Research report

Depression and associated factors in internal migrant workers in China

Peiyuan Qiu [a], Eric Caine [b], Yang Yang [a], Quan Chen [a], Jin Li [c], Xiao Ma [a],*

[a] West China School of Public Health, Sichuan University, Chengdu, China
[b] Department of Psychiatry, University of Rochester Medical Center, Rochester, NY, USA
[c] Department of Psychiatry, West China Hospital, Sichuan University, Chengdu, China

ABSTRACT

Background: Internal migrant workers are a large population in China. Current health related studies among this population mainly focused on infectious disease, maternal health and occupational diseases and injuries. However, very limited studies were paid attention to mental health of migrant workers though it is an important public health issue.
Aims: The current study aims to understand prevalence of depression symptoms and factors associated with depression among Chinese migrant workers using novel methods to develop a comprehensive sample.
Methods: Respondent-driven sampling (RDS) was employed to recruit the target population, who are required 1) not to hold a *hukou* indicative of living in central areas or near suburbs of Chengdu city; 2) to be 16 years or older; 3) not to be a student. The Center for Epidemiologic Depression Scale (CES-D) was used to measure depression symptoms of migrant workers. And then Structural Equation Model (SEM) was applied to explore factors associated with depression among Chinese migrant workers.
Results: Among 1180 migrant workers, 23.7% of them had clinically relevant depression symptoms (CES-D score>=16), and 12.8% were consistent with a clinical diagnosis of depression (CES-D score>=21). Self-rated economic status, city adaptation status, and self-rated health had negative effects on depression. Social economic status (SES) affected depression, and was mediated by self-rated economic status and self-rated health. City adaptation status was affected by length of residence in the city, satisfaction with one's job, and the social support that one could obtain while living in the city.
Conclusions: The findings indicated a higher prevalence of depression symptoms among migrant workers comparing to general population reported by previous studies, identified possible factors associated with depression symptoms, and also explored relationships between these factors. Our study provides a model to understand mental health of Chinese internal migrant workers and to generate important research questions for the future.

© 2011 Elsevier B.V. All rights reserved.

1. Introduction

China is experiencing the largest in-country migration in history. Data in *The 2010 Report on the Development of China's Migrant Population* (National Population and Family Planning Commission of P.R. China, 2010) showed that China's migrant population had reached 211 million in 2009. Migrant workers are defined as people who are 16 years and older, and who leave their *hukou* (registered residence in China) to work in another place.

Internal migration in China occurs without a change in *hukou* status. For decades, the *hukou* system had functioned like an "internal passport system," where a person's *hukou* defined access to employment, housing, social welfare, and educational opportunities (Chan, 1996). When strictly enforced in times

past, one's *hukou* defined where an individual could live and work (Roberts, 1997); while the use of a person's *hukou* to control internal mobility has relaxed greatly during the recent decades of economic transformation, with many rural migrants moving to metropolitan manufacturing and construction centers to supply the needed workforce for China's robust economic expansion, it continues to influence access to employment, social welfare, education, and health services.

Researchers in the United States and the United Kingdom have described elevated levels of morbidity due to mental disorders among immigrants, particularly depression and anxiety (Aroian and Norris, 2003; Burvill et al., 1983; Cuellar et al., 2004; Hovey and Magana, 2000a; Kimura et al., 1975; Murray and Williams, 1986). Investigations of factors possibly contributing to their susceptibility have implicated a combination of rapid personal changes together with disorganization of migrants' psychosocial contexts, and family and social systems (Heilemann et al., 2004; Mann, 2004; Shen and Takeuchi, 2001). Thus far, current research on migrants' health in China has focused principally on infectious diseases, maternal health, and occupational disease and injuries (Hu, 2008). The general mental health of migrant workers in China, not to mention the depression, has received relatively less attention. Depression-related disability, in particular, has a powerful impact on workforce productivity that in turn threatens economic development and the harmony and stability of society.

The few studies now available suggest that depression may be a serious problem among China's internal migrants. Chen et al. (2006) employed the Self-Rating Depression Scale (SDS) to investigate depressive symptoms; the mean score among migrants was significantly higher than the norm for the general population, and the prevalence of depressive symptoms was 34.2%. Lin et al. (2006) investigated 866 female migrant workers in Beijing using the Center for Epidemiological Studies — Depressed (CES-D) scale, finding that 23% female migrants had clinically relevant depressive symptoms. Taken together, the relatively few available studies suggest that the mental health status of internal migrant workers requires further study.

The study that we report was conducted in Chengdu, the capital of Southwest China's Sichuan Province, with a population of 12.87 million in 2009. While Sichuan is one of the provinces to export migrant workers, Chengdu itself receives a large number of migrant workers from other cities in the province and from poor rural areas. According to the 2009 data from Chengdu Bureau of Statistics, there were 1.47 million migrants in Chengdu, 11.4% of the total population. Despite this large scale of migration, their mental health needs receive little attention. Wang's study on anxiety of migrants in Chengdu found a higher prevalence of anxiety symptoms compared with general population (Wang et al., 2007). This may indicate a high level of distress among this population, which in turn could influence quality of life and even compromise workforce productivity.

In this study, we survey the prevalence of depression symptoms using CES-D among Chinese migrant workers, and then explore factors associated with depression symptoms and interactions between them. Results from previous studies on potential factors associated with depression symptoms were used to form the theoretical framework for Structural Equation Model (SEM).

1.1. Theoretical framework for constructing the SEM

1.1.1. Socioeconomic status and depression

Several studies in general population found that subjects with lower SES were more likely to be depressed than those with higher SES (Huurre et al., 2007; Molarius et al., 2009). Also, research in immigrants indicated SES was inversely related to mental health status (Gresenz et al., 2001). The possible reasons might be people with lower SES will encounter a great number of stressful life events, and they have fewer resources to address difficulties (Kim et al., 2005). Chinese internal migration is economic-driven migration. Rural people leave their lands to earn money in the cities, and people from western areas migrate to east coast areas in order to improve their income. However, many times, they are facing discriminatory treatment in terms of working hours, payment, living and working environment, education and social welfare (Dong and Bowles, 2002), experiencing low SES. In the study, we examine explicitly whether SES will negatively relate to depressive symptoms. Several authors (Hu et al., 2005; Kopp et al., 2004; Operario et al., 2004; Singh-Manoux et al., 2003) argue that "subjective SES," related to one's sense of economic wellbeing, has a stronger relationship to health status than objective measures of SES. In our study, we investigated the subjective SES of respondents as well as other measures, and expected that it would show a negative relation with depressive symptoms.

1.1.2. Physical health and depression

Many previous studies have indicated an association between the presence of depressive symptoms and medical conditions such as diabetes, stroke, myocardial infarction, congestive heart failure, and cancer (Carney and Freedland, 2003; Frasure-Smith et al., 1993; Katon, 2003; Koenig, 1998; Pohjasvaara et al., 1998). Thus we proposed that poor health contributes to depressive symptoms. Migrant workers are usually regarded as young and healthy, and few of them suffer from chronic diseases. Nonetheless, many of them will take dirty and dangerous work that local residents avoid, and this in turn may affect their health status. Moreover, not all migrant workers have intact health status; we encountered disabled workers who worked in massage shops or as parking attendants. In our study we posited that better health would be associated with fewer depressive symptoms.

1.1.3. Social support and depression

The effect of social support on depression has been well documented (Badger and Collins-Joyce, 2000; Chou, 2009; Fagg et al., 2008; Hovey, 2000b; Norah, 2007). Buffer effect theory suggests that social supports act as a buffer to environmental stresses, which may decrease one's susceptibility to mental disorders (Caplan and Caplan, 2000). In many cases, moving from one place to another to live and work means attenuation or loss of an individual's old social network and support. Thus, migration for work, which may not entail the development of new permanent networks, may place individuals at greater risk for mental distress or disorders. Chinese workers tend to migrate with their relatives, friends and people from the same location (Lao Xiang), which could mitigate the effects from losing social network and support. Nonetheless, we would anticipate that changes of social network and social support

will adversely affect their mental health. We hypothesized that a lesser degree social support would be associated with higher reported symptoms of mental distress.

1.1.4. City adaptation and depression

Acculturation is reported by the previous studies to be another potentially important, though controversial factor for depression in immigrants (Kim et al., 2005; Miranda and Umhoefer, 1998; Nguyen and Peterson, 1993; Rivera, 2007; Shen and Takeuchi, 2001). Cultural identity, language proficiency and cultural competence were used in the previous study to measure acculturation of migrants (Park and Bernstein, 2008; Rivera, 2007). Despite China's regional linguistic and cultural diversity, migrant workers do not face many of the challenges experienced by international immigrants. Moreover, 90% of Chengdu's migrants are drawn from other cities in Sichuan Province and from Chongqing, where people have similar dialects and cultures (Tang, 2006). Thus, measuring city adaptation is more appropriate in our sample. While most migrant workers in Chengdu do not face language and cultural, they like others confront the substantial rural-to-urban transition that is common in major Chinese industrial zones that draw from distant regions. In our study, we examined this city adaptation, and expected that migrants who reported more positive adaption also would evidence better mental health.

1.1.5. Other potential factors

Several previous studies have reported that duration of migrant status was associated with depression (Kim et al., 2005; Lai, 2004). They found that the longer migrants stay in the new environment, the better they could adapt themselves to the environment. Additional contributing factors, irrespective of migrant status, may include female gender (Kessler et al., 1994), genetic risk factors (i.e. a positive family history of depression) (Lieb et al., 2002), psychiatric disorders of the individual (Aalto-Setala et al., 2002), marital status (Prigerson et al., 1994), job satisfaction (Lee et al., 2009), and negative life events (Hammen, 1992; Prigerson et al., 1994). Since psychiatric illness is a sensitive topic in China, we did not ask respondents' history of psychiatric illness. Instead, we did ask if there was any family member with psychiatric illness. However, there are only four respondents reported having family members with psychiatric illness so that we did not include it in the analysis.

1.1.6. Interactions between factors

Factors such as the ones that we have discussed may variably contribute to both the development and severity of depression symptoms. They do not function independently. For example, objective SES likely will influence subjective SES, city adaptation, and self-rated health. And level of social support, duration of migration, and job satisfaction may influence reported city adaptation.

2. Methods

2.1. Sample and procedure

Participants of this study were recruited as part of the program on health demands and utilization of Chinese internal migrants in Chengdu, Sichuan Province, China, which was conducted through Sep 2008 to July 2009. To be eligible for the study, respondents had to satisfy three inclusion criteria: 1) they did not hold a *hukou* indicative of living in central areas or near suburbs of Chengdu city; 2) they must have been 16 years or older; and 3) they could not be a student.

We used Respondent-Driven Sampling (RDS) in an effort to recruit representative sample, given participants' marginal status and often-transient living circumstances. RDS involves a chain-referral procedure. A total of 12 seeds were selected after taking gender, age, occupation, and living sites into consideration. Each seed was given three coded coupons to recruit peers. We then consented and enrolled persons who presented one of these valid coupons and who we deemed eligible; in turn, each new enrollee was given three coded coupons for the purpose of recruiting peers. RDS goes beyond random sampling and is inherently more effective when there is no defining boundary of a potential target population, preventing development of a definitive sampling frame, or when it is difficult to clarify. The method is superior to other snowball sampling techniques by incorporating sampling procedures and analytical tools that allow for calculating unbiased population estimates (Salganik and Hechathorn, 2004). In previous studies, non-probability sampling strategies were employed so that construction sectors and factories were the mostly popular study sits for researchers. These sampling strategies were more likely to recruit male and younger migrant workers working in construction and manufacturing sectors, but less likely to include dispersed migrant workers, such as those who work for themselves, babysitters, unemployment, and so on. RDS has its unique advantages in penetrating targeted population and recruiting scattered subjects (Appendix A).

In total, 1270 respondents were recruited. At the time of participation, 1180 were employed, and these comprised our sample, as we wanted to understand the role of work-related factors in our investigation.[1] Face-to-face interviews were conducted at Wuhou district office of the Center for Disease Control (CDC), which is located downtown and conveniently accessible using public transportation. Informed consent was obtained from all participants following a protocol that was approved by Sichuan University Medical Ethic Committee.

2.2. Measures

2.2.1. Depressive symptoms

We used the CES-D to measure depression (Radloff, 1977). In addition to its wide use in the general population, the CES-D has been administered to migrant workers (Alderete et al., 1999). It contains 20 items that are scored by respondents to indicate the frequency of symptoms during the previous week, using a scale of 0–less than a day, 1 — 1–2 days, 2 — 2–3 days, and 3 — 5–7 days. Radloff recommended a threshold of 16 for indicating the likely presence of clinically significant depressive symptoms; reaching a threshold of 21 is viewed as consistent with a clinical diagnosis of depression. She also identified four factors — Depressed Affect, Positive Affect, Somatic Symptoms

---

[1] Since SEM does not allow any missing data, including unemployed migrants who did not have information of job satisfaction will fail the model. No significant difference of depression symptom rates between employed (23.7%) and unemployed (24.4%) was found by Chi-square test ($P = 0.863$).

and Retarded Activity, and Interpersonal Relations (Radloff, 1977; Sheehan et al., 1995). For purposes of the SEM, Depressed Affect and Positive Affect were combined into one dimension in this study. CES-D has been translated into Chinese, and its reliability and validity have been proved by several studies (Yuan et al., 1998; Zhang et al., 2004).

2.2.2. Social support

Respondents were asked to list the most important ten people to them in Chengdu. And then four questions were asked. 1) If you need to borrow money, whom of these people you will ask for help from; 2) If you are in a bad mood, whom of these people you will ask for comfort from; 3) If you need some advisory, whom of these people you will ask for suggestions from; 4) When you are free, whom of these people you will enjoy time with? The number of people they could get each kind of support from was set as the scores for instrument support, emotion support, information support and entertainment support, respectively. The score ranges from 0 to 10 for each social support dimension.

2.2.3. Other variables

Respondents were asked to report their income and expense per month, education level, and duration of migration

in Chengdu. Also, they were asked to report how they thought of their economic status when compared with residents in Chengdu, people in their hometown, and migrant workers around them, respectively. City adaptation was measured by asking respondents regarding their feelings for Chengdu, and how they have adapted themselves to their new environment. Self-rated health was measured by asking two questions. One is that "in general, what do you think of your health (excellent, very good, good, moderate and not good)", and the other one is "what do you think of your health when comparing with people in your age (better, equal, and worse)". In addition, respondents were asked to report how satisfied they are with their job (very satisfied, satisfied, moderate, unsatisfied, and very unsatisfied), and if there was any adverse life event that happened in their life in the past year.

2.3. Model construction and statistical method

Based on the theoretical framework, we constructed a structural equation model. The three factors of depression symptoms measured by CES-D were set as the endogenous latent variables — Affective Symptoms, Somatic Symptoms and Retarded Activity, and Interpersonal Relations, which were extracted from 9, 7, and 4 endogenous observed variables from

Table 1
Latent variables and observed variables.

Latent variables (Abbreviation)	Observed variables (Abbreviation)
Affect Symptoms (AS)	I felt that I could not shake of the blues even with help from family or friends (Blue)
	I felt lonely (Lonely)
	I had crying spells (Cry)
	I felt sad (Sad)
	I felt depressed (Depressed)
	I felt hopeful about the future (Hope)
	I was happy (Happy)
	I enjoyed life (Enjoy)
	I felt I was just as good as other people (Good)
Somatic Symptoms (SS)	My appetite was poor (Eat)
	I was bothered by things that usually don't bothered me (Bother)
	I had trouble keeping my mind on what I was doing (Mind)
	I felt that everything I did was an effort (Effort)
	My sleep was restless (Sleep)
	I talked less than usual (Talk)
	I could not get going (Work)
Interpersonal Relations (IR)	I thought my life had been a failure (Failure)
	I felt fearful (Fear)
	People were unfriendly (Unfriendly)
	I felt that people dislike me (Dislike)
Social Economic Status (SES)	Income per month (Income)
	Expense per month (Expense)
	Education level (Edu)
City Adaptation Status (CAD)	Do you love Chengdu? (Love)
	Do you adapt to life in Chengdu (Adapt)
Self-rated Economic Status (SRE)	Do you think your income is higher, lower than or equal to that of residents of Chengdu (CD)
	Do you think your income is higher, lower than or equal to that of people in your hometown (Home)
	Do you think your income is higher, lower than or equal to that of people around you (Around)
Self-rated Health Status (HEA)	What do you think of your health? (Shealth)
	What do you think of your health when comparing with people in your age (Chealth)
Social Support (SUP)	Instrument support (Instrument)
	Emotion support (Emotion)
	Information support (Information)
	Entertainment support (Entertainment)
	Gender (Gender)
	Adverse life events (ALE)
	Length of residence in Chengdu (Length)
	How satisfied are you with your job? (Satisfaction)

CES-D scale, respectively (Radloff, 1977; Sheehan et al., 1995). SES, self-rated economic status, self-rated health, social support, and city adaptation were set as exogenous latent variables in the model, and they had direct effects on the three factors. Corresponding exogenous observed variables were shown in Table 1. Gender, adverse life events, job satisfaction, and the length of migration were set as exogenous observed variables, which had direct effects on depression factors. Latent variables and observed variables and corresponding abbreviation were shown in Table 1. The initial structural equation model was shown in Fig. 1.

Descriptive analysis procedures were performed to demonstrate demographic information, prevalence of depression related symptoms and so on. Structural equations were conducted by AMOS, using the Asymptotically Distribution-free method. Standardized path coefficients, direct and indirect effects were presented. Chi-square (χ^2) coupled with the degrees of freedom (df) (Carmines and McIver, 1981), the goodness of fit index (GFI), the normed fit index (NFI) (Bentler, 1990), the comparative fit index (CFI), as well as the root mean square error of approximation (RMSEA) (Browne and Cudeck, 1993) were shown to measure the model fit globally and incrementally. And then, the initial model was modified according to results from Maximum Likelihood Estimate to obtain a better and reasonable model.

3. Results

3.1. Descriptive statistics

Among the 1180 respondents, 49.0% were males and 46.0% were married. The age distribution was 38.0% for group 16–25 years, 27.7% for group 26–35 years, 24.7% for group 36–45 years, and 9.6% for age 46 years and older. Of the respondents, 3.3% were illiterate, 17.8% completed primary school, 36.3% completed middle school, 23.1% completed high school, and 19.6% completed college or above. Duration of residence in Chengdu was broadly distributed: 19.3% had lived there less than 1 year, 24.8% for 1 to 3 years, 17.3% for 3 to 5 years, and 38.6% for more than 5 years.

Average monthly income was RMB 1421.2 ($225), while average expense was RMB 980.3 ($155.6). Comparing themselves to others, 68.1% of the respondents believed they had lower incomes than local residents, while 60.3% thought they earned more than those living in their hometown, and 57.6% thought they could get as much money as their migrant peers.
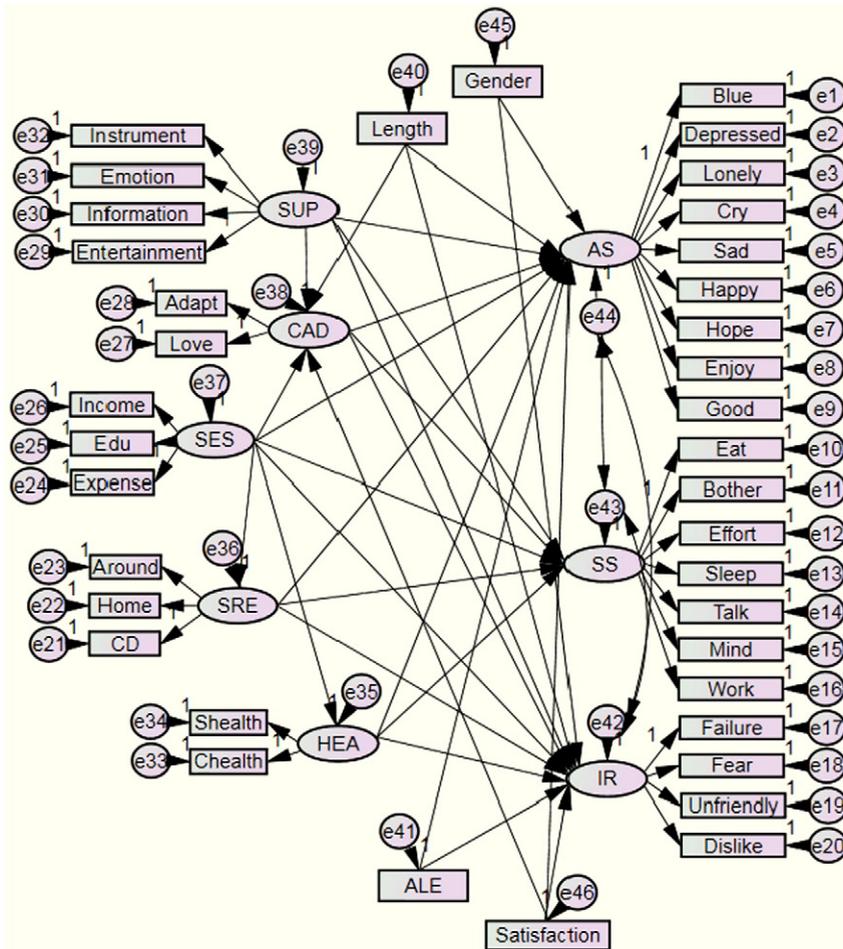

Fig. 1. Initial structural equation model of factors associated with depression and interaction between them among internal Chinese migrant workers.

Regarding to physical health, 5.5% of the respondents reported excellent health, 30.6% reported very good health, 27.0% reported good health, 33.1% reported moderate health, and 3.7% reported bad health. Comparing themselves with age peers, 31.7% of the respondents thought they were in better health.

Work satisfaction followed a roughly normal distribution: 3.6% of the respondents said they were very satisfied, 33.6% were satisfied, 49.5% were moderately satisfied, 11.6% were not satisfied, and 1.6% were very dissatisfied.

The range of social support score was 0 to 10. The average scores for instrument support, emotion support, information support and entertainment support, respectively, were 4.8 ± 3.1, 5.0 ± 3.1, 6.6 ± 3.1, and 7.4 ± 3.0.

The range of CES-D score of the respondents was 0 to 49. The average score was 10.4 ± 8.6. In our group, 76.3% of respondents (901) scored below 16 and 23.7% (279) had score that were indicative of significant depression symptoms. Of the total sample, 12.7% (150) had scores equal to or greater than 21, highly suggestive of a clinical diagnosis of depression. Distribution of CES-D score of migrant workers is shown in Fig. 2.

3.2. Structural equation model

The initial model was established as shown in Fig. 1. Multiple correlations failed to reach significance: 1) between adverse life events, and affective symptoms and interpersonal relations; 2) between SES and affective symptoms, somatic systems, and interpersonal relations; 3) between duration of migration in Chengdu and affective symptoms and interpersonal relations; and 4) between gender and affective symptoms and interpersonal relations. Thus, these links were deleted from the model. Even though satisfaction with job was significantly associated with affective symptoms and interpersonal relations, the correlation coefficients were small (0.076, 0.082), suggesting little meaningful ties. We chose to delete these two links as well. A more satisfactory model was attained, shown in Fig. 3 with coefficients on the paths.
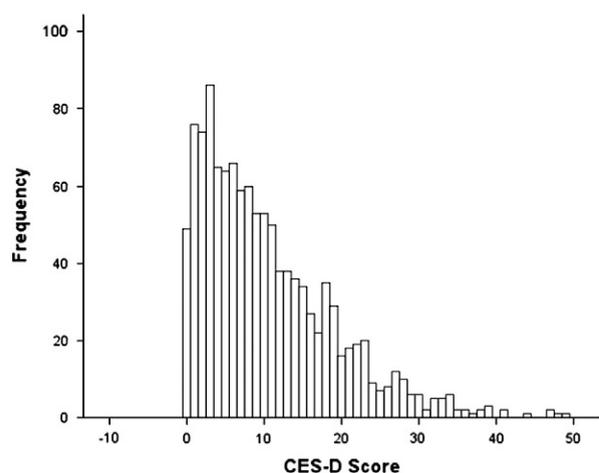
Self-rated economic status was negatively related to affective symptoms and interpersonal relations with correlation coefficient being -0.090 and -0.126 respectively. City adaptation status had negative relation with affective symptoms, somatic symptoms and interpersonal relations with correlation coefficient being -0.247, -0.171, and -0.197, respectively. And at the same time, city adaptation was affected by length of migration and job satisfaction. Self-rated health had negative effects on affective symptoms, somatic symptoms, and interpersonal relations with correlation coefficient being -0.304, -0.366, and -0.210, respectively. SES affected depression symptoms mediated by self-rated economic status, and self-rated health. The model demonstrated that self-rated health, self-rated economic status and city adaptation status were proximal factors associated with depressive symptoms, while SES, duration of migration and job satisfaction were distal factors that associated with the development and severity of depressive symptoms.

3.3. Model assessment

The goodness-of-fit test yielded a chi-square of 2220.274 ($df = 580$, $P < 0.001$). The GFI was 0.895. The NFI was 0.789. The CFI was 0.834. And the RMSEA was 0.049. The indexes of initial model and final model were given in Table 2. These results indicated a good fit of the structural equation model of influential factors for depressive symptoms among internal Chinese migrant workers.

4. Discussion

To the best of our knowledge, this is the first systematic study among Chinese migrant workers of the prevalence of depressive symptoms and associated factors, as well as relationships among these factors. The prevalence of clinically relevant symptoms was 23.7% in our sample, which was higher than the general Chinese population (Li et al., 2009; Xiao et al., 2003). The prevalence among our participants was lower than that reported by Chen et al. (2006), and close to Lin's (2006) results.

As part of our work we also examined whether the major Sichuan earthquake on May 12, 2008 – five months before our study – influenced our outcomes. Only 18.7% (221) of the respondents described the earthquake as a major life event. Moreover, the relationship between experiencing the earthquake as an adverse life event and depressive symptoms was not statistically significant. The earthquake did not disrupt Metropolitan Chengdu, and our participants may have recovered by the time of study. Alternatively, it is possible that people whose hometowns were severely destroyed, or whose family members were lost in the earthquake, had departed from Chengdu and were not recruited in the study.

Results of our study showed that self-rated health contributed the most to the development and severity of depressive symptoms among migrant workers. Migrant workers typically are characterized as young and healthy, and they go to work in developed areas for better income and better life. Good health is essential for competing with other people when seeking jobs and increasing income. Migrants typically have no health insurance from cities or counties

Fig. 2. Distribution of CES-D score of 1180 migrant workers.

Fig. 3. Final structural equation model of factors associated with depression and interaction between them among internal Chinese migrant workers.

outside their *hukou*, and the costs of care for any medical condition can be substantial. The average income of migrant workers in our sample was RMB 1,421.2 ($225), the average out-patient cost was RMB 187 ($27.5), and the average in-patient cost was RMB 4477 ($658.4). Among our respondents, 12.5% (148) had Urban Employee Basic Medical Insurance (UEBMI), 1.2% (14) had Urban Resident Basic Medical Insurance (URBMI), 62.9% (742) had New Cooperative Medical Scheme (NCMS), 16.3% (192) had Comprehensive Insurance, which is a special insurance established particularly for migrant workers in Chengdu, and 7.1% (84) had no medical insurance. Since fund raising of the NCMS is based on a county level, most counties require their members to use approved facilities within the county; migrant workers, especially those from distant counties, could hardly use it in the cities. That is to say, almost 70% of the respondents could not get any reimbursement if they seek medical care in the

cities. Although migrant workers are young and healthy, they are vulnerable people in the cities, facing discriminatory treatment in their living and working environments, their working hours and their social insurance, all of which could place them at risk for health problems. Improving their working and living environments, providing effective and affordable medical services and solving medical insurance issues are critical to the protection for both the physical *and* the mental health of migrant workers. Our results directly address the latter conclusion.

In contrast to results from previous studies (Gresenz et al., 2001; Muramatsu, 2003) indicating that SES has a direct association with depressive symptoms, our research found that SES was distal factor. Although SES is an objective indicator, high SES or low SES is not an absolute concept. Therefore, some researchers put forward the concept of subjective SES, and tested its relationship with health. They found subjective SES was more likely to be related to health comparing to objective SES. High or low objective SES depends on the frame of reference one chooses (Singh-Manoux et al., 2003). Li's study (Li et al., 2007) on mental health of rural-to-urban migrant workers, urban residents, and rural residents showed that the mental health of rural residents was better than the other two populations. This indicated to us that subjective SES may be closely related to depressive symptoms; our findings indicate that objective SES affects depression mediated by subjective SES, as well as other factors such as physical health.

Table 2
Measures of fit for the depression model of internal Chinese migrant workers.

	χ^2	df	χ^2/df	GFI	NFI	CFI	RMSEA
Initial model	2422.188	637	3.802	0.894	0.775	0.822	0.049
Final model	2220.274	580	3.828	0.895	0.789	0.834	0.049

df = degree of freedom; GFI = goodness of fit index; NFI = normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation.

In our study, we measured city adaptation instead of acculturation. Although Chinese migrant workers do not face as many language and cultural barriers as immigrants to a new country, they face continuing discrimination. In addition to previously noted problems with employment and social welfare, their children also suffer from the *hukou* barrier, typically not being allowed into cities' public school systems, which effectively continues disadvantage from one generation to next. Ren's (Ren and Wu, 2006) investigation in Shanghai reported that most migrant workers had negative attitudes on the city where they live and work, and most of them expressed their willingness to go back to their hometown. They did not have the feeling of belonging to the city. In our study, we found that most respondents report adapting well to the city. One explanation may have been that most of them were residents of Sichuan Province, better adapting themselves to Chengdu. Of the 1180, 741 (62.8%) reported that they were willing to stay in Chengdu. The longer they stayed in Chengdu, the better they adapted; greater job satisfaction also was associated with better adaptation. However, if they could not remain employed, respondents said that they would return home. In-depth interview should be done in a future study to better understand what enhances or inhibits city adaptation.

The relationship between social support and depression was reported by several studies (Chou, 2009; Kim et al., 2005; Rivera, 2007). We found in our study that social support did not impact depression directly, but mediated by city adaptation. The more social supports migrant workers could obtain from family, friends and colleagues, the better they could adapt themselves to the new environment. We examined the relationships between migrant workers and the most important people for them in Chengdu raised by themselves. Data showed that 25.1% were family members and relatives, 11.8% were *Lao Xiang* (people from the same place), 26.2% are colleagues, and 36.8% are new friends of migrant workers, indicating that colleagues and new friends are the main resources of social supports for migrant workers. This is a sign of integrating into the new environment, which will accelerate city adaptation and further benefits mental health of migrant workers.

4.1. Strengths and limitations

By using RDS, we were able to reach a wider range of migrant workers instead of recruiting participants restricted to specific work sites. The study also benefitted from the use of SEM to explore factors associated with depressive symptoms and to model the relationships among these factors.

We recognize several important limitations as well. Although RDS can improve the diversity and representative quality of a sample, we found that ours had geographical limits, likely reflecting what might be termed a 'boundary of inconvenience.' We have reported that it is likely that we would have had a greater geographic reach had we used more than one site for study interviews.

We also recognize that while it was suited for this type of study, the CES-D cannot be used to render a clinical diagnosis, thus limiting some of our understanding. Nonetheless, our results point to a high prevalence of depressive symptoms at a level consistent with clinically significant conditions that can interfere with well-being and work productivity. In addition, potential risk factors for depression (e.g., a history of

psychiatric disorders, significant interpersonal distress, heavy use of alcohol) were not investigated in the study, which may affect the strength of specific associations in our model.

We are very aware that this was a cross-sectional study, and while SEM allows the development of a model to array the potential factors that contribute to depression, it cannot be used to attribute causal relations or "risk factors." To understand dynamic processes that potentially contribute to the development of depressive symptoms, longitudinal research designs will be needed.

5. Conclusions

Our study reinforced prior work that reported a high prevalence of depressive symptoms among migrant workers who migrant to developed cities to find jobs in the booming economy. Proximal factors associated with depressive conditions included self-rated health, self-rated economic status, and city adaptation status. Distal factors included social support, SES, length of city residence, and job satisfaction. Future longitudinal studies should examine potential causal risks as well as factors that may be protective. Our results may differ from others, in part, because most of the migrants lived in rural regions of the same province as their destination-city. This differs greatly from cities such as Shenzhen and Guangzhou in Guangdong Province, which draw workers from far away region. Nonetheless, our study provides a framework for future comparative work that seeks to examine similar processes in other regions of China.

Appendix A

Although gender, age, and occupation were taken into consideration at the stage of seed selection, the initial sample of 10 was viewed by us as deficient in two respects. No seeds in the group were older than age 46 years, and none were working in construction sites. However, as the referral chain grew over the time of our sampling, the composition of each wave changed and gradually stabilized. The final sample compositions are shown in the last row of Table 3.

References

Aalto-Setala, T., Marttunen, M., Tuulio-Henriksson, A., et al., 2002. Depressive symptoms in adolescence as predictors of early adulthood depressive disorders and maladjustment. The American Journal of Psychiatry 159 (7), 1235–1237.

Table 3
Sample size and gender, age, and occupation compositions of each wave.

Wave	n	Change in recruits	Gender (n) (%)		Age (n) (%)				Occupation[a] (n) (%)						
			Male	Female	16–25	26–35	36–45	≥46	1	2	3	4	5	6	7
0	10	–	7(70.0)	3(30.0)	3(30.0)	3(30.0)	4(40.0)	0(0.0)	0(0.0)	1(10.0)	1(10.0)	3(30.0)	3(30.0)	1(10.0)	1(10.0)
1	26	26	11(42.3)	15(57.7)	8(30.8)	16(61.5)	1(3.8)	1(3.8)	0(0.0)	4(15.4%)	1(3.8%)	13(50.0%)	4(15.4%)	4(15.4%)	0(0.0)
1–2	85	59	22(37.3)	37(62.7)	14(23.7)	31(52.5)	7(11.9)	7(11.9)	2(3.4)	5(8.5)	10(16.9)	13(22.0)	17(28.8)	5(8.5)	7(11.9)
2–3	212	127	60(47.2)	67(52.8)	39(30.7)	42(33.1)	31(24.4)	15(11.8)	8(6.3)	9(7.1)	19(15.0)	35(27.6)	37(29.1)	8(6.3)	11(8.7)
3–4	441	229	100(43.7)	129(56.3)	89(38.9)	65(28.4)	54(23.6)	21(9.2)	16(7.0)	16(7.0)	32(14.0)	44(19.2)	78(34.1)	28(12.2)	15(6.6)
4–5	902	461	236(51.2)	225(48.8)	162(35.1)	110(23.9)	129(28.0)	60(13.0)	43(9.3)	33(7.2)	67(14.5)	96(20.8)	149(32.3)	41(8.9)	32(6.9)
5–6	1256	354	165(46.6)	189(53.4)	164(46.3)	85(24.0)	77(21.8)	28(7.9)	37(10.5)	26(7.3)	47(13.3)	63(17.8)	132(37.3)	24(6.8)	25(7.1)
Total	1266	1256	601(47.5)	665(52.5)	479(37.8)	352(27.8)	303(23.9)	132(10.4)	106(8.4)	94(7.4)	177(14.0)	267(21.1)	420(33.2)	111(8.8)	91(7.2)

[a] Occupation: 1 – construction; 2 – manufacturing; 3 – restaurant and entertainment; 4 – commercial; 5 – services; 6 – office work; 7 – unemployment.

Alderete, E., Vega, W.A., Kolody, B., et al., 1999. Depressive symptomatology: prevalence and psychosocial risk factors among Mexican migrant farm-workers in California. Journal of Community Psychology 27, 457–471.

Molarius, Anu, Berglund, Kenneth, Eriksson, Charli, 2009. Mental health symptoms in relation to socioeconomic conditions and lifestyles — a population-based study in Sweden. BMC Public Health 302 (9), 1471–2458.

Aroian, K.J., Norris, A.E., 2003. Depression trajectories in relatively recent immigrants. Comprehensive Psychiatry 44 (5), 420–427.

Badger, T.A., Collins-Joyce, P., 2000. Depression, psychosocial resources, and functional ability in older adults. Clinical Nursing Research 9 (3), 238–255.

Bentler, P.M., 1990. Comparative fit indexes in structural models. Psychological Bulletin 107, 238–246.

Browne, M.W., Cudeck, R., 1993. Alternative ways of assessing model fit. In: Bollen, K.A., Long, J.S. (Eds.), Testing Structural Equation Models. Sage, Newbury Park, CA, pp. 136–162.

Burvill, P.W., Armstrong, B.K., Carlson, D.J., 1983. Attempted suicide and immigration in Perth, Western Australia, 1969–1978. Acta Psychiatrica Scandinavica 68, 89–99.

Caplan, G., Caplan, R., 2000. Principles of community psychiatry. Community Mental Health Journal 36 (1), 7–24.

Carmines, E.G., McIver, J.P., 1981. Analyzing models with unobserved variables. In: Bohrnstedt, G.W., Borgatta, E.F. (Eds.), Social Measurement: Current Issues. Sage, Beverly Hills, CA.

Carney, R.M., Freedland, K.E., 2003. Depression, mortality, and medical morbidity in patients with coronary heart disease. Biological Psychiatry 54, 241–247.

Chan, K.W., 1996. Post-Mao China: a two-class urban society in the making. International Journal of Urban and Regional Research 20 (1), 134–150.

Chen, Z., Zhang, X., Chen, X., et al., 2006. Relationship between depression and self-rated health among floating population [in Chinese]. Chinese Journal of Health Education 22 (10), 747–749.

Chou, K.L., 2009. Pre-migration planning and depression among new migrants to Hong Kong: the moderating role of social support. Journal of Affective Disorders 114, 85–93.

Cuellar, I., Bastida, E., Braccio, S.M., 2004. Residency in the United States, subjective well-being, and depression in an older Mexican-origin sample. Journal of Aging and Health 16 (4), 447–466.

Dong, X., Bowles, P., 2002. Segmentation and discrimination in China's emerging industrial labor market. China Economic Review 13 (2–3), 170–196.

Fagg, J., Curtis, S., Stansfeld, S.A., et al., 2008. Area social fragmentation, social support for individuals and psychosocial health in young adults: evidence from a national survey in England. Social Science & Medicine 66, 242–254.

Frasure-Smith, N., Lesperance, F., Talajic, M., 1993. Depression following myocardial infarction: impact on 6-month survival. JAMA 270, 1819–1825.

Gresenz, C.R., Sturm, R., Tang, L., 2001. Income and mental health: unraveling community and individual level relationships. Journal of Mental Health Policy and Economic 4 (4), 197–203.

Hammen, C., 1992. Live events and depression: the plot thickens. American Journal of Community Psychology 20 (2), 179–193.

Heilemann, M., Frutos, L., Lee, K., Kury, F.S., 2004. Protective strength factors, resources, and risks in relation to depressive symptoms among childbearing women of Mexican descent. Health Care for Women International 25 (1), 88–106.

Hovey, J.D., Magana, C., 2000. Acculturative stress, anxiety, and depression among Mexican immigrant farmworkers in the Midwest United States. Journal of Immigrant Health 2, 119–131.

Hovey, J.D., 2000. Psychosocial predictors of depression among Central American immigrants. Psychological Reports 86 (3 Pt 2), 1237–1240.

Hu, X., 2008. Internal Migration and Health in China. Lancet 372 (9651), 1717–1719.

Hu, P., Adler, N.E., Goldman, N., et al., 2005. Relationship between subjective social status and measures of health in older Taiwanese persons. Journal of the American Geriatrics Society 53, 483–488.

Huurre, Taina, Eerola, Mervi, Rahkonen, Ossi, 2007. Does social support affect the relationship between socioeconomic status and depression? A longitudinal study from adolescent to adulthood. Journal of Affective Disorders 100, 55–64.

Katon, W.J., 2003. Clinical and health services relationships between major depression, depressive symptoms, and general medical illness. Biological Psychiatry 54, 216–226.

Kessler, R.C., McGonagle, K.A., Nelson, C.B., et al., 1994. Sex and depression in the National Comorbidity Survey. II: cohort effects. Journal of Affective Disorders 30, 15–26.

Kimura, S.P., Mikolashek, P.L., Kirk, S.A., 1975. Madness in paradise: psychiatric crisis among newcomers in Honolulu. Hawaii Medical Journal 34, 275–278.

Kim, Miyong T., Han, Hae-Ra, Shin, Hye Sook, 2005. Factors associated with depression — experience of immigrant populations: a study of Korean immigrants. Archives of Psychiatric Nursing 19 (5), 217–225.

Koenig, H.G., 1998. Depression in hospitalized older patients with congestive heart failure. General Hospital Psychiatry 20, 29–43.

Kopp, M., Skrabski, A., Rethelyi, J., et al., 2004. Self-rated health, subjective social status and middle-aged mortality in a changing society. Behavioral Medicine 30, 65–70.

Lai, D.W., 2004. Depression among elderly Chinese–Canadian immigrants from Mainland China. Chinese Medical Journal 117 (5), 677–683.

Lee, S.M., Lee, M.B., Liao, S.C., et al., 2009. Relationship between mental health and job satisfaction among employees in a medical center department of laboratory medicine. Journal of the Formosan Medical Association 108 (2), 146–154.

Li, H., Zhou, W., Gao, H., et al., 2009. An epidemiological survey of depression in urban population of Xuzhou [in Chinese]. Journal of Clinical Psychosomatic Disease 15 (2), 133–135.

Li, L., Wang, H.M., Ye, X.J., et al., 2007. The mental health status of Chinese rural-urban migrant workers: comparison with permanent urban and rural dwellers. Social Psychiatry Epidemiology 42 (9), 716–722.

Lieb, R., Isensee, B., Hofler, M., et al., 2002. Parental major depression and the risk of depression and other mental disorders in the offspring: a prospective-longitudinal community study. Archives of General Psychiatry 59 (4), 365–374.

Lin, D., Fang, X., Lin, X., 2006. The relationship between mobility, depression and smoking, alcohol use among rural-to-urban female migrants in Beijing [in Chinese]. Chinese Journal of Clinical Psychology 14 (6), 614–616.

Mann, M.A., 2004. Immigrant parents and their emigrant adolescents: the tension of inner and outer worlds. American Journal of Psychoanalysis 64 (2), 143–153.

Miranda, A.O., Umhoefer, D.L., 1998. Depression and social interest differences between Latinos in dissimilar acculturation stages. Journal of Mental Health Counseling 20, 159–172.

Muramatsu, N., 2003. County-level income inequality and depression among older Americans. Health Services Research 38 (6 Pt. 2), 1863–1883.

Murray, J., Williams, P., 1986. Self-reported illness and general practice consultations in Asian born and British born residents of West London. Social Psychiatry 21, 136–145.

National Population and Family Planning Commission of P.R. China, 2010. The 2010 Report on the Development of China's Floating Population [in Chinese]. http://www.chinapop.gov.cn/xwzx/zwyw/201006/t20100626_208390.html.

Nguyen, L., Peterson, C., 1993. Depressive symptoms among Vietnamese–American college students. Journal of Social Psychology 31, 617–639.

Norah, E., 2007. Mulvaney-Day, Margarita Alegria, William Sribney. Social cohesion, social support, and health among Latinos in the United States. Social Science & Medicine 64, 477–495.

Operario, D., Adler, N.E., Williams, D.R., 2004. Subjective social status: Reliability and predictive utility for global health. Psychology & Health 19 (2), 237–246.

Park, S.Y., Bernstein, K.S., 2008. Depression and Korean American immigrants. Archives of Psychiatric Nursing 22 (1), 12–19.

Prigerson, H.G., Reynolds III, C.F., Frank, E., et al., 1994. Stressful life events, social rhythms, and depressive symptoms among the elderly: an examination of hypothesized causal linkages. Psychiatry Research 51 (1), 33–49.

Pohjasvaara, T., Leppavuori, A., Siira, I., et al., 1998. Frequency and clinical determinants of poststroke depression. Stroke 29, 2311–2317.

Radloff, L.S., 1977. The CES-D Scale: a self-report depression scale for research in the general population. Applied Psychological Measurement 1, 385–401.

Ren, Y., Wu, Y., 2006. Social integration of floating population in Urban China: a literature review [in Chinese]. Population Research 30 (3), 87–94.

Rivera, F.I., 2007. Contextualizing the experience of young Latino adults: acculturation, social support and depression. Journal of Immigrant and Minority Health 9, 237–244.

Roberts, K.D., 1997. China's "Tidal Wave" of migrant labor: what can we learn from Mexican undocumented migration to the United States? The International Migration Review 31 (2), 249–291.

Salganik, M.J., Hechathorn, D.D., 2004. Sampling and estimation in hidden populations using respondent driven sampling. Sociological Methodology 34, 193–239.

Sheehan, T.J., Fifield, J., Reisine, S., Tennen, H., 1995. The measurement structure of the center for epidemiologic studies depression scale. Journal of Personality Assessment 64 (3), 507–521.

Shen, B.J., Takeuchi, D.T., 2001. A structural model of acculturation and mental health status among Chinese Americans. American Journal of Community Psychology 29 (3), 387–418.

Singh-Manoux, A., Adler, N.E., Marmot, M.G., 2003. Subjective social status: its determinants and its association with measures of ill-health in the Whitehall II study. Social Science & Medicine 56, 1321–1333.

Tang, P., 2006. Characteristics of migrants in Chengdu [in Chinese]. Sichuan Architecture 26, 33–38.

Wang, Q., Fu, X., Wei, Y., et al., 2007. The study on anxiety and its influence factors of floating population in Chengdu [in Chinese]. Journal of Preventive Medicine Information 23 (5), 544–546.

Xiao, L., Zhang, S., Wang, W., et al., 2003. A pilot survey of depressive symptoms and depression in a community of shanghai [in Chinese]. Chinese Journal of Behavioral Medical Science 9 (3), 200–201.

Yuan, J., Chen, J., Zhu, Z., et al., 1998. Study on validity of Center for Epidemiologic Studies Depression Scale using in Chinese community [in Chinese]. Shanghai Archives of Psychiatry 10 (3), 150–151.

Zhang, W., Tang, M., Liu, X., 2004. The prevalence of depression disorder among residents aged 55 or over in Chengdu area [in Chinese]. Chinese Journal Geriatric 23 (12), 883–885.