to increase social support, improve work team functioning, and enhance employee mental health. *J Organ Behav*; 1995::335–52.
18. Hyyppä MT, Mäki J. Social participation and health in a community rich in stock of social capital. *Health Educ Res* 2003;**18**:770–9.
19. Wright LK. Mental health in older spouses: the dynamic interplay of resources, depression, quality of the marital relationship, and social participation. *Issues Ment Health Nurs* 1990;**11**:49–70.
20. Barrera M, Ainlay SL. The structure of social support: a conceptual and empirical analysis. *J Community Psychol* 1983;**11**:133–43.
21. Yang T, Li F, Yang X, Wu Z, Feng X, Wang Y, et al. Smoking patterns and sociodemographic factors associated with tobacco use among Chinese rural male residents: a descriptive analysis. *BMC Public Health* 2008;**8**:248.
22. Cohen S, Kamarack T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;**24**:385–96.
23. Tseng WS, Wu DYH, Wu D. *Chinese culture and mental health*. Orlando, FL: Academic Press; 1985. pp. 192–10.
24. Williams DR, Yu Y, Jackson JS, Anderson NB. Racial differences in physical and mental health: socioeconomic status, stress, and discrimination. *J Health Psychol* 1997;**2**:335–51.
25. Chan J, Su Z, Jin J. Mental health status of rural–urban migrant workers. *Medical Review* 2008;**1**:3–5.
26. Veenhoven R. Hedonism and happiness. *J Happiness Stud* 2003;**4**:437–57.
27. Bukov AJ, Maas I, Lampert T. Social participation in very old age: cross-sectional and longitudinal findings from BASE. *Psychol Sci Soc Sci* 2003;**57**:510–7.