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

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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

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

Conclusions: Findings suggest that there is a strong connection between social integration and mental health in internal migrant adolescents. Interventions such as promoting social interaction and understanding of regional culture are needed to enhance psychological integration and furthermore improve the mental health of migrant adolescents.

Key words: Social integration; Mental health; Internal migrant; Adolescents.

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 fundings 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.[1] Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.[2] According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.[3] 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,[4] and they accounted for 12.8% of overall adolescents' population in China.[5]

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.[6-8] 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.[9] 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.[10, 11]

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

health of migrant adolescents might be better[12, 13] or worse.[14, 15] However, a comprehensive report indicated that the mental health of migrant adolescents in China was inferior compared with local adolescents due to the influence of hukou system in majority studies.[16] Another study in Guangzhou showed that the detection rate of depression symptoms in migrant adolescents was 21.8%, far higher than local adolescents (11.2%),[17] also higher than adolescents in other countries.[18] Mental problem in childhood and adolescence is associated with many negative outcomes, including impaired social, work, and family functioning in adolescence and into adulthood.[19] Therefore, a better understanding of the risk factors for mental health among this vulnerable population are significant to public health of the internal migrant adolescents in China.

Studies showed that among many factors that affect adolescents' mental health, social integration is uniquely relevant to migrant adolescents.[20] The social integration theory was originally developed to explain the achievements of immigrants' adaptation, acculturation process, and identity in a developed society.[2] A high level of social integration means that migrants had gained social support and social resources in the new adopted environment.[21] Many studies had found that social integration positively correlates with mental health in various types of immigrants,[22-24] but only a few paid attention beyond the adult migrants.[25] No research has been conducted to explore the role and the pathway of social integration on mental health among internal migrant adolescents in China. On the other hand, since there was no consistent

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

The primary aim of this study is to confirm this hypothesis using a structure model analysis with data from a cross-sectional study in Guangzhou, China. Specifically, we aimed to: (1) to assess the status of mental health and social integration of migrant adolescents; and (2) to test the aforementioned hypothesized structural relationship between social integration and mental health of migrant adolescents. We hope to find some new intervention strategies suitable for migrant adolescents to improve their

mental health by exploring the pathways of social integration indicators affecting mental health.

Methods

Study sites

This cross-sectional survey study was conducted in Tianhe and Baiyun districts in Guangzhou, China from April to May in 2016. Guangzhou is the capital city of Guangdong Province with a population of 12.7 million, and has led the economic reform and openness in China since the 1980s, Guangzhou has also become a major receiving city with 0.6 million internal migrant adolescents.[4, 5]

As the capital city of Guangdong province, Guangzhou has its distinguished Cantonese culture, language and customs. The primary dialect spoken in Guangzhou, 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. Within each district, we chose three private migrant junior high schools using a purposive sampling method.

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 minus 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 adolescents if they found an important answer in the questionnaire missing. Research assistants received standardized training by the research team, and the quality control was implemented during data collection.

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

Measures

Indicators of mental health included anxiety and depression indices. Anxiety was measured by Social Anxiety Scale for Children (SASC), and depression was measured by the dimension of Major Depression (MDD) of a Brief Child and Family Phone Interview. The SASC was developed to measure social anxiety among American

adolescents between 7~16 years of age, and it consists of 10 items scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total scores ranging from 0 to 20, and higher scores indicating less anxiety.[39] The MDD was developed to measure major depression among Ontario adolescents between 6~18 years of age, and it consists of 6 items scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total score ranging from 0 to 12. Higher scores indicate less depression.[40] The Cronbach's alpha of SASC applied on normal Chinese adolescents was 0.79,[41] and the Cronbach's alpha of MDD applied on Ontario adolescents was 0.86.[40]

Social integration consisted of acculturation and psychological integration. Based on acculturation theories developed by Colleen Ward and comprehensive literature review, [30-32,34] the research team designed the measurement of the social integration, which was consisted of 15 items with a total score ranging from 15 to 61 (See Table 1). Higher scores indicate higher levels of social integration. Acculturation was measured by 3 latent variables: social interaction (two items), customs (five items) and language (four items). Customs consists of questions about preferences for food (two items), clothing (two items) and social custom (one item). Each item had 3 to 5 choices. Some questions were rated on a scale ranging from 1 (“No”) to 3 (“Yes”), some questions were rated on a scale ranging from 1 (“Completely not/Never”) to 4 (“Completely/Usually”), and some questions were rated on a scale ranging from 1 (“Never”) to 5 (“Always”). Psychological integration was measured by four questions that asked about “sense of belonging” and “satisfaction of urban life”. Sense of

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

Demographic and other covariates

To better understand the association between social integration and mental health, we also included demographics which were reported to be associated with mental health in children and adolescents.[18, 42] These adjustment variables included age (in years), gender (male or female), place of origin (Guangdong province or other provinces in China) and length of stay in Guangzhou (in years).

Data processing and statistical analysis

Statistical analyses were performed using the software IBM SPSS 20.0 and IBM Amos 24.0. Descriptive statistics including the mean, standard deviation (SD), frequency and proportion were used to summarise the demographics, social integration and mental health of the study participants. Differences in mental health by demographic variables were assessed using t-test or F-test. Multivariate regression models were conducted to assess the association between latent variables of social integration and mental health. The latent variables of social integration were independent variables, and the scores of SASC and MDD were dependent variables. Demographic variables were used as confounding factors. SEM were used to assess the proposed structural relationship among the social integration dimensions and

mental health. Data-model fitting in the structural equation modelling analysis was assessed using the following four indices: Goodness of Fit Index (GFI) (>0.9), Comparative Fit Index (CFI) (>0.9), Root Mean Square Error of Approximation (RMSEA) (< 0.05) and Chi-square/df (<3). Cronbach alpha were computed to assess the reliability of the latent variables. The validity of the data was evaluated by the model fitting indices of SEM and the composite reliability of each latent variable.

Results

A total of 1,233 completed surveys, the response rate was 92.1%, 83 were excluded because of the contradiction of the information provided, 28 were excluded because of incomplete data for several key variables (e.g. questions about social integration and mental health), yielding 1,122 participants (91.0%) for analyses. Table 2 demonstrates that among the 1,122 participants, there were more boys (55%) than girls (45%), and most of them (93%) aged in 13-16 years old, nearly half of them (47%) came from other provinces, and many of them (78%) had lived in Guangzhou more than 5 years. There were significant differences between boys' scores (14.67±3.72) and girls' scores (13.41±4.01) in anxiety scale (P<0.001). 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 ones.

Table 1 showed the overall mean score of social integration of migrant adolescents

was 37.45, and SD was 6.35. In psychological integration dimension, 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 customs integration dimension, the majority of adolescents had high acceptance of urban clothing, and many of the adolescents preferred the lifestyle in their hometown in traditional customs and diet. In social interaction dimension, many of migrant adolescents (48%) failed to interact with local adolescents. In language dimension, nearly half of the adolescents knew the local language well. The mean scores of these questions were computed for modelling analysis.

Table 3 showed multiple regression analysis indicated a positive relationship between the total MDD score, total SASC score and psychological integration after controlling for age, gender, place of origin and residence time ($P<0.001$), while the total SASC score had a negative relationship with custom integration ($P=0.03$). The language skills and social interaction had no significant correlation with total MDD score and total SASC score ($P>0.05$).

Structural equation model was used to explore the internal relations of the various latent variables of social integration and their impact on mental health. Figure 2 shows that psychological integration had direct effect on MDD ($\beta=0.30$) and it was the key variable fully mediating the impact of acculturation components on MDD. Of the three acculturation components, customs had the strongest influence on psychological

integration (β=0.37), followed by social interaction (β=0.24) and language (β=0.17). The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, Chi-square/df=2.1. Figure 3 also shows psychological integration had direct effect on SASC (β=0.28) and it fully mediated the impact of two acculturation components (i.e. language and social interaction) on SASC, whereas the customs showed both a direct negative effect (β=-0.17) and an indirect positive effect via psychological integration on social anxiety. Of the three acculturation components, customs had the strongest influence on psychological integration (β=0.51), followed by social interaction (β=0.13) and language (β=0.11). The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, Chi-square/df=2.2. The hypothesised model produced a good fit to the sample data.

We evaluated the measures to confirm their reliability and validity. In our study, SASC demonstrated the Cronbach's alpha coefficient of 0.82, and MDD demonstrated the Cronbach's alpha coefficient of 0.78. Even the measure of social integration was self-developed, most correlation coefficient of each question's score and the total score of the dimension exceeded 0.5, and the Cronbach α of each latent variable exceeded 0.5 while the Cronbach α of the overall scale exceeded 0.7 (See Table 1); This indicated that the questionnaire had acceptable reliability. In Figure 2, the composite reliability of latent variables were: 0.8082(language), 0.5616(social interaction), 0.5952 (customs), 0.8233(psychological integration). In Figure 3, the composite reliability of latent variables were: 0.8028(language), 0.5935(social interaction)， 0.5176(customs)， 0.8134(psychological integration). These indices all

exceed 0.5. On the other hand, all indices used to assess data-model fitting in SEM satisfied statistical requirements. This indicated the measure of social integration had acceptable validity.[43]

Discussion

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. We found the social integration is positively correlated with mental health. The underlying pathway of this relationship was explored. Psychological integration plays an important mediating role between acculturation and mental health. Three latent variables of acculturation indirectly affect mental health through psychological integration, of which customs have the greatest impact on psychological integration，followed by social interaction and language.

Anxiety and depressive symptoms among migrant adolescents between 11-17 years of age were found severe in this study. The mean MDD scores of boys and girls were 8.78 and 8.56 respectively, very close to a mean score of 8.11 of adolescents referred to mental health outpatient services in Ontario.[44] The average SASC scores of migrant adolescents were significantly lower than the average level of Chinese adolescents aged 13-16 years old (boys: 14.67 vs 16.34; girls: 13.41 vs 15.59).[41] In addition, migrant girls experienced more anxiety symptoms than boys, and older adolescents experienced more anxiety and depressive symptoms than younger peers. These results

are consistent with the previous literature.[18] All these figures confirmed that migrant adolescents' mental health was not optimistic in China, and emphasized the urgent need for improvement in migrant adolescents' mental health, especially among older adolescent girls.

The average score of social integration of migrant adolescents was low. It showed that the level of social integration of migrant adolescents had much room for improvement. It is worth noting that, we found adolescents are mostly satisfied with life in Guangzhou, and many of them had high willingness to integrate into the city. However, most migrant adolescents had undefined identification or thought that they are outsiders, and their score of sense of belonging was relatively low. This contradiction may deepen the psychological pressure, and affect their mental health.[27]

The findings from the multiple regression analysis and structural equation model largely supported our hypothesis as when the important role of psychological integration on social integration manifested in the model. Psychological integration directly and positively affect the level of mental health (β=0.30 and 0.28), and it was considered as the higher level integration and also be the outcome of the social integration.[45] The self-identity, which was contained in psychological integration, had been also shown positively correlated with youngers' mental health.[29] Therefore, this view was verified among Chinese migrant adolescents in our study.

The indirect relations between acculturation components (i.e language, social interaction and customs) and mental health via psychological integration were also significant. Although language was found as an important factor in social integration among international immigrants[28] and international students[46], it had the least influence on psychological integration in this study. This difference is mainly because Mandarin is widely used at schools, which diminished the language barrier. Compared to the language, social interaction had a larger influence on psychological integration (β=0.24 and 0.13). Previous research showed similar conclusion that fewer mental health problems were found among adolescents making friends from their own and other cultures.[47] Unfortunately, the cross-cultural friendships of immigrant adolescents are less reciprocal than same culture friendships.[48] The same situation also occurred in our study, 48% of migrant adolescents had no friends among the local adolescents, and only 11% of migrant adolescents hope to make friends with local adolescents. Hence, further understanding the persistence of traditional social groups and identities is crucial for the development of psychological integration that will ensure mental health. Different from the other two, the customs had the largest influence on psychological integration (β=0.37 and 0.51), and it also directly aggravate the symptoms of anxiety (β= -0.17). These might be explained by Berry's acculturation strategies theory.[31] Adolescents whose strategies were "separation" or "marginalisation" might favor traditionalism, and this lifestyle may minimize the stress related to facing new dress, diets and social custom.[47] Meanwhile, adolescents whose strategies were "integration" or "assimilation" had better custom integration,

but they might be more anxious if they feel a great resistance in the acculturation process. Therefore, the result showed that customs have both positive and negative effects on mental health. This phenomenon was also found in other studie.[22] These results suggested that continued efforts are needed to address regional cultural barriers to promote the psychological integration of migrant adolescents.

Our findings suggest that both the level of social integration and the mental health status of migrant adolescents can be improved in China. The social integration is positively correlated with mental health, and psychological integration plays an important mediating role between acculturation and mental health. This finding laid the foundation for further research on the social integration structure of internal migrant adolescents. Our study also indicates that regional culture and social interaction can be used to enhance the sense of belonging and improve the mental health of migrant adolescents. Therefore, we suggest that the impact of social integration on mental health should be paid attention to when psychological interventions were taken on migrant adolescents with different cultural backgrounds in the world. Such as the schools with migrant students to scale up the efforts in preventing mental health problems among migrant adolescents by adding contents of regional culture on mental health counselling clinic or mental health education programs. Activities, including extracurricular programs with local adolescents that can enhance social interaction also should be encouraged at the schools.

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

Cronbach's alpha of 0.70, two dimensions were having Cronbach's alpha of 0.52 and 0.55. It indicated the reliability of measurement was reluctantly accepted but need to be further improved. Future research may improve the reliability of the developed social integration scale by modifying some items. Second, the MDD had not been used in Chinese adolescents before, so the validity of this scale may be affected. Third, data used for this study was collected through a cross-sectional survey. A longitudinal study may be necessary to verify the observed relationship between social integration and mental health.

Conclusion

Findings suggest the mental health and social integration of internal migrant adolescents in Guangzhou need to be promoted, and there is a strong connection between social integration and mental health. Psychological integration plays an important mediating role between acculturation and mental health. The impact of social integration on mental health should be paid attention to when psychological interventions were taken on internal migrant adolescents from different cultural backgrounds. Interventions such as promoting social interaction and understanding of regional culture are needed to enhance psychological integration and furthermore improve the mental health of internal migrant adolescents.

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Contributors

LS took part in data analysis and wrote the manuscript. WC and JB contributed to the revisions of the manuscript. YL participated in study design and data collection. LL contributed to design the project and the supervision on project conducting. All authors read and approved the final manuscript.

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Competing interests

No competing interests.

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.

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Table 1. Social integration of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach α
Psychological integration				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)			
Customs				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)			
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)			
Social interaction				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)			
Language				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)			
Sometimes	280 (25)			
Once in a while	441 (39)			
Never	220 (20)			
15. Do you listen to Cantonese songs?		2.48 (0.94)	0.51	
Usually	185 (17)			
Sometimes	338 (30)			
Once in a while	426 (38)			
Never	173 (15)			
Total	1122	37.45(6.35)		0.772

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)	*P* value	SASC Mean (SD)	*P* value
Gender			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)	
Age (years)			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)	
Place of origin			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)	
Length of stay in Guangzhou			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

	MDD		SASC	
Variables	β (95%CI)	*P* value	β (95%CI)	*P* value
Language	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
Social-interaction	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
Custom	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
Psychological integration	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
Gender				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
Place of origin				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
Age				
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
Length of stay in Guangzhou				
<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: β = standardized regression coefficient; 95%CI=95% Confidence interval.

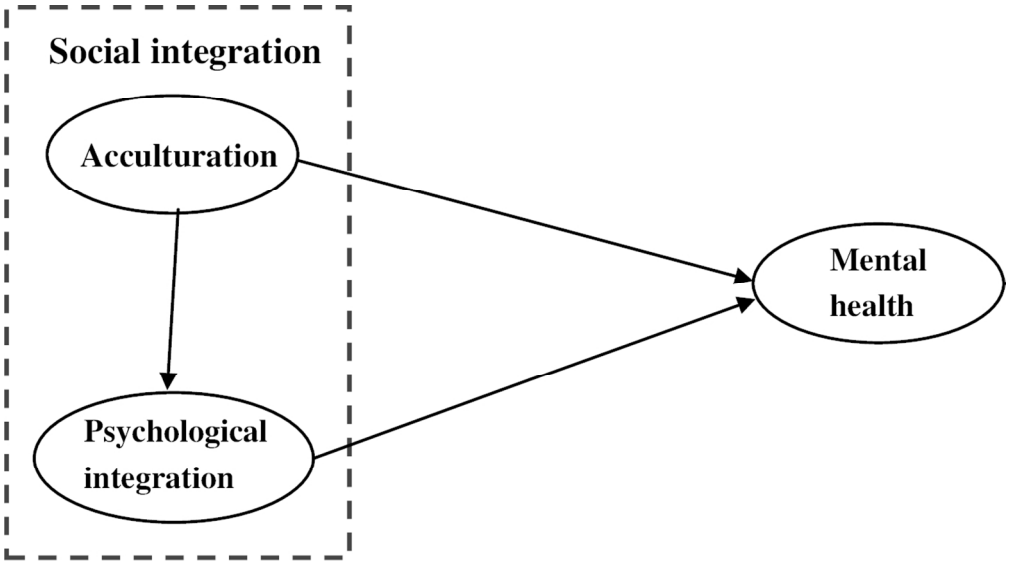

Figure 1. Schematic conceptual model

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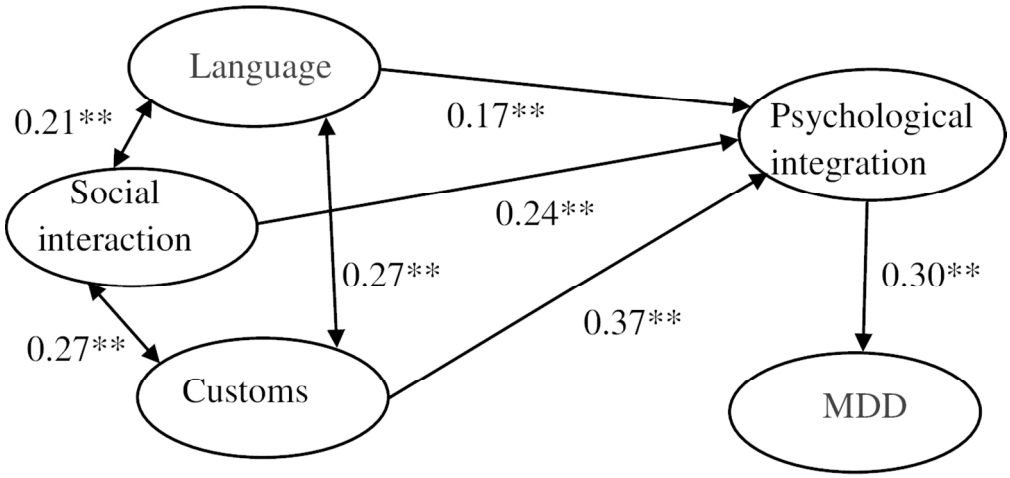

Figure 2. Structural equation modelling of social integration and MDD. Standardized path coefficients are reported, and only significant paths are depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, Chi-square/df=2.1. **: p<0.001

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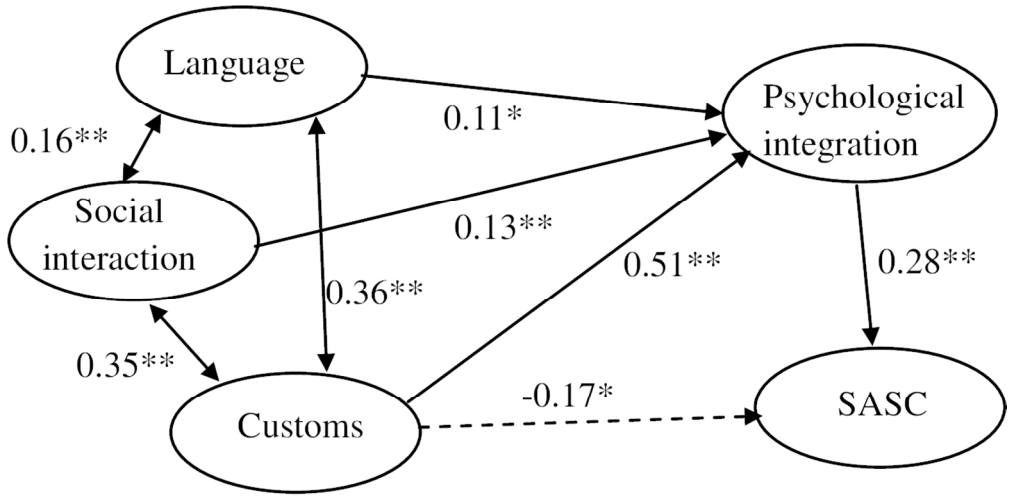

Figure 3 Structural equation modelling of social integration and SASC. Standardized path coefficients are reported, and only significant paths are depicted in the figure. Dotted line represent negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, Chi-square/df=2.2. *: p<0.01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

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	page #12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	page #12-13
		(b) Indicate number of participants with missing data for each variable of interest	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	page #13
		(*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	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #14
Discussion			
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
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	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.

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

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

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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

impact on SASC, whereas the lifestyle showed a direct negative effect (p=0.003, β=-0.17) on SASC. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment (p<0.001, β=0.37 and 0.51), followed by social interaction (p<0.001, β=0.24 and 0.13) and language (p<0.001, β=0.17 and 0.11).

Conclusions: The association between acculturation and mental health of internal migrant adolescents was complex and could be mediated by psychological adjustment. Interventions such as promoting local language and social interaction should be needed to enhance psychological adjustment and furthermore improve the mental health of migrant adolescents.

Key words: Acculturation; Mental health; Internal migrant; Adolescents.

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.[1] Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.[2] According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.[3] 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,[4] and they accounted for 12.8% of overall adolescents' population in China.[5]

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.[6-8] 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.[9] 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.[10, 11]

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

have been contradictory.[12] Some studies have found that migrant adolescents have better mental health outcomes than adolescents in the host community. [13, 14] In contrast others have shown that migrant adolescents had poorer mental health outcomes than their non-migrants counterparts. [15, 16]. These contradictory results could be a result of the difference of migrant characteristics and methods of measurement in these studies.[12] However, a literature review indicated that the mental health of internal migrant adolescents in China was inferior compared with local adolescents in majority studies, due to the influence of hukou system.[17] Particularly a study in Guangzhou showed that the detection rate of depression symptoms in migrant adolescents was 21.8%, far higher than local adolescents (11.2%),[18] also higher than local adolescents in other countries.[19] Mental problem in childhood and adolescence was associated with many negative outcomes, including impaired social, work, and family functioning in adolescence and into adulthood.[20] Therefore, a better understanding of the risk factors for mental health among this vulnerable population was significant to public health of the internal migrant adolescents in China.

Studies showed that among many factors that affect adolescents' mental health, acculturation was uniquely relevant to migrant adolescents.[21] The acculturation has been conceived as a dynamic process involving multiple aspects in which individuals gradually adjust to a new environment.[22] In this process, migrants had to face psychological distress brought by the major life changes that might leads to deterioration in mental health.[23] Many studies had found acculturation associated with

mental health in various types of immigrants,[24,25]but there were no obvious or consistent pattern of findings that could be identified.[26] While acculturation appeared inversely related to morbidity in some populations,[27, 28] psychiatric disorders increased with acculturation in others.[29, 30]

Due to the uncertain nature of these findings, seldom of them have been brought to bear on prevention or intervention-oriented programs in mental health-related areas.[31] These contradictory findings might result from disparities between measurement instruments because there was no generally accepted acculturation model, and these studies adopt different dimensions to measure acculturation.[26] On the other hand, many studies have combined acculturation into a composite score to explore its relationship with health,[27,32,33] which might blurred the potentially variable effects of different acculturation dimensions on mental health.[34] In addition to these defects, the mechanism of acculturation affecting mental health of migrant adolescents had not been well investigated. Previous studies had shown that psychological adjustment was one of main outcomes of acculturation,[35-36] while psychological adjustment reflected migrants' cognitive, emotional, perceptual to respond in new life circumstances.[37,38] Meanwhile, psychological adjustment was proven closely related to mental health.[39] So, psychological adjustment might play an important role in the relationship between acculturation and mental health. Finally, the majority of studies examining the association between acculturation and mental health in ethno cultural groups were conducted with Latino and Asian samples,[40] but few researchs had focus on internal

Chinese migrants, especially on adolescents. Thus, we hypothesized that acculturation of adolescents could affect their mental health directly and indirectly via psychological adjustment.

Therefore, the primary aim of this study is to confirm this hypothesis using a structure model analysis with data from a cross-sectional study in Guangzhou, China. Specifically, we aimed to: (1) to assess the status of mental health and acculturation of migrant adolescents; and (2) to test the aforementioned hypothesized structural relationship between acculturation, psychological adjustment and mental health of migrant adolescents, and explore the impact of each acculturation dimension on mental health.

Methods

Study sites

This cross-sectional survey study was conducted in Tianhe and Baiyun districts in Guangzhou, China from April to May in 2016. Guangzhou is the capital city of Guangdong Province with a population of 12.7 million, and has led the economic reform and openness in China since the 1980s, Guangzhou has also become a major receiving city with 0.6 million internal migrant adolescents.[4, 5]

As the capital city of Guangdong province, Guangzhou has its distinguished Cantonese culture, language and customs. The primary dialect spoken in Guangzhou,

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,[41] therefore, using purposive sampling method, we chosed 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 minus 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

the quality control was implemented during data collection.

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

Patient and public involvement

No patients were involved in this study. Study participants were offered feedback of the study results and will be informed of this publication.

Measurement

Dependent variables: mental health

Indicators of mental health included anxiety and depression indices. Anxiety was measured by Social Anxiety Scale for Children (SASC), and depression was measured by the dimension of Major Depression (MDD) of a Brief Child and Family Phone Interview. The SASC was developed to measure social anxiety among American adolescents between 7~16 years of age, and it included 10 items yielding two dimensions, including fear of negative evaluation and social avoidance and distress. The response to each item scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total scores ranging from 0 to 20, and higher scores indicated less anxiety.[42] The MDD was developed to measure major depression among Ontario

adolescents between 6~18 years of age, and it consisted of 6 items scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total score ranging from 0 to 12. Higher scores indicated less depression.[43] The Cronbach's alpha of SASC applied on normal Chinese adolescents was 0.79,[44] and the Cronbach's alpha of MDD applied on Ontario adolescents was 0.86.[43]

Independent variables: Acculturation and psychological adjustment

Gordon described acculturation, or cultural and behavioral assimilation, as a phase of assimilation, which was the foundation of unidimensional acculturation theory.[45] In this theory, individuals were placed on a continuum of identities ranging from exclusively heritage culture to exclusively mainstream culture. More recently, Berry put forward the bidimensional acculturation theory,[46] which suggested that both heritage and mainstream cultural identities were free to vary independently, and acculturation strategies could be divided into four categories: separation, integration, assimilation, and marginalization. Despite there were some evidences in favor of bidimensional acculturation,[47] the majority of self-report acculturation scales reflect a unidimensional framework in public health studies.[48] Majority of these studies showed a linear relationship between acculturation and psychological distress was better demonstrated by the unidimensional model,[31] while only a few studies show a curvilinear relationship which was better demonstrated by the bidimensional model.[26] On the other hand, the measurement of unidimensional acculturation was simpler than that of bidimensional acculturation and convenient for young adolescents to

understand in data collection process.[47] So, the unidimensional acculturation theory was adopt in this study. Based on comprehensive literature review,[49-50] the research team designed the measurement of acculturation, which was consisted of 11 items with a total score ranging from 11 to 45 (See Table 1). Higher scores indicate individual's higher acceptance to the host culture. Acculturation was measured by 3 latent variables: social interaction (two items), lifestyle (five items) and language (four items). Lifestyle consists of questions about preferences for food (two items), clothing (two items) and social custom (one item). Each item had 3 to 5 choices. Some questions were rated on a scale ranging from 1 ("No") to 3 ("Yes"), some questions were rated on a scale ranging from 1 ("Completely not/Never") to 4 ("Completely/Usually"), and some questions were rated on a scale ranging from 1 ("Never") to 5 ("Always").

Psychological adjustment focuses on the emotional reactions during cross-cultural transitions,[51] it was measured by four questions that asked about "sense of belonging"[52] and "satisfaction of urban life"[53] in this study. Sense of belonging was assessed by one question with a scale ranging from 1 ("outsiders") to 4 ("Guangzhou people"). Satisfaction of urban life was assessed by three questions with a scale ranging from 1 ("Very not") to 5 ("Very sure").

Demographic and other covariates

To better understand the association between acculturation and mental health, we also

included demographics which were reported to be associated with mental health in children and adolescents. These adjustment variables included age (in years), gender (male or female), place of origin (Guangdong province or other provinces in China) and length of stay in Guangzhou (in years). [19, 54]

Data processing and statistical analysis

Statistical analyses were performed using the software IBM SPSS 20.0 and IBM Amos 24.0. Descriptive statistics including the mean, standard deviation (SD), frequency and proportion were used to summarise the demographics, acculturation, psychological adjustment and mental health of the study participants. Differences in mental health by demographic variables were assessed using t-test or F-test. Multivariate regression models were conducted to assess the association between latent variables of acculturation and mental health. The latent variables of acculturation were independent variables, and the scores of SASC and MDD were dependent variables. Demographic variables were used as confounding factors. SEM were used to assess the proposed structural relationship among the acculturation dimensions, psychological adjustment and mental health. Data-model fitting in the structural equation modelling analysis was assessed using the following four indices: Goodness of Fit Index (GFI) (>0.9), Comparative Fit Index (CFI) (>0.9), Root Mean Square Error of Approximation (RMSEA) (< 0.05) and the chi-square associated with each degree of freedom (CMIN/df) (<3). Cronbach alpha were computed to assess the reliability of the latent variables. The construct validity of the acculturation

measurement was evaluated by the model fitting indices of confirmatory factor analysis (CFA) and the composite reliability of each latent variable.

Results

A total of 1,233 completed surveys, the response rate was 92.1%, 83 were excluded because of the contradiction of 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 analyses. Table 2 demonstrated that among the 1,122 participants, there were more boys (55%) than girls (45%), and most of them (93%) aged in 13-16 years old, nearly half of them (47%) came from other provinces, and many of them (78%) had lived in Guangzhou more than 5 years. There were significant differences between boys' scores (14.67±3.72) and girls' scores (13.41±4.01) in anxiety scale (P<0.001). The boys' MDD mean score was 8.78 ±2.17, and the girls' MDD mean score was 8.56 ±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 ones.

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 lifestyle dimension, 98% of adolescents had acceptance of urban clothing, and many of the adolescents preferred the lifestyle in their hometown in

traditional customs and diet. In social interaction dimension, many of migrant adolescents (48%) failed to interact with local adolescents. In language dimension, 54% of the adolescents could understand local language (item score≧2), but only 24% of the adolescents could speak local language (item score≧2). The mean scores of these questions were computed for modelling analysis.

Table 3 showed multiple regression analysis indicated a positive relationship between the total MDD score, total SASC score and psychological adjustment after controlling for age, gender, place of origin and residence time ($P<0.001$), while the total SASC score had a negative relationship with lifestyle ($P=0.03$). The language and social interaction had no significant correlation with total MDD score and total SASC score ($P>0.05$).

Structural equation model was used to explore the internal relations of the latent variables of acculturation, psychological adjustment and their impact on mental health. Figure 1 showed that psychological adjustment had direct effect on MDD ($\beta=0.30$) and it was the key variable fully mediating the impact of acculturation components on MDD. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment ($\beta=0.37$), followed by social interaction ($\beta=0.24$) and language ($\beta=0.17$). The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, CMIN/df=2.1. Figure 2 also showed psychological adjustment had direct effect on SASC ($\beta=0.28$) and it fully mediated the impact of two acculturation components (i.e.

language and social interaction) on SASC, whereas the lifestyle showed both a direct negative effect (β=-0.17) and an indirect positive effect via psychological adjustment on SASC. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment (β=0.51), followed by social interaction (β=0.13) and language (β=0.11). The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, CMIN/df=2.2. In total, psychological adjustment had the greatest impact on both MDD and SASC. Higher level of language and social interaction indicated less anxiety and depression, while lifestyle towards mainstream society indicate more anxiety and less depression. The influence coefficients of each latent variable on mental health were showed in Table 4.

We evaluated the measurements to confirm their reliability and validity. In our study, SASC demonstrated the Cronbach's alpha coefficient of 0.82, and MDD demonstrated the Cronbach's alpha coefficient of 0.78. Even the measure of acculturation and psychological adjustment were self-developed, most correlation coefficient of each question's score and the total score of the dimension exceeded 0.5, and the Cronbach α of each latent variable exceeded 0.5 while the Cronbach α of the overall scale exceeded 0.7 (See Table 1); This indicated that the questionnaire had acceptable reliability. In Figure 1, the composite reliability of latent variables were: 0.8082(language), 0.5616(social interaction), 0.5952 (lifestyle), 0.8233(psychological adjustment). In Figure 2, the composite reliability of latent variables were: 0.8028(language), 0.5935(social interaction) , 0.5176(lifestyle) ,

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.[55]

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.[56] 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

score of 8.11 of adolescents referred to mental health outpatient services in Ontario.[57] The average SASC scores of migrant adolescents were significantly lower than the Chinese normal adolescents aged 13-16 years old (boys: 14.67 vs 16.34; girls: 13.41 vs 15.59).[44] In addition, migrant girls experienced more anxiety symptoms than boys, and older adolescents experienced more anxiety and depressive symptoms than younger peers. These results are consistent with the previous literature.[19] All these findings emphasized the urgent need for improvement in migrant adolescents' mental health, especially among older girls. The average score of acculturation of migrant adolescents was in the middle. It showed that the level of acculturation of migrant adolescents had much room for improvement.

The findings from the multiple regression analysis and structural equation model largely supported our hypothesis as when the important role of psychological adjustment on acculturation manifested in the model. Psychological adjustment directly and positively affect the level of mental health (β=0.30 and 0.28), and it was considered as the higher level integration and also be the outcome of the acculturation.[36] Therefore, this view was verified among Chinese migrant adolescents in our study.

The indirect relations between acculturation components (i.e language, social interaction and lifestyle) and mental health via psychological adjustment were also significant. Although language was found as an important factor in acculturation

among international immigrants[58] and international students[59], it had the least influence on psychological adjustment in this study. This difference is mainly because Mandarin is widely used at schools, which diminished the language barrier. Compared to the language, social interaction had a larger influence on psychological adjustment (β=0.24 and 0.13). Previous research showed similar conclusion that fewer mental health problems were found among adolescents making friends from their own and other cultures.[60] Unfortunately, the cross-cultural friendships of immigrant adolescents were less reciprocal than same culture friendships.[61] The same situation also occurred in our study, 48% of migrant adolescents had no friends among the local adolescents, and only 11% of migrant adolescents hoped to make friends with local adolescents. Hence, further understanding the persistence of traditional social groups and identities is crucial for the development of psychological adjustment that will ensure mental health. Different from the other two, the lifestyle had the largest influence on psychological adjustment (β=0.37 and 0.51), and it also directly aggravated the symptoms of anxiety (β= -0.17). On the one hand, people who changed the lifestyle to the mainstream culture may aggravate the stress related to facing new dress, diets and social custom[60], and have a negative impact on mental health. While on the other hand, adjusted oneself to the mainstream lifestyle will promote cultural communication with the local adolescents,[62] thereby improving psychological adjustment. Therefore, the result showed that lifestyle had both positive and negative effects on mental health. This phenomenon was also found in other studie.[63] These results suggested that despite the impact of lifestyle on mental health

is somewhat uncertain, to improve language skills and communicate with local adolescents can effectively improve mental health of internal migrant adolescents in Guangzhou. This also explained to some extent why previous studies on acculturation and mental health had not reached a consistent conclusion.[26] Because the dimensions used to measure acculturation were not completely consistent in different studies,[48] and the impacts of different dimensions on mental health may be much different or even completely opposite. Therefore, the further researches should adopt a unified acculturation measurement, and explore the relationship between single dimension of acculturation and mental health.

Methodological discussion

In this study, SEM was carried out on the basis of multiple regression analysis. The multiple regression had only one dependent variable, while the structural equation model can make one variable both as independent variable and dependent variable, thus we find the mediating effect of psychological adjustment on the relationship between acculturation and mental health. In addition, the SEM could directly show us the impact of different dimensions of acculturation on mental health, so that we can find the most influential dimensions and to propose corresponding interventions.

Policy recommendations

Due to the results of our study, we suggest that the impact of acculturation on mental health should be paid attention to when psychological interventions were taken on

migrant adolescents with different cultural backgrounds. Such as the schools with migrant students to scale up the efforts in preventing mental health problems among migrant adolescents by adding contents of local language and regional culture on mental health education programs. Activities, including extracurricular programs with local adolescents that can enhance social interaction also should be encouraged at the schools.

Our study also has some limitations. First of all, although a self-designed multidimensional scale measured acculturation with the acceptable overall Cronbach's alpha of 0.70, two dimensions were having Cronbach's alpha of 0.52 and 0.55. The factor loadings of some items were also relatively low. It indicated the reliability of measurement was reluctantly accepted but need to be further improved. Future research may improve the reliability of the developed acculturation scale by modifying some items. Second, the MDD had not been used in Chinese adolescents before, so the validity of this scale may be affected, and we can not get the results of the scale applied to Chinese normal adolescents. Third, some confounding factors which might influence the mental health of adolescents were not included in this study, such as the parental mental health. Fourth, data used for this study was collected through a cross-sectional survey. A longitudinal study may be necessary to verify the observed relationship between acculturation and mental health.

Conclusion

Findings suggest there is a strong connection between acculturation, psychological adjustment and mental health. Psychological adjustment plays an important mediating role between acculturation and mental health. Higher level of language and social interaction indicate less anxiety and depression, while higher level of lifestyle indicate more anxiety and less depression. We should pay attention to the impact of acculturation on mental health when psychological interventions were taken on migrant adolescents with different cultural backgrounds.

Figure legends:

Figure 1. Structural equation modelling of acculturation, psychological adjustment and MDD. *Note*: 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, 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.

Figure 2. Structural equation modelling of acculturation, psychological adjustment and SASC. *Note*: 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, 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; FEN, fear of negative evaluation; SAD, social avoidance and distress.

Figure 3. The confirmatory factor analysis model of acculturation. *Note*: Standardized path coefficients are 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.

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Contributors

LS took part in data analysis and wrote the manuscript. WC and JB contributed to the revisions of the manuscript. YL participated in study design and data collection. LL contributed to design the project and the supervision on project conducting. All authors read and approved the final manuscript.

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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).

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Data sharing statement

No additional data are available.

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Table 1. Psychological adjustment and acculturation of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach α
Psychological adjustment				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)			
Lifestyle				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)			
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)			
Social interaction				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)			
Language				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)			
Sometimes	280 (25)			
Once in a while	441 (39)			
Never	220 (20)			
15. Do you listen to Cantonese songs?		2.48 (0.94)	0.51	
Usually	185 (17)			
Sometimes	338 (30)			
Once in a while	426 (38)			
Never	173 (15)			

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)	*P* value	SASC Mean (SD)	*P* value
Gender			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)	
Age (years)			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)	
Place of origin			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)	
Length of stay in Guangzhou			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

	MDD		SASC	
Variables	β (95%CI)	*P* value	β (95%CI)	*P* value
Language	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
Social-interaction	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
Lifestyle	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
Psychological adjustment	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
Gender				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
Place of origin				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
Age				
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
Length of stay in Guangzhou				
<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: β = 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.

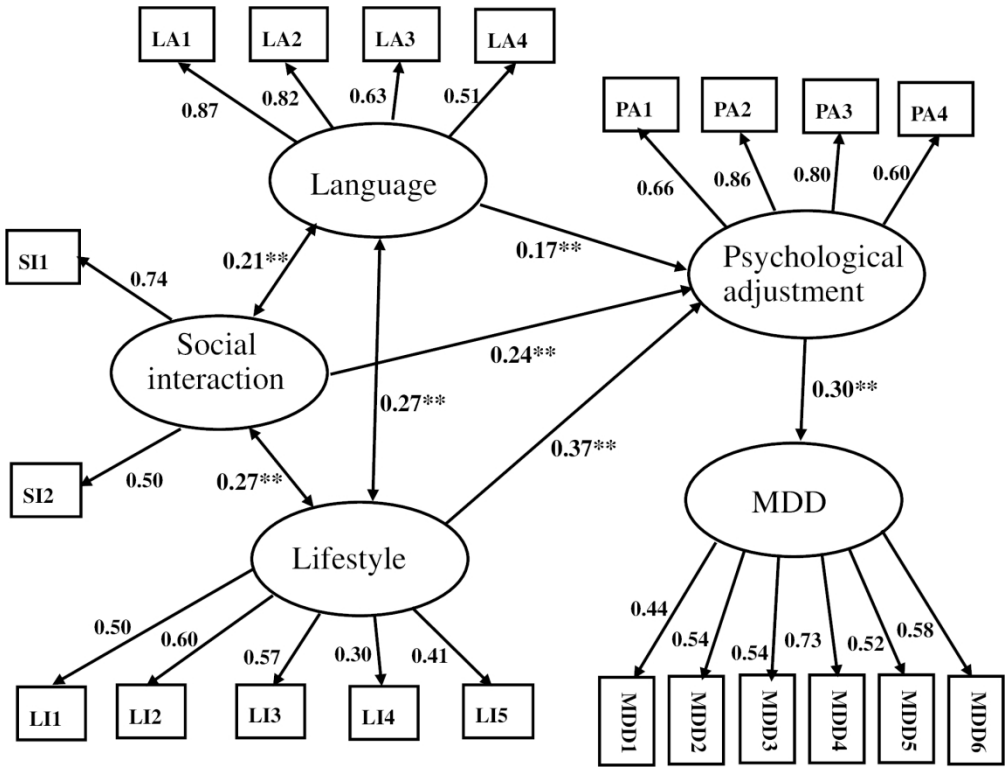

Figure 1. Structural equation modelling of acculturation, psychological adjustment and MDD. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, CMIN/df=2.1. **: p<0.001. LA1-LA4, the four 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)

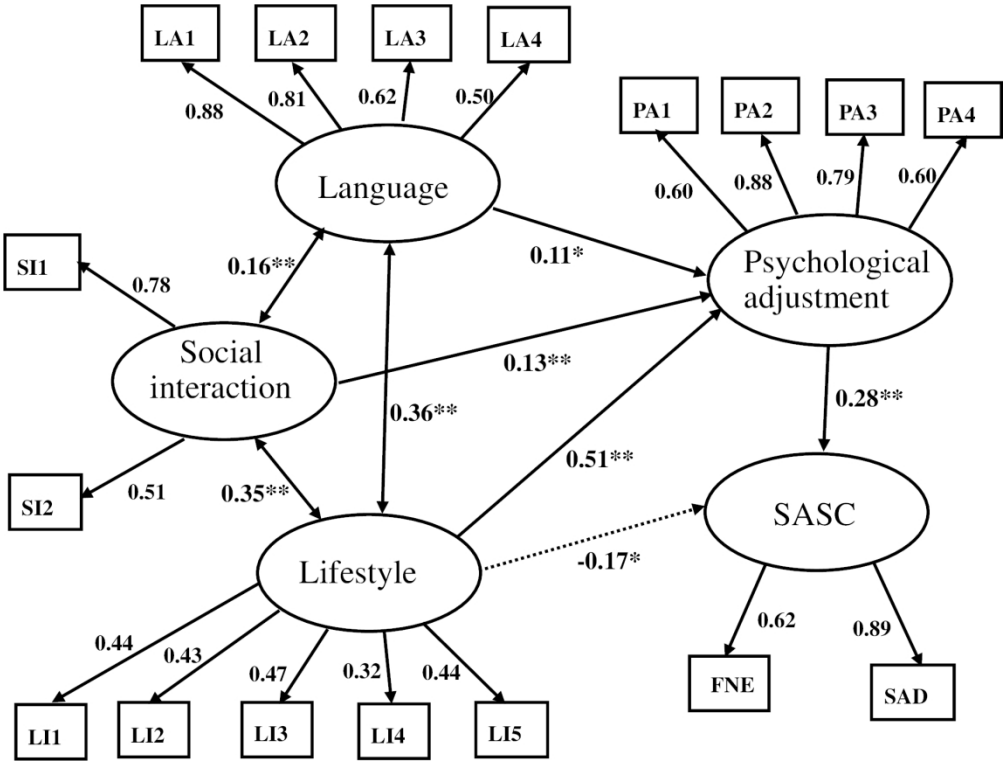

Figure 2. Structural equation modelling of acculturation, psychological adjustment and SASC. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. Dotted line represented negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, 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; FEN, fear of negative evaluation; SAD, social avoidance and distress.

169x128mm (300 x 300 DPI)

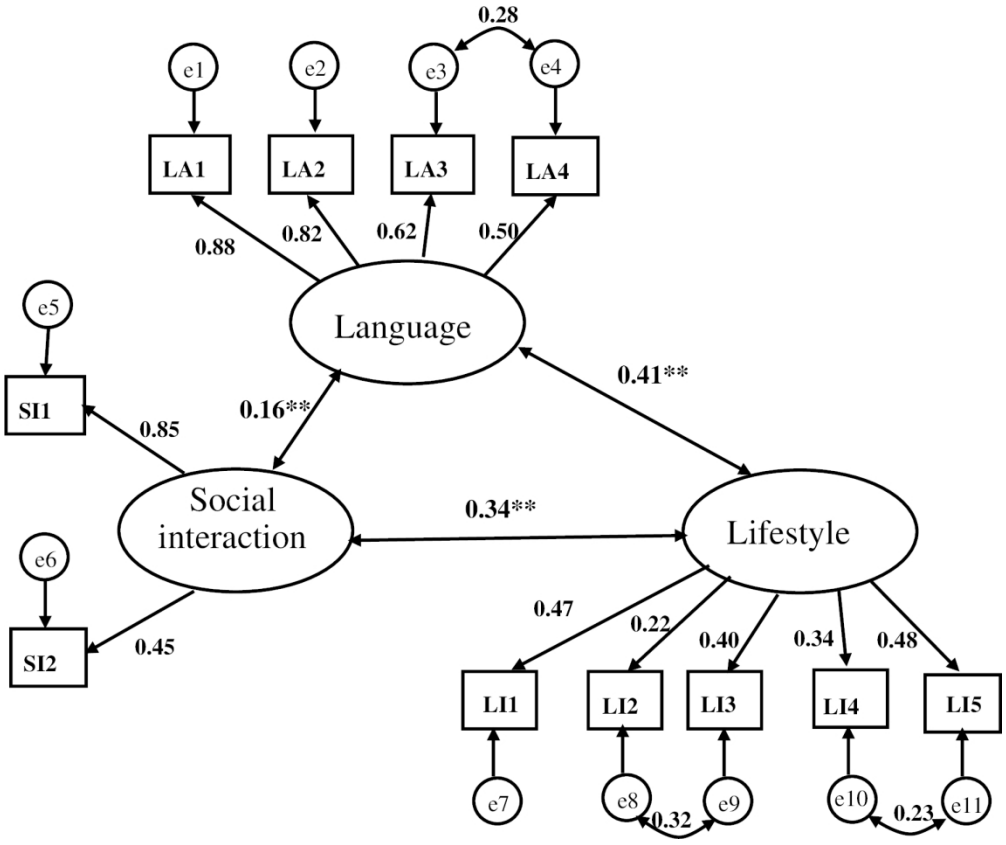

Figure 3. The confirmatory factor analysis model of acculturation. Note: Standardized path coefficients were reported. The data-model fit indices: P=0.129>0.05, CMIN/df=1.26, GFI=0.992, CFI=0.996, RMSEA=0.015. **: p<0.001. LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items 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 #
Title and abstract	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
Introduction			
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
Methods			
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	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	page #14
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	page #14
		(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	page #15
		(*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	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #16
Discussion			
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
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	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.

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

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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

(p=0.003, β=-0.17) on SASC. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment (p<0.001, β=0.37 and 0.51), followed by social interaction (p<0.001, β=0.24 and 0.13) and language (p<0.001, β=0.17 and 0.11).

Conclusions: The association between acculturation and the mental health of internal migrant adolescents was complex and could be mediated by psychological adjustment. Interventions such as promoting local language and social interaction are needed to enhance psychological adjustment and further improve the mental health of migrant adolescents.

Key words: Acculturation; Mental health; Internal migrant; Adolescents.

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.[1] Internal migrant populations worldwide are even larger, and a quarter of this total was accounted for by China's 245 million internal migrants.[2] According to a national report in 2014, 62.5% of internal migrants in China were accompanied by their families.[3] 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,[4] and they accounted for 12.8% of the overall adolescent population in China.[5]

Concerns for the welfare of these internal migrant adolescents were exacerbated in China by the household registration (hukou in Chinese) system, whichwould traditionally block migrant adolescents who do not have a city registration from getting an education in urban public schools.[6-8] 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.[9] 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.[10, 11]

Findings from global studies on the mental health of migrant and non-migrant adolescents have been contradictory.[12] Some studies have found that migrant

adolescents had better mental health outcomes than adolescents in the host community. [13, 14] In contrast, others have shown that migrant adolescents had poorer mental health outcomes than their non-migrant counterparts. [15, 16]. These contradictory results could be a result of differences in migrant characteristics and methods of measurement in these studies.[12] However, a literature review showed that the mental health of internal migrant adolescents in China was inferior compared with that of local adolescents in the majority of studies due to the influence of the hukou system.[17] In particular, a study in Guangzhou showed that the detection rate of depressive symptoms in migrant adolescents was 21.8%, far higher than in local adolescents (11.2%),[18] which was also higher than in local adolescents in other countries.[19] Mental problems in childhood and adolescence have been associated with many negative outcomes, including impaired social, work, and family functioning in adolescence and into adulthood.[20] Therefore, a better understanding of the risk factors for mental health within this vulnerable population is important for the public health of internal migrant adolescents in China.

Studies have shown that among many factors that affect adolescents' mental health, acculturation is uniquely relevant to migrant adolescents.[21] Acculturation has been conceived as a dynamic process involving multiple aspects in which individuals gradually adjust to a new environment.[22] In this process, migrants had to face psychological distress brought on by major life changes that might lead to deterioration in mental health.[23] Many studies have found acculturation to be associated with mental health in various types of immigrants,[24,25]but there were no obvious or consistent

patterns of findings that could be identified.[26] While acculturation appeared inversely related to morbidity in some populations,[27, 28] psychiatric disorders increased with acculturation in others.[29, 30]

Due to the uncertain nature of these findings, they have seldom been brought to bear on prevention or intervention-oriented programmes in mental health-related areas.[31] These contradictory findings might result from disparities between measurement instruments because there was no generally accepted acculturation model, and these studies adopted different dimensions to measure acculturation.[26] On the other hand, many studies have combined acculturation into a composite score to explore its relationship with health,[27,32,33] which might blur the potentially variable effects of different acculturation dimensions on mental health.[34] In addition to these limitations, the mechanism of acculturation affecting the mental health of migrant adolescents has not been well investigated. Previous studies have shown that psychological adjustment is one of the main outcomes of acculturation,[35-36] while psychological adjustment reflected migrants' cognitive, emotional, and perceptual responses in new life circumstances.[37,38] Meanwhile, psychological adjustment was indicated to be closely related to mental health.[39] Therefore, psychological adjustment might play an important role in the relationship between acculturation and mental health. Finally, the majority of studies examining the association between acculturation and mental health in ethno-cultural groups were conducted with Latino and Asian samples,[40] but few studies have focused on internal Chinese migrants, especially on adolescents. Thus, we hypothesized

that acculturation of adolescents could affect their mental health directly and indirectly via psychological adjustment.

Therefore, the primary aim of this study was to confirm this hypothesis using a structural model analysis with data from a cross-sectional study in Guangzhou, China. Specifically, we aimed to (1) assess the status of mental health and acculturation of migrant adolescents; and (2) test the aforementioned hypothesized structural relationship among acculturation, psychological adjustment and mental health of migrant adolescents, and explore the impact of each acculturation dimension on mental health.

Methods

Study sites

This cross-sectional survey study was conducted in Tianhe and Baiyun districts in Guangzhou, China from April to May 2016. Guangzhou is the capital city of Guangdong Province with a population of 12.7 million, and has led the economic reform and openness in China since the 1980s. Guangzhou has also become a major receiving city with 0.6 million internal migrant adolescents.[4, 5]

As the capital city of Guangdong province, Guangzhou has its distinctive Cantonese culture, language and customs. The primary dialect spoken in Guangzhou, 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 their large migrant populations. Since 95% of migrant adolescents in Guangdong province are studying in schools,[41] using a purposive sampling method, we chose three private junior high schools with large numbers of migrant students in each district.

Study participants and sampling

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

The survey took 20–30 minutes for each student to complete. Meanwhile, 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 each questionnaire, the 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 quality control was implemented during data collection.

The survey protocol was approved by the Institutional Review Board at Sun Yat-sen University, China (reference [2015] No.42). Each adolescent was asked to bring informed consent form to their parents or guardians and have them sign it before filling out the questionnaire.

Patient and public involvement

No patients were involved in this study. Study participants were offered feedback of the study results and will be informed of this publication.

Measurement

Dependent variables: mental health

The indicators of mental health included anxiety and depression indices. Anxiety was measured by the Social Anxiety Scale for Children (SASC), and depression was measured by the dimension of Major Depression (MDD) in the Brief Child and Family Phone Interview. The SASC was developed to measure social anxiety among American adolescents between 7 and 16 years of age, and it included 10 items yielding two dimensions, including fear of negative evaluation and social avoidance and distress. The response to each item is scored on a 3-point scale (0=always, 1=sometimes, 2=never), with total scores ranging from 0 to 20, and higher scores indicated less anxiety.[42] The MDD was developed to measure major depression among Ontario adolescents between 6 and 18 years of age, and it consisted of 6 items scored on a 3-

point scale (0=always, 1=sometimes, 2=never), with a total score ranging from 0 to 12. Higher scores indicated less depression.[43] The Cronbach's alpha of SASC applied to normal Chinese adolescents was 0.79,[44] and the Cronbach's alpha of MDD applied to Ontario adolescents was 0.86.[43]

Independent variables: Acculturation and psychological adjustment

Gordon described acculturation, or cultural and behavioural assimilation, as a phase of assimilation, which was the foundation of unidimensional acculturation theory.[45] In this theory, individuals were placed on a continuum of identities ranging from exclusively heritage culture to exclusively mainstream culture. More recently, Berry put forward the bidimensional acculturation theory,[46] which suggested that both heritage and mainstream cultural identities were free to vary independently, and acculturation strategies could be divided into four categories: separation, integration, assimilation, and marginalization. Despite some evidence in favour of bidimensional acculturation,[47] the majority of self-report acculturation scales reflected a unidimensional framework in public health studies.[48] The majority of these studies showed that a linear relationship between acculturation and psychological distress was better demonstrated by the unidimensional model,[31] while only a few studies showed a curvilinear relationship that was better demonstrated by the bidimensional model.[26] On the other hand, the measurement of unidimensional acculturation was simpler than that of bidimensional acculturation and convenient for young adolescents to understand in the data collection process.[47] Therefore, the unidimensional acculturation theory was adopted in this study.

Based on a comprehensive literature review,[49-50] the research team designed the questionnaire to measure acculturation, which consisted of 11 items with a total score ranging from 11 to 45 (See Table 1). Higher scores indicate individual's higher acceptance of the host culture. Acculturation was measured by 3 latent variables: social interaction (two items), lifestyle (five items) and language (four items). Lifestyle consists of questions about preferences for food (two items), clothing (two items) and social custom (one item). Each item had 3 to 5 choices. Some questions were rated on a scale ranging from 1 ("No") to 3 ("Yes"), some questions were rated on a scale ranging from 1 ("Completely not/Never") to 4 ("Completely/Usually"), and some questions were rated on a scale ranging from 1 ("Never") to 5 ("Always").

Psychological adjustment focused on emotional reactions during cross-cultural transitions,[51] and it was measured by four questions that asked about "sense of belonging"[52] and "satisfaction of urban life"[53] in this study. Sense of belonging was assessed by one question with a scale ranging from 1 ("outsiders") to 4 ("Guangzhou people"). Satisfaction of urban life was assessed by three questions with a scale ranging from 1 ("Very not") to 5 ("Very sure").

Demographic and other covariates

To better understand the association between acculturation and mental health, we also included demographics that were reported to be associated with mental health in children and adolescents. These adjustment variables included age (in years), gender

(male or female), place of origin (Guangdong province or other provinces in China) and length of stay in Guangzhou (in years). [19, 54]

Data processing and statistical analysis

Statistical analyses were performed using the software IBM SPSS 20.0 and IBM Amos 24.0. Descriptive statistics including the mean, standard deviation (SD), frequency and proportion were used to summarize the demographics, acculturation, psychological adjustment and mental health of the study participants. Differences in mental health by demographic variables were assessed using t-test or F-test. Multivariate regression models were conducted to assess the association between latent variables of acculturation and mental health. The latent variables of acculturation were the independent variables, and the scores of SASC and MDD were the dependent variables. Demographic variables were used as confounding factors. SEM was used to assess the proposed structural relationship among the acculturation dimensions, psychological adjustment and mental health. Data-model fitting in the structural equation modelling analysis were assessed using the following four indices: Goodness of Fit Index (GFI) (>0.9), Comparative Fit Index (CFI) (>0.9), Root Mean Square Error of Approximation (RMSEA) (< 0.05) and the chi-square associated with each degree of freedom (CMIN/df) (<3). Cronbach's alpha was computed to assess the reliability of the latent variables. The construct validity of the acculturation measurement was evaluated by the model fitting indices of confirmatory factor analysis (CFA) and the composite reliability of each latent variable.

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±3.72) and girls' scores (13.41±4.01) on the anxiety scale (P<0.001). The boys' MDD mean score was 8.78 ±2.17, and the girls' MDD mean score was 8.56 ±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

adolescents (48%) failed to interact with local adolescents. In the language dimension, 54% of the adolescents could understand the local language (item score ≧2), but only 24% of the adolescents could speak the local language (item score ≧2). The mean scores of these questions were computed for modelling analysis.

Table 3 showed that multiple regression analysis indicated a positive relationship among the total MDD score, total SASC score and psychological adjustment after controlling for age, gender, place of origin and residence time ($P<0.001$), while the total SASC score had a negative relationship with lifestyle ($P=0.03$). The language and social interaction had no significant correlation with total MDD score and total SASC score ($P>0.05$).

SEM was used to explore the internal relationships among the latent variables of acculturation, psychological adjustment and their impact on mental health. Figure 1 showed that psychological adjustment had a direct effect on MDD ($\beta=0.30$) and it was the key variable fully mediating the impact of acculturation components on MDD. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment ($\beta=0.37$), followed by social interaction ($\beta=0.24$) and language ($\beta=0.17$). The data-model fit indices were GFI=0.97, CFI=0.96, RMSEA=0.03, and CMIN/df=2.1. Figure 2 also showed psychological adjustment had a direct effect on SASC ($\beta=0.28$) and that it fully mediated the impact of two acculturation components (i.e. language and social interaction) on SASC, whereas

lifestyle showed both a direct negative effect (β=-0.17) and an indirect positive effect via psychological adjustment on SASC. Of the three acculturation components, lifestyle had the strongest influence on psychological adjustment (β=0.51), followed by social interaction (β=0.13) and language (β=0.11). The data-model fit indices were GFI=0.97, CFI=0.97, RMSEA=0.03, and CMIN/df=2.2. In total, psychological adjustment had the greatest impact on both MDD and SASC. A higher level of language and social interaction indicated less anxiety and depression, while a lifestyle towards mainstream culture indicated more anxiety and less depression. The influence coefficients of each latent variable on mental health were showed in Table 4.

We evaluated the scales to confirm their reliability and validity. In our study, SASC demonstrated a Cronbach's αcoefficient of 0.82, and MDD demonstrated a Cronbach's αcoefficient of 0.78. Even though the scales of acculturation and psychological adjustment were self-developed, most correlation coefficients of each question's score and the total score of the dimension exceeded 0.5, and the Cronbach's α of each latent variable exceeded 0.5 while the Cronbach's α of the overall scale exceeded 0.7 (See Table 1). This indicated that the questionnaire had acceptable reliability. In Figure 1, the composite reliability results for the latent variables were 0.8082 (language), 0.5616 (social interaction), 0.5952 (lifestyle), and 0.8233 (psychological adjustment). In Figure 2, the composite reliability results for the latent variables were 0.8028 (language), 0.5935 (social interaction), 0.5176 (lifestyle), and 0.8134 (psychological adjustment). These indices all exceed 0.5. On the other hand, the results for 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 scale of acculturation had acceptable construct validity.[55]

Discussion

Results discussion

This was 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 that 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 had 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.[56] Anxiety and depressive symptoms among migrant adolescents between 11 and 17 years of age were found to be relatively serious in this study. The mean MDD scores of boys and girls were 8.78 and 8.56 respectively, very close to the mean score of 8.11 of adolescents referred to mental health outpatient services in Ontario.[57] The average SASC scores of migrant adolescents were significantly lower than the scores

of normal Chinese adolescents aged 13-16 years old (boys: 14.67 vs 16.34, respectively; girls: 13.41 vs 15.59, respectively).[44] In addition, migrant girls experienced more anxiety than boys, and older adolescents experienced more anxiety and depressive symptoms than their younger peers. These results were consistent with the previous literature.[19] All these findings emphasized the urgent need for improvement in migrant adolescents' mental health, especially among older girls. The average acculturation score of migrant adolescents was in the middle. It showed that the level of acculturation of migrant adolescents had much room for improvement.

The findings from the multiple regression analysis and structural equation model largely supported our hypothesis as when the important role of psychological adjustment on acculturation manifested in the model. Psychological adjustment directly and positively affected the level of mental health (β=0.30 and 0.28), and it was considered to be the higher level of integration and also to be the outcome of acculturation.[36] Thus, this view was verified among Chinese migrant adolescents in our study.

The indirect relationships between acculturation components (i.e., language, social interaction and lifestyle) and mental health via psychological adjustment were also significant. Although language was found to be an important factor in acculturation among international immigrants[58] and international students[59], it had the least influence on psychological adjustment in this study. This difference was mainly because

Mandarin was widely used at school, which diminished the language barrier. Compared to language, social interaction had a larger influence on psychological adjustment (β=0.24 and 0.13). Previous research showed a similar conclusion that fewer mental health problems were found among adolescents making friends from their own and other cultures.[60] Unfortunately, the cross-cultural friendships of immigrant adolescents were less reciprocal than the same culture friendships.[61] The same situation also occurred in our study, 48% of migrant adolescents had no friends among the local adolescents, and only 11% of migrant adolescents hoped to make friends with local adolescents. Hence, further understanding the persistence of traditional social groups and identities was crucial for the development of psychological adjustment that will ensure mental health. In contrast to the other two, lifestyle had the largest influence on psychological adjustment (β=0.37 and 0.51), and it also directly aggravated the symptoms of anxiety (β= -0.17). On the one hand, adopting the mainstream lifestyle may aggravate the stress related to facing new dress, diets and social custom[60], which may have a negative impact on the mental health of migrant adolescents. On the other hand, adjusting oneself to the mainstream lifestyle will promote cultural communication with local adolescents,[62] thereby improving psychological adjustment. Therefore, the results showed that lifestyle had both positive and negative effects on mental health. This phenomenon was also found in other studies.[63] These results suggested that despite the impact of lifestyle on mental health being somewhat uncertain, improving language skills and communicating with local adolescents could effectively improve the mental health of internal migrant adolescents in Guangzhou.

This also explained to some extent why previous studies on acculturation and mental health had not reached a consistent conclusion.[26] Because the dimensions used to measure acculturation were not completely consistent in different studies,[48] the impacts of different dimensions on mental health may be much different or even opposite. Therefore, further research should adopt unified acculturation measurement and explore the relationship between single dimension of acculturation and mental health.

Methodological discussion

Both multiple regression analysis and SEM were performed in this study. The multiple regression had only one dependent variable, while the SEM could include one variable as both an independent variable and a dependent variable. Thus we found a mediating effect of psychological adjustment on the relationship between acculturation and mental health. In addition, the SEM could directly show us the impact of different dimensions of acculturation on mental health, thus, we could find the most influential dimensions and propose corresponding interventions.

Policy recommendations

Based on the results of our study, we suggested that the impact of acculturation on mental health should be considered when psychological interventions are implemented with migrant adolescents of different cultural backgrounds. For example, schools with migrant students scale up the efforts to prevent mental health problems among migrant adolescents by adding content of local language and regional culture to mental health

education programmes. Activities, including extracurricular programmes with local adolescents that could enhance social interaction, should also be encouraged at the schools.

Our study also had some limitations. First, although a self-designed multidimensional scale measured acculturation with an acceptable overall Cronbach's α of 0.70, two dimensions had Cronbach's α of 0.52 and 0.55. The factor loadings of some items were also relatively low. This indicated the reliability of measurement was reluctantly accepted but need to be further improved. Future research may improve the reliability of the developed acculturation scale by modifying some items. Second, the MDD had not been used in Chinese adolescents before, so the validity of this scale may be affected, and we could not get the results of the scale applied to Chinese normal adolescents. Third, some confounding factors which might influence the mental health of adolescents were not included in this study, such as the parental mental health. Fourth, data used for this study was collected through a cross-sectional survey. A longitudinal study may be necessary to verify the observed relationship between acculturation and mental health.

Conclusion

Findings suggested there was a strong association among acculturation, psychological adjustment and mental health. Psychological adjustment played an important mediating role between acculturation and mental health. A higher level of language and social

interaction indicated less anxiety and depression, while a higher level of mainstream lifestyle indicated more anxiety and less depression. We should pay attention to the impact of acculturation on mental health when psychological interventions are implemented with migrant adolescents of different cultural backgrounds.

Figure legends:

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.

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; FEN, fear of negative evaluation; SAD, social avoidance and distress.

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.

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Contributors

LS participated in data analysis and wrote the manuscript. WC and JB contributed to revision of the manuscript. YL participated in study design and data collection. LL contributed to the design of the project and the supervision of project implementation. All authors read and approved the final manuscript.

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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).

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Data sharing statement

No additional data are available.

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Table 1. Psychological adjustment and acculturation of migrant adolescents

Items	N (%)	Mean (SD)	Item-total r	Cronbach's α
Psychological adjustment				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)			
Lifestyle				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)			

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)			
Social interaction				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)			
Language				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)			

Sometimes	280 (25)		
Once in a while	441 (39)		
Never	220 (20)		
15. Do you listen to Cantonese songs?		2.48 (0.94)	0.51
Usually	185 (17)		
Sometimes	338 (30)		
Once in a while	426 (38)		
Never	173 (15)		

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)	*P* value	SASC Mean (SD)	*P* value
Gender			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)	
Age (years)			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)	
Place of origin			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)	
Length of stay in Guangzhou			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

	MDD		SASC	
Variables	β (95%CI)	*P* value	β (95%CI)	*P* value
Language	0.04 (-0.02,0.08)	0.194	0.04 (-0.03,0.14)	0.219
Social-interaction	-0.05 (-0.24,0.01)	0.085	-0.04 (-0.39,0.07)	0.178
Lifestyle	-0.03 (-0.08,0.03)	0.404	-0.07 (-0.21,-0.01)	0.030
Psychological adjustment	0.28 (0.19,0.32)	<0.001	0.19 (0.20,0.42)	<0.001
Gender				
Boy (ref)				
Girl	-0.07 (-0.57,-0.06)	0.015	-0.17 (-1.81,-0.89)	<0.001
Place of origin				
Guangdong province (ref)				
Other province	0.02 (-0.19,0.37)	0.532	0.04 (-0.23,0.78)	0.287
Age				
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
Length of stay in Guangzhou				
<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: β = 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.

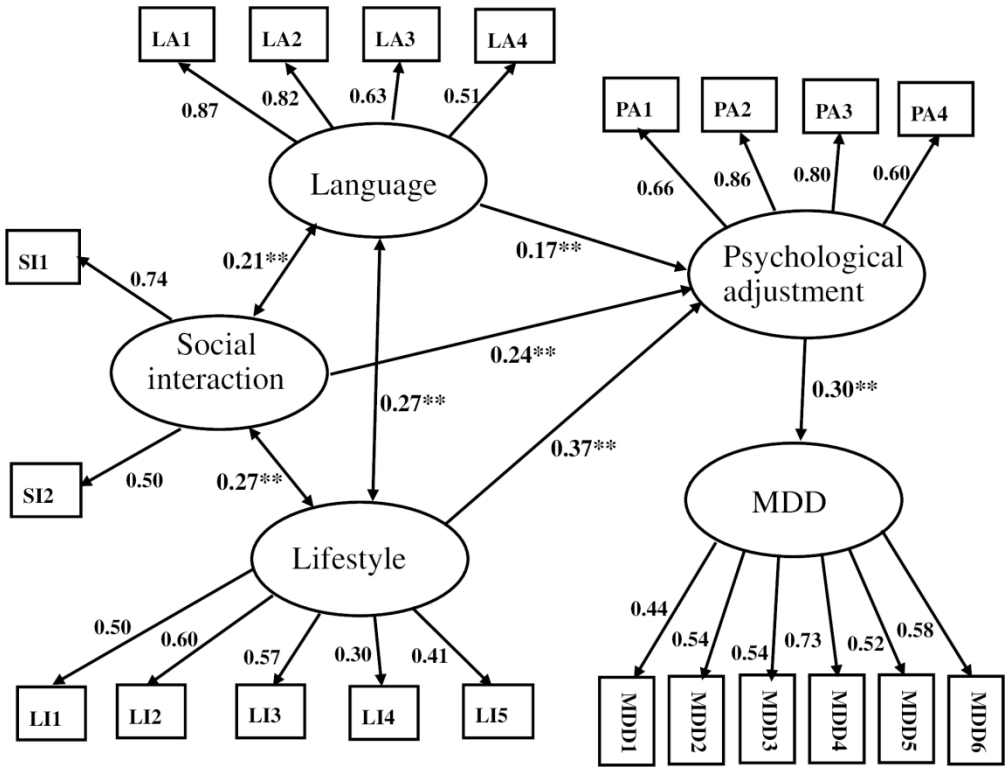

Figure 1. Structural equation modelling of acculturation, psychological adjustment and MDD. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. The data-model fit indices: GFI=0.97, CFI=0.96, RMSEA=0.03, CMIN/df=2.1. **: p<0.001. LA1-LA4, the four 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)

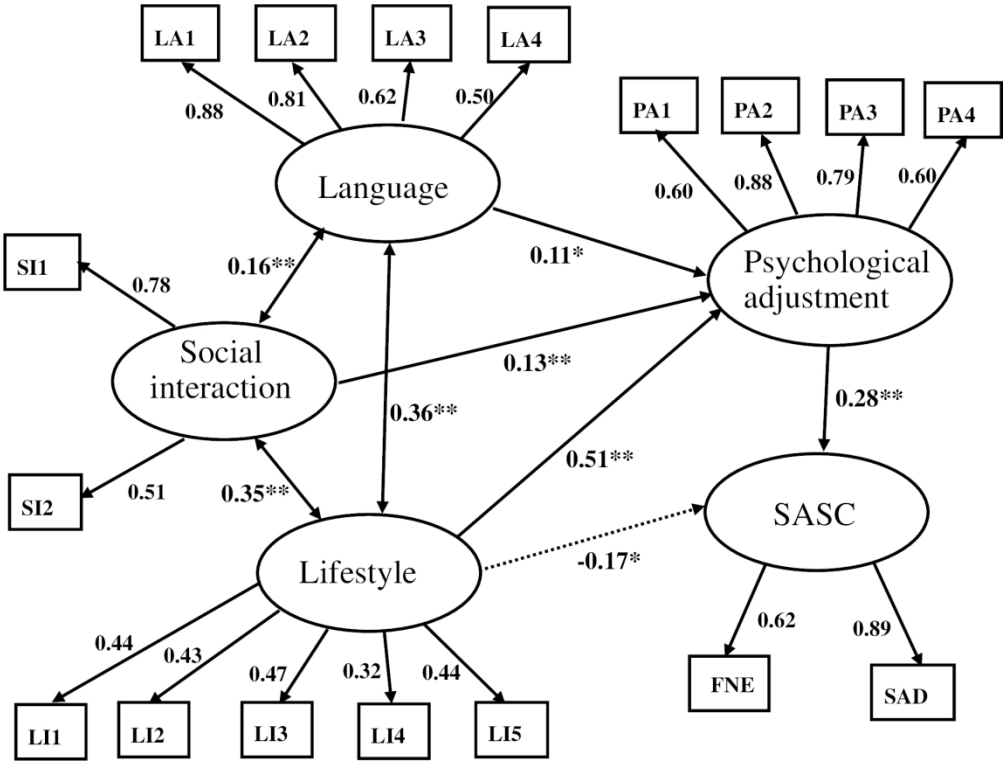

Figure 2. Structural equation modelling of acculturation, psychological adjustment and SASC. Note: Standardized path coefficients were reported, and only significant paths were depicted in the figure. Dotted line represented negative relationship. The data-model fit indices: GFI=0.97, CFI=0.97, RMSEA=0.03, 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; FEN, fear of negative evaluation; SAD, social avoidance and distress.

169x128mm (300 x 300 DPI)

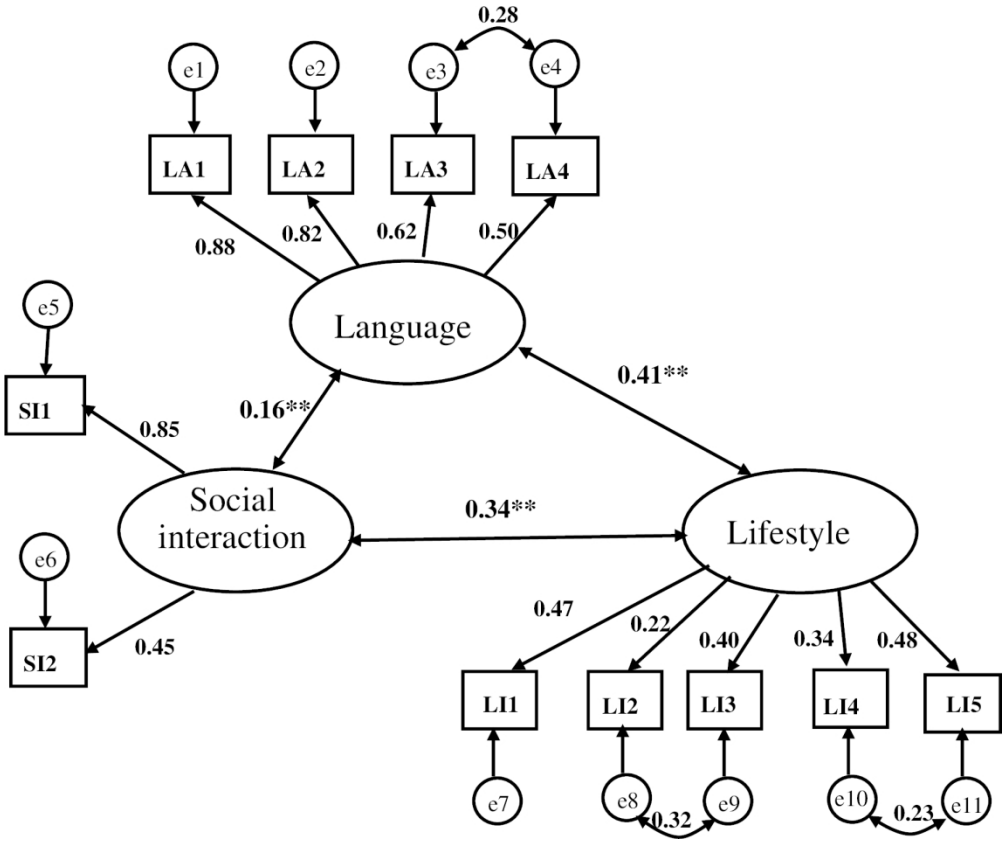

Figure 3. The confirmatory factor analysis model of acculturation. Note: Standardized path coefficients were reported. The data-model fit indices: P=0.129>0.05, CMIN/df=1.26, GFI=0.992, CFI=0.996, RMSEA=0.015. **: p<0.001. LA1-LA4, the four items measuring respondents' language; SI1-SI2, the two items 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 #
Title and abstract	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
Introduction			
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
Methods			
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	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	page #14
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	page #14
		(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	page #15
		(*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	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	page #16
Discussion			
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
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	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.