

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [editorial.bmjopen@bmj.com](mailto:editorial.bmjopen@bmj.com)

# BMJ Open

## Impact of psychological integration and acculturation on mental health among migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-022712
Article Type:	Research
Date Submitted by the Author:	02-Mar-2018
Complete List of Authors:	Shi, Lishuo; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Chen, Wen; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Bouey, Jennifer; Georgetown University - School of Nursing and Health Studies, Department of International Health Lin, Yanwei; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Ling, Li; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy
Keywords:	social integration, MENTAL HEALTH, Internal migrant, Adolescents

SCHOLARONE™  
Manuscripts

1  
2  
3  
4 **Impact of psychological integration and acculturation on mental health among**  
5  
6 **migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study**  
7  
8  
9

10 Lishuo Shi<sup>1,2#</sup>, Wen Chen<sup>1,2#</sup>, Jennifer Bouey<sup>3</sup>, Yanwei Lin<sup>1,2</sup>, Li Ling<sup>1,2\*</sup>  
11  
12

13 <sup>1</sup> Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun  
14 Yat-sen University, Guangzhou, Guangdong, China  
15

16 <sup>2</sup> Sun Yat-sen Center for Migrant Health Policy, Sun Yat-sen University, Guangzhou,  
17 Guangdong, China  
18

19 <sup>3</sup> Department of International Health, School of Nursing and Health Studies,  
20 Georgetown University, Washington DC, United States of America  
21  
22

23 #Lishuo Shi and Wen Chen have equally contributed to the work and are co-first  
24 authors.  
25  
26  
27  
28  
29

30  
31  
32  
33  
34  
35  
36  
37  
38 **\*Corresponding author:** Li Ling  
39

40 74, Zhongshan Road 2, Faculty of Medical Statistics and Epidemiology, School of  
41 Public Health, Sun Yat-sen University, Guangzhou, China.  
42

43 E-mail: lingli@mail.sysu.edu.cn  
44

45 Tel/Fax: 86-20-87333319.  
46  
47  
48  
49

50 **Word count:** 3395 word  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Abstract

**Objectives:** This study was aimed to examine the pathway and associations between social integration (including psychological integration and acculturation, i.e., language, social interaction, and customs) and mental health of internal migrant adolescents in China.

**Design:** Cross-sectional questionnaire study.

**Setting:** Six private migrant junior high schools located in Tianhe and Baiyun Districts in Guangzhou were chosen to be the study sites.

**Participants:** Totally 1,122 migrant adolescents aged 11-17 years old completed the study.

**Main outcome measures:** Mental health was measured by Social Anxiety Scale for Children (SASC) and Major Depression (MDD) in a Brief Child and Family Phone Interview. Social integration was measured by a self-designed and varified questionnaire. Multiple regression models and structural equation models (SEM) were performed to analyze the association between social integration and mental health while controlling for participant demographic characteristics.

**Results:** The average MDD scores for boys were 8.78 (SD=2.17) and girls were 8.56 (SD=2.22), while the average SASC scores for boys were 14.67 (SD=3.72) and girls were 13.41 (SD=4.01). The mean score of social integration was 37.45 (SD=6.35). Psychological integration had direct effect on MDD ( $p<0.001$ ,  $\beta=0.30$ ) and SASC ( $p<0.001$ ,  $\beta=0.28$ ), and it was the key variable fully mediating the impact of

1  
2  
3 acculturation components on MDD and partly mediating the impact on SASC,  
4  
5  
6 whereas the customs showed a direct negative effect ( $p=0.003$ ,  $\beta=-0.17$ ) on SASC. Of  
7  
8 the three acculturation components, customs had the strongest influence on  
9  
10 psychological integration ( $p<0.001$ ,  $\beta=0.37$  and  $0.51$ ), followed by social interaction  
11  
12 ( $p<0.001$ ,  $\beta=0.24$  and  $0.13$ ) and language ( $p<0.001$ ,  $\beta=0.17$  and  $0.11$ ).

15  
16 **Conclusions:** Findings suggest that there is a strong connection between social  
17  
18 integration and mental health in internal migrant adolescents. Interventions such as  
19  
20 promoting social interaction and understanding of regional culture are needed to  
21  
22 enhance psychological integration and furthermore improve the mental health of  
23  
24 migrant adolescents.  
25  
26

27  
28 **Key words:** Social integration; Mental health; Internal migrant; Adolescents.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Article Summary

### Strengths and limitations of this study:

• This is the first known study to investigate the applicability of social integration theory in understanding the mental health problems among the migrant adolescents in China. Our findings provide new ways to improve the mental health of migrant adolescents in China.

• The underlying mechanism of the effects of social integration on mental health of migrant adolescents were not comprehensively analysed in previous studies, and we used structural equation modelling to clearly quantify the integrated effect of various social integration dimensions on mental health, which will provide evidence for improving psychological intervention strategy of migrant adolescents.

• The reliability and validity of the scale for measuring the social integration of migrant adolescents needs to be further improved.

• This cross-sectional study is unable to make causal inferences between social integration and mental health because it did not control for all possible confounding variables.

## Introduction

The United Nations reported a 50% increase in international migration between 1990 and 2013, resulting in an estimated 232 million international migrants.<sup>1</sup> Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.<sup>2</sup> According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.<sup>3</sup> As a result, there were 35.81 million internal migrant adolescents under 17 years old in China in 2010, up by 41.37% since 2005,<sup>4</sup> and they accounted for 12.8% of overall adolescents' population in China.<sup>5</sup>

Concerns for the welfare of these internal migrant adolescents were exacerbated in China by its household registration (hukou in Chinese) system that would traditionally block migrant adolescents who do not have a city registration from getting an education in urban public schools.<sup>6-8</sup> In addition, similar to international migrant adolescents worldwide, internal migrant adolescents also have to adjust to the significant differences in dialects, culture, economic development, and social environment across different regions of China.<sup>9</sup> Poor educational investment and the acculturation pressure could have a negative influence on migrant adolescents' overall well beings, especially putting stress to their mental health.<sup>10, 11</sup>

Data from global studies showed that compared with local adolescents, the mental

1  
2  
3 health of migrant adolescents might be better<sup>12, 13</sup> or worse.<sup>14, 15</sup> However, a  
4  
5 comprehensive report indicated that the mental health of migrant adolescents in China  
6  
7 was inferior compared with local adolescents due to the influence of hukou system in  
8  
9 majority studies.<sup>16</sup> Another study in Guangzhou showed that the detection rate of  
10  
11 depression symptoms in migrant adolescents was 21.8%, far higher than local  
12  
13 adolescents (11.2%),<sup>17</sup> also higher than adolescents in other countries.<sup>18</sup> Mental  
14  
15 problem in childhood and adolescence is associated with many negative outcomes,  
16  
17 including impaired social, work, and family functioning in adolescence and into  
18  
19 adulthood.<sup>19</sup> Therefore, a better understanding of the risk factors for mental health  
20  
21 among this vulnerable population are significant to public health of the internal  
22  
23 migrant adolescents in China.  
24  
25  
26  
27  
28  
29  
30  
31  
32

33 Studies showed that among many factors that affect adolescents' mental health,  
34  
35 social integration is uniquely relevant to migrant adolescents.<sup>20</sup> The social integration  
36  
37 theory was originally developed to explain the achievements of immigrants'  
38  
39 adaptation, acculturation process, and identity in a developed society.<sup>2</sup> A high level of  
40  
41 social integration means that migrants had gained social support and social resources  
42  
43 in the new adopted environment.<sup>21</sup> Many studies had found that social integration  
44  
45 positively correlates with mental health in various types of immigrants,<sup>22-24</sup> but only a  
46  
47 few paid attention beyond the adult migrants.<sup>25</sup> No research has been conducted to  
48  
49 explore the role and the pathway of social integration on mental health among internal  
50  
51 migrant adolescents in China. On the other hand, since there was no consistent  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 measurement scale of social integration, previous studies on social integration of  
4 adolescents had focused on social interaction<sup>26</sup> or family integration and religious  
5 integration.<sup>25</sup> But in fact, these are just part of social integration. Factors such as the  
6 sense of belonging to the city and the adaptation of language and customs are also  
7 important elements of social integration, and proven to be associated with mental  
8 health.<sup>27-29</sup> So we pursue the idea that complete social integration should be consisted  
9 of acculturation and psychological integration. Acculturation consists of three latent  
10 variables of language, customs and social interaction in this study, which were proven  
11 to be important elements of acculturation.<sup>30-32</sup> Psychological integration, also known  
12 as “perceived integration”, included the sense of belonging to a certain group and the  
13 spiritual feeling of the individual as a member of the group.<sup>33, 34</sup> Psychological  
14 integration was found related to indicators of psychological functioning,<sup>35, 36</sup> and it  
15 was also affected by social functioning such as social interaction.<sup>37, 38</sup> Thus, we  
16 hypothesized the adolescents' social integration could positively affect mental health,  
17 and the acculturation could affect mental health directly and indirectly via  
18 psychological integration, see figure 1.

19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44 The primary aim of this study is to confirm this hypothesis using a structure model  
45 analysis with data from a cross-sectional study in Guangzhou, China. Specifically, we  
46 aimed to: (1) to assess the status of mental health and social integration of migrant  
47 adolescents; and (2) to test the aforementioned hypothesized structural relationship  
48 between social integration and mental health of migrant adolescents. We hope to find  
49 some new intervention strategies suitable for migrant adolescents to improve their  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 mental health by exploring the pathways of social integration indicators affecting  
4  
5  
6 mental health.  
7

## 8 **Methods**

### 9 *Study sites*

10  
11 This cross-sectional survey study was conducted in Tianhe and Baiyun districts in  
12  
13 Guangzhou, China from April to May in 2016. Guangzhou is the capital city of  
14  
15 Guangdong Province with a population of 12.7 million, and has led the economic  
16  
17 reform and openness in China since the 1980s, Guangzhou has also become a major  
18  
19 receiving city with 0.6 million internal migrant adolescents.<sup>4, 5</sup>  
20  
21  
22  
23  
24  
25  
26  
27

28 As the capital city of Guangdong province, Guangzhou has its distinguished  
29  
30 Cantonese culture, language and customs. The primary dialect spoken in Guangzhou,  
31  
32 Cantonese, is unique to Guangdong province and its adjacent areas including Hong  
33  
34 Kong and Macau. This unique language environment adds significant barriers for  
35  
36 migrant adolescents' adaptation to the social and cultural environment of Guangzhou  
37  
38 compared to other regions of China. Tianhe and Baiyun Districts were chosen to be  
39  
40 the study sites due to its large migrant populations. Within each district, we chose  
41  
42 the study sites due to its large migrant populations. Within each district, we chose  
43  
44 three private migrant junior high schools using a purposive sampling method.  
45  
46  
47  
48  
49

### 50 *Study participants and sampling*

51  
52 All migrant students in the grade 7-8 from these six schools participated in the study.  
53

54  
55 All eligible students finished a self-administered questionnaire. The study inclusion  
56  
57

1  
2  
3 criteria were: 1) students in the chosen grade of the school did not have hukou in  
4  
5  
6 Guangzhou, 2) at least one of the students' parent did not have hukou in Guangzhou,  
7  
8  
9 3) students were under 18 years old.

10  
11  
12  
13 The survey took 20–30 minutes for each student to finish. Meanwhile, in order to  
14  
15 ensure the independence and anonymity of the survey, the research assistants were  
16  
17 required to wait for completion of the questionnaires outside the classroom. After  
18  
19 collecting the questionnaire, research assistants would check it carefully, and contact  
20  
21 the adolescents if they found an important answer in the questionnaire missing.  
22  
23 Research assistants received standardized training by the research team, and the  
24  
25 quality control was implemented during data collection.  
26  
27  
28  
29  
30  
31  
32

33 The survey protocol was approved by Institutional Review Board at Sun Yat-sen  
34  
35 University, China (reference [2015] No.42). Each adolescent was asked to bring  
36  
37 informed consent to parents or guardians and let them sign on it before filling out the  
38  
39 questionnaire.  
40  
41  
42  
43  
44

#### 45 *Measures*

46  
47 Indicators of mental health included anxiety and depression indices. Anxiety was  
48  
49 measured by Social Anxiety Scale for Children (SASC), and depression was measured  
50  
51 by the dimension of Major Depression (MDD) of a Brief Child and Family Phone  
52  
53 Interview. The SASC was developed to measure social anxiety among American  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 adolescents between 7~16 years of age, and it consists of 10 items scored on a 3-point  
4  
5 scale (0=always, 1=sometimes, 2=never), with total scores ranging from 0 to 20, and  
6  
7  
8 higher scores indicating less anxiety.<sup>39</sup> The MDD was developed to measure major  
9  
10 depression among Ontario adolescents between 6~18 years of age, and it consists of 6  
11  
12 items scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total score  
13  
14 ranging from 0 to 12. Higher scores indicate less depression.<sup>40</sup> The Cronbach's alpha  
15  
16 of SASC applied on normal Chinese adolescents was 0.79,<sup>41</sup> and the Cronbach's alpha  
17  
18 of MDD applied on Ontario adolescents was 0.86.<sup>40</sup>  
19  
20  
21  
22  
23  
24

25 Social integration consisted of acculturation and psychological integration. Based  
26  
27 on acculturation theories developed by Colleen Ward and comprehensive literature  
28  
29 review,<sup>30-32,34</sup> the research team designed the measurement of the social integration,  
30  
31  
32 which was consisted of 15 items with a total score ranging from 15 to 61 (See Table  
33  
34 1). Higher scores indicate higher levels of social integration. Acculturation was  
35  
36 measured by 3 latent variables: social interaction (two items), customs (five items)  
37  
38 and language (four items). Customs consists of questions about preferences for food  
39  
40 (two items), clothing (two items) and social custom (one item). Each item had 3 to 5  
41  
42 choices. Some questions were rated on a scale ranging from 1 (“No”) to 3 (“Yes”),  
43  
44 some questions were rated on a scale ranging from 1 (“Completely not/Never”) to 4  
45  
46 (“Completely/Usually”), and some questions were rated on a scale ranging from 1  
47  
48 (“Never”) to 5 (“Always”). Psychological integration was measured by four questions  
49  
50 that asked about “sense of belonging” and “satisfaction of urban life”. Sense of  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 belonging was assessed by one question with a scale ranging from 1 (“outsiders”) to 4  
4  
5 (“Guangzhou people”). Satisfaction of urban life was assessed by three questions with  
6  
7 a scale ranging from 1 (“Very not”) to 5 (“Very sure”).  
8  
9

### 10 11 12 13 *Demographic and other covariates*

14  
15 To better understand the association between social integration and mental health, we  
16  
17 also included demographics which were reported to be associated with mental health  
18  
19 in children and adolescents.<sup>18, 42</sup> These adjustment variables included age (in years),  
20  
21 gender (male or female), place of origin (Guangdong province or other provinces in  
22  
23 China) and length of stay in Guangzhou (in years).  
24  
25  
26  
27  
28  
29

### 30 31 *Data processing and statistical analysis*

32  
33 Statistical analyses were performed using the software IBM SPSS 20.0 and IBM  
34  
35 Amos 24.0. Descriptive statistics including the mean, standard deviation (SD),  
36  
37 frequency and proportion were used to summarise the demographics, social  
38  
39 integration and mental health of the study participants. Differences in mental health  
40  
41 by demographic variables were assessed using t-test or F-test. Multivariate regression  
42  
43 models were conducted to assess the association between latent variables of social  
44  
45 integration and mental health. The latent variables of social integration were  
46  
47 independent variables, and the scores of SASC and MDD were dependent variables.  
48  
49 Demographic variables were used as confounding factors. SEM were used to assess  
50  
51 the proposed structural relationship among the social integration dimensions and  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 mental health. Data-model fitting in the structural equation modelling analysis was  
4 assessed using the following four indices: Goodness of Fit Index (GFI) (>0.9),  
5  
6 Comparative Fit Index (CFI) (>0.9), Root Mean Square Error of Approximation  
7  
8 (RMSEA) (< 0.05) and Chi-square/df (<3). Cronbach alpha were computed to assess  
9  
10 the reliability of the latent variables. The validity of the data was evaluated by the  
11  
12 model fitting indices of SEM and the composite reliability of each latent variable.  
13  
14  
15  
16  
17  
18  
19  
20

## 21 **Results**

22  
23 A total of 1,233 completed surveys, the response rate was 92.1%, 83 were excluded  
24 because of the contradiction of the information provided, 28 were excluded because  
25  
26 of incomplete data for several key variables (e.g. questions about social integration  
27  
28 and mental health), yielding 1,122 participants (91.0%) for analyses. Table 2  
29  
30 demonstrates that among the 1,122 participants, there were more boys (55%) than  
31  
32 girls (45%), and most of them (93%) aged in 13-16 years old, nearly half of them  
33  
34 (47%) came from other provinces, and many of them (78%) had lived in Guangzhou  
35  
36 more than 5 years. There were significant differences between boys' scores  
37  
38 (14.67±3.72) and girls' scores (13.41±4.01) in anxiety scale ( $P<0.001$ ). The mean  
39  
40 scores of SASC and MDD for participants were significantly different by age ( $P<0.05$ ;  
41  
42  $P<0.01$ ). Students who were younger had better mental health compared with older  
43  
44  
45  
46  
47  
48  
49  
50 ones.

51  
52  
53  
54 Table 1 showed the overall mean score of social integration of migrant adolescents  
55  
56

1  
2  
3 was 37.45, and SD was 6.35. In psychological integration dimension, only 7% of the  
4 surveyed adolescents considered themselves to be Guangzhou people, but the ones  
5 who loved and were willing to live in Guangzhou accounted for more than 60% of  
6 these adolescents. In customs integration dimension, the majority of adolescents had  
7 high acceptance of urban clothing, and many of the adolescents preferred the lifestyle  
8 in their hometown in traditional customs and diet. In social interaction dimension,  
9 many of migrant adolescents (48%) failed to interact with local adolescents. In  
10 language dimension, nearly half of the adolescents knew the local language well. The  
11 mean scores of these questions were computed for modelling analysis.  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27

28 Table 3 showed multiple regression analysis indicated a positive relationship  
29 between the total MDD score, total SASC score and psychological integration after  
30 controlling for age, gender, place of origin and residence time ( $P<0.001$ ), while the  
31 total SASC score had a negative relationship with custom integration ( $P=0.03$ ). The  
32 language skills and social interaction had no significant correlation with total MDD  
33 score and total SASC score ( $P>0.05$ ).  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44

45 Structural equation model was used to explore the internal relations of the various  
46 latent variables of social integration and their impact on mental health. Figure 2 shows  
47 that psychological integration had direct effect on MDD ( $\beta=0.30$ ) and it was the key  
48 variable fully mediating the impact of acculturation components on MDD. Of the  
49 three acculturation components, customs had the strongest influence on psychological  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 integration ( $\beta=0.37$ ), followed by social interaction ( $\beta=0.24$ ) and language ( $\beta=0.17$ ).  
4  
5  
6 The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, Chi-square/df=2.1.  
7  
8 Figure 3 also shows psychological integration had direct effect on SASC ( $\beta=0.28$ ) and  
9  
10 it fully mediated the impact of two acculturation components (i.e. language and social  
11  
12 interaction) on SASC, whereas the customs showed both a direct negative effect  
13  
14 ( $\beta=-0.17$ ) and an indirect positive effect via psychological integration on social  
15  
16 anxiety. Of the three acculturation components, customs had the strongest influence  
17  
18 on psychological integration ( $\beta=0.51$ ), followed by social interaction ( $\beta=0.13$ ) and  
19  
20 language ( $\beta=0.11$ ). The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03,  
21  
22 Chi-square/df=2.2. The hypothesised model produced a good fit to the sample data.  
23  
24  
25  
26  
27  
28  
29

30 We evaluated the measures to confirm their reliability and validity. In our study,  
31  
32 SASC demonstrated the Cronbach's alpha coefficient of 0.82, and MDD demonstrated  
33  
34 the Cronbach's alpha coefficient of 0.78. Even the measure of social integration was  
35  
36 self-developed, most correlation coefficient of each question's score and the total  
37  
38 score of the dimension exceeded 0.5, and the Cronbach  $\alpha$  of each latent variable  
39  
40 exceeded 0.5 while the Cronbach  $\alpha$  of the overall scale exceeded 0.7 (See Table 1);  
41  
42 This indicated that the questionnaire had acceptable reliability. In Figure 2, the  
43  
44 composite reliability of latent variables were: 0.8082(language), 0.5616(social  
45  
46 interaction), 0.5952 (customs), 0.8233(psychological integration). In Figure 3, the  
47  
48 composite reliability of latent variables were: 0.8028(language), 0.5935(social  
49  
50 interaction), 0.5176(customs), 0.8134(psychological integration). These indices all  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 exceed 0.5. On the other hand, all indices used to assess data-model fitting in SEM  
4  
5  
6 satisfied statistical requirements. This indicated the measure of social integration had  
7  
8 acceptable validity.<sup>43</sup>  
9

## 13 **Discussion**

14  
15 This is the first known study to investigate the applicability of social integration  
16  
17 theory in understanding the mental health problems among the migrant adolescents in  
18  
19 China. We found the social integration is positively correlated with mental health. The  
20  
21 underlying pathway of this relationship was explored. Psychological integration plays  
22  
23 an important mediating role between acculturation and mental health. Three latent  
24  
25 variables of acculturation indirectly affect mental health through psychological  
26  
27 integration, of which customs have the greatest impact on psychological integration,  
28  
29 followed by social interaction and language.  
30  
31  
32  
33  
34  
35  
36  
37

38 Anxiety and depressive symptoms among migrant adolescents between 11-17 years  
39  
40 of age were found severe in this study. The mean MDD scores of boys and girls were  
41  
42 8.78 and 8.56 respectively, very close to a mean score of 8.11 of adolescents referred  
43  
44 to mental health outpatient services in Ontario.<sup>44</sup> The average SASC scores of migrant  
45  
46 adolescents were significantly lower than the average level of Chinese adolescents  
47  
48 aged 13-16 years old (boys: 14.67 vs 16.34; girls: 13.41 vs 15.59).<sup>41</sup> In addition,  
49  
50 migrant girls experienced more anxiety symptoms than boys, and older adolescents  
51  
52 experienced more anxiety and depressive symptoms than younger peers. These results  
53  
54  
55  
56  
57

1  
2  
3 are consistent with the previous literature.<sup>18</sup> All these figures confirmed that migrant  
4 adolescents' mental health was not optimistic in China, and emphasized the urgent  
5 need for improvement in migrant adolescents' mental health, especially among older  
6 adolescent girls.  
7  
8  
9  
10  
11  
12  
13  
14  
15

16 The average score of social integration of migrant adolescents was low. It showed  
17 that the level of social integration of migrant adolescents had much room for  
18 improvement. It is worth noting that, we found adolescents are mostly satisfied with  
19 life in Guangzhou, and many of them had high willingness to integrate into the city.  
20 However, most migrant adolescents had undefined identification or thought that they  
21 are outsiders, and their score of sense of belonging was relatively low. This  
22 contradiction may deepen the psychological pressure, and affect their mental health.<sup>27</sup>  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34

35 The findings from the multiple regression analysis and structural equation model  
36 largely supported our hypothesis as when the important role of psychological  
37 integration on social integration manifested in the model. Psychological integration  
38 directly and positively affect the level of mental health ( $\beta=0.30$  and  $0.28$ ), and it was  
39 considered as the higher level integration and also be the outcome of the social  
40 integration.<sup>45</sup> The self-identity, which was contained in psychological integration, had  
41 been also shown positively correlated with youngers' mental health.<sup>29</sup> Therefore, this  
42 view was verified among Chinese migrant adolescents in our study.  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 The indirect relations between acculturation components (i.e language, social  
5  
6 interaction and customs) and mental health via psychological integration were also  
7  
8 significant. Although language was found as an important factor in social integration  
9  
10 among international immigrants<sup>28</sup> and international students<sup>46</sup>, it had the least  
11  
12 influence on psychological integration in this study. This difference is mainly because  
13  
14 Mandarin is widely used at schools, which diminished the language barrier. Compared  
15  
16 to the language, social interaction had a larger influence on psychological integration  
17  
18 ( $\beta=0.24$  and  $0.13$ ). Previous research showed similar conclusion that fewer mental  
19  
20 health problems were found among adolescents making friends from their own and  
21  
22 other cultures.<sup>47</sup> Unfortunately, the cross-cultural friendships of immigrant  
23  
24 adolescents are less reciprocal than same culture friendships.<sup>48</sup> The same situation  
25  
26 also occurred in our study, 48% of migrant adolescents had no friends among the local  
27  
28 adolescents, and only 11% of migrant adolescents hope to make friends with local  
29  
30 adolescents. Hence, further understanding the persistence of traditional social  
31  
32 groups and identities is crucial for the development of psychological integration that  
33  
34 will ensure mental health. Different from the other two, the customs had the largest  
35  
36 influence on psychological integration ( $\beta=0.37$  and  $0.51$ ), and it also directly  
37  
38 aggravate the symptoms of anxiety ( $\beta= -0.17$ ). These might be explained by Berry's  
39  
40 acculturation strategies theory.<sup>31</sup> Adolescents whose strategies were "separation" or  
41  
42 "marginalisation" might favor traditionalism, and this lifestyle may minimize the  
43  
44 stress related to facing new dress, diets and social custom.<sup>47</sup> Meanwhile, adolescents  
45  
46 whose strategies were "integration" or "assimilation" had better custom integration,  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57

1  
2  
3 but they might be more anxious if they feel a great resistance in the acculturation  
4  
5  
6 process. Therefore, the result showed that customs have both positive and negative  
7  
8 effects on mental health. This phenomenon was also found in other studie.<sup>22</sup> These  
9  
10 results suggested that continued efforts are needed to address regional cultural barriers  
11  
12 to promote the psychological integration of migrant adolescents.  
13  
14

15  
16 Our findings suggest that both the level of social integration and the mental health  
17  
18 status of migrant adolescents can be improved in China. The social integration is  
19  
20 positively correlated with mental health, and psychological integration plays an  
21  
22 important mediating role between acculturation and mental health. This finding laid  
23  
24 the foundation for further research on the social integration structure of internal  
25  
26 migrant adolescents. Our study also indicates that regional culture and social  
27  
28 interaction can be used to enhance the sense of belonging and improve the mental  
29  
30 health of migrant adolescents. Therefore, we suggest that the impact of social  
31  
32 integration on mental health should be paid attention to when psychological  
33  
34 interventions were taken on migrant adolescents with different cultural backgrounds  
35  
36 in the world. Such as the schools with migrant students to scale up the efforts in  
37  
38 preventing mental health problems among migrant adolescents by adding contents of  
39  
40 regional culture on mental health counselling clinic or mental health education  
41  
42 programs. Activities, including extracurricular programs with local adolescents that  
43  
44 can enhance social interaction also should be encouraged at the schools.  
45  
46  
47  
48  
49  
50

51  
52 Our study also has some limitations. First of all, although a self-designed  
53  
54 multidimensional scale measured social integration with the acceptable overall  
55  
56

1  
2  
3 Cronbach's alpha of 0.70, two dimensions were having Cronbach's alpha of 0.52 and  
4  
5  
6 0.55. It indicated the reliability of measurement was reluctantly accepted but need to  
7  
8 be further improved. Future research may improve the reliability of the developed  
9  
10 social integration scale by modifying some items. Second, the MDD had not been  
11  
12 used in Chinese adolescents before, so the validity of this scale may be affected. Third,  
13  
14 data used for this study was collected through a cross-sectional survey. A longitudinal  
15  
16 study may be necessary to verify the observed relationship between social integration  
17  
18 and mental health.  
19  
20  
21  
22  
23  
24

## 25 **Conclusion**

26  
27 Findings suggest the mental health and social integration of internal migrant  
28  
29 adolescents in Guangzhou need to be promoted, and there is a strong connection  
30  
31 between social integration and mental health. Psychological integration plays an  
32  
33 important mediating role between acculturation and mental health. The impact of  
34  
35 social integration on mental health should be paid attention to when psychological  
36  
37 interventions were taken on internal migrant adolescents from different cultural  
38  
39 backgrounds. Interventions such as promoting social interaction and understanding of  
40  
41 regional culture are needed to enhance psychological integration and furthermore  
42  
43 improve the mental health of internal migrant adolescents.  
44  
45  
46  
47  
48  
49  
50  
51

## 52 **Acknowledgements**

53  
54 The survey was supported by Sun Yat-sen Center for Migrant Health Policy and the  
55  
56  
57  
58  
59  
60

1  
2  
3 six investigated schools. We thank all participants and investigators for this study. We  
4  
5 are also grateful to all giving valuable comments on this paper.  
6  
7

### 8 **Contributors**

9  
10 LS took part in data analysis and wrote the manuscript. WC and JB contributed to the  
11  
12 revisions of the manuscript. YL participated in study design and data collection. LL  
13  
14 contributed to design the project and the supervision on project conducting. All  
15  
16 authors read and approved the final manuscript.  
17  
18  
19

### 20 **Funding**

21  
22 This work was supported by China Medical Board grant number [12-111].  
23  
24

### 25 **Competing interests**

26  
27 No competing interests.  
28  
29

### 30 **Participant consent**

31  
32 Obtained.  
33  
34

### 35 **Ethics approval**

36  
37 This study was approved by the Institutional Review Board (IRB) of the School of  
38  
39 Public Health, Sun Yat-sen University in China ([2015] No.42).  
40  
41

### 42 **Provenance and peer review**

43  
44 Not commissioned; externally peer reviewed.  
45  
46

### 47 **Data sharing statement**

48  
49 No additional data are available.  
50  
51  
52  
53

### 54 **References:**

- 1  
2  
3 1. UN News - Number of international migrants rises above 232 million, UN reports.  
4  
5  
6 2013.
- 7  
8 2. Lin Y, Zhang Q, Chen W, et al. Association between Social Integration and Health  
9  
10 among Internal Migrants in ZhongShan, China. PLOS ONE 2016;11(2):e148397.
- 11  
12 3. Chengrong D, Ge Y. Study on the Latest Situation of Floating Children in China.  
13  
14 Population Journal 2008(06):23-31.
- 15  
16 4. Office for the Sixth Population Census of China. Major figures on 2010  
17  
18 population census of China: China Statistics Press, 2011.
- 19  
20 5. All China Women's Federation. National Report on Children left in rural areas  
21  
22 and migrant children. Chinese Women's Movement 2013(6):30-34.
- 23  
24 6. Fu Q, Ren Q. Educational inequality under China's rural - urban divide: The  
25  
26 hukou system and return to education. Environment & Planning A  
27  
28 2010;42(3):592-610.
- 29  
30 7. Goodburn C. Learning from migrant education: A case study of the schooling of  
31  
32 rural migrant children in Beijing. International Journal of Educational Development  
33  
34 2009;29(5):495-504.
- 35  
36 8. Chen Y, Feng S. Access to public schools and the education of migrant children in  
37  
38 China ☆. China Economic Review 2013;26(1):75-88.
- 39  
40 9. Gui Y, Berry JW, Zheng Y. Migrant worker acculturation in China ☆.  
41  
42 International Journal of Intercultural Relations 2012;36(4):598-610.
- 43  
44 10. Yang L, Chen X, Li S, et al. Path Analysis of Acculturative Stress Components  
45  
46 and Their Relationship with Depression Among International Students in China.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56

1  
2  
3  
4 Stress & Health Journal of the International Society for the Investigation of Stress  
5  
6 2016;160(4):1957-1964.  
7

8  
9 11. Gao Q, Li H, Zou H, et al. The mental health of children of migrant workers in  
10  
11 Beijing: the protective role of public school attendance. Scandinavian Journal of  
12  
13 Psychology 2015;56(4):384.  
14

15  
16 12. Mood C, Jonsson JO, Låftman SB. Immigrant Integration and Youth Mental  
17  
18 Health in Four European Countries. European Sociological Review 2016;32(6):w27.  
19

20  
21 13. Goodman A, Patel V, Leon DA. Child mental health differences amongst ethnic  
22  
23 groups in Britain: a systematic review. BMC PUBLIC HEALTH 2008;8(1):1-11.  
24

25  
26 14. Brettschneider AK, Hölling H, Schlack R, et al. [Mental health in adolescents in  
27  
28 Germany: A comparison with regard to migration background and country of origin].  
29  
30 Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz  
31  
32 2015;58(4-5):80-85.  
33

34  
35 15. Bhui KS, Lenguerrand E, Maynard MJ, et al. Does cultural integration explain a  
36  
37 mental health advantage for adolescents? INT J EPIDEMIOL 2012;41(3):791-802.  
38

39  
40 16. Sun X, Chen M, Chan KL. A meta-analysis of the impacts of internal migration  
41  
42 on child health outcomes in China. BMC PUBLIC HEALTH 2015;16(1):1-11.  
43

44  
45 17. Zhao Y. Relationship between social support and depression of migrant children:  
46  
47 the mediating effect of core-self evaluations. Chinese Journal of School Health  
48  
49 2014;35(12):1844-1846.  
50

51  
52 18. Thombs BD, Roseman M, Kloda LA. Depression screening and mental health  
53  
54 outcomes in children and adolescents: a systematic review protocol. Systematic  
55  
56



1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Reviews 2012;1(1):58.

19. Williams SB, O'Connor EA, Eder M, et al. Screening for child and adolescent depression in primary care settings: a systematic evidence review for the US Preventive Services Task Force. *PEDIATRICS* 2009;123(4):e716.

20. C. P. Assimilation in American Life. The Role of Race, Religion, and National Origins by Milton M. Gordon. *American Journal of Sociology* 1965;4(Volume 70, Number 4):134.

21. Berkman LF, Glass T, Brissette I, et al. From social integration to health: Durkheim in the new millennium. *SOC SCI MED* 2000 2000-09-01;51(6):843-857.

22. Na L, Hample D. Psychological pathways from social integration to health: An examination of different demographic groups in Canada. *SOC SCI MED* 2016;151:196-205.

23. Li W. Explicit and Implicit Psychological Acculturation, and Mental Health of Tibetan High School students: Sichuan Normal University; 2010.

24. Schick M, Zumwald A, Knöpfli B, et al. Challenging future, challenging past: the relationship of social integration and psychological impairment in traumatized refugees. *European Journal of Psychotraumatology* 2016;7:28057.

25. Rose T, Sean J, Joseph S, et al. Social integration and the mental health of Black adolescents. *Child Development* 2014;85(3):1003-1018.

26. Rodkin PC, Wilson T, Ahn HJ. Social integration between African American and European American children in majority black, majority white, and multicultural elementary classrooms. *New Directions for Child & Adolescent Development*

1  
2  
3 2007;2007(118):25.  
4

5  
6 27. Wong DFK, Lam D, Yan P, et al. The Impacts of Acculturative Stress and Social  
7  
8 Competence on the Mental Health of Mainland Chinese Immigrant Youth in Hong  
9  
10 Kong. *The British Journal of Social Work* 2004;34(7):1009-1024.  
11

12  
13 28. Delander L, Hammarstedt M, Månsson J, et al. Integration of immigrants: the role  
14  
15 of language proficiency and experience. *Evaluation Review: A Journal of Applied*  
16  
17 *Social Research* 2005;29(1):24-41.  
18

19  
20 29. Pesigan IJ, Luyckx K, Alampay LP. Brief report: identity processes in Filipino  
21  
22 late adolescents and young adults: parental influences and mental health outcomes.  
23  
24 *Journal of Adolescence* 2014;37(5):599-604.  
25

26  
27 30. Unger JB, Gallahen P, Shakib S, et al. The AHIMSA Acculturation Scale: A New  
28  
29 Measure of Acculturation for Adolescents in a Multicultural Society. *The Journal of*  
30  
31 *Early Adolescence* 2002;22(3):225-251.  
32

33  
34 31. Berry JW. Immigration, Acculturation, and Adaptation. *Applied Psychology*  
35  
36 1997;46(1):5-34.  
37

38  
39 32. Ward C. Acculturation and adaptation revisited. *Journal of Cross-Cultural*  
40  
41 *Psychology* 1999;30(4):422-442.  
42

43  
44 33. Keyes CF. Ethnic adaptation and identity : the Karen on the Thai frontier with  
45  
46 Burma: Institute for the Study of Human Issues, 1979.  
47

48  
49 34. Bollen KA, Hoyle RH. Perceived Cohesion: A Conceptual and Empirical  
50  
51 Examination. *Social Forces* 1990;69(2):479-504.  
52

53  
54 35. Young AF, Russell A, Powers JR. The sense of belonging to a neighbourhood: can  
55  
56

1  
2  
3  
4 it be measured and is it related to health and well being in older women? SOC SCI  
5  
6 MED 2004;59(12):2627-2637.

7  
8 36. Hagerty BM, Williams RA, Coyne JC, et al. Sense of belonging and indicators of  
9  
10 social and psychological functioning. ARCH PSYCHIAT NURS 1996;10(4):235.

11  
12 37. Chow DHPH. Sense of Belonging and Life Satisfaction among Hong Kong  
13  
14 Adolescent Immigrants in Canada. Journal of Ethnic & Migration Studies  
15  
16 2007;33(3):511-520.

17  
18 38. Maestas R, Vaquera GS, Zehr LM. Factors Impacting Sense of Belonging at a  
19  
20 Hispanic-Serving Institution. Journal of Hispanic Higher Education  
21  
22 2007;6(3):237-256.

23  
24 39. La Greca AM, Dandes SK, Wick P, et al. Development of the Social Anxiety  
25  
26 Scale for Children: Reliability and Concurrent Validity. Journal of Clinical Child &  
27  
28 Adolescent Psychology 1988;17(1):84-91.

29  
30 40. Cunningham CE, Boyle MH, Hong S, et al. The Brief Child and Family Phone  
31  
32 Interview (BCFPI): 1. Rationale, development, and description of a computerized  
33  
34 children's mental health intake and outcome assessment tool. J CHILD PSYCHOL  
35  
36 PSYC 2009;50(4):416-423.

37  
38 41. Li F, Su L, Jin Y. Norm of the screen for child social anxiety related emotional  
39  
40 disorders in Chinese urban children. CHINESE JOURNAL OF CHILD HEALTH  
41  
42 CARE 2006;14(4):335-337.

43  
44 42. Lorenzoblanco EI, Unger JB, Baezcondegarbanati L, et al. Acculturation,  
45  
46 enculturation, and symptoms of depression in Hispanic youth: the roles of gender,  
47  
48  
49  
50  
51

1  
2  
3  
4 Hispanic cultural values, and family functioning. *Journal of Youth and Adolescence*  
5  
6 2012;41(10):1350-1365.

7  
8 43. Bacon DR, Others A. Composite Reliability in Structural Equations Modeling.  
9  
10 EDUC PSYCHOL MEAS 1995;55(3):394-406.

11  
12 44. Boyle MH, Cunningham CE, Georgiades K, et al. The Brief Child and Family  
13  
14 Phone Interview (BCFPI): 2. Usefulness in screening for child and adolescent  
15  
16 psychopatholog. *J CHILD PSYCHOL PSYC* 2009;50(4):424.  
17  
18

19  
20 45. Yue Z, Li S, Feldman MW. Concept construction and Empirical Analysis of  
21  
22 Social Integration for Rural-Urban Migrants in China. *Modern Economic Science*  
23  
24 2012(1):1-11.  
25  
26

27  
28 46. Lawani AO, Gai X, Titilayo A. The Effects of Continental Background, Language  
29  
30 Proficiency and Length of Stay on Social Adjustment Experience of International  
31  
32 Students in Northern China. *Revista De Cercetare Şi Intervenție Socială*  
33  
34 2012;37(37):91-106.  
35  
36

37  
38 47. Bhui K, Stansfeld S, Head J, et al. Cultural identity, acculturation, and mental  
39  
40 health among adolescents in east London's multiethnic community. *Journal of*  
41  
42 *Epidemiology & Community Health* 2005;59(4):296-302.  
43  
44

45  
46 48. Horenczyk G, Tatar M. Friendship expectations among immigrant adolescents  
47  
48 and their host peers. *Journal of Adolescence* 1998;21(1):69-82.  
49  
50

Table 1. Social integration of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach $\alpha$
<b>Psychological integration</b>				0.665
1. Where do you think you belong to?		1.89 (1.02)	0.66	
Outsiders	575 (51)			
Unknown	170 (15)			
Both	297 (27)			
Guangzhou people	80 (7)			
2. Do you like Guangzhou?		3.91 (0.75)	0.86	
Very not	9 (1)			
Not	19 (2)			
Unclear	254 (23)			
Like	619 (55)			
Very like	221 (20)			
3. Are you satisfied with your life in Guangzhou?		3.87 (0.72)	0.80	
Very not	8 (1)			
Not	29 (3)			
Unclear	237 (21)			
Sure	677 (60)			
Very sure	171 (15)			
4. Would you like to live in Guangzhou always?		3.59 (0.95)	0.60	
Very not	16 (1)			
Not	176 (16)			
Unclear	203 (18)			
Sure	582 (52)			
Very sure	145 (13)			
<b>Customs</b>				0.524

1				
2				
3	5. Do you like to celebrate the			
4	Spring Festival in Guangzhou?	2.16 (0.93)	0.49	
5	Very not	341 (30)		
6	Not	331 (30)		
7	Average	379 (34)		
8	Sure	71 (6)		
9				
10	6. Do you think Guangzhou people			
11	dressed nice?	2.29 (0.49)	0.60	
12	Not	20 (2)		
13	Average	758 (68)		
14	Yes	344 (31)		
15				
16	7. Do you like the clothes in			
17	Guangzhou?	3.06 (1.17)	0.57	
18	Very not	33 (3)		
19	Not	429 (38)		
20	Unclear	252 (23)		
21	Sure	242 (22)		
22	Very sure	166 (15)		
23				
24	8. Do you eat Cantonese cuisine?	2.88 (0.84)	0.30	
25	Always	55 (5)		
26	Usually	99 (9)		
27	Sometimes	703 (63)		
28	Once in a while	188 (17)		
29	Never	77 (7)		
30				
31	9. Do you like to eat Cantonese			
32	cuisine?	1.75 (0.84)	0.41	
33	No	571 (51)		
34	Average	261 (23)		
35	Yes	290 (26)		
36				
37	<b>Social interaction</b>			0.553
38				
39	10. Where did your major good			
40	friends come from?	1.61 (0.66)	0.50	
41	Outside	543 (48)		
42	Both place	470 (42)		
43	Local	109 (10)		
44				
45	11. Do you hope your classmates			
46	and friends to be local children?	1.89 (0.57)	0.74	
47	No	247 (22)		
48	Average	749 (67)		
49	Yes	126 (11)		
50				
51	<b>Language</b>			0.811
52				
53	12. Can you understand Cantonese?	2.69 (0.93)	0.87	
54	Completely	268 (24)		
55	Most	335 (30)		
56				
57				
58				
59				
60				

1				
2				
3	A little	419 (37)		
4	Completely not	100 (9)		
5	13. Can you speak Cantonese?		2.00 (0.94)	0.82
6	Completely	110 (10)		
7	Most	159 (14)		
8	A little	470 (42)		
9	Completely not	383 (34)		
10	14. Do you watch TV programs in			
11	Cantonese?		2.38 (0.97)	0.63
12	Usually	181 (16)		
13	Sometimes	280 (25)		
14	Once in a while	441 (39)		
15	Never	220 (20)		
16	15. Do you listen to Cantonese			
17	songs?		2.48 (0.94)	0.51
18	Usually	185 (17)		
19	Sometimes	338 (30)		
20	Once in a while	426 (38)		
21	Never	173 (15)		
22	Total	1122	37.45(6.35)	0.772
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				

Table 2. Demographic characteristics by anxiety (SASC) and major depression (MDD) scales among 1,122 migrant children in Guangzhou, China in 2016

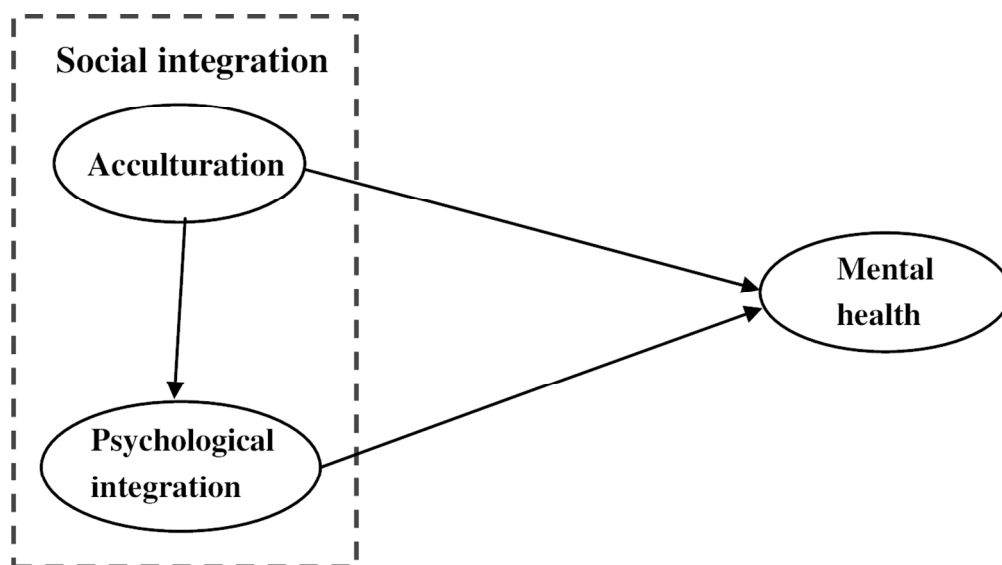
Variables	N (%)	MDD Mean (SD)	<i>P</i> value	SASC Mean (SD)	<i>P</i> value
<b>Gender</b>			0.097		<0.001
Boys	621 (55)	8.78 (2.17)		14.67 (3.72)	
Girls	501 (45)	8.56 (2.22)		13.41 (4.01)	
<b>Age (years)</b>			0.003		0.043
11~12	75 (7)	9.01 (2.30)		14.47 (4.09)	
13	391 (35)	8.97 (2.10)		14.51 (3.89)	
14	452 (40)	8.49 (2.28)		13.86 (3.91)	
15~16	204 (18)	8.47 (2.07)		13.77 (3.80)	
<b>Place of origin</b>			0.318		0.525
Guangdong province	592 (53)	8.75 (2.16)		14.04 (3.75)	
Other province	530 (47)	8.62 (2.23)		14.19 (4.08)	
<b>Length of stay in Guangzhou</b>			0.132		0.444
<5 years	241 (22)	8.57 (2.18)		14.24 (3.94)	
5 to 10 years	317 (28)	8.56 (2.16)		14.29 (3.69)	
>10 years	540 (48)	8.83 (2.22)		13.97 (4.04)	



Table 3. Associations between social integration indicators with mental health scales (MDD and SASC) after the adjustment of demographic characteristics among 1,122 migrant children in Guangzhou, China in 2016

Variables	MDD		SASC	
	$\beta$ (95%CI)	<i>P</i> value	$\beta$ (95%CI)	<i>P</i> value
<b>Language</b>	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
<b>Social-interaction</b>	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
<b>Custom</b>	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
<b>Psychological integration</b>	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
<b>Gender</b>				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
<b>Place of origin</b>				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
<b>Age</b>				
11~12 (ref)				
13	0.01 (-0.49,0.56)	0.893	0.03 (-0.72,1.18)	0.630
14	-0.09 (-0.93,0.12)	0.132	-0.05 (-1.31,0.58)	0.446
15~17	-0.07 (-0.95,0.19)	0.194	-0.05 (-1.57,0.50)	0.309
<b>Length of stay in Guangzhou</b>				
<5 years (ref)				
5 to 10 years	-0.05 (-0.58,0.14)	0.235	-0.01 (-0.77,0.53)	0.711
>10 years	-0.01 (-0.40,0.28)	0.737	-0.06 (-1.08,0.14)	0.130

Note:  $\beta$  = standardized regression coefficient; 95%CI=95% Confidence interval.



25 Figure 1. Schematic conceptual model

26 116x64mm (300 x 300 DPI)

27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

review only

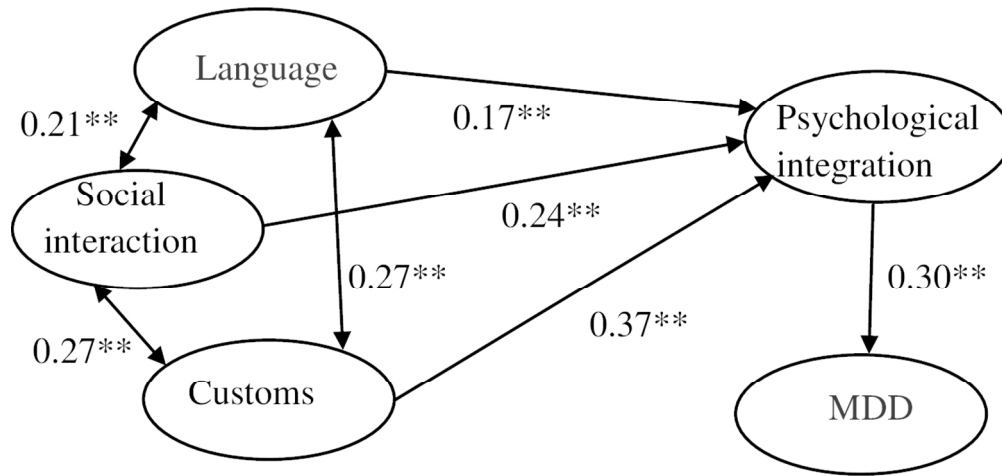


Figure 2. Structural equation modelling of social integration and MDD. Standardized path coefficients are reported, and only significant paths are depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, Chi-square/df=2.1. \*\*:  $p < 0.001$

116x54mm (300 x 300 DPI)

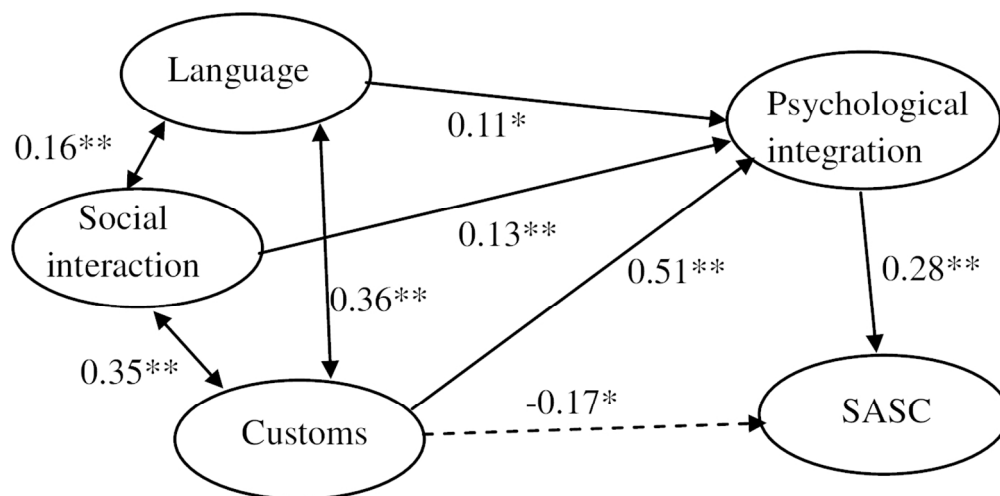


Figure 3 Structural equation modelling of social integration and SASC. Standardized path coefficients are reported, and only significant paths are depicted in the figure. Dotted line represent negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, Chi-square/df=2.2. \*:  $p < 0.01$  \*\*:  $p < 0.001$

117x57mm (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 #
<b>Title and abstract</b>	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	page # 1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	page # 2-3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	page # 5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	page # 7
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	page # 8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	page # 8
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	page # 8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	page #9-11
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	page #9-11
Bias	9	Describe any efforts to address potential sources of bias	page #9
Study size	10	Explain how the study size was arrived at	page #8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	page #9-11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	page #11
		(b) Describe any methods used to examine subgroups and interactions	page #11
		(c) Explain how missing data were addressed	page #9
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	page #12
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest	page #12-13 page #12
Outcome data	15*	Report numbers of outcome events or summary measures	page #12
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	page #13
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #14
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	page #15
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	page #18-19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	page #15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	page #18
<b>Other information</b>			
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	page #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](http://www.strobe-statement.org).

# BMJ Open

## Impact of acculturation and psychological adjustment on mental health among migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-022712.R1
Article Type:	Research
Date Submitted by the Author:	27-Sep-2018
Complete List of Authors:	Shi, Lishuo; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Chen, Wen; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Bouey, Jennifer; Georgetown University - School of Nursing and Health Studies, Department of International Health Lin, Yanwei; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Ling, Li; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	MENTAL HEALTH, Internal migrant, Adolescents, Acculturation

SCHOLARONE™  
Manuscripts

1  
2  
3  
4 **Impact of acculturation and psychological adjustment on mental health among**  
5  
6 **migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study**  
7  
8  
9

10 Lishuo Shi<sup>1,2#</sup>, Wen Chen<sup>1,2#</sup>, Jennifer Bouey<sup>3</sup>, Yanwei Lin<sup>1,2</sup>, Li Ling<sup>1,2\*</sup>  
11  
12

13 <sup>1</sup> Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun  
14 Yat-sen University, Guangzhou, Guangdong, China  
15  
16

17 <sup>2</sup> Sun Yat-sen Center for Migrant Health Policy, Sun Yat-sen University, Guangzhou,  
18 Guangdong, China  
19  
20

21 <sup>3</sup> Department of International Health, School of Nursing and Health Studies,  
22 Georgetown University, Washington DC, United States of America  
23  
24  
25  
26  
27  
28  
29

30 #Lishuo Shi and Wen Chen have equally contributed to the work and are co-first  
31 authors.  
32  
33  
34  
35  
36  
37

38 \*Corresponding author: Li Ling  
39

40 74, Zhongshan Road 2, Faculty of Medical Statistics and Epidemiology, School of  
41 Public Health, Sun Yat-sen University, Guangzhou, China.  
42  
43

44 E-mail: lingli@mail.sysu.edu.cn  
45  
46

47 Tel/Fax: 86-20-87333319.  
48  
49

50 **Word count:** 3844 word  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## Abstract

**Objectives:** The aim of this study was to examine the pathway and associations between acculturation (i.e., language, social interaction, and lifestyle), psychological adjustment and mental health of internal migrant adolescents in China.

**Design:** Cross-sectional questionnaire study.

**Setting:** Six private migrant junior high schools located in Tianhe and Baiyun Districts in Guangzhou were chosen to be the study sites.

**Participants:** Totally 1,122 migrant adolescents aged 11-17 years old completed the study.

**Main outcome measures:** Mental health was measured by Social Anxiety Scale for Children (SASC) and Major Depression (MDD) in a Brief Child and Family Phone Interview. Acculturation and psychological adjustment were measured by a self-designed and verified questionnaire. Multiple regression models and structural equation models (SEM) were performed to analyze the association between acculturation, psychological adjustment and mental health while controlling for participant demographic characteristics.

**Results:** The average MDD scores for boys were 8.78 (SD=2.17) and girls were 8.56 (SD=2.22), while the average SASC scores for boys were 14.67 (SD=3.72) and girls were 13.41 (SD=4.01). Psychological adjustment had direct positive effect on MDD ( $p<0.001$ ,  $\beta=0.30$ ) and SASC ( $p<0.001$ ,  $\beta=0.28$ ), and it was the key variable fully mediating the impact of acculturation components on MDD and partly mediating the

1  
2  
3 impact on SASC, whereas the lifestyle showed a direct negative effect ( $p=0.003$ ,  
4  $\beta=-0.17$ ) on SASC. Of the three acculturation components, lifestyle had the strongest  
5  
6 influence on psychological adjustment ( $p<0.001$ ,  $\beta=0.37$  and  $0.51$ ), followed by social  
7  
8 interaction ( $p<0.001$ ,  $\beta=0.24$  and  $0.13$ ) and language ( $p<0.001$ ,  $\beta=0.17$  and  $0.11$ ).  
9  
10  
11

12  
13 **Conclusions:** The association between acculturation and mental health of internal  
14  
15 migrant adolescents was complex and could be mediated by psychological adjustment.  
16  
17 Interventions such as promoting local language and social interaction should be  
18  
19 needed to enhance psychological adjustment and furthermore improve the mental  
20  
21 health of migrant adolescents.  
22  
23  
24

25 **Key words:** Acculturation; Mental health; Internal migrant; Adolescents.  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Article Summary

### Strengths and limitations of this study:

• This is the first known study to investigate the applicability of acculturation theory in understanding the mental health problems among migrant adolescents in China.

Our findings provided new ways to improve the mental health of migrant adolescents in China.

• The underlying mechanism of the effects of acculturation on mental health of migrant adolescents were not comprehensively analysed in previous studies, and we used structural equation modelling to clearly quantify the integrated effect of various acculturation dimensions on mental health, which will provide evidence for improving psychological intervention strategy of migrant adolescents.

• The reliability and validity of the scale for measuring the acculturation of migrant adolescents needs to be further improved.

• This cross-sectional study is unable to make causal inferences between acculturation and mental health because it did not control for all possible confounding variables.

## Introduction

The United Nations reported a 49% increase in international migration between 2000 and 2017, resulting in an estimated 258 million international migrants.<sup>1</sup> Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.<sup>2</sup> According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.<sup>3</sup> As a result, there were 35.81 million internal migrant adolescents under 17 years old in China in 2010, up by 41.37% since 2005,<sup>4</sup> and they accounted for 12.8% of overall adolescents' population in China.<sup>5</sup>

Concerns for the welfare of these internal migrant adolescents were exacerbated in China by its household registration (hukou in Chinese) system that would traditionally block migrant adolescents who do not have a city registration from getting an education in urban public schools.<sup>6-8</sup> In addition, similar to international migrant adolescents worldwide, internal migrant adolescents also had to adjust to the significant differences in dialects, culture, economic development, and social environment across different regions of China.<sup>9</sup> Poor educational investment and the acculturation pressure could have a negative influence on migrant adolescents' overall well beings, especially putting stress to their mental health.<sup>10, 11</sup>

Findings from global studies mental health of migrant and non-migrant adolescents

1  
2  
3 have been contradictory.<sup>12</sup> Some studies have found that migrant adolescents have  
4 better mental health outcomes than adolescents in the host community.<sup>13, 14</sup> In contrast  
5  
6 others have shown that migrant adolescents had poorer mental health outcomes than  
7  
8 their non-migrants counterparts.<sup>15, 16</sup> These contradictory results could be a result of  
9  
10 the difference of migrant characteristics and methods of measurement in these  
11  
12 studies.<sup>12</sup> However, a literature review indicated that the mental health of internal  
13  
14 migrant adolescents in China was inferior compared with local adolescents in  
15  
16 majority studies, due to the influence of hukou system.<sup>17</sup> Particularly a study in  
17  
18 Guangzhou showed that the detection rate of depression symptoms in migrant  
19  
20 adolescents was 21.8%, far higher than local adolescents (11.2%),<sup>18</sup> also higher than  
21  
22 local adolescents in other countries.<sup>19</sup> Mental problem in childhood and adolescence  
23  
24 was associated with many negative outcomes, including impaired social, work, and  
25  
26 family functioning in adolescence and into adulthood.<sup>20</sup> Therefore, a better  
27  
28 understanding of the risk factors for mental health among this vulnerable population  
29  
30 was significant to public health of the internal migrant adolescents in China.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

43 Studies showed that among many factors that affect adolescents' mental health,  
44  
45 acculturation was uniquely relevant to migrant adolescents.<sup>21</sup> The acculturation has  
46  
47 been conceived as a dynamic process involving multiple aspects in which individuals  
48  
49 gradually adjust to a new environment.<sup>22</sup> In this process, migrants had to face  
50  
51 psychological distress brought by the major life changes that might leads to  
52  
53 deterioration in mental health.<sup>23</sup> Many studies had found acculturation associated with  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 mental health in various types of immigrants,<sup>24,25</sup> but there were no obvious or  
4  
5  
6 consistent pattern of findings that could be identified.<sup>26</sup> While acculturation appeared  
7  
8  
9 inversely related to morbidity in some populations,<sup>27, 28</sup> psychiatric disorders  
10  
11 increased with acculturation in others.<sup>29, 30</sup>  
12  
13  
14  
15

16 Due to the uncertain nature of these findings, seldom of them have been brought to  
17  
18 bear on prevention or intervention-oriented programs in mental health-related areas.<sup>31</sup>  
19  
20 These contradictory findings might result from disparities between measurement  
21  
22 instruments because there was no generally accepted acculturation model, and these  
23  
24 studies adopt different dimensions to measure acculturation.<sup>26</sup> On the other hand,  
25  
26  
27 many studies have combined acculturation into a composite score to explore its  
28  
29 relationship with health,<sup>27,32,33</sup> which might blurred the potentially variable effects of  
30  
31 different acculturation dimensions on mental health.<sup>34</sup> In addition to these defects, the  
32  
33 mechanism of acculturation affecting mental health of migrant adolescents had not  
34  
35 been well investigated. Previous studies had shown that psychological adjustment was  
36  
37 one of main outcomes of acculturation,<sup>35-36</sup> while psychological adjustment reflected  
38  
39 migrants' cognitive, emotional, perceptual to respond in new life circumstances.<sup>37,38</sup>  
40  
41  
42 Meanwhile, psychological adjustment was proven closely related to mental health.<sup>39</sup>  
43  
44  
45 So, psychological adjustment might play an important role in the relationship between  
46  
47 acculturation and mental health. Finally, the majority of studies examining the  
48  
49 association between acculturation and mental health in ethno cultural groups were  
50  
51 conducted with Latino and Asian samples,<sup>40</sup> but few researchs had focus on internal  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Chinese migrants, especially on adolescents. Thus, we hypothesized that acculturation  
4  
5 of adolescents could affect their mental health directly and indirectly via  
6  
7 psychological adjustment.  
8  
9

10  
11  
12  
13 Therefore, the primary aim of this study is to confirm this hypothesis using a  
14  
15 structure model analysis with data from a cross-sectional study in Guangzhou, China.  
16  
17 Specifically, we aimed to: (1) to assess the status of mental health and acculturation of  
18  
19 migrant adolescents; and (2) to test the aforementioned hypothesized structural  
20  
21 relationship between acculturation, psychological adjustment and mental health of  
22  
23 migrant adolescents, and explore the impact of each acculturation dimension on  
24  
25 mental health.  
26  
27  
28  
29  
30  
31  
32

## 33 **Methods**

### 34 *Study sites*

35  
36  
37 This cross-sectional survey study was conducted in Tianhe and Baiyun districts in  
38  
39 Guangzhou, China from April to May in 2016. Guangzhou is the capital city of  
40  
41 Guangdong Province with a population of 12.7 million, and has led the economic  
42  
43 reform and openness in China since the 1980s, Guangzhou has also become a major  
44  
45 receiving city with 0.6 million internal migrant adolescents.<sup>4, 5</sup>  
46  
47  
48  
49  
50  
51

52  
53 As the capital city of Guangdong province, Guangzhou has its distinguished  
54  
55 Cantonese culture, language and customs. The primary dialect spoken in Guangzhou,  
56  
57

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Cantonese, is unique to Guangdong province and its adjacent areas including Hong Kong and Macau. This unique language environment adds significant barriers for migrant adolescents' adaptation to the social and cultural environment of Guangzhou compared to other regions of China. Tianhe and Baiyun Districts were chosen to be the study sites due to its large migrant populations. Since 95% of migrant adolescents in Guangdong province are studying in schools,<sup>41</sup> therefore, using purposive sampling method, we chose three private junior high schools with large numbers of migrant students in each district, respectively.

#### *Study participants and sampling*

All migrant students in the grade 7-8 from these six schools participated in the study. All eligible students finished a self-administered questionnaire. The study inclusion criteria were: 1) students in the chosen grade of the school did not have hukou in Guangzhou, 2) at least one of the students' parent did not have hukou in Guangzhou, 3) students were under 18 years old.

The survey took 20–30 minutes for each student to finish. Meanwhile, in order to ensure the independence and anonymity of the survey, the research assistants were required to wait for completion of the questionnaires outside the classroom. After collecting the questionnaire, research assistants would check it carefully, and contact the adolescent immediately if they found an important answer in the questionnaire missing. Research assistants received standardized training by the research team, and



1  
2  
3 the quality control was implemented during data collection.  
4  
5  
6  
7

8 The survey protocol was approved by Institutional Review Board at Sun Yat-sen  
9 University, China (reference [2015] No.42). Each adolescent was asked to bring  
10 informed consent to parents or guardians and let them sign on it before filling out the  
11 questionnaire.  
12  
13  
14  
15  
16  
17

### 18 19 20 *Patient and public involvement* 21

22 No patients were involved in this study. Study participants were offered feedback of  
23 the study results and will be informed of this publication.  
24  
25  
26  
27

### 28 29 30 *Measurement* 31

#### 32 *Dependent variables: mental health* 33

34 Indicators of mental health included anxiety and depression indices. Anxiety was  
35 measured by Social Anxiety Scale for Children (SASC), and depression was measured  
36 by the dimension of Major Depression (MDD) of a Brief Child and Family Phone  
37 Interview. The SASC was developed to measure social anxiety among American  
38 adolescents between 7~16 years of age, and it included 10 items yielding two  
39 dimensions, including fear of negative evaluation and social avoidance and distress.  
40 The response to each item scored on a 3-point scale (0=always, 1=sometimes,  
41 2=never), with total scores ranging from 0 to 20, and higher scores indicated less  
42 anxiety.<sup>42</sup> The MDD was developed to measure major depression among Ontario  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 adolescents between 6~18 years of age, and it consisted of 6 items scored on a 3-point  
4 scale (0=always, 1=sometimes, 2=never), with total score ranging from 0 to 12.  
5  
6 Higher scores indicated less depression.<sup>43</sup> The Cronbach's alpha of SASC applied on  
7  
8 normal Chinese adolescents was 0.79,<sup>44</sup> and the Cronbach's alpha of MDD applied on  
9  
10 Ontario adolescents was 0.86.<sup>43</sup>  
11  
12  
13  
14  
15  
16  
17

18 *Independent variables: Acculturation and psychological adjustment*  
19

20 Gordon described acculturation, or cultural and behavioral assimilation, as a phase of  
21 assimilation, which was the foundation of unidimensional acculturation theory.<sup>45</sup> In  
22 this theory, individuals were placed on a continuum of identities ranging from  
23 exclusively heritage culture to exclusively mainstream culture. More recently, Berry  
24 put forward the bidimensional acculturation theory,<sup>46</sup> which suggested that both  
25 heritage and mainstream cultural identities were free to vary independently, and  
26 acculturation strategies could be divided into four categories: separation, integration,  
27 assimilation, and marginalization. Despite there were some evidences in favor of  
28 bidimensional acculturation,<sup>47</sup> the majority of self-report acculturation scales reflect a  
29 unidimensional framework in public health studies.<sup>48</sup> Majority of these studies  
30 showed a linear relationship between acculturation and psychological distress was  
31 better demonstrated by the unidimensional model,<sup>31</sup> while only a few studies show a  
32 curvilinear relationship which was better demonstrated by the bidimensional model.<sup>26</sup>  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 understand in data collection process.<sup>47</sup> So, the unidimensional acculturation theory  
4  
5 was adopted in this study. Based on comprehensive literature review,<sup>49-50</sup> the research  
6  
7 team designed the measurement of acculturation, which consisted of 11 items  
8  
9 with a total score ranging from 11 to 45 (See Table 1). Higher scores indicate  
10  
11 individual's higher acceptance to the host culture. Acculturation was measured by 3  
12  
13 latent variables: social interaction (two items), lifestyle (five items) and language  
14  
15 (four items). Lifestyle consists of questions about preferences for food (two items),  
16  
17 clothing (two items) and social custom (one item). Each item had 3 to 5 choices.  
18  
19 Some questions were rated on a scale ranging from 1 ("No") to 3 ("Yes"), some  
20  
21 questions were rated on a scale ranging from 1 ("Completely not/Never") to 4  
22  
23 ("Completely/Usually"), and some questions were rated on a scale ranging from 1  
24  
25 ("Never") to 5 ("Always").  
26  
27  
28  
29  
30  
31  
32  
33  
34

35 Psychological adjustment focuses on the emotional reactions during cross-cultural  
36  
37 transitions,<sup>51</sup> it was measured by four questions that asked about "sense of  
38  
39 belonging"<sup>52</sup> and "satisfaction of urban life"<sup>53</sup> in this study. Sense of belonging was  
40  
41 assessed by one question with a scale ranging from 1 ("outsiders") to 4 ("Guangzhou  
42  
43 people"). Satisfaction of urban life was assessed by three questions with a scale  
44  
45 ranging from 1 ("Very not") to 5 ("Very sure").  
46  
47  
48  
49  
50  
51

#### 52 *Demographic and other covariates*

53

54 To better understand the association between acculturation and mental health, we also  
55  
56  
57

1  
2  
3 included demographics which were reported to be associated with mental health in  
4  
5 children and adolescents. These adjustment variables included age (in years), gender  
6  
7 (male or female), place of origin (Guangdong province or other provinces in China)  
8  
9 and length of stay in Guangzhou (in years).<sup>19, 54</sup>  
10  
11  
12  
13  
14

#### 15 *Data processing and statistical analysis*

16  
17 Statistical analyses were performed using the software IBM SPSS 20.0 and IBM  
18  
19 Amos 24.0. Descriptive statistics including the mean, standard deviation (SD),  
20  
21 frequency and proportion were used to summarise the demographics, acculturation,  
22  
23 psychological adjustment and mental health of the study participants. Differences in  
24  
25 mental health by demographic variables were assessed using t-test or F-test.  
26  
27  
28 Multivariate regression models were conducted to assess the association between  
29  
30 latent variables of acculturation and mental health. The latent variables of  
31  
32 acculturation were independent variables, and the scores of SASC and MDD were  
33  
34 dependent variables. Demographic variables were used as confounding factors. SEM  
35  
36 were used to assess the proposed structural relationship among the acculturation  
37  
38 dimensions, psychological adjustment and mental health. Data-model fitting in the  
39  
40 structural equation modelling analysis was assessed using the following four indices:  
41  
42 Goodness of Fit Index (GFI) (>0.9), Comparative Fit Index (CFI) (>0.9), Root Mean  
43  
44 Square Error of Approximation (RMSEA) (< 0.05) and the chi-square associated with  
45  
46 each degree of freedom (CMIN/df) (<3). Cronbach alpha were computed to assess the  
47  
48 reliability of the latent variables. The construct validity of the acculturation  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 measurement was evaluated by the model fitting indices of confirmatory factor  
4 analysis (CFA) and the composite reliability of each latent variable.  
5  
6  
7  
8  
9

## 10 **Results**

11  
12 A total of 1,233 completed surveys, the response rate was 92.1%, 83 were excluded  
13 because of the contradiction of the information provided, 28 were excluded because  
14 of incomplete data for several key variables (e.g. questions about acculturation and  
15 mental health), yielding 1,122 participants (91.0%) for analyses. Table 2 demonstrated  
16 that among the 1,122 participants, there were more boys (55%) than girls (45%), and  
17 most of them (93%) aged in 13-16 years old, nearly half of them (47%) came from  
18 other provinces, and many of them (78%) had lived in Guangzhou more than 5 years.  
19 There were significant differences between boys' scores ( $14.67 \pm 3.72$ ) and girls' scores  
20 ( $13.41 \pm 4.01$ ) in anxiety scale ( $P < 0.001$ ). The boys' MDD mean score was  $8.78 \pm 2.17$ ,  
21 and the girls' MDD mean score was  $8.56 \pm 2.22$ . The mean scores of SASC and MDD  
22 for participants were significantly different by age ( $P < 0.05$ ;  $P < 0.01$ ). Students who  
23 were younger had better mental health compared with older ones.  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44

45 Table 1 showed that in psychological adjustment, only 7% of the surveyed  
46 adolescents considered themselves to be Guangzhou people, but the ones who loved  
47 and were willing to live in Guangzhou accounted for more than 60% of these  
48 adolescents. In lifestyle dimension, 98% of adolescents had acceptance of urban  
49 clothing, and many of the adolescents preferred the lifestyle in their hometown in  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 traditional customs and diet. In social interaction dimension, many of migrant  
4 adolescents (48%) failed to interact with local adolescents. In language dimension, 54%  
5 of the adolescents could understand local language (item score  $\geq 2$ ), but only 24% of  
6 the adolescents could speak local language (item score  $\geq 2$ ). The mean scores of these  
7 questions were computed for modelling analysis.  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17

18 Table 3 showed multiple regression analysis indicated a positive relationship  
19 between the total MDD score, total SASC score and psychological adjustment after  
20 controlling for age, gender, place of origin and residence time ( $P < 0.001$ ), while the  
21 total SASC score had a negative relationship with lifestyle ( $P = 0.03$ ). The language  
22 and social interaction had no significant correlation with total MDD score and total  
23 SASC score ( $P > 0.05$ ).  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34

35 Structural equation model was used to explore the internal relations of the latent  
36 variables of acculturation, psychological adjustment and their impact on mental health.  
37 Figure 1 showed that psychological adjustment had direct effect on MDD ( $\beta = 0.30$ )  
38 and it was the key variable fully mediating the impact of acculturation components on  
39 MDD. Of the three acculturation components, lifestyle had the strongest influence on  
40 psychological adjustment ( $\beta = 0.37$ ), followed by social interaction ( $\beta = 0.24$ ) and  
41 language ( $\beta = 0.17$ ). The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03,  
42 CMIN/df=2.1. Figure 2 also showed psychological adjustment had direct effect on  
43 SASC ( $\beta = 0.28$ ) and it fully mediated the impact of two acculturation components (i.e.  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 language and social interaction) on SASC, whereas the lifestyle showed both a direct  
4 negative effect ( $\beta=-0.17$ ) and an indirect positive effect via psychological adjustment  
5 on SASC. Of the three acculturation components, lifestyle had the strongest influence  
6 on SASC. Of the three acculturation components, lifestyle had the strongest influence  
7 on psychological adjustment ( $\beta=0.51$ ), followed by social interaction ( $\beta=0.13$ ) and  
8 language ( $\beta=0.11$ ). The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03,  
9 CMIN/df=2.2. In total, psychological adjustment had the greatest impact on both  
10 MDD and SASC. Higher level of language and social interaction indicated less  
11 anxiety and depression, while lifestyle towards mainstream society indicate more  
12 anxiety and less depression. The influence coefficients of each latent variable on  
13 mental health were showed in Table 4.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29

30 We evaluated the measurements to confirm their reliability and validity. In our  
31 study, SASC demonstrated the Cronbach's alpha coefficient of 0.82, and MDD  
32 demonstrated the Cronbach's alpha coefficient of 0.78. Even the measure of  
33 acculturation and psychological adjustment were self-developed, most correlation  
34 coefficient of each question's score and the total score of the dimension exceeded 0.5,  
35 and the Cronbach  $\alpha$  of each latent variable exceeded 0.5 while the Cronbach  $\alpha$  of the  
36 overall scale exceeded 0.7 (See Table 1); This indicated that the questionnaire had  
37 acceptable reliability. In Figure 1, the composite reliability of latent variables were:  
38 0.8082(language), 0.5616(social interaction), 0.5952 (lifestyle), 0.8233(psychological  
39 adjustment). In Figure 2, the composite reliability of latent variables were:  
40 0.8028(language), 0.5935(social interaction) , 0.5176(lifestyle) ,  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

0.8134(psychological adjustment). These indices all exceed 0.5. On the other hand, the result of the CFA of the acculturation measurement showed good data-model fit indices:  $P=0.129>0.05$ ,  $CMIN/df=1.26$ ,  $GFI=0.992$ ,  $CFI=0.996$ ,  $RMSEA=0.015$ . See Figure 3. This indicated the measurement of acculturation had acceptable construct validity.<sup>55</sup>

## Discussion

### *Result discussion*

This is the first known study to investigate the applicability of acculturation theory in understanding the mental health problems among the internal migrant adolescents in China. We found the language and social interaction were positively correlated with mental health, while lifestyle showed mixed correlations with mental health. The underlying pathway of this relationship was explored. Three latent variables of acculturation indirectly affect mental health through psychological adjustment, of which lifestyle have the greatest impact on psychological adjustment, followed by social interaction and language.

A total of 1122 valid samples were included in the analysis. The sample size met the requirement for multivariable analysis which should be ten times more than the number of variables.<sup>56</sup> Anxiety and depressive symptoms among migrant adolescents between 11-17 years of age were found relatively serious in this study. The mean MDD scores of boys and girls were 8.78 and 8.56 respectively, very close to a mean



1  
2  
3 score of 8.11 of adolescents referred to mental health outpatient services in Ontario.<sup>57</sup>  
4  
5  
6 The average SASC scores of migrant adolescents were significantly lower than the  
7  
8 Chinese normal adolescents aged 13-16 years old (boys: 14.67 vs 16.34; girls: 13.41  
9  
10 vs 15.59).<sup>44</sup> In addition, migrant girls experienced more anxiety symptoms than boys,  
11  
12 and older adolescents experienced more anxiety and depressive symptoms than  
13  
14 younger peers. These results are consistent with the previous literature.<sup>19</sup> All these  
15  
16 findings emphasized the urgent need for improvement in migrant adolescents' mental  
17  
18 health, especially among older girls. The average score of acculturation of migrant  
19  
20 adolescents was in the middle. It showed that the level of acculturation of migrant  
21  
22 adolescents had much room for improvement.  
23  
24  
25  
26  
27  
28  
29

30 The findings from the multiple regression analysis and structural equation model  
31  
32 largely supported our hypothesis as when the important role of psychological  
33  
34 adjustment on acculturation manifested in the model. Psychological adjustment  
35  
36 directly and positively affect the level of mental health ( $\beta=0.30$  and  $0.28$ ), and it was  
37  
38 considered as the higher level integration and also be the outcome of the  
39  
40 acculturation.<sup>36</sup> Therefore, this view was verified among Chinese migrant adolescents  
41  
42 in our study.  
43  
44  
45  
46  
47  
48  
49

50 The indirect relations between acculturation components (i.e language, social  
51  
52 interaction and lifestyle) and mental health via psychological adjustment were also  
53  
54 significant. Although language was found as an important factor in acculturation  
55  
56  
57  
58  
59  
60

1  
2  
3 among international immigrants<sup>58</sup> and international students<sup>59</sup>, it had the least  
4  
5 influence on psychological adjustment in this study. This difference is mainly because  
6  
7 Mandarin is widely used at schools, which diminished the language barrier. Compared  
8  
9 to the language, social interaction had a larger influence on psychological adjustment  
10  
11 ( $\beta=0.24$  and  $0.13$ ). Previous research showed similar conclusion that fewer mental  
12  
13 health problems were found among adolescents making friends from their own and  
14  
15 other cultures.<sup>60</sup> Unfortunately, the cross-cultural friendships of immigrant  
16  
17 adolescents were less reciprocal than same culture friendships.<sup>61</sup> The same situation  
18  
19 also occurred in our study, 48% of migrant adolescents had no friends among the local  
20  
21 adolescents, and only 11% of migrant adolescents hoped to make friends with local  
22  
23 adolescents. Hence, further understanding the persistence of traditional social  
24  
25 groups and identities is crucial for the development of psychological adjustment that  
26  
27 will ensure mental health. Different from the other two, the lifestyle had the largest  
28  
29 influence on psychological adjustment ( $\beta=0.37$  and  $0.51$ ), and it also directly  
30  
31 aggravated the symptoms of anxiety ( $\beta= -0.17$ ). On the one hand, people who  
32  
33 changed the lifestyle to the mainstream culture may aggravate the stress related to  
34  
35 facing new dress, diets and social custom<sup>60</sup>, and have a negative impact on mental  
36  
37 health. While on the other hand, adjusted oneself to the mainstream lifestyle will  
38  
39 promote cultural communication with the local adolescents,<sup>62</sup> thereby improving  
40  
41 psychological adjustment. Therefore, the result showed that lifestyle had both positive  
42  
43 and negative effects on mental health. This phenomenon was also found in other  
44  
45 studie.<sup>63</sup> These results suggested that despite the impact of lifestyle on mental health  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 is somewhat uncertain, to improve language skills and communicate with local  
4  
5 adolescents can effectively improve mental health of internal migrant adolescents in  
6  
7 Guangzhou. This also explained to some extent why previous studies on acculturation  
8  
9 and mental health had not reached a consistent conclusion.<sup>26</sup> Because the dimensions  
10  
11 used to measure acculturation were not completely consistent in different studies,<sup>48</sup>  
12  
13 and the impacts of different dimensions on mental health may be much different or  
14  
15 even completely opposite. Therefore, the further researches should adopt a unified  
16  
17 acculturation measurement, and explore the relationship between single dimension of  
18  
19 acculturation and mental health.  
20  
21  
22  
23  
24  
25  
26  
27

#### 28 *Methodological discussion*

29  
30 In this study, SEM was carried out on the basis of multiple regression analysis. The  
31  
32 multiple regression had only one dependent variable, while the structural equation  
33  
34 model can make one variable both as independent variable and dependent variable,  
35  
36 thus we find the mediating effect of psychological adjustment on the relationship  
37  
38 between acculturation and mental health. In addition, the SEM could directly show us  
39  
40 the impact of different dimensions of acculturation on mental health, so that we can  
41  
42 find the most influential dimensions and to propose corresponding interventions.  
43  
44  
45  
46  
47  
48  
49

#### 50 *Policy recommendations*

51  
52 Due to the results of our study, we suggest that the impact of acculturation on mental  
53  
54 health should be paid attention to when psychological interventions were taken on  
55  
56  
57  
58  
59  
60

1  
2  
3 migrant adolescents with different cultural backgrounds. Such as the schools with  
4  
5 migrant students to scale up the efforts in preventing mental health problems among  
6  
7 migrant adolescents by adding contents of local language and regional culture on  
8  
9 mental health education programs. Activities, including extracurricular programs with  
10  
11 local adolescents that can enhance social interaction also should be encouraged at the  
12  
13 schools.  
14  
15  
16  
17  
18  
19

20 Our study also has some limitations. First of all, although a self-designed  
21  
22 multidimensional scale measured acculturation with the acceptable overall Cronbach's  
23  
24 alpha of 0.70, two dimensions were having Cronbach's alpha of 0.52 and 0.55. The  
25  
26 factor loadings of some items were also relatively low. It indicated the reliability of  
27  
28 measurement was reluctantly accepted but need to be further improved. Future  
29  
30 research may improve the reliability of the developed acculturation scale by  
31  
32 modifying some items. Second, the MDD had not been used in Chinese adolescents  
33  
34 before, so the validity of this scale may be affected, and we can not get the results of  
35  
36 the scale applied to Chinese normal adolescents. Third, some confounding factors  
37  
38 which might influence the mental health of adolescents were not included in this study,  
39  
40 such as the parental mental health. Fourth, data used for this study was collected  
41  
42 through a cross-sectional survey. A longitudinal study may be necessary to verify the  
43  
44 observed relationship between acculturation and mental health.  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54

## 55 **Conclusion**

56  
57  
58  
59  
60

1  
2  
3 Findings suggest there is a strong connection between acculturation, psychological  
4 adjustment and mental health. Psychological adjustment plays an important mediating  
5 role between acculturation and mental health. Higher level of language and social  
6 interaction indicate less anxiety and depression, while higher level of lifestyle indicate  
7 more anxiety and less depression. We should pay attention to the impact of  
8 acculturation on mental health when psychological interventions were taken on  
9 migrant adolescents with different cultural backgrounds.  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

### 23 **Figure legends:**

24  
25 **Figure 1.** Structural equation modelling of acculturation, psychological adjustment  
26 and MDD. *Note:* Standardized path coefficients are reported, and only significant  
27 paths are depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96,  
28 RMSEA=0.03, CMIN/df=2.1. \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring  
29 respondents' language; SI1-SI2, the two items measuring respondents' social  
30 interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the  
31 four items measuring respondents' psychological adjustment; MDD1-MDD6, the six  
32 items measuring respondents' Major Depression.  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44

45 **Figure 2.** Structural equation modelling of acculturation, psychological adjustment  
46 and SASC. *Note:* Standardized path coefficients are reported, and only significant  
47 paths are depicted in the figure. Dotted line represent negative relationship. The  
48 data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, CMIN/df=2.2. \*:  $p < 0.05$   
49 \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 two items measuring respondents' social interaction; LI1-LI5, the five items  
4  
5 measuring respondents' lifestyle; PA1-PA4, the four items measuring respondents'  
6  
7 psychological adjustment; FEN, fear of negative evaluation; SAD, social avoidance  
8  
9 and distress.  
10  
11

12  
13 **Figure 3.** The confirmatory factor analysis model of acculturation. *Note:* Standardized  
14  
15 path coefficients are reported. The data-model fit indices:  $P=0.129>0.05$ ,  
16  
17 CMIN/df=1.26, GFI=0.992, CFI=0.996, RMSEA=0.015. \*\*:  $p<0.001$ . LA1-LA4, the  
18  
19 four items measuring respondents' language; SI1-SI2, the two items measuring  
20  
21 respondents' social interaction; LI1-LI5, the five items measuring respondents'  
22  
23 lifestyle.  
24  
25  
26  
27  
28  
29

### 30 **Acknowledgements**

31  
32 The survey was supported by Sun Yat-sen Center for Migrant Health Policy and the  
33  
34 six investigated schools. We thank all participants and investigators for this study. We  
35  
36 are also grateful to all giving valuable comments on this paper.  
37  
38  
39

### 40 **Contributors**

41  
42 LS took part in data analysis and wrote the manuscript. WC and JB contributed to the  
43  
44 revisions of the manuscript. YL participated in study design and data collection. LL  
45  
46 contributed to design the project and the supervision on project conducting. All  
47  
48 authors read and approved the final manuscript.  
49  
50  
51

### 52 **Funding**

53  
54 This work was supported by China Medical Board grant number [12-111].  
55  
56  
57

**Competing interests**

None declared.

**Participant consent**

Obtained.

**Ethics approval**

This study was approved by the Institutional Review Board (IRB) of the School of Public Health, Sun Yat-sen University in China ([2015] No.42).

**Provenance and peer review**

Not commissioned; externally peer reviewed.

**Data sharing statement**

No additional data are available.

**References:**

1. Department of Economic and Social Affairs United Nations. International Migration Report 2017 Highlights[J]. 2017.
2. Lin Y, Zhang Q, Chen W, et al. Association between Social Integration and Health among Internal Migrants in ZhongShan, China. PLOS ONE 2016;11(2):e148397.
3. Chengrong D, Ge Y. Study on the Latest Situation of Floating Children in China. Population Journal 2008(06):23-31.
4. Office for the Sixth Population Census of China. Major figures on 2010 population census of China: China Statistics Press, 2011.
5. All China Women's Federation. National Report on Children left in rural areas

1  
2  
3 and migrant children. *Chinese Women's Movement* 2013(6):30-34.

4  
5  
6 6. Fu Q, Ren Q. Educational inequality under China's rural - urban divide: The  
7  
8 hukou system and return to education. *Environment & Planning A*  
9  
10 2010;42(3):592-610.

11  
12  
13 7. Goodburn C. Learning from migrant education: A case study of the schooling of  
14  
15 rural migrant children in Beijing. *International Journal of Educational Development*  
16  
17 2009;29(5):495-504.

18  
19  
20 8. Chen Y, Feng S. Access to public schools and the education of migrant children in  
21  
22 China ☆. *China Economic Review* 2013;26(1):75-88.

23  
24  
25 9. Gui Y, Berry JW, Zheng Y. Migrant worker acculturation in China ☆.  
26  
27 *International Journal of Intercultural Relations* 2012;36(4):598-610.

28  
29  
30 10. Yang L, Chen X, Li S, et al. Path Analysis of Acculturative Stress Components  
31  
32 and Their Relationship with Depression Among International Students in China.  
33  
34 *Stress & Health Journal of the International Society for the Investigation of Stress*  
35  
36 2016;160(4):1957-1964.

37  
38  
39 11. Gao Q, Li H, Zou H, et al. The mental health of children of migrant workers in  
40  
41 Beijing: the protective role of public school attendance. *Scandinavian Journal of*  
42  
43 *Psychology* 2015;56(4):384.

44  
45  
46 12. Stevens G W, Vollebergh W A. Mental health in migrant children[J]. *Journal of*  
47  
48 *Child Psychology & Psychiatry*, 2010, 49(3):276-294.

49  
50  
51 13. Mood C, Jonsson JO, Låftman SB. Immigrant Integration and Youth Mental  
52  
53 Health in Four European Countries. *European Sociological Review* 2016;32(6):w27.  
54  
55  
56



- 1  
2  
3  
4 14. Goodman A, Patel V, Leon DA. Child mental health differences amongst ethnic  
5  
6 groups in Britain: a systematic review. BMC PUBLIC HEALTH 2008;8(1):1-11.  
7  
8  
9 15. Brettschneider AK, Hölling H, Schlack R, et al. [Mental health in adolescents in  
10  
11 Germany: A comparison with regard to migration background and country of origin].  
12  
13 Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz  
14  
15 2015;58(4-5):80-85.  
16  
17  
18 16. Bhui KS, Lenguerrand E, Maynard MJ, et al. Does cultural integration explain a  
19  
20 mental health advantage for adolescents? INT J EPIDEMIOLOGY 2012;41(3):791-802.  
21  
22  
23 17. Sun X, Chen M, Chan KL. A meta-analysis of the impacts of internal migration  
24  
25 on child health outcomes in China. BMC PUBLIC HEALTH 2015;16(1):1-11.  
26  
27  
28 18. Zhao Y. Relationship between social support and depression of migrant children:  
29  
30 the mediating effect of core-self evaluations. Chinese Journal of School Health  
31  
32 2014;35(12):1844-1846.  
33  
34  
35 19. Thombs BD, Roseman M, Kloda LA. Depression screening and mental health  
36  
37 outcomes in children and adolescents: a systematic review protocol. Systematic  
38  
39 Reviews 2012;1(1):58.  
40  
41  
42 20. Williams SB, O'Connor EA, Eder M, et al. Screening for child and adolescent  
43  
44 depression in primary care settings: a systematic evidence review for the US  
45  
46 Preventive Services Task Force. PEDIATRICS 2009;123(4):e716.  
47  
48  
49 21. C. P. Assimilation in American Life. The Role of Race, Religion, and National  
50  
51 Origins by Milton M. Gordon. American Journal of Sociology 1965;4(Volume 70,  
52  
53 Number 4):134.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3  
4 22. Berry J W. Psychology of acculturation.[J]. Nebraska Symposium on Motivation  
5  
6 Nebraska Symposium on Motivation, 1989, 37(4):201.  
7
- 8  
9 23. Berry J W, Annis R C. Acculturative stress: The role of ecology, culture and  
10  
11 differentiation.[J]. Journal of Cross-Cultural Psychology, 1974, 5(4):382-406.  
12
- 13  
14 24. Smokowski P R, Bacallao M L. Acculturation, Internalizing Mental Health  
15  
16 Symptoms, and Self-Esteem: Cultural Experiences of Latino Adolescents in North  
17  
18 Carolina[J]. Child Psychiatry & Human Development, 2007, 37(3):273-292.  
19
- 20  
21 25. Nakash O, Nagar M, Shoshani A, et al. The effect of acculturation and  
22  
23 discrimination on mental health symptoms and risk behaviors among adolescent  
24  
25 migrants in Israel[J]. Cultural Diversity & Ethnic Minority Psychology, 2012,  
26  
27 18(3):228.  
28
- 29  
30 26. Rogler L H, Cortes D E, Malgady R G. Acculturation and mental health status  
31  
32 among Hispanics: Convergence and new directions for research.[J]. American  
33  
34 Psychologist, 1991, 46(6):585-97.  
35
- 36  
37 27. Jang Y, Chiriboga D A. Social activity and depressive symptoms in Korean  
38  
39 American older adults: the conditioning role of acculturation.[J]. J Aging Health, 2011,  
40  
41 23(5):767-781.  
42
- 43  
44 28. Takeuchi D T, Chung R C, Lin K M, et al. Lifetime and twelve-month prevalence  
45  
46 rates of major depressive episodes and dysthymia among Chinese Americans in Los  
47  
48 Angeles.[J]. American Journal of Psychiatry, 1998, 155(10):1407.  
49
- 50  
51 29. Guglani S, Coleman P G, Sonuga-Barke E J S. Mental health of elderly Asians in  
52  
53 Britain: a comparison of Hindus from nuclear and extended families of differing  
54  
55

- 1  
2  
3 cultural identities[J]. *International Journal of Geriatric Psychiatry*, 2000, 15(11):1046.  
4  
5  
6 30. Nguyen L, Peterson C. Depressive symptoms among Vietnamese-American  
7  
8 college students[J]. *Journal of Social Psychology*, 1993, 133(1):65.  
9  
10  
11 31. Adrados J L R. Acculturation: The Broader View. Theoretical Framework of the  
12  
13 Acculturation Scales[J]. *International Journal of the Addictions*, 2015,  
14  
15 32(12-13):1919-1924.  
16  
17  
18 32. Mehta S. Relationship between acculturation and mental health for Asian Indian  
19  
20 immigrants in the United States.[J]. *Genetic Social & General Psychology*  
21  
22 *Monographs*, 1998, 124(1):61.  
23  
24  
25 33. Peng B L, Zou G Y, Chen W, et al. Association between health service utilisation  
26  
27 of internal migrant children and parents' acculturation in Guangdong, China: a  
28  
29 cross-sectional study[J]. *Bmj Open*, 2018, 8(1):e018844.  
30  
31  
32 34. Ying Y W. Cultural orientation and psychological well-being in Chinese  
33  
34 Americans[J]. *American Journal of Community Psychology*, 1995, 23(6):893-911.  
35  
36  
37 35. Ouarasse O A, van de Vijver F J R. The role of demographic variables and  
38  
39 acculturation attitudes in predicting sociocultural and psychological adaptation in  
40  
41 Moroccans in the Netherlands[J]. *International Journal of Intercultural Relations*,  
42  
43 2005, 29(3): 251-272.  
44  
45  
46 36. Swagler M A, Jome L R M. The Effects of Personality and Acculturation on the  
47  
48 Adjustment of North American Sojourners in Taiwan[J]. *Journal of Counseling*  
49  
50 *Psychology*, 2005, 52(4): 527.  
51  
52  
53 37. Kim E, Cain K, McCubbin M. Maternal and paternal parenting, acculturation, and  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 young adolescents' psychological adjustment in Korean American families[J]. *Journal*  
4  
5  
6 of Child and Adolescent Psychiatric Nursing, 2006, 19(3): 112-129.
- 7  
8 38. Ward C, Kennedy A. Psychological and socio-cultural adjustment during  
9  
10 cross-cultural transitions: A comparison of secondary students overseas and at  
11  
12 home[J]. *International journal of psychology*, 1993, 28(2): 129-147.
- 13  
14 39. Olasupo M O, Idemudia E S, Dimatkakso M. Adjustment, psychological  
15  
16 well-being and mental health of first year students in a South African university[J].  
17  
18 *North American Journal of Psychology*, 2018, 20(1):55-68.
- 19  
20 40. Koneru V K, de Mamani A G W, Flynn P M, et al. Acculturation and mental health:  
21  
22 Current findings and recommendations for future research[J]. *Applied and Preventive*  
23  
24 *Psychology*, 2007, 12(2): 76-96.
- 25  
26 41. Zhou H, Qu Z Y, Zhang Q L. Survey on the development and needs of migrant  
27  
28 children in nine cities of China[J]. *Youth Studies*, 2005(2):1-7.
- 29  
30 42. La Greca AM, Dandes SK, Wick P, et al. Development of the Social Anxiety  
31  
32 Scale for Children: Reliability and Concurrent Validity. *Journal of Clinical Child &*  
33  
34 *Adolescent Psychology* 1988;17(1):84-91.
- 35  
36 43. Cunningham CE, Boyle MH, Hong S, et al. The Brief Child and Family Phone  
37  
38 Interview (BCFPI): 1. Rationale, development, and description of a computerized  
39  
40 children's mental health intake and outcome assessment tool. *J CHILD PSYCHOL*  
41  
42 *PSYC* 2009;50(4):416-423.
- 43  
44 44. Li F, Su L, Jin Y. Norm of the screen for child social anxiety related emotional  
45  
46 disorders in Chinese urban children. *CHINESE JOURNAL OF CHILD HEALTH*  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56

1  
2  
3 CARE 2006;14(4):335-337.  
4

5  
6 45. Gordon M M. Assimilation in American life:[M]. Oxford University Press, 1964.  
7

8  
9 46. Berry J W. Acculturation strategies and adaptation.[J]. 2007:69-82.  
10

11 47. Ryder A G, Alden L E, Paulhus D L. Is acculturation unidimensional or  
12 bidimensional? A head-to-head comparison in the prediction of personality,  
13 self-identity, and adjustment.[J]. Journal of Personality & Social Psychology, 2000,  
14 79(1):49-65.  
15  
16  
17  
18  
19

20 48. Matsudaira T. Measures of psychological acculturation: A review[J]. Transcultural  
21 psychiatry, 2006, 43(3): 462-487.  
22  
23  
24

25 49. Unger JB, Gallahen P, Shakib S, et al. The AHIMSA Acculturation Scale: A New  
26 Measure of Acculturation for Adolescents in a Multicultural Society. The Journal of  
27 Early Adolescence 2002;22(3):225-251.  
28  
29  
30  
31

32 50. Ward C. Acculturation and adaptation revisited. Journal of Cross-Cultural  
33 Psychology 1999;30(4):422-442.  
34  
35  
36

37 51. Ward C, Kennedy A. Psychological and socio-cultural adjustment during  
38 cross-cultural transitions: A comparison of secondary students overseas and at  
39 home[J]. International journal of psychology, 1993, 28(2): 129-147.  
40  
41  
42  
43  
44

45 52. Tian L, Zhang L, Huebner E S, et al. The longitudinal relationship between school  
46 belonging and subjective well-being in school among elementary school students[J].  
47 Applied Research in Quality of Life, 2016, 11(4): 1269-1285.  
48  
49

50 53. Zhang J, Mandl H, Wang E. Personality, acculturation, and psychosocial  
51 adjustment of Chinese international students in Germany[J]. Psychol Rep, 2010,  
52  
53  
54  
55  
56

1  
2  
3  
4 107(2):511-525.

5  
6 54. Lorenzoblanco EI, Unger JB, Baezcondegarbanati L, et al. Acculturation,  
7  
8 enculturation, and symptoms of depression in Hispanic youth: the roles of gender,  
9  
10 Hispanic cultural values, and family functioning. *Journal of Youth and Adolescence*  
11  
12 2012;41(10):1350-1365.

13  
14  
15 55. Bacon DR, Others A. Composite Reliability in Structural Equations Modeling.  
16  
17 *EDUC PSYCHOL MEAS* 1995;55(3):394-406.

18  
19  
20 56. Tanaka J S. "How Big Is Big Enough?": Sample Size and Goodness of Fit in  
21  
22 *Structural Equation Models with Latent Variables*[J]. *Child Development*, 1987,  
23  
24 58(1):134-146.

25  
26  
27 57. Boyle MH, Cunningham CE, Georgiades K, et al. The Brief Child and Family  
28  
29 Phone Interview (BCFPI): 2. Usefulness in screening for child and adolescent  
30  
31 psychopatholog. *J CHILD PSYCHOL PSYC* 2009;50(4):424.

32  
33  
34 58. Delander L, Hammarstedt M, Månsson J, et al. Integration of immigrants: the role  
35  
36 of language proficiency and experience. *Evaluation Review: A Journal of Applied*  
37  
38 *Social Research* 2005;29(1):24-41.

39  
40  
41 59. Lawani AO, Gai X, Titilayo A. The Effects of Continental Background, Language  
42  
43 Proficiency and Length of Stay on Social Adjustment Experience of International  
44  
45 Students in Northern China. *Revista De Cercetare Şi Intervenție Socială*  
46  
47 2012;37(37):91-106.

48  
49  
50 60. Bhui K, Stansfeld S, Head J, et al. Cultural identity, acculturation, and mental  
51  
52 health among adolescents in east London's multiethnic community. *Journal of*  
53  
54

Epidemiology & Community Health 2005;59(4):296-302.

61. Horenczyk G, Tatar M. Friendship expectations among immigrant adolescents and their host peers. *Journal of Adolescence* 1998;21(1):69-82.

62. André M. N. Renzaho, Julie Green, David Mellor, et al. Parenting, family functioning and lifestyle in a new culture: the case of African migrants in Melbourne, Victoria, Australia[J]. *Child & Family Social Work*, 2011, 16(2):228-240.

63. Griffith J. Relationship between Acculturation and Psychological Impairment in Adult Mexican Americans.[J]. *Hispanic Journal of Behavioral Sciences*, 1983, 5(4):431-459.

Table 1. Psychological adjustment and acculturation of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach $\alpha$
<b>Psychological adjustment</b>				0.665
1. Where do you think you belong to?		1.89 (1.02)	0.66	
Outsiders	575 (51)			
Unknown	170 (15)			
Both	297 (27)			
Guangzhou people	80 (7)			
2. Do you like Guangzhou?		3.91 (0.75)	0.86	
Very not	9 (1)			
Not	19 (2)			
Unclear	254 (23)			
Like	619 (55)			
Very like	221 (20)			
3. Are you satisfied with your life in Guangzhou?		3.87 (0.72)	0.80	
Very not	8 (1)			
Not	29 (3)			
Unclear	237 (21)			
Sure	677 (60)			
Very sure	171 (15)			
4. Would you like to live in Guangzhou always?		3.59 (0.95)	0.60	

1				
2				
3	Very not	16 (1)		
4	Not	176 (16)		
5	Unclear	203 (18)		
6	Sure	582 (52)		
7	Very sure	145 (13)		
8				
9	<b>Lifestyle</b>			0.524
10	5. Do you like to celebrate the			
11	Spring Festival in Guangzhou?		2.16 (0.93)	0.49
12				
13	Very not	341 (30)		
14	Not	331 (30)		
15	Average	379 (34)		
16	Sure	71 (6)		
17				
18	6. Do you think Guangzhou people			
19	dressed nice?		2.29 (0.49)	0.60
20				
21	Not	20 (2)		
22	Average	758 (68)		
23	Yes	344 (31)		
24				
25	7. Do you like the clothes in			
26	Guangzhou?		3.06 (1.17)	0.57
27				
28	Very not	33 (3)		
29	Not	429 (38)		
30	Unclear	252 (23)		
31	Sure	242 (22)		
32	Very sure	166 (15)		
33				
34	8. Do you eat Cantonese cuisine?		2.88 (0.84)	0.30
35				
36	Always	55 (5)		
37	Usually	99 (9)		
38	Sometimes	703 (63)		
39	Once in a while	188 (17)		
40	Never	77 (7)		
41				
42	9. Do you like to eat Cantonese			
43	cuisine?		1.75 (0.84)	0.41
44				
45	No	571 (51)		
46	Average	261 (23)		
47	Yes	290 (26)		
48				
49	<b>Social interaction</b>			0.553
50	10. Where did your major good			
51	friends come from?		1.61 (0.66)	0.50
52				
53	Outside	543 (48)		
54	Both place	470 (42)		
55	Local	109 (10)		
56				
57	11. Do you hope your classmates			
58	and friends to be local children?		1.89 (0.57)	0.74
59				
60	No	247 (22)		



1				
2				
3	Average	749 (67)		
4	Yes	126 (11)		
5	<b>Language</b>			0.811
6	12. Can you understand Cantonese?		2.69 (0.93)	0.87
7	Completely	268 (24)		
8	Most	335 (30)		
9	A little	419 (37)		
10	Completely not	100 (9)		
11	13. Can you speak Cantonese?		2.00 (0.94)	0.82
12	Completely	110 (10)		
13	Most	159 (14)		
14	A little	470 (42)		
15	Completely not	383 (34)		
16	14. Do you watch TV programs in			
17	Cantonese?		2.38 (0.97)	0.63
18	Usually	181 (16)		
19	Sometimes	280 (25)		
20	Once in a while	441 (39)		
21	Never	220 (20)		
22	15. Do you listen to Cantonese			
23	songs?		2.48 (0.94)	0.51
24	Usually	185 (17)		
25	Sometimes	338 (30)		
26	Once in a while	426 (38)		
27	Never	173 (15)		
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				

Table 2. Demographic characteristics by anxiety (SASC) and major depression (MDD) scales among 1,122 migrant children in Guangzhou, China in 2016

Variables	N (%)	MDD Mean (SD)	<i>P</i> value	SASC Mean (SD)	<i>P</i> value
<b>Gender</b>			0.097		<0.001
Boys	621 (55)	8.78 (2.17)		14.67 (3.72)	
Girls	501 (45)	8.56 (2.22)		13.41 (4.01)	
<b>Age (years)</b>			0.003		0.043
11~12	75 (7)	9.01 (2.30)		14.47 (4.09)	
13	391 (35)	8.97 (2.10)		14.51 (3.89)	
14	452 (40)	8.49 (2.28)		13.86 (3.91)	
15~16	204 (18)	8.47 (2.07)		13.77 (3.80)	
<b>Place of origin</b>			0.318		0.525
Guangdong province	592 (53)	8.75 (2.16)		14.04 (3.75)	
Other province	530 (47)	8.62 (2.23)		14.19 (4.08)	
<b>Length of stay in Guangzhou</b>			0.132		0.444
<5 years	241 (22)	8.57 (2.18)		14.24 (3.94)	
5 to 10 years	317 (28)	8.56 (2.16)		14.29 (3.69)	
>10 years	540 (48)	8.83 (2.22)		13.97 (4.04)	

Table 3. Associations between acculturation dimensions, psychological adjustment and mental health scales (MDD and SASC) after the adjustment of demographic characteristics among 1,122 migrant children in Guangzhou, China in 2016

Variables	MDD		SASC	
	$\beta$ (95%CI)	<i>P</i> value	$\beta$ (95%CI)	<i>P</i> value
<b>Language</b>	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
<b>Social-interaction</b>	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
<b>Lifestyle</b>	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
<b>Psychological adjustment</b>	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
<b>Gender</b>				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
<b>Place of origin</b>				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
<b>Age</b>				
11~12 (ref)				
13	0.01 (-0.49,0.56)	0.893	0.03 (-0.72,1.18)	0.630
14	-0.09 (-0.93,0.12)	0.132	-0.05 (-1.31,0.58)	0.446
15~17	-0.07 (-0.95,0.19)	0.194	-0.05 (-1.57,0.50)	0.309
<b>Length of stay in Guangzhou</b>				
<5 years (ref)				
5 to 10 years	-0.05 (-0.58,0.14)	0.235	-0.01 (-0.77,0.53)	0.711

>10 years	-0.01 (-0.40,0.28)	0.737	-0.06 (-1.08,0.14)	0.130
-----------	--------------------	-------	--------------------	-------

*Note:*  $\beta$  = standardized regression coefficient; 95%CI=95% Confidence interval.

Table 4. The effects of acculturation dimensions and psychological adjustment on mental health in the SEM

Latent Variables	SASC			MDD		
	Direct effect(95%CI)	Indirect effect(95%CI)	Total effect(95%CI)	Direct effect(95%CI)	Indirect effect(95%CI)	Total effect(95%CI)
<b>Language</b>	ns	0.03(0.01~0.05)	0.03(0.01~0.05)	ns	0.05(0.04~0.06)	0.05(0.04~0.06)
<b>Social interaction</b>	ns	0.04(0.02~0.06)	0.04(0.02~0.06)	ns	0.07(0.03~0.11)	0.07(0.03~0.11)
<b>Lifestyle</b>	-0.17(-0.29~-0.05)	0.15(0.07~0.23)	-0.03(-0.05~-0.01)	ns	0.11(0.06~0.16)	0.11(0.06~0.16)
<b>Psychological adjustment</b>	0.28(0.23~0.33)	-	0.28(0.23~0.33)	0.30(0.27~0.33)	-	0.30(0.27~0.33)

*Note:* ns: non-significant; 95%CI=95% Confidence interval.

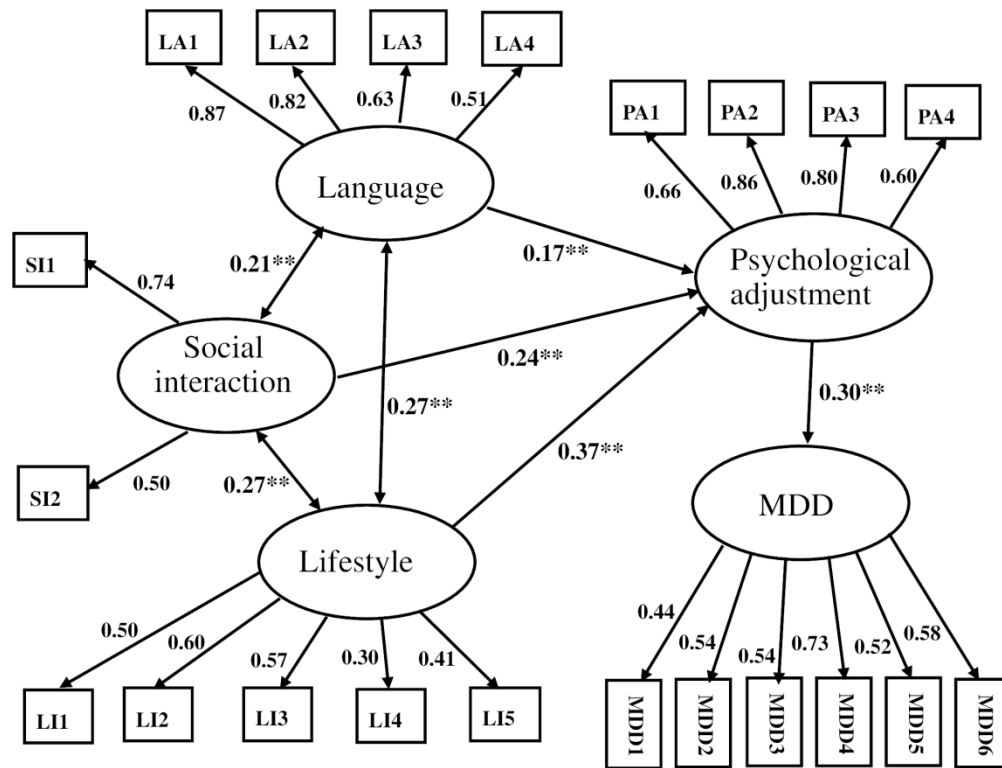


Figure 1. Structural equation modelling of acculturation, psychological adjustment and MDD. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, CMIN/df=2.1. \*\*: p<0.001. LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the four items measuring respondents' psychological adjustment; MDD1-MDD6, the six items measuring respondents' Major Depression.

175x132mm (300 x 300 DPI)

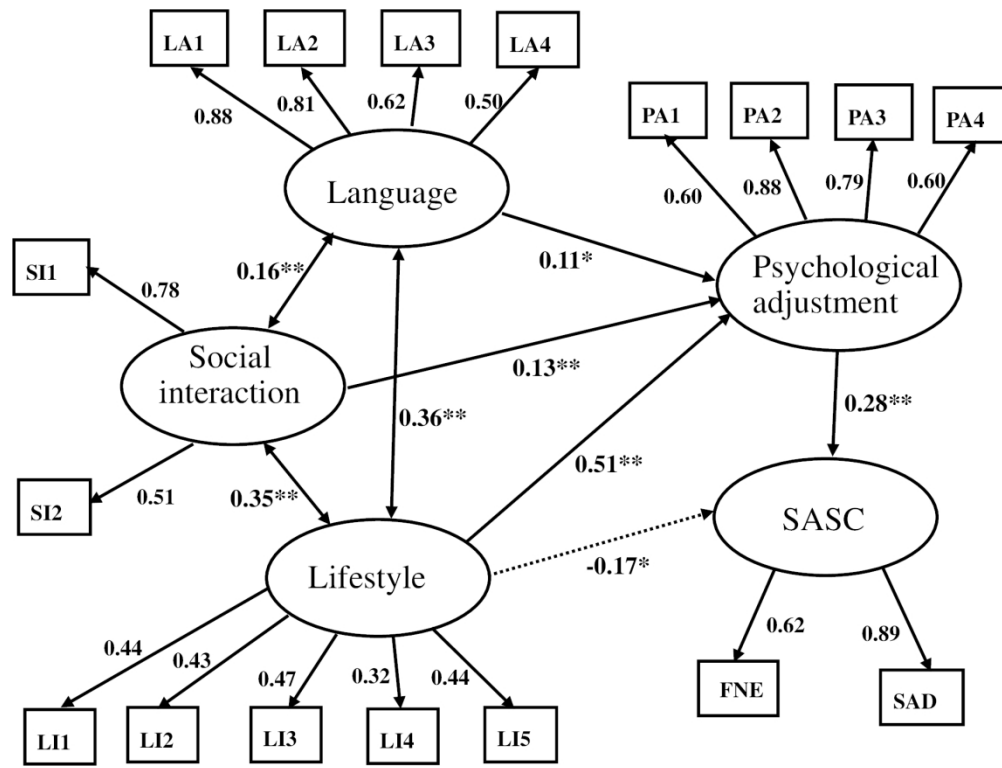


Figure 2. Structural equation modelling of acculturation, psychological adjustment and SASC. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. Dotted line represented negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, CMIN/df=2.2. \*:  $p < 0.05$  \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the four items measuring respondents' psychological adjustment; FNE, fear of negative evaluation; SAD, social avoidance and distress.

169x128mm (300 x 300 DPI)

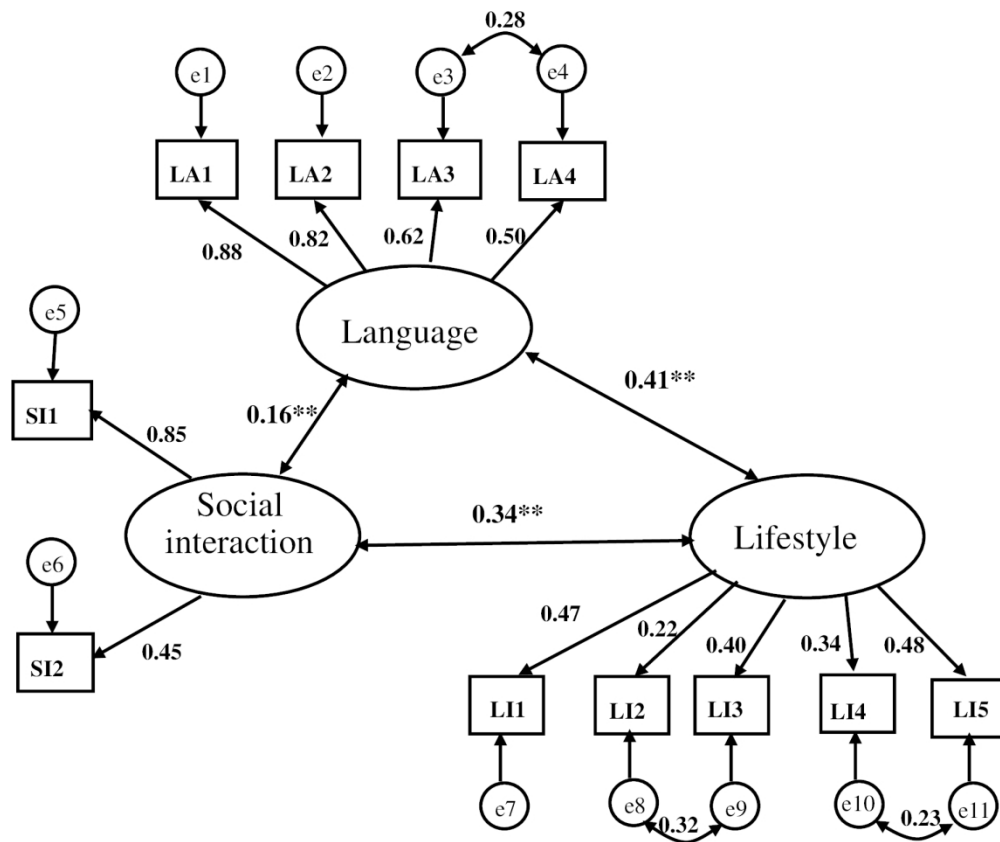


Figure 3. The confirmatory factor analysis model of acculturation. Note: Standardized path coefficients were reported. The data-model fit indices:  $P=0.129 > 0.05$ ,  $CMIN/df=1.26$ ,  $GFI=0.992$ ,  $CFI=0.996$ ,  $RMSEA=0.015$ . \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle.

161x134mm (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 #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	page # 1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	page # 2-3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	page # 5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	page # 7-8
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	page # 8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	page # 9
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	page # 9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	page #10-12
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	page #10-12
Bias	9	Describe any efforts to address potential sources of bias	page #9
Study size	10	Explain how the study size was arrived at	page #9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	page #13
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	page #13
		(b) Describe any methods used to examine subgroups and interactions	page #13
		(c) Explain how missing data were addressed	page #9
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			



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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	page #14
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest	page #14
Outcome data	15*	Report numbers of outcome events or summary measures	page #14
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	page #15
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #16
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	page #17
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	page #21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	page #17-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	page #20
<b>Other information</b>			
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	page #23

\*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](http://www.strobe-statement.org).

# BMJ Open

## Impact of acculturation and psychological adjustment on mental health among migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-022712.R2
Article Type:	Research
Date Submitted by the Author:	16-Nov-2018
Complete List of Authors:	Shi, Lishuo; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Chen, Wen; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Bouey, Jennifer; Georgetown University - School of Nursing and Health Studies, Department of International Health Lin, Yanwei; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy Ling, Li; Sun Yat-sen University-School of Public Health, Faculty of Medical Statistics and Epidemiology; Sun Yat-sen University, Sun Yat-sen Center for Migrant Health Policy
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	MENTAL HEALTH, Internal migrant, Adolescents, Acculturation

SCHOLARONE™  
Manuscripts

1  
2  
3  
4 **Impact of acculturation and psychological adjustment on mental health among**  
5  
6 **migrant adolescents in Guangzhou, China: a cross-sectional questionnaire study**  
7  
8  
9

10  
11 Lishuo Shi<sup>1,2#</sup>, Wen Chen<sup>1,2#</sup>, Jennifer Bouey<sup>3</sup>, Yanwei Lin<sup>1,2</sup>, Li Ling<sup>1,2\*</sup>  
12  
13

14 <sup>1</sup> Faculty of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-  
15 sen University, Guangzhou, Guangdong, China  
16  
17

18 <sup>2</sup> Sun Yat-sen Center for Migrant Health Policy, Sun Yat-sen University, Guangzhou,  
19 Guangdong, China  
20  
21

22 <sup>3</sup> Department of International Health, School of Nursing and Health Studies,  
23 Georgetown University, Washington DC, United States of America  
24  
25  
26  
27  
28  
29

30  
31  
32 #Lishuo Shi and Wen Chen have equally contributed to the work and are co-first authors.  
33  
34  
35  
36

37 **\*Corresponding author:** Li Ling  
38

39  
40 74, Zhongshan Road 2, Faculty of Medical Statistics and Epidemiology, School of  
41 Public Health, Sun Yat-sen University, Guangzhou, China.  
42  
43

44  
45 E-mail: lingli@mail.sysu.edu.cn  
46

47  
48 Tel/Fax: 86-20-87333319.  
49

50  
51 **Word count:** 3894 word  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Abstract

**Objectives:** The aim of this study was to examine the pathway and associations among acculturation (i.e., language, social interaction, and lifestyle), psychological adjustment and mental health of internal migrant adolescents in China.

**Design:** Cross-sectional questionnaire study.

**Setting:** Six private migrant junior high schools located in Tianhe and Baiyun Districts in Guangzhou were chosen as the study sites.

**Participants:** A total of 1,122 migrant adolescents aged 11-17 years old completed the study.

**Main outcome measures:** Mental health was measured by using the Social Anxiety Scale for Children (SASC) and Major Depression (MDD) in a Brief Child and Family Phone Interview. Acculturation and psychological adjustment were measured by a self-designed and verified questionnaire. Multiple regression models and structural equation models (SEM) were performed to analyse the association among acculturation, psychological adjustment and mental health while controlling for participant demographic characteristics.

**Results:** The average MDD scores for boys were 8.78 (SD=2.17) and for girls were 8.56 (SD=2.22), while the average SASC scores for boys were 14.67 (SD=3.72) and for girls were 13.41 (SD=4.01). Psychological adjustment had direct a positive effect on MDD ( $p<0.001$ ,  $\beta=0.30$ ) and SASC ( $p<0.001$ ,  $\beta=0.28$ ), and it was the key variable fully mediating the impact of acculturation components on MDD and partly mediating the impact of acculturation on SASC, whereas lifestyle showed a direct negative effect

1  
2  
3  
4 (p=0.003,  $\beta$ =-0.17) on SASC. Of the three acculturation components, lifestyle had the  
5  
6 strongest influence on psychological adjustment (p<0.001,  $\beta$ =0.37 and 0.51), followed  
7  
8 by social interaction (p<0.001,  $\beta$ =0.24 and 0.13) and language (p<0.001,  $\beta$ =0.17 and  
9  
10 0.11).  
11  
12

13  
14 **Conclusions:** The association between acculturation and the mental health of internal  
15  
16 migrant adolescents was complex and could be mediated by psychological adjustment.  
17  
18 Interventions such as promoting local language and social interaction are needed to  
19  
20 enhance psychological adjustment and further improve the mental health of migrant  
21  
22 adolescents.  
23  
24  
25

26  
27 **Key words:** Acculturation; Mental health; Internal migrant; Adolescents.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Article Summary

### Strengths and limitations of this study:

• This is the first known study to investigate the applicability of acculturation theory in understanding mental health problems among migrant adolescents in China. Our findings provide new ways to improve the mental health of migrant adolescents in China.

• The underlying mechanism of the effects of acculturation on the mental health of migrant adolescents was not comprehensively analysed in previous studies, and we used structural equation modelling to clearly quantify the integrated effect of various acculturation dimensions on mental health, which will provide evidence for improving the psychological intervention strategy for migrant adolescents.

• The reliability and validity of the scale for measuring the acculturation of migrant adolescents need to be further improved.

• The results of this cross-sectional study cannot be used to make causal inferences regarding acculturation and mental health because it did not control for all possible confounding variables.

## Introduction

The United Nations reported a 49% increase in international migration between 2000 and 2017, resulting in an estimated 258 million international migrants.<sup>1</sup> Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.<sup>2</sup> According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.<sup>3</sup> As a result, there were 35.81 million internal migrant adolescents under 17 years old in China in 2010, up by 41.37% since 2005,<sup>4</sup> and they accounted for 12.8% of the overall adolescent population in China.<sup>5</sup>

Concerns for the welfare of these internal migrant adolescents were exacerbated in China by the household registration (hukou in Chinese) system, which would traditionally block migrant adolescents who do not have a city registration from getting an education in urban public schools.<sup>6-8</sup> In addition, similar to international migrant adolescents worldwide, internal migrant adolescents also had to adjust to significant differences in dialects, culture, economic development, and social environment across different regions of China.<sup>9</sup> Poor educational investment and the acculturation pressure could have a negative influence on migrant adolescents' overall well beings, especially putting stress on their mental health.<sup>10, 11</sup>

Findings from global studies on the mental health of migrant and non-migrant adolescents have been contradictory.<sup>12</sup> Some studies have found that migrant

1  
2  
3  
4 adolescents had better mental health outcomes than adolescents in the host community.  
5  
6  
7 <sup>13, 14</sup> In contrast, others have shown that migrant adolescents had poorer mental health  
8  
9 outcomes than their non-migrant counterparts. <sup>15, 16</sup> These contradictory results could  
10  
11 be a result of differences in migrant characteristics and methods of measurement in  
12  
13 these studies.<sup>12</sup> However, a literature review showed that the mental health of internal  
14  
15 migrant adolescents in China was inferior compared with that of local adolescents in  
16  
17 the majority of studies due to the influence of the hukou system.<sup>17</sup> In particular, a study  
18  
19 in Guangzhou showed that the detection rate of depressive symptoms in migrant  
20  
21 adolescents was 21.8%, far higher than in local adolescents (11.2%),<sup>18</sup> which was also  
22  
23 higher than in local adolescents in other countries.<sup>19</sup> Mental problems in childhood and  
24  
25 adolescence have been associated with many negative outcomes, including impaired  
26  
27 social, work, and family functioning in adolescence and into adulthood.<sup>20</sup> Therefore, a  
28  
29 better understanding of the risk factors for mental health within this vulnerable  
30  
31 population is important for the public health of internal migrant adolescents in China.  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

43 Studies have shown that among many factors that affect adolescents' mental health,  
44  
45 acculturation is uniquely relevant to migrant adolescents.<sup>21</sup> Acculturation has been  
46  
47 conceived as a dynamic process involving multiple aspects in which individuals  
48  
49 gradually adjust to a new environment.<sup>22</sup> In this process, migrants had to face  
50  
51 psychological distress brought on by major life changes that might lead to deterioration  
52  
53 in mental health.<sup>23</sup> Many studies have found acculturation to be associated with mental  
54  
55 health in various types of immigrants,<sup>24,25</sup> but there were no obvious or consistent  
56  
57  
58  
59  
60



1  
2  
3  
4 patterns of findings that could be identified.<sup>26</sup> While acculturation appeared inversely  
5  
6 related to morbidity in some populations,<sup>27, 28</sup> psychiatric disorders increased with  
7  
8 acculturation in others.<sup>29, 30</sup>  
9  
10  
11  
12  
13

14 Due to the uncertain nature of these findings, they have seldom been brought to bear  
15  
16 on prevention or intervention-oriented programmes in mental health-related areas.<sup>31</sup>  
17  
18 These contradictory findings might result from disparities between measurement  
19  
20 instruments because there was no generally accepted acculturation model, and these  
21  
22 studies adopted different dimensions to measure acculturation.<sup>26</sup> On the other hand,  
23  
24 many studies have combined acculturation into a composite score to explore its  
25  
26 relationship with health,<sup>27,32,33</sup> which might blur the potentially variable effects of  
27  
28 different acculturation dimensions on mental health.<sup>34</sup> In addition to these limitations,  
29  
30 the mechanism of acculturation affecting the mental health of migrant adolescents has  
31  
32 not been well investigated. Previous studies have shown that psychological adjustment  
33  
34 is one of the main outcomes of acculturation,<sup>35-36</sup> while psychological adjustment  
35  
36 reflected migrants' cognitive, emotional, and perceptual responses in new life  
37  
38 circumstances.<sup>37,38</sup> Meanwhile, psychological adjustment was indicated to be closely  
39  
40 related to mental health.<sup>39</sup> Therefore, psychological adjustment might play an important  
41  
42 role in the relationship between acculturation and mental health. Finally, the majority  
43  
44 of studies examining the association between acculturation and mental health in ethno-  
45  
46 cultural groups were conducted with Latino and Asian samples,<sup>40</sup> but few studies have  
47  
48 focused on internal Chinese migrants, especially on adolescents. Thus, we hypothesized  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 that acculturation of adolescents could affect their mental health directly and indirectly  
5  
6 via psychological adjustment.  
7  
8  
9

10  
11 Therefore, the primary aim of this study was to confirm this hypothesis using a  
12 structural model analysis with data from a cross-sectional study in Guangzhou, China.  
13  
14 Specifically, we aimed to (1) assess the status of mental health and acculturation of  
15  
16 migrant adolescents; and (2) test the aforementioned hypothesized structural  
17  
18 relationship among acculturation, psychological adjustment and mental health of  
19  
20 migrant adolescents, and explore the impact of each acculturation dimension on mental  
21  
22 health.  
23  
24  
25  
26  
27  
28  
29  
30  
31

## 32 **Methods**

### 33 *Study sites*

34  
35 This cross-sectional survey study was conducted in Tianhe and Baiyun districts in  
36  
37 Guangzhou, China from April to May 2016. Guangzhou is the capital city of  
38  
39 Guangdong Province with a population of 12.7 million, and has led the economic  
40  
41 reform and openness in China since the 1980s. Guangzhou has also become a major  
42  
43 receiving city with 0.6 million internal migrant adolescents.<sup>4, 5</sup>  
44  
45  
46  
47  
48  
49  
50  
51

52  
53 As the capital city of Guangdong province, Guangzhou has its distinctive  
54  
55 Cantonese culture, language and customs. The primary dialect spoken in Guangzhou,  
56  
57 Cantonese, is unique to Guangdong province and its adjacent areas including Hong  
58  
59  
60

1  
2  
3  
4 Kong and Macau. This unique language environment adds significant barriers for  
5  
6 migrant adolescents' adaptation to the social and cultural environment of Guangzhou  
7  
8 compared to other regions of China. Tianhe and Baiyun Districts were chosen to be the  
9  
10 study sites due to their large migrant populations. Since 95% of migrant adolescents in  
11  
12 Guangdong province are studying in schools,<sup>41</sup> using a purposive sampling method, we  
13  
14 chose three private junior high schools with large numbers of migrant students in each  
15  
16 district.  
17  
18  
19  
20  
21  
22  
23  
24

### 25 *Study participants and sampling*

26  
27 All migrant students in grades 7-8 from these six schools participated in the study. All  
28  
29 eligible students completed a self-administered questionnaire. The study inclusion  
30  
31 criteria were as follows: 1) students in the chosen grade of the school did not have  
32  
33 hukou in Guangzhou, 2) at least one of the students' parents did not have hukou in  
34  
35 Guangzhou, and 3) students were under 18 years old.  
36  
37  
38  
39  
40  
41  
42

43 The survey took 20–30 minutes for each student to complete. Meanwhile, to ensure  
44  
45 the independence and anonymity of the survey, the research assistants were required to  
46  
47 wait for completion of the questionnaires outside the classroom. After collecting each  
48  
49 questionnaire, the research assistants would check it carefully and contact the  
50  
51 adolescent immediately if they found an important answer in the questionnaire missing.  
52  
53 Research assistants received standardized training by the research team, and quality  
54  
55 control was implemented during data collection.  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7 The survey protocol was approved by the Institutional Review Board at Sun Yat-sen  
8  
9 University, China (reference [2015] No.42). Each adolescent was asked to bring  
10  
11 informed consent form to their parents or guardians and have them sign it before filling  
12  
13 out the questionnaire.  
14  
15

### 16 17 18 19 *Patient and public involvement*

20  
21  
22 No patients were involved in this study. Study participants were offered feedback of  
23  
24 the study results and will be informed of this publication.  
25  
26

### 27 28 29 *Measurement*

#### 30 31 32 *Dependent variables: mental health*

33  
34  
35 The indicators of mental health included anxiety and depression indices. Anxiety was  
36  
37 measured by the Social Anxiety Scale for Children (SASC), and depression was  
38  
39 measured by the dimension of Major Depression (MDD) in the Brief Child and Family  
40  
41 Phone Interview. The SASC was developed to measure social anxiety among American  
42  
43 adolescents between 7 and 16 years of age, and it included 10 items yielding two  
44  
45 dimensions, including fear of negative evaluation and social avoidance and distress.  
46  
47  
48 The response to each item is scored on a 3-point scale (0=always, 1=sometimes,  
49  
50 2=never), with total scores ranging from 0 to 20, and higher scores indicated less  
51  
52 anxiety.<sup>42</sup> The MDD was developed to measure major depression among Ontario  
53  
54 adolescents between 6 and 18 years of age, and it consisted of 6 items scored on a 3-  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 point scale (0=always, 1=sometimes, 2=never), with a total score ranging from 0 to 12.  
5  
6 Higher scores indicated less depression.<sup>43</sup> The Cronbach's alpha of SASC applied to  
7  
8 normal Chinese adolescents was 0.79,<sup>44</sup> and the Cronbach's alpha of MDD applied to  
9  
10 Ontario adolescents was 0.86.<sup>43</sup>  
11  
12  
13  
14  
15  
16

17 *Independent variables: Acculturation and psychological adjustment*  
18

19 Gordon described acculturation, or cultural and behavioural assimilation, as a phase of  
20  
21 assimilation, which was the foundation of unidimensional acculturation theory.<sup>45</sup> In this  
22  
23 theory, individuals were placed on a continuum of identities ranging from exclusively  
24  
25 heritage culture to exclusively mainstream culture. More recently, Berry put forward  
26  
27 the bidimensional acculturation theory,<sup>46</sup> which suggested that both heritage and  
28  
29 mainstream cultural identities were free to vary independently, and acculturation  
30  
31 strategies could be divided into four categories: separation, integration, assimilation,  
32  
33 and marginalization. Despite some evidence in favour of bidimensional acculturation,<sup>47</sup>  
34  
35 the majority of self-report acculturation scales reflected a unidimensional framework  
36  
37 in public health studies.<sup>48</sup> The majority of these studies showed that a linear relationship  
38  
39 between acculturation and psychological distress was better demonstrated by the  
40  
41 unidimensional model,<sup>31</sup> while only a few studies showed a curvilinear relationship that  
42  
43 was better demonstrated by the bidimensional model.<sup>26</sup> On the other hand, the  
44  
45 measurement of unidimensional acculturation was simpler than that of bidimensional  
46  
47 acculturation and convenient for young adolescents to understand in the data collection  
48  
49 process.<sup>47</sup> Therefore, the unidimensional acculturation theory was adopted in this study.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 Based on a comprehensive literature review,<sup>49-50</sup> the research team designed the  
5  
6 questionnaire to measure acculturation, which consisted of 11 items with a total score  
7  
8 ranging from 11 to 45 (See Table 1). Higher scores indicate individual's higher  
9  
10 acceptance of the host culture. Acculturation was measured by 3 latent variables: social  
11  
12 interaction (two items), lifestyle (five items) and language (four items). Lifestyle  
13  
14 consists of questions about preferences for food (two items), clothing (two items) and  
15  
16 social custom (one item). Each item had 3 to 5 choices. Some questions were rated on  
17  
18 a scale ranging from 1 (“No”) to 3 (“Yes”), some questions were rated on a scale  
19  
20 ranging from 1 (“Completely not/Never”) to 4 (“Completely/Usually”), and some  
21  
22 questions were rated on a scale ranging from 1 (“Never”) to 5 (“Always”).  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32

33 Psychological adjustment focused on emotional reactions during cross-cultural  
34  
35 transitions,<sup>51</sup> and it was measured by four questions that asked about “sense of  
36  
37 belonging”<sup>52</sup> and “satisfaction of urban life”<sup>53</sup> in this study. Sense of belonging was  
38  
39 assessed by one question with a scale ranging from 1 (“outsiders”) to 4 (“Guangzhou  
40  
41 people”). Satisfaction of urban life was assessed by three questions with a scale ranging  
42  
43 from 1 (“Very not”) to 5 (“Very sure”).  
44  
45  
46  
47  
48  
49  
50

#### 51 *Demographic and other covariates*

52  
53 To better understand the association between acculturation and mental health, we also  
54  
55 included demographics that were reported to be associated with mental health in  
56  
57 children and adolescents. These adjustment variables included age (in years), gender  
58  
59  
60

1  
2  
3  
4 (male or female), place of origin (Guangdong province or other provinces in China)  
5  
6 and length of stay in Guangzhou (in years).<sup>19, 54</sup>  
7  
8  
9

### 10 11 *Data processing and statistical analysis* 12

13  
14 Statistical analyses were performed using the software IBM SPSS 20.0 and IBM Amos  
15  
16 24.0. Descriptive statistics including the mean, standard deviation (SD), frequency and  
17  
18 proportion were used to summarize the demographics, acculturation, psychological  
19  
20 adjustment and mental health of the study participants. Differences in mental health by  
21  
22 demographic variables were assessed using t-test or F-test. Multivariate regression  
23  
24 models were conducted to assess the association between latent variables of  
25  
26 acculturation and mental health. The latent variables of acculturation were the  
27  
28 independent variables, and the scores of SASC and MDD were the dependent variables.  
29  
30 Demographic variables were used as confounding factors. SEM was used to assess the  
31  
32 proposed structural relationship among the acculturation dimensions, psychological  
33  
34 adjustment and mental health. Data-model fitting in the structural equation modelling  
35  
36 analysis were assessed using the following four indices: Goodness of Fit Index (GFI)  
37  
38 (>0.9), Comparative Fit Index (CFI) (>0.9), Root Mean Square Error of Approximation  
39  
40 (RMSEA) (< 0.05) and the chi-square associated with each degree of freedom  
41  
42 (CMIN/df) (<3). Cronbach's alpha was computed to assess the reliability of the latent  
43  
44 variables. The construct validity of the acculturation measurement was evaluated by the  
45  
46 model fitting indices of confirmatory factor analysis (CFA) and the composite  
47  
48 reliability of each latent variable.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Results

A total of 1,233 adolescents completed the questionnaire in this survey. The response rate was 92.1%; 83 were excluded because of contradictions in the information provided, 28 were excluded because of incomplete data for several key variables (e.g. questions about acculturation and mental health), yielding 1,122 participants (91.0%) for analysis. Table 2 demonstrated that among the 1,122 participants, there were more boys (55%) than girls (45%), and most of them (93%) were aged 13-16 years old, nearly half of them (47%) came from other provinces, and many of them (78%) have lived in Guangzhou for more than five years. There were significant differences between boys' scores ( $14.67 \pm 3.72$ ) and girls' scores ( $13.41 \pm 4.01$ ) on the anxiety scale ( $P < 0.001$ ). The boys' MDD mean score was  $8.78 \pm 2.17$ , and the girls' MDD mean score was  $8.56 \pm 2.22$ . The mean scores of SASC and MDD for participants were significantly different by age ( $P < 0.05$ ;  $P < 0.01$ ). Students who were younger had better mental health compared with older students.

Table 1 showed that in psychological adjustment, only 7% of the surveyed adolescents considered themselves to be Guangzhou people, but the ones who loved and were willing to live in Guangzhou accounted for more than 60% of these adolescents. In the lifestyle dimension, 98% of adolescents had acceptance of urban clothing, and many of the adolescents preferred the lifestyle in their hometown in terms of traditional customs and diet. In the social interaction dimension, many of migrant



1  
2  
3  
4 adolescents (48%) failed to interact with local adolescents. In the language dimension,  
5  
6 54% of the adolescents could understand the local language (item score  $\geq 2$ ), but only  
7  
8 24% of the adolescents could speak the local language (item score  $\geq 2$ ). The mean  
9  
10 scores of these questions were computed for modelling analysis.  
11  
12  
13  
14  
15  
16

17 Table 3 showed that multiple regression analysis indicated a positive relationship  
18  
19 among the total MDD score, total SASC score and psychological adjustment after  
20  
21 controlling for age, gender, place of origin and residence time ( $P < 0.001$ ), while the total  
22  
23 SASC score had a negative relationship with lifestyle ( $P = 0.03$ ). The language and social  
24  
25 interaction had no significant correlation with total MDD score and total SASC score  
26  
27 ( $P > 0.05$ ).  
28  
29  
30  
31  
32  
33  
34

35 SEM was used to explore the internal relationships among the latent variables of  
36  
37 acculturation, psychological adjustment and their impact on mental health. Figure 1  
38  
39 showed that psychological adjustment had a direct effect on MDD ( $\beta = 0.30$ ) and it was  
40  
41 the key variable fully mediating the impact of acculturation components on MDD. Of  
42  
43 the three acculturation components, lifestyle had the strongest influence on  
44  
45 psychological adjustment ( $\beta = 0.37$ ), followed by social interaction ( $\beta = 0.24$ ) and  
46  
47 language ( $\beta = 0.17$ ). The data-model fit indices were GFI=0.97, CFI=0.96,  
48  
49 RMSEA=0.03, and CMIN/df=2.1. Figure 2 also showed psychological adjustment had  
50  
51 a direct effect on SASC ( $\beta = 0.28$ ) and that it fully mediated the impact of two  
52  
53 acculturation components (i.e. language and social interaction) on SASC, whereas  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 lifestyle showed both a direct negative effect ( $\beta=-0.17$ ) and an indirect positive effect  
5  
6 via psychological adjustment on SASC. Of the three acculturation components, lifestyle  
7  
8 had the strongest influence on psychological adjustment ( $\beta=0.51$ ), followed by social  
9  
10 interaction ( $\beta=0.13$ ) and language ( $\beta=0.11$ ). The data-model fit indices were GFI=0.97,  
11  
12 CFI=0.97, RMSEA=0.03, and CMIN/df=2.2. In total, psychological adjustment had the  
13  
14 greatest impact on both MDD and SASC. A higher level of language and social  
15  
16 interaction indicated less anxiety and depression, while a lifestyle towards mainstream  
17  
18 culture indicated more anxiety and less depression. The influence coefficients of each  
19  
20 latent variable on mental health were showed in Table 4.  
21  
22  
23  
24  
25  
26  
27  
28  
29

30 We evaluated the scales to confirm their reliability and validity. In our study, SASC  
31  
32 demonstrated a Cronbach's  $\alpha$  coefficient of 0.82, and MDD demonstrated a Cronbach's  
33  
34  $\alpha$  coefficient of 0.78. Even though the scales of acculturation and psychological  
35  
36 adjustment were self-developed, most correlation coefficients of each question's score  
37  
38 and the total score of the dimension exceeded 0.5, and the Cronbach's  $\alpha$  of each latent  
39  
40 variable exceeded 0.5 while the Cronbach's  $\alpha$  of the overall scale exceeded 0.7 (See  
41  
42 Table 1). This indicated that the questionnaire had acceptable reliability. In Figure 1,  
43  
44 the composite reliability results for the latent variables were 0.8082 (language), 0.5616  
45  
46 (social interaction), 0.5952 (lifestyle), and 0.8233 (psychological adjustment). In Figure  
47  
48 2, the composite reliability results for the latent variables were 0.8028 (language),  
49  
50 0.5935 (social interaction) , 0.5176 (lifestyle) , and 0.8134 (psychological  
51  
52 adjustment). These indices all exceed 0.5. On the other hand, the results for the CFA of  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 the acculturation measurement showed good data-model fit indices:  $P=0.129>0.05$ ,  
5  
6 CMIN/df=1.26, GFI=0.992, CFI=0.996, RMSEA=0.015. See Figure 3. This indicated  
7  
8 the scale of acculturation had acceptable construct validity.<sup>55</sup>  
9  
10  
11  
12  
13

## 14 **Discussion**

### 15 *Results discussion*

16  
17 This was the first known study to investigate the applicability of acculturation theory  
18  
19 in understanding the mental health problems among the internal migrant adolescents in  
20  
21 China. We found that language and social interaction were positively correlated with  
22  
23 mental health, while lifestyle showed mixed correlations with mental health. The  
24  
25 underlying pathway of this relationship was explored. Three latent variables of  
26  
27 acculturation indirectly affect mental health through psychological adjustment, of  
28  
29 which lifestyle had the greatest impact on psychological adjustment, followed by  
30  
31 social interaction and language.  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

43 A total of 1122 valid samples were included in the analysis. The sample size met the  
44  
45 requirement for multivariable analysis, which should be ten times more than the number  
46  
47 of variables.<sup>56</sup> Anxiety and depressive symptoms among migrant adolescents between  
48  
49 11 and 17 years of age were found to be relatively serious in this study. The mean MDD  
50  
51 scores of boys and girls were 8.78 and 8.56 respectively, very close to the mean score  
52  
53 of 8.11 of adolescents referred to mental health outpatient services in Ontario.<sup>57</sup> The  
54  
55 average SASC scores of migrant adolescents were significantly lower than the scores  
56  
57  
58  
59  
60

1  
2  
3  
4 of normal Chinese adolescents aged 13-16 years old (boys: 14.67 vs 16.34, respectively;  
5  
6 girls: 13.41 vs 15.59, respectively).<sup>44</sup> In addition, migrant girls experienced more  
7  
8 anxiety than boys, and older adolescents experienced more anxiety and depressive  
9  
10 symptoms than their younger peers. These results were consistent with the previous  
11  
12 literature.<sup>19</sup> All these findings emphasized the urgent need for improvement in migrant  
13  
14 adolescents' mental health, especially among older girls. The average acculturation  
15  
16 score of migrant adolescents was in the middle. It showed that the level of acculturation  
17  
18 of migrant adolescents had much room for improvement.  
19  
20  
21  
22  
23  
24  
25  
26

27 The findings from the multiple regression analysis and structural equation model  
28  
29 largely supported our hypothesis as when the important role of psychological  
30  
31 adjustment on acculturation manifested in the model. Psychological adjustment directly  
32  
33 and positively affected the level of mental health ( $\beta=0.30$  and  $0.28$ ), and it was  
34  
35 considered to be the higher level of integration and also to be the outcome of  
36  
37 acculturation.<sup>36</sup> Thus, this view was verified among Chinese migrant adolescents in our  
38  
39 study.  
40  
41  
42  
43  
44  
45  
46  
47

48 The indirect relationships between acculturation components (i.e., language, social  
49  
50 interaction and lifestyle) and mental health via psychological adjustment were also  
51  
52 significant. Although language was found to be an important factor in acculturation  
53  
54 among international immigrants<sup>58</sup> and international students<sup>59</sup>, it had the least influence  
55  
56 on psychological adjustment in this study. This difference was mainly because  
57  
58  
59  
60

1  
2  
3  
4 Mandarin was widely used at school, which diminished the language barrier. Compared  
5  
6 to language, social interaction had a larger influence on psychological adjustment  
7  
8 ( $\beta=0.24$  and  $0.13$ ). Previous research showed a similar conclusion that fewer mental  
9  
10 health problems were found among adolescents making friends from their own and  
11  
12 other cultures.<sup>60</sup> Unfortunately, the cross-cultural friendships of immigrant adolescents  
13  
14 were less reciprocal than the same culture friendships.<sup>61</sup> The same situation also  
15  
16 occurred in our study, 48% of migrant adolescents had no friends among the local  
17  
18 adolescents, and only 11% of migrant adolescents hoped to make friends with local  
19  
20 adolescents. Hence, further understanding the persistence of traditional social groups  
21  
22 and identities was crucial for the development of psychological adjustment that will  
23  
24 ensure mental health. In contrast to the other two, lifestyle had the largest influence on  
25  
26 psychological adjustment ( $\beta=0.37$  and  $0.51$ ), and it also directly aggravated the  
27  
28 symptoms of anxiety ( $\beta= -0.17$ ). On the one hand, adopting the mainstream lifestyle  
29  
30 may aggravate the stress related to facing new dress, diets and social custom<sup>60</sup>, which  
31  
32 may have a negative impact on the mental health of migrant adolescents. On the other  
33  
34 hand, adjusting oneself to the mainstream lifestyle will promote cultural  
35  
36 communication with local adolescents,<sup>62</sup> thereby improving psychological adjustment.  
37  
38 Therefore, the results showed that lifestyle had both positive and negative effects on  
39  
40 mental health. This phenomenon was also found in other studies.<sup>63</sup> These results  
41  
42 suggested that despite the impact of lifestyle on mental health being somewhat  
43  
44 uncertain, improving language skills and communicating with local adolescents could  
45  
46 effectively improve the mental health of internal migrant adolescents in Guangzhou.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 This also explained to some extent why previous studies on acculturation and mental  
5  
6 health had not reached a consistent conclusion.<sup>26</sup> Because the dimensions used to  
7  
8 measure acculturation were not completely consistent in different studies,<sup>48</sup> the impacts  
9  
10 of different dimensions on mental health may be much different or even opposite.  
11  
12 Therefore, further research should adopt unified acculturation measurement and  
13  
14 explore the relationship between single dimension of acculturation and mental health.  
15  
16  
17  
18  
19  
20  
21

### 22 *Methodological discussion*

23  
24 Both multiple regression analysis and SEM were performed in this study. The multiple  
25  
26 regression had only one dependent variable, while the SEM could include one variable  
27  
28 as both an independent variable and a dependent variable. Thus we found a mediating  
29  
30 effect of psychological adjustment on the relationship between acculturation and mental  
31  
32 health. In addition, the SEM could directly show us the impact of different dimensions  
33  
34 of acculturation on mental health, thus, we could find the most influential dimensions  
35  
36 and propose corresponding interventions.  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

### 47 *Policy recommendations*

48  
49 Based on the results of our study, we suggested that the impact of acculturation on  
50  
51 mental health should be considered when psychological interventions are implemented  
52  
53 with migrant adolescents of different cultural backgrounds. For example, schools with  
54  
55 migrant students scale up the efforts to prevent mental health problems among migrant  
56  
57 adolescents by adding content of local language and regional culture to mental health  
58  
59  
60

1  
2  
3  
4 education programmes. Activities, including extracurricular programmes with local  
5  
6 adolescents that could enhance social interaction, should also be encouraged at the  
7  
8 schools.  
9

10  
11  
12  
13  
14 Our study also had some limitations. First, although a self-designed  
15  
16 multidimensional scale measured acculturation with an acceptable overall Cronbach's  
17  
18  $\alpha$  of 0.70, two dimensions had Cronbach's  $\alpha$  of 0.52 and 0.55. The factor loadings of  
19  
20 some items were also relatively low. This indicated the reliability of measurement was  
21  
22 reluctantly accepted but need to be further improved. Future research may improve the  
23  
24 reliability of the developed acculturation scale by modifying some items. Second, the  
25  
26 MDD had not been used in Chinese adolescents before, so the validity of this scale may  
27  
28 be affected, and we could not get the results of the scale applied to Chinese normal  
29  
30 adolescents. Third, some confounding factors which might influence the mental health  
31  
32 of adolescents were not included in this study, such as the parental mental health. Fourth,  
33  
34 data used for this study was collected through a cross-sectional survey. A longitudinal  
35  
36 study may be necessary to verify the observed relationship between acculturation and  
37  
38 mental health.  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

## 50 **Conclusion**

51  
52 Findings suggested there was a strong association among acculturation, psychological  
53  
54 adjustment and mental health. Psychological adjustment played an important mediating  
55  
56 role between acculturation and mental health. A higher level of language and social  
57  
58  
59  
60

1  
2  
3  
4 interaction indicated less anxiety and depression, while a higher level of mainstream  
5  
6 lifestyle indicated more anxiety and less depression. We should pay attention to the  
7  
8 impact of acculturation on mental health when psychological interventions are  
9  
10 implemented with migrant adolescents of different cultural backgrounds.  
11  
12  
13  
14  
15  
16

17 **Figure legends:**

18  
19 **Figure 1.** Structural equation modelling of acculturation, psychological adjustment and  
20 MDD. *Note:* Standardized path coefficients were reported, and only significant paths  
21 were depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96,  
22 RMSEA=0.03, CMIN/df=2.1. \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring  
23 respondents' language; SI1-SI2, the two items measuring respondents' social  
24 interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the  
25 four items measuring respondents' psychological adjustment; MDD1-MDD6, the six  
26 items measuring respondents' Major Depression.  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39

40 **Figure 2.** Structural equation modelling of acculturation, psychological adjustment and  
41 SASC. *Note:* Standardized path coefficients were reported, and only significant paths  
42 were depicted in the figure. Dotted line represented negative relationship. The data-  
43 model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, CMIN/df=2.2. \*:  $p < 0.05$  \*\*:  
44  $p < 0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two  
45 items measuring respondents' social interaction; LI1-LI5, the five items measuring  
46 respondents' lifestyle; PA1-PA4, the four items measuring respondents' psychological  
47 adjustment; FEN, fear of negative evaluation; SAD, social avoidance and distress.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3  
4 **Figure 3.** The confirmatory factor analysis model of acculturation. *Note:* Standardized  
5  
6 path coefficients were reported. The data-model fit indices:  $P=0.129>0.05$ ,  
7  
8 CMIN/df=1.26, GFI=0.992, CFI=0.996, RMSEA=0.015. \*\*:  $p<0.001$ . LA1-LA4, the  
9  
10 four items measuring respondents' language; SI1-SI2, the two items measuring  
11  
12 respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle.  
13  
14  
15  
16  
17  
18

### 19 **Acknowledgements**

20  
21  
22 The survey was supported by Sun Yat-sen Center for Migrant Health Policy and the six  
23  
24 participating schools. We thank all participants and investigators for this study. We are  
25  
26 also grateful to all who provided valuable comments on this paper.  
27  
28  
29

### 30 **Contributors**

31  
32 LS participated in data analysis and wrote the manuscript. WC and JB contributed to  
33  
34 revision of the manuscript. YL participated in study design and data collection. LL  
35  
36 contributed to the design of the project and the supervision of project implementation.  
37  
38  
39 All authors read and approved the final manuscript.  
40  
41  
42

### 43 **Funding**

44  
45 This work was supported by the China Medical Board grant number [12-111].  
46  
47

### 48 **Competing interests**

49  
50 None declared.  
51  
52

### 53 **Participant consent**

54  
55 Obtained.  
56  
57

### 58 **Ethics approval**

1  
2  
3  
4 This study was approved by the Institutional Review Board (IRB) of the School of  
5  
6 Public Health, Sun Yat-sen University in China ([2015] No.42).  
7  
8

9 **Provenance and peer review**

10  
11 Not commissioned; externally peer reviewed.  
12  
13

14 **Data sharing statement**

15  
16 No additional data are available.  
17  
18  
19  
20  
21

22 **References:**

- 23  
24  
25 1. Department of Economic and Social Affairs United Nations. International  
26  
27 Migration Report 2017 Highlights[J]. 2017.  
28  
29  
30 2. Lin Y, Zhang Q, Chen W, et al. Association between Social Integration and Health  
31  
32 among Internal Migrants in ZhongShan, China. PLOS ONE 2016;11(2):e148397.  
33  
34  
35 3. Chengrong D, Ge Y. Study on the Latest Situation of Floating Children in China.  
36  
37 Population Journal 2008(06):23-31.  
38  
39  
40 4. Office for the Sixth Population Census of China. Major figures on 2010 population  
41  
42 census of China: China Statistics Press, 2011.  
43  
44  
45 5. All China Women's Federation. National Report on Children left in rural areas and  
46  
47 migrant children. Chinese Women's Movement 2013(6):30-34.  
48  
49  
50 6. Fu Q, Ren Q. Educational inequality under China's rural - urban divide: The hukou  
51  
52 system and return to education. Environment & Planning A 2010;42(3):592-610.  
53  
54  
55 7. Goodburn C. Learning from migrant education: A case study of the schooling of  
56  
57 rural migrant children in Beijing. International Journal of Educational Development  
58  
59  
60

1  
2  
3  
4 2009;29(5):495-504.  
5

6 8. Chen Y, Feng S. Access to public schools and the education of migrant children in  
7  
8  
9 China ☆. *China Economic Review* 2013;26(1):75-88.  
10

11 9. Gui Y, Berry JW, Zheng Y. Migrant worker acculturation in China ☆. *International*  
12  
13  
14 *Journal of Intercultural Relations* 2012;36(4):598-610.  
15

16 10. Yang L, Chen X, Li S, et al. Path Analysis of Acculturative Stress Components and  
17  
18  
19 Their Relationship with Depression Among International Students in China. *Stress &*  
20  
21  
22 *Health Journal of the International Society for the Investigation of Stress*  
23  
24  
25 2016;160(4):1957-1964.  
26

27 11. Gao Q, Li H, Zou H, et al. The mental health of children of migrant workers in  
28  
29  
30 Beijing: the protective role of public school attendance. *Scandinavian Journal of*  
31  
32  
33 *Psychology* 2015;56(4):384.  
34

35 12. Stevens G W, Vollebergh W A. Mental health in migrant children[J]. *Journal of*  
36  
37  
38 *Child Psychology & Psychiatry*, 2010, 49(3):276-294.  
39

40 13. Mood C, Jonsson JO, Låftman SB. Immigrant Integration and Youth Mental Health  
41  
42  
43 in Four European Countries. *European Sociological Review* 2016;32(6):w27.  
44

45 14. Goodman A, Patel V, Leon DA. Child mental health differences amongst ethnic  
46  
47  
48 groups in Britain: a systematic review. *BMC PUBLIC HEALTH* 2008;8(1):1-11.  
49

50 15. Brettschneider AK, Hölling H, Schlack R, et al. [Mental health in adolescents in  
51  
52  
53 Germany: A comparison with regard to migration background and country of origin].  
54  
55  
56 *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2015;58(4-5):80-85.  
57

58 16. Bhui KS, Lenguerrand E, Maynard MJ, et al. Does cultural integration explain a  
59  
60

- 1  
2  
3  
4 mental health advantage for adolescents? *INT J EPIDEMIOL* 2012;41(3):791-802.  
5  
6  
7 17. Sun X, Chen M, Chan KL. A meta-analysis of the impacts of internal migration on  
8  
9 child health outcomes in China. *BMC PUBLIC HEALTH* 2015;16(1):1-11.  
10  
11  
12 18. Zhao Y. Relationship between social support and depression of migrant children:  
13  
14 the mediating effect of core-self evaluations. *Chinese Journal of School Health*  
15  
16 2014;35(12):1844-1846.  
17  
18  
19 19. Thombs BD, Roseman M, Kloda LA. Depression screening and mental health  
20  
21 outcomes in children and adolescents: a systematic review protocol. *Systematic*  
22  
23 *Reviews* 2012;1(1):58.  
24  
25  
26  
27 20. Williams SB, O'Connor EA, Eder M, et al. Screening for child and adolescent  
28  
29 depression in primary care settings: a systematic evidence review for the US Preventive  
30  
31 Services Task Force. *PEDIATRICS* 2009;123(4):e716.  
32  
33  
34  
35 21. C. P. Assimilation in American Life. The Role of Race, Religion, and National  
36  
37 Origins by Milton M. Gordon. *American Journal of Sociology* 1965;4(Volume 70,  
38  
39 Number 4):134.  
40  
41  
42  
43 22. Berry J W. Psychology of acculturation.[J]. *Nebraska Symposium on Motivation*  
44  
45 *Nebraska Symposium on Motivation*, 1989, 37(4):201.  
46  
47  
48 23. Berry J W, Annis R C. Acculturative stress: The role of ecology, culture and  
49  
50 differentiation.[J]. *Journal of Cross-Cultural Psychology*, 1974, 5(4):382-406.  
51  
52  
53 24. Smokowski P R, Bacallao M L. Acculturation, Internalizing Mental Health  
54  
55 Symptoms, and Self-Esteem: Cultural Experiences of Latino Adolescents in North  
56  
57 Carolina[J]. *Child Psychiatry & Human Development*, 2007, 37(3):273-292.  
58  
59  
60

- 1  
2  
3  
4 25. Nakash O, Nagar M, Shoshani A, et al. The effect of acculturation and  
5  
6 discrimination on mental health symptoms and risk behaviors among adolescent  
7  
8 migrants in Israel[J]. *Cultural Diversity & Ethnic Minority Psychology*, 2012,  
9  
10 18(3):228.  
11  
12  
13  
14 26. Rogler L H, Cortes D E, Malgady R G. Acculturation and mental health status  
15  
16 among Hispanics: Convergence and new directions for research.[J]. *American*  
17  
18 *Psychologist*, 1991, 46(6):585-97.  
19  
20  
21  
22 27. Jang Y, Chiriboga D A. Social activity and depressive symptoms in Korean  
23  
24 American older adults: the conditioning role of acculturation.[J]. *J Aging Health*, 2011,  
25  
26 23(5):767-781.  
27  
28  
29  
30 28. Takeuchi D T, Chung R C, Lin K M, et al. Lifetime and twelve-month prevalence  
31  
32 rates of major depressive episodes and dysthymia among Chinese Americans in Los  
33  
34 Angeles.[J]. *American Journal of Psychiatry*, 1998, 155(10):1407.  
35  
36  
37  
38 29. Guglani S, Coleman P G, Sonuga-Barke E J S. Mental health of elderly Asians in  
39  
40 Britain: a comparison of Hindus from nuclear and extended families of differing  
41  
42 cultural identities[J]. *International Journal of Geriatric Psychiatry*, 2000, 15(11):1046.  
43  
44  
45  
46 30. Nguyen L, Peterson C. Depressive symptoms among Vietnamese-American college  
47  
48 students[J]. *Journal of Social Psychology*, 1993, 133(1):65.  
49  
50  
51  
52 31. Adrados J L R. Acculturation: The Broader View. Theoretical Framework of the  
53  
54 *Acculturation Scales*[J]. *International Journal of the Addictions*, 2015, 32(12-13):1919-  
55  
56 1924.  
57  
58  
59 32. Mehta S. Relationship between acculturation and mental health for Asian Indian  
60

1  
2  
3  
4 immigrants in the United States.[J]. Genetic Social & General Psychology Monographs,  
5  
6 1998, 124(1):61.  
7

8  
9 33. Peng B L, Zou G Y, Chen W, et al. Association between health service utilisation  
10  
11 of internal migrant children and parents' acculturation in Guangdong, China: a cross-  
12  
13 sectional study[J]. Bmj Open, 2018, 8(1):e018844.  
14  
15

16  
17 34. Ying Y W. Cultural orientation and psychological well-being in Chinese  
18  
19 Americans[J]. American Journal of Community Psychology, 1995, 23(6):893-911.  
20  
21

22  
23 35. Ouarasse O A, van de Vijver F J R. The role of demographic variables and  
24  
25 acculturation attitudes in predicting sociocultural and psychological adaptation in  
26  
27 Moroccans in the Netherlands[J]. International Journal of Intercultural Relations, 2005,  
28  
29 29(3): 251-272.  
30  
31

32  
33 36. Swagler M A, Jome L R M. The Effects of Personality and Acculturation on the  
34  
35 Adjustment of North American Sojourners in Taiwan[J]. Journal of Counseling  
36  
37 Psychology, 2005, 52(4): 527.  
38  
39

40  
41 37. Kim E, Cain K, McCubbin M. Maternal and paternal parenting, acculturation, and  
42  
43 young adolescents' psychological adjustment in Korean American families[J]. Journal  
44  
45 of Child and Adolescent Psychiatric Nursing, 2006, 19(3): 112-129.  
46  
47

48  
49 38. Ward C, Kennedy A. Psychological and socio-cultural adjustment during cross-  
50  
51 cultural transitions: A comparison of secondary students overseas and at home[J].  
52  
53 International journal of psychology, 1993, 28(2): 129-147.  
54  
55

56  
57 39. Olasupo M O, Idemudia E S, Dimatkakso M. Adjustment, psychological well-being  
58  
59 and mental health of first year students in a South African university[J]. North  
60

1  
2  
3  
4 American Journal of Psychology, 2018, 20(1):55-68.

5  
6 40. Koneru V K, de Mamani A G W, Flynn P M, et al. Acculturation and mental health:  
7  
8 Current findings and recommendations for future research[J]. Applied and Preventive  
9  
10 Psychology, 2007, 12(2): 76-96.

11  
12  
13 41. Zhou H, Qu Z Y, Zhang Q L. Survey on the development and needs of migrant  
14  
15 children in nine cities of China[J]. Youth Studies, 2005(2):1-7.

16  
17  
18 42. La Greca AM, Dandes SK, Wick P, et al. Development of the Social Anxiety Scale  
19  
20 for Children: Reliability and Concurrent Validity. Journal of Clinical Child &  
21  
22 Adolescent Psychology 1988;17(1):84-91.

23  
24  
25 43. Cunningham CE, Boyle MH, Hong S, et al. The Brief Child and Family Phone  
26  
27 Interview (BCFPI): 1. Rationale, development, and description of a computerized  
28  
29 children's mental health intake and outcome assessment tool. J CHILD PSYCHOL  
30  
31 PSYC 2009;50(4):416-423.

32  
33  
34 44. Li F, Su L, Jin Y. Norm of the screen for child social anxiety related emotional  
35  
36 disorders in Chinese urban children. CHINESE JOURNAL OF CHILD HEALTH  
37  
38 CARE 2006;14(4):335-337.

39  
40  
41 45. Gordon M M. Assimilation in American life:[M]. Oxford University Press, 1964.

42  
43  
44 46. Berry J W. Acculturation strategies and adaptation.[J]. 2007:69-82.

45  
46  
47 47. Ryder A G, Alden L E, Paulhus D L. Is acculturation unidimensional or  
48  
49 bidimensional? A head-to-head comparison in the prediction of personality, self-  
50  
51 identity, and adjustment.[J]. Journal of Personality & Social Psychology, 2000,  
52  
53 79(1):49-65.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3  
4 48. Matsudaira T. Measures of psychological acculturation: A review[J]. *Transcultural*  
5  
6 *psychiatry*, 2006, 43(3): 462-487.  
7  
8  
9 49. Unger JB, Gallahen P, Shakib S, et al. The AHIMSA Acculturation Scale: A New  
10  
11 Measure of Acculturation for Adolescents in a Multicultural Society. *The Journal of*  
12  
13 *Early Adolescence* 2002;22(3):225-251.  
14  
15  
16 50. Ward C. Acculturation and adaptation revisited. *Journal of Cross-Cultural*  
17  
18 *Psychology* 1999;30(4):422-442.  
19  
20  
21 51. Ward C, Kennedy A. Psychological and socio-cultural adjustment during cross-  
22  
23 cultural transitions: A comparison of secondary students overseas and at home[J].  
24  
25 *International journal of psychology*, 1993, 28(2): 129-147.  
26  
27  
28 52. Tian L, Zhang L, Huebner E S, et al. The longitudinal relationship between school  
29  
30 belonging and subjective well-being in school among elementary school students[J].  
31  
32 *Applied Research in Quality of Life*, 2016, 11(4): 1269-1285.  
33  
34  
35 53. Zhang J, Mandl H, Wang E. Personality, acculturation, and psychosocial adjustment  
36  
37 of Chinese international students in Germany[J]. *Psychol Rep*, 2010, 107(2):511-525.  
38  
39  
40 54. Lorenzoblanco EI, Unger JB, Baezcondegarbanati L, et al. Acculturation,  
41  
42 enculturation, and symptoms of depression in Hispanic youth: the roles of gender,  
43  
44 Hispanic cultural values, and family functioning. *Journal of Youth and Adolescence*  
45  
46 2012;41(10):1350-1365.  
47  
48  
49 55. Bacon DR, Others A. Composite Reliability in Structural Equations Modeling.  
50  
51 *EDUC PSYCHOL MEAS* 1995;55(3):394-406.  
52  
53  
54 56. Tanaka J S. "How Big Is Big Enough?": Sample Size and Goodness of Fit in  
55  
56  
57  
58  
59  
60



1  
2  
3  
4 Structural Equation Models with Latent Variables[J]. Child Development, 1987,  
5  
6 58(1):134-146.

7  
8  
9 57. Boyle MH, Cunningham CE, Georgiades K, et al. The Brief Child and Family  
10  
11 Phone Interview (BCFPI): 2. Usefulness in screening for child and adolescent  
12  
13 psychopatholog. J CHILD PSYCHOL PSYC 2009;50(4):424.

14  
15  
16 58. Delander L, Hammarstedt M, Månsson J, et al. Integration of immigrants: the role  
17  
18 of language proficiency and experience. Evaluation Review: A Journal of Applied  
19  
20 Social Research 2005;29(1):24-41.

21  
22  
23 59. Lawani AO, Gai X, Titilayo A. The Effects of Continental Background, Language  
24  
25 Proficiency and Length of Stay on Social Adjustment Experience of International  
26  
27 Students in Northern China. Revista De Cercetare Şi Intervenție Socială  
28  
29 2012;37(37):91-106.

30  
31  
32 60. Bhui K, Stansfeld S, Head J, et al. Cultural identity, acculturation, and mental  
33  
34 health among adolescents in east London's multiethnic community. Journal of  
35  
36 Epidemiology & Community Health 2005;59(4):296-302.

37  
38  
39 61. Horenczyk G, Tatar M. Friendship expectations among immigrant adolescents and  
40  
41 their host peers. Journal of Adolescence 1998;21(1):69-82.

42  
43  
44 62. André M. N. Renzaho, Julie Green, David Mellor, et al. Parenting, family  
45  
46 functioning and lifestyle in a new culture: the case of African migrants in Melbourne,  
47  
48 Victoria, Australia[J]. Child & Family Social Work, 2011, 16(2):228-240.

49  
50  
51 63. Griffith J. Relationship between Acculturation and Psychological Impairment in  
52  
53 Adult Mexican Americans.[J]. Hispanic Journal of Behavioral Sciences, 1983,  
54  
55  
56  
57  
58  
59  
60

5(4):431-459.

Table 1. Psychological adjustment and acculturation of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach's $\alpha$
<b>Psychological adjustment</b>				0.665
1. Where do you think you belong to?		1.89 (1.02)	0.66	
Outsiders	575 (51)			
Unknown	170 (15)			
Both	297 (27)			
Guangzhou people	80 (7)			
2. Do you like Guangzhou?		3.91 (0.75)	0.86	
Very not	9 (1)			
Not	19 (2)			
Unclear	254 (23)			
Like	619 (55)			
Very like	221 (20)			
3. Are you satisfied with your life in Guangzhou?		3.87 (0.72)	0.80	
Very not	8 (1)			
Not	29 (3)			
Unclear	237 (21)			
Sure	677 (60)			
Very sure	171 (15)			
4. Would you like to live in Guangzhou always?		3.59 (0.95)	0.60	
Very not	16 (1)			
Not	176 (16)			
Unclear	203 (18)			
Sure	582 (52)			
Very sure	145 (13)			
<b>Lifestyle</b>				0.524
5. Do you like to celebrate the Spring Festival in Guangzhou?		2.16 (0.93)	0.49	
Very not	341 (30)			
Not	331 (30)			
Average	379 (34)			
Sure	71 (6)			
6. Do you think Guangzhou people dressed nice?		2.29 (0.49)	0.60	
Not	20 (2)			
Average	758 (68)			

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Yes	344 (31)		
7. Do you like the clothes in Guangzhou?		3.06 (1.17)	0.57
Very not	33 (3)		
Not	429 (38)		
Unclear	252 (23)		
Sure	242 (22)		
Very sure	166 (15)		
8. Do you eat Cantonese cuisine?		2.88 (0.84)	0.30
Always	55 (5)		
Usually	99 (9)		
Sometimes	703 (63)		
Once in a while	188 (17)		
Never	77 (7)		
9. Do you like to eat Cantonese cuisine?		1.75 (0.84)	0.41
No	571 (51)		
Average	261 (23)		
Yes	290 (26)		
<b>Social interaction</b>			0.553
10. Where did your major good friends come from?		1.61 (0.66)	0.50
Outside	543 (48)		
Both place	470 (42)		
Local	109 (10)		
11. Do you hope your classmates and friends to be local children?		1.89 (0.57)	0.74
No	247 (22)		
Average	749 (67)		
Yes	126 (11)		
<b>Language</b>			0.811
12. Can you understand Cantonese?		2.69 (0.93)	0.87
Completely	268 (24)		
Most	335 (30)		
A little	419 (37)		
Completely not	100 (9)		
13. Can you speak Cantonese?		2.00 (0.94)	0.82
Completely	110 (10)		
Most	159 (14)		
A little	470 (42)		
Completely not	383 (34)		
14. Do you watch TV programs in Cantonese?		2.38 (0.97)	0.63
Usually	181 (16)		

---

1			
2			
3			
4	Sometimes	280 (25)	
5	Once in a while	441 (39)	
6	Never	220 (20)	
7	15. Do you listen to Cantonese		
8	songs?		2.48 (0.94) 0.51
9			
10	Usually	185 (17)	
11	Sometimes	338 (30)	
12	Once in a while	426 (38)	
13	Never	173 (15)	
14			

---

For peer review only

Table 2. Demographic characteristics by anxiety (SASC) and major depression (MDD) scales among 1,122 migrant adolescents in Guangzhou, China in 2016

Variables	N (%)	MDD Mean (SD)	<i>P</i> value	SASC Mean (SD)	<i>P</i> value
<b>Gender</b>			0.097		<0.001
Boys	621 (55)	8.78 (2.17)		14.67 (3.72)	
Girls	501 (45)	8.56 (2.22)		13.41 (4.01)	
<b>Age (years)</b>			0.003		0.043
11~12	75 (7)	9.01 (2.30)		14.47 (4.09)	
13	391 (35)	8.97 (2.10)		14.51 (3.89)	
14	452 (40)	8.49 (2.28)		13.86 (3.91)	
15~16	204 (18)	8.47 (2.07)		13.77 (3.80)	
<b>Place of origin</b>			0.318		0.525
Guangdong province	592 (53)	8.75 (2.16)		14.04 (3.75)	
Other province	530 (47)	8.62 (2.23)		14.19 (4.08)	
<b>Length of stay in Guangzhou</b>			0.132		0.444
<5 years	241 (22)	8.57 (2.18)		14.24 (3.94)	
5 to 10 years	317 (28)	8.56 (2.16)		14.29 (3.69)	
>10 years	540 (48)	8.83 (2.22)		13.97 (4.04)	

Table 3. Associations between acculturation dimensions, psychological adjustment and mental health scales (MDD and SASC) after the adjustment of demographic characteristics among 1,122 migrant adolescents in Guangzhou, China in 2016

Variables	MDD		SASC	
	$\beta$ (95%CI)	<i>P</i> value	$\beta$ (95%CI)	<i>P</i> value
<b>Language</b>	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
<b>Social-interaction</b>	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
<b>Lifestyle</b>	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
<b>Psychological adjustment</b>	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
<b>Gender</b>				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
<b>Place of origin</b>				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
<b>Age</b>				
11~12 (ref)				
13	0.01 (-0.49,0.56)	0.893	0.03 (-0.72,1.18)	0.630
14	-0.09 (-0.93,0.12)	0.132	-0.05 (-1.31,0.58)	0.446
15~17	-0.07 (-0.95,0.19)	0.194	-0.05 (-1.57,0.50)	0.309
<b>Length of stay in Guangzhou</b>				
<5 years (ref)				
5 to 10 years	-0.05 (-0.58,0.14)	0.235	-0.01 (-0.77,0.53)	0.711
>10 years	-0.01 (-0.40,0.28)	0.737	-0.06 (-1.08,0.14)	0.130

Note:  $\beta$  = standardized regression coefficient; 95%CI=95% Confidence interval.

Table 4. The effects of acculturation dimensions and psychological adjustment on mental health in the SEM

Latent Variables	SASC			MDD		
	Direct effect(95%CI)	Indirect effect(95%CI)	Total effect(95%CI)	Direct effect(95%CI)	Indirect effect(95%CI)	Total effect(95%CI)
Language	ns	0.03(0.01~0.05)	0.03(0.01~0.05)	ns	0.05(0.04~0.06)	0.05(0.04~0.06)
Social interaction	ns	0.04(0.02~0.06)	0.04(0.02~0.06)	ns	0.07(0.03~0.11)	0.07(0.03~0.11)
Lifestyle	-0.17(-0.29~-0.05)	0.15(0.07~0.23)	-0.03(-0.05~-0.01)	ns	0.11(0.06~0.16)	0.11(0.06~0.16)
Psychological adjustment	0.28(0.23~0.33)	-	0.28(0.23~0.33)	0.30(0.27~0.33)	-	0.30(0.27~0.33)

Note: ns: non-significant; 95%CI=95% Confidence interval.

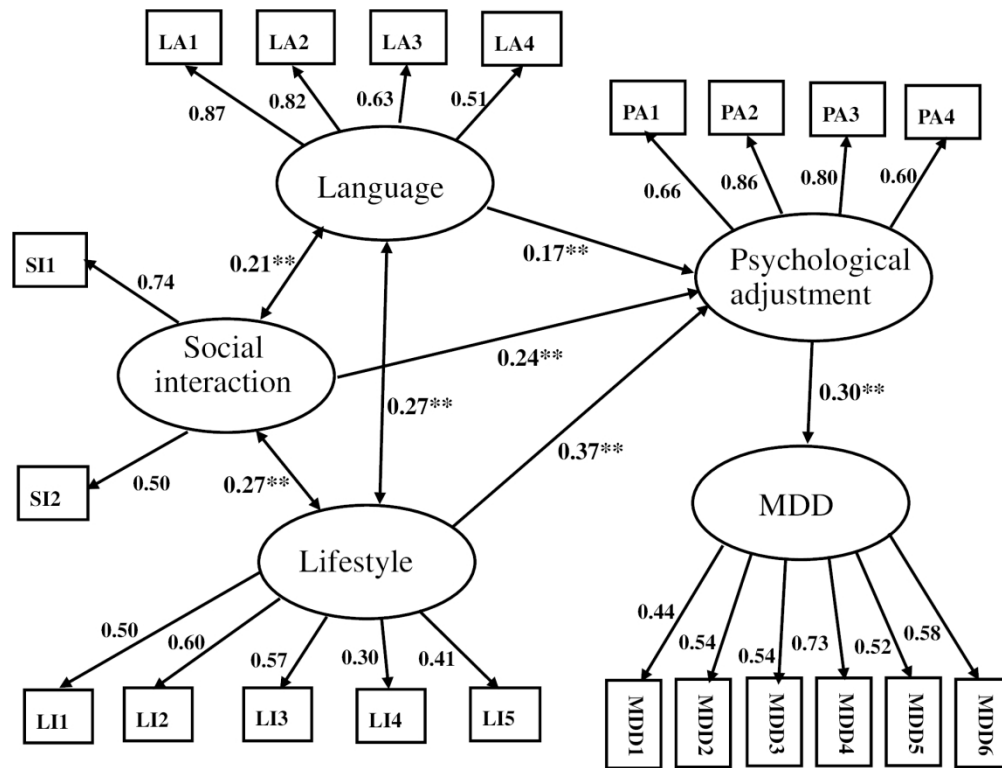


Figure 1. Structural equation modelling of acculturation, psychological adjustment and MDD. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, CMIN/df=2.1. \*\*: p<0.001. LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the four items measuring respondents' psychological adjustment; MDD1-MDD6, the six items measuring respondents' Major Depression.

175x132mm (300 x 300 DPI)



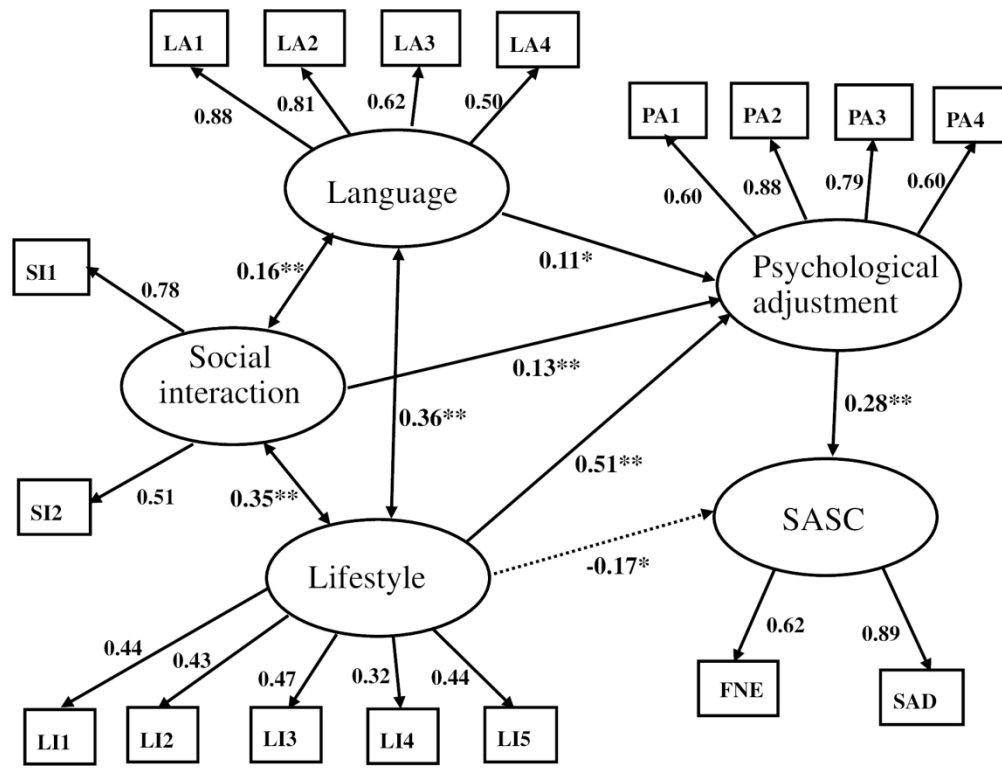


Figure 2. Structural equation modelling of acculturation, psychological adjustment and SASC. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. Dotted line represented negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, CMIN/df=2.2. \*:  $p < 0.05$  \*\*:  $p < 0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle; PA1-PA4, the four items measuring respondents' psychological adjustment; FNE, fear of negative evaluation; SAD, social avoidance and distress.

169x128mm (300 x 300 DPI)

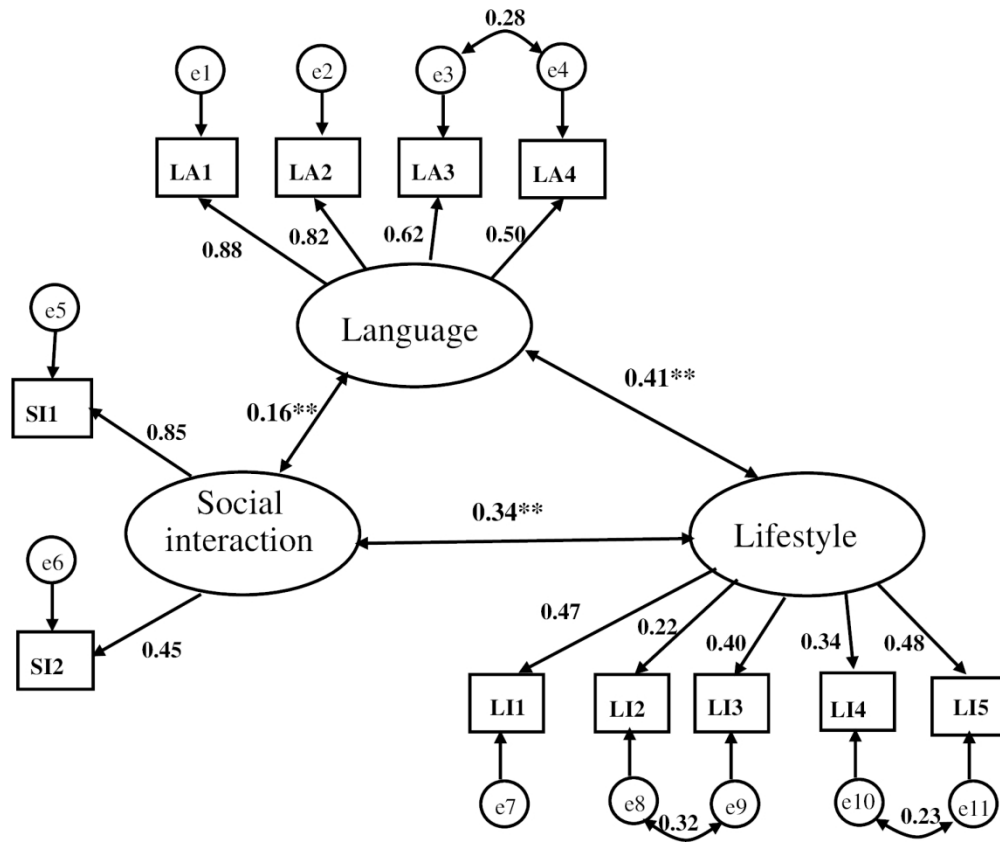


Figure 3. The confirmatory factor analysis model of acculturation. Note: Standardized path coefficients were reported. The data-model fit indices:  $P=0.129>0.05$ ,  $CMIN/df=1.26$ ,  $GFI=0.992$ ,  $CFI=0.996$ ,  $RMSEA=0.015$ . \*\*:  $p<0.001$ . LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items measuring respondents' social interaction; LI1-LI5, the five items measuring respondents' lifestyle.

161x134mm (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 #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	page # 1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	page # 2-3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	page # 5-7
Objectives	3	State specific objectives, including any prespecified hypotheses	page # 7-8
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	page # 8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	page # 9
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	page # 9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	page #10-12
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	page #10-12
Bias	9	Describe any efforts to address potential sources of bias	page #9
Study size	10	Explain how the study size was arrived at	page #9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	page #13
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	page #13
		(b) Describe any methods used to examine subgroups and interactions	page #13
		(c) Explain how missing data were addressed	page #9
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			

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 (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	page #14
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest	page #14
Outcome data	15*	Report numbers of outcome events or summary measures	page #14
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 (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	page #15
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #16
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	page #17
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	page #21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	page #17-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	page #20
<b>Other information</b>			
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	page #23

\*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](http://www.strobe-statement.org).