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Trajectories of Depressive Symptoms among Multicultural Middle and High School Adolescents: A Longitudinal Study Using Latent Class Growth Model

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Purpose: This study aimed to identify latent classifications based on trajectories of change in depressive symptoms among multicultural adolescents in middle and high school and to identify factors that influence classification.
Methods: This study used six time-point data from the Multicultural Adolescents Panel Study (MAPS) conducted by the National Youth Policy Institute (NYPI). We longitudinally analyzed data from 2014 to 2019, which corresponds to the participants' middle and high school years. Latent Growth Curve Modeling (LGCM) was used to analyze the depressive developmental trajectories of multicultural youth in middle and high school. Latent Class Growth Modeling (LCGM) was used to determine the number and shape of latent classes according to the type of depression among multicultural adolescents. We applied multinomial logistics regression analysis to explore the predictors of each class.
Results: A model with three latent classes was identified: (1) low-decreasing class (intercept=13.34, slope=-0.07, 37.9%), (2) moderate-increasing class (intercept=17.76, slope=0.41, 47.6%), (3) high-increasing class (intercept=23.22, slope=0.44, 14.5%). Multinomial logistic regression showed multicultural adolescents who were male, experienced high acculturative stress and social withdrawal, and had low self-esteem, life satisfaction, and family support tended to belong to either the moderate-increasing or high-increasing class.
Conclusion: These findings suggest that preliminary assessments of gender, acculturation stress, self-esteem, life satisfaction, social withdrawal, and family support among multicultural adolescents may be valuable for developing tailored mental health programs.

Keywords: Depression; Multicultural; Adolescents; Latent class analysis; Longitudinal studies

Introduction

Background

In Korea, there has been a steady increase in the influx of marriage immigrants, foreign workers, and international students in the past 30 years. In particular, as the international marriage culture has taken hold in Korea, there has been a steady inflow of marriage immigrants. Although the annual number of marriage immigrants stagnated during the COVID-19 pandemic, it has since recovered to the pre-pandemic levels, reaching approximately 175,000 by of the end of December 2023 [1]. In addition, the number of students from multicultural families continues to increase, and according to the 2023 Brief Statistics on Korean Education, the number of multicultural students is currently approximately 180,000 [2].

Adolescents experience various emotional difficulties. These difficulties are related to the fact that they experience emotional instability due to physical development and social tasks in the transition process from childhood to adulthood in the life cycle [3]. Depressive symptoms and problems that occur during ado-

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lescence have been reported to be strongly associated with aggressive behavior, school truancy, and suicide [4]. Emotional confusion and turmoil during adolescence can lead to depression and even mental disorders [5], and longitudinal studies have shown that depression during adolescence is highly likely to lead to depression in adulthood [6,7].

Multicultural adolescents experience various challenges in peer relationships and learning due to differences in appearance, language barriers, and identity confusion [8,9]. As a result, multicultural adolescents are reported to mainly have problems such as anxiety, depression, low self-esteem, school maladjustment, and delinquency, with a particularly higher likelihood of experiencing depression compared to their non-multicultural peers [10,11]. This higher likelihood of depression among multicultural adolescents stems from the combined impact of factors such as value differences between adolescents and their parents, experiences of school discrimination, language and cultural barriers, and the developmental changes of adolescence [12]. Adolescent mental health problems can increase medical costs and, in the long term, lead to social issues and reduced labor productivity, resulting in societal costs [13]. Multicultural adolescents, in particular, are more likely to develop conditions like depression and anxiety disorders without adequate psychological and emotional support, highlighting the need for early intervention [13].

There are differences in the patterns of change in the level of depression over time in multicultural adolescents among countries. In Korea, the level of depression in multicultural adolescents was found to show a tendency to gradually increase over time [14]. On the other hand, among multicultural adolescents in the United States, the level of depression was found to tend to decrease over time [15,16]. These differences in the patterns of change in depression may be due to the fact that Korean adolescents experience higher levels of stress related to schoolwork and college entrance exams, compared to adolescents in western countries [17], and multicultural adolescents in Korea are most likely to experience a higher level of depression because their academic difficulties would increase as they advance to higher grade levels in school [18]. Therefore, considering that adolescence is the phase of life when rapid changes in the pattern of depressive symptoms occur, it is required to pay attention to the depressive symptoms of multicultural adolescents in middle and high school, and perform active interventions to alleviate their depressive symptoms [4,19].

There are various factors affecting depression in multicultural adolescents. First, one of the factors is acculturation stress that occurs when multicultural adolescents experience cultural and psychological changes as they come into contact with a new culture [20]. The experience of acculturation stress, which generally results from differences in values between children and parents, experiences of discrimination at school, and language and cultural barriers, has been found to be a main cause of depression in multicultural adolescents [21-23]. Self-esteem and self-resilience are sub-domains of self-perception. Low self-esteem and self-resilience in multicultural adolescents have been shown to be factors that can increase depression, and discrimination and bullying have been found to be main causes of low levels of self-esteem and self-resilience [10,23,24]. On the other hand, it has been shown that social support is a factor that can reduce depression, and plays an important role in helping adolescents to become emotionally stable and appropriately adjust to a new environment or school life, and a lack of social support such as parental support and peer support may increase the risk of developing depression [12]. In addition, a higher level of bicultural acceptance attitude and a higher level of body satisfaction have been found to be associated with a lower level of depression in multicultural adolescents [25,26]. Meanwhile, social withdrawal has been reported to have a negative partial mediating effect on the relationships of bicultural acceptance attitude and body satisfaction with depression [25,26]. In addition, life satisfaction has been shown to be negatively correlated with depression, and is considered a major predictor of depression [27].

However, few studies have specifically examined the patterns of change in depression and the factors influencing depression among multicultural adolescents attending middle and high schools. Moreover, previous studies of depression in adolescents had limitations in closely examining changes in depression over time in middle and high school students because high school students were excluded from the participants in some studies [4,12], elementary, middle, and high school students were all included as the participants [28], or depression in adolescents was studied by cross-sectional analysis [29]. In addition, in order to understand depressive symptoms in multicultural adolescents attending middle and high schools, and provide a basis for the diagnosis of their depressive symptoms, it is necessary to actively conduct long-term longitudinal studies on changes in depressive symptoms over time as well as cross-sectional studies.

Therefore, this study aimed to identify the developmental trajectories and influencing factors of depressive symptoms in multicultural adolescents in middle and high school through latent class analysis by using the Multicultural Adolescents Panel Study (MAPS) data of the National Youth Policy Institute. This study

is expected to contribute to the development of strategies for the prevention and treatment of mental health problems, including depression and suicide.

Aims and objectives

This study aimed to identify latent classes based on the developmental trajectories of depression symptoms in multicultural adolescents in middle and high school using data from the Multicultural Adolescents Panel Study, and to identify factors influencing the division of participants into different latent classes. The specific objectives of this study are as follows: 1) To investigate the developmental trajectories of depressive symptoms over time in multicultural adolescents in middle and high school; 2) to determine the number and shape of latent classes with distinct trajectories of depressive symptoms; 3) to identify the factors influencing the distinct patterns of depressive symptoms trajectories.

Methods

Study design

This study is a secondary analysis research that conducted a longitudinal analysis of the data collected during the six-year period 2014-2019 corresponding to middle and high school years of the participants from the Multicultural Adolescents Panel Study (MAPS).

Research data and participants

This study used a panel data from the datasets of the first panel of the Multicultural Adolescents Panel Study (MAPS) conducted by the National Youth Policy Institute (NYPI). The first panel of the MAPS consisted of the multicultural adolescents who were fourth graders in elementary school at the time when the panel was constructed, and data collection was carried out annually from 2011 to 2020. In this case, multicultural adolescents refer to children from international marriages, immigrant adolescents who were born in a foreign country, and the participants of the MAPS mainly consisted of children from international marriages. The surveys from 2011 to 2018, corresponding to the 1st to the 8th waves of the MAPS, were conducted by computer-assisted personal interviewing, but the surveys from 2019 and 2020, corresponding to the 9th and 10th waves of the MAPS, were conducted by tablet-assisted personal interviewing by professional survey interviewers. Specific details regarding the MAPS can be found in the panel survey overview of the Korea Youth and Children Data Archive [30].

The participants of the present study were multicultural adolescents in middle and high school. This study used the 2014-2019 data among the datasets of the first panel of the Multicultural Adolescents Panel Study, and the sample size of the data was 1,635 people. Among them, only those who participated in three or more out of the six waves of the MAPS from 2014 to 2019 were finally selected as the participants, and as a result, a total of 1,264 people were included in the final analysis.

Research variables

1. Dependent variable: Depression

In the MAPS data used in this study, depressive symptoms were measured using a scale presented by Lee et al. [32], which is a partially revised and supplemented version of the Korean version of the Symptom Checklist-90-Revision (SCL-90-R) developed by Kim [31]. Because the SCL-90-R and its Korean version were developed as a tool for adults, only 10 items of the scale were used, excluding 3 items that are not suitable for children and adolescents. The 10 items include items such as 'I don't have much energy', 'I feel unhappy or sad and depressed.' Each item is assessed on a 4-point Likert scale ranging from 1 point (='Not at all') to 4 points (='Very much'), and a higher total score indicates a higher level of depressive symptoms. The value of Cronbach's α was reported as .91 by Kim & Song [33], and it was calculated as .86 in this study.

2. Independent variables

1) General characteristics

The general characteristics analyzed in this study were selected based on previous studies [12,19,29,33,34], and the analyzed general characteristics included the gender of multicultural adolescents, size of the region of residence, average monthly household income, and the age and education level of each parent. The age of each parent was divided into 10-year intervals from 20-29 years (<30) to 50 years or older (≥50), and the education level of each parent was divided into three categories: middle school or lower, high school, and college or higher. The size of the region of residence was divided into metropolitan cities, medium-sized cities, and towns.

2) Variables related to multiculturalism

Regarding variables related to multiculturalism, acculturation stress and bicultural acceptance attitude were included in the analysis, based on previous studies. Acculturation stress was investigated using a scale presented by Hong [36], which is a partially modified version of the scale developed by Hovey & King [35]. Each item of the scale is assessed on a 4-point Likert scale

ranging from 1 point (='Not at all') to 4 points (='Very much'), and higher scores indicate higher levels of acculturative stress. The Cronbach's α value was .71 in Hong's study [36], and it was .79 in this study.

Bicultural acceptance attitude was examined by using a modified version of the scale of Nho & Hong [37]. As in the assessment of acculturation stress, bicultural acceptance attitude was rated on a 4-point Likert scale, and a higher score indicates a more positive attitude. The Cronbach's α value was reported as .76 by Nho & Hong [37], and it was .78 in this study.

3) Individual characteristics

In this study, among individual characteristic variables, body satisfaction, self-esteem, self-resilience, life satisfaction, and social withdrawal were included in the analysis. The specific items were constructed through the study by Yang et al. [38] on the items of the survey on the first panel of the MAPS, and they were revised to develop an easy-to-understand and simple scale in consideration of the age of the participants through processes such as expert consultation, a preliminary survey, and factor analysis when the items were created. As a result, body satisfaction was measured using some items of the domain of physical self-concept of the scale used by Han [39]. Self-esteem was assessed using a part of the self-esteem scale among the subscales of the self-concept scale used by Park & Oh [41], which is a Korean version of the self-concept scale developed by Coopersmith [40]. Self-resilience was measured using a Korean version of the scale developed by Block & Kremen [42], and the Korean version used was the tool used by Kim et al. [44], which is a partially modified version of the Korean version developed by Yoo & Shim [43]. Life satisfaction was measured by extracting items related to the level of happiness from the study by Kim et al. [44]. Social withdrawal was measured by using a scale presented by Lee et al. [32], which is a modified version of a scale developed by Kim and Kim [45].

Body satisfaction, self-esteem, self-resilience, life satisfaction, and social withdrawal were all assessed on a 4-point Likert scale ranging from 1 point (='Not at all') to 4 points (='Very much'). Higher scores indicate higher levels of body satisfaction, self-esteem, self-resilience, and life satisfaction. Meanwhile, for social withdrawal, higher scores indicate higher levels of social withdrawal. In previous studies, the Cronbach's α values were reported as .69 for body satisfaction [39], .83 for self-esteem [46], .91 for self-resilience [34], .75 for life satisfaction [47], and .79~.86 for social withdrawal [45, 48]. In this study, the Cronbach's α values were .55 for body satisfaction, .79 for self-esteem, .90 for self-resilience, .86 for life satisfaction, and .89 for social withdrawal.

4) Environmental variables

The environmental variables experienced by multicultural youth included family support, friend support, and teacher support. In the data from the MAPS 1, all the three variables mentioned above were measured using the tool proposed by Han & Yoo [49], but the items for teacher support were used after partially revising them. Family support was measured on a 4-point Likert scale ranging from 1 point (='Not at all') to 4 points (='Very much'), and friend support and teacher support were measured on a 5-point Likert scale ranging from 1 point (='Not at all') to 5 points (='Very much'). A higher score indicates receiving greater support. In Han's study [19], the Cronbach's α values were .95 for family support, .96 for friend support, and .95 for teacher support. In this study, the Cronbach's α values were calculated as.94 for family support, .96 for friend support, and .95 for teacher support.

Data analysis

In this study, the developmental trajectories of depression in multicultural adolescents in middle and high school were analyzed by the latent growth curve modeling (LGCM) using the panel data collected annually from 2014 to 2019. First, unconditional model analysis was performed to examine whether a linear model fits the data of the developmental trajectories of depression, and the intercept and slope of the developmental trajectories of depression were examined. The model fit was assessed using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). In addition, latent class growth modeling (LCGM) analysis for the developmental trajectories of depression was conducted, and predictors of depression were identified to divide the patterns of depression in the participants into different latent classes.

In order to investigate depression in multicultural adolescents in middle and high school in terms of the patterns of change in depression, the number of latent classes was determined by LCGM analysis. As for the statistical criteria used for determining the number of latent classes, information criteria, χ^2 test, and the quality of classification can be used as the criteria. After determining the number of latent classes, multinomial logistic regression analysis was conducted to identify predictive factors for the division of distinct latent classes of depression in multicultural adolescents.

In data analysis, descriptive statistics, χ^2 test, one-way ANOVA, and multinomial logistic regression analysis were performed by

SPSS/WIN 26.0 (IBM Corp., Armonk, NY, USA), and analyses using LGCM and LCGM were conducted by Mplus 8.4 (Muthen & Muthen, Los Angeles, CA, USA).

Ethical considerations

This study was conducted using publicly available data, and received an exemption determination by the Institutional Review Board of the university that is the affiliated institution of the researcher (IRB No. ABN01-202308-08-V1). The research data was obtained and used after a review by the relevant institution after submitting a request for the data to the Korea Youth and Children Data Archive.

Results

General characteristics and developmental trajectories of depression among multicultural adolescents in middle and high school

The participants of this study were multicultural students constituting the first panel of the MAPS. More specifically, this study was conducted with a total of 1,264 multicultural adolescents who participated in three or more surveys among the six waves of the MAPS conducted from 2014 to 2019. Out of the 1,264 multicultural adolescents, 49.0% (n = 620) were male students, and 51.0% (n = 644) were female students. The mean age of the participants was 13.96 ± 0.35 years. Out of the 1,264 adolescents, 317 people (25.0%) lived in metropolitan cities, 567 people (44.9%) lived in medium-sized cities, and 380 people (30.1%) lived in towns. The average monthly household income was approximately 2.45 million won. Regarding the variables related to multiculturalism, the mean score for acculturation stress was 14.45 ± 3.39 points, and the mean score for bicultural acceptance attitude was 29.17 ± 3.83 points. The mean score for body satisfaction was 15.39 ± 1.25 points, the mean score for self-esteem was 12.74 ± 2.12 points, and the mean score for self-resilience was 42.85 ± 6.36 points. Also, the mean score for life satisfaction was 9.47 ± 1.85 points, and the mean score for social withdrawal was 11.73 ± 3.68 points. In terms of social support, the mean score for family support was 22.39 ± 3.79 points, the mean score for friend support was 28.95 ± 5.14 points, and the mean score for teacher support was 22.65 ± 5.03 points (Table 1).

The mean scores (out of 40 points) for depression in multicultural adolescents in middle and high school by year were 16.85 ± 5.29 points in 2014, 17.04 ± 5.28 points in 2015, 17.40 ± 5.51 points in 2016, 17.84 ± 5.67 points in 2017, 17.49 ± 5.92 points in 2018, and 18.20 ± 5.71 in 2019. The results of analyzing the developmental trajectories of depression using LGCM are shown in Table 2. The mean intercept value for depression was 16.89 points ($p < .001$), and the mean value of the slope was 0.24

Table 1. Characteristics of Samples (N=1,264)

Characteristics	Categories or range	n (%) or M ± SD
Gender	Boy	620 (49.0)
	Girl	644 (51.0)
Age	13-17	13.96 ± 0.35
Region of residence	Metropolitan	317 (25.0)
	Medium-sized city	567 (44.9)
	Small town	380 (30.1)
Monthly income (10,000KRW)	< 100	46 (3.7)
	100- < 200	347 (27.5)
	200- < 300	456 (36.0)
	300- < 400	329 (26.0)
	≥ 400	86 (6.8)
Father's age	25-64	44.58 ± 5.12
	< 30	14 (1.1)
	30-39	178 (14.1)
	40-49	838 (66.3)
	≥ 50	234 (18.5)
Mother's age	35-75	50.16 ± 4.60
	< 40	18 (1.4)
	40-49	494 (39.0)
	50-59	660 (52.2)
	60-69	26 (2.1)
	≥ 70	1 (0.1)
	Missing	65 (5.2)
Father's education level	College or higher	533 (42.2)
	High school	590 (46.7)
	Middle school	141 (11.1)
Mother's education level	College or higher	267 (21.1)
	High school	621 (49.1)
	Middle school	376 (29.8)
Acculturation stress†	4-40	14.45 ± 3.39
Bi-cultural acceptance attitude†	4-40	29.17 ± 3.83
Body satisfaction†	6-24	15.39 ± 1.25
Self-esteem†	4-16	12.74 ± 2.12
Self-resilience†	14-56	42.85 ± 6.36
Life satisfaction†	3-12	9.47 ± 1.85
Social withdrawal†	5-20	11.73 ± 3.68
Family's support†	7-28	22.39 ± 3.79
Friend's support†	7-35	28.95 ± 5.14
Teacher's support†	6-30	22.65 ± 5.03

†Higher scores indicate greater acculturation stress, better bi-cultural acceptance attitude, body satisfaction, self-esteem, self-resilience, and life satisfaction, greater social withdrawal, and higher levels of support from family, friends, and teachers.

Table 2. Trajectory of Depressive Symptoms (*N*=1,264)

	Mean	SE	*p*	Model Fit			
				X^2 (*p*)	CFI	TLI	RMSEA
Intercept	16.89	0.14	< .001	2668.68 (< .001)	0.96	0.96	0.07
Slope	0.24	0.04	< .001				

SE=Standard error; CFI=Comparative fit index; TLI=Tucker–Lewis index; RMSEA =Root mean square error of approximation.

Table 3. Determining the Number of Latent Classes according to the Trajectory (*N*=1,264)

Model fit	Model			
	2 classes	3 classes	4 classes	5 classes
Loglikelihood	-21553.77	-21297.26	-21231.26	-21168.53
AIC	43145.55	42646.51	42528.51	42417.05
BIC	43243.25	42780.21	42698.20	42622.73
Adjusted BIC	43182.90	42697.62	42593.38	42495.67
VLMRT	0.00	0.00	0.02	0.39
LMR LRT	0.00	0.00	0.02	0.40
BLRT	0.00	0.00	0.00	0.00
Entropy	0.81	0.81	0.74	0.74
Class 1	647 (51.2)	479 (37.9)	216 (17.1)	183 (14.5)
Class 2	646 (48.8)	602 (47.6)	421 (33.3)	380 (30.1)
Class 3		183 (14.5)	452 (35.8)	213 (16.8)
Class 4			175 (13.8)	379 (30.0)
Class 5				109 (8.6)

AIC = Akaike information criterion; BIC = Bayesian information criterion; VLMART = Vuong-Lo-Mendell-Rubin Test; LMRLRT = Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT = Bootstrapped likelihood ratio test.

($p < .001$), showing that there was a statistically significant increase in the level of depression. The χ^2 value was 2668.68 ($p < .001$) and was statistically significant. The CFI and TLI were 0.9 or higher, and RMSEA was less than 0.08, indicating that the research model had a good fit [50].

Latent classes according to the developmental trajectories of depression in multicultural adolescents in middle and high school

The results of identifying latent classes according to the developmental trajectories of depression in multicultural adolescents in middle and high school by using LCGM are shown in Tables 3 and 4. The statistical criteria for determining the number of latent classes include information indexes, χ^2 test, and quality of classification. More specifically, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and adjusted BIC, which are the information indices of each model, were examined, and all the indices showed a tendency to decrease with the increase of the number of latent classes. Afterwards, the Vuong-Lo-Mendell-Rubin Test (VLMRT), Lo-Mendell-Rubin adjusted Likelihood Ratio Test (LMR LRT), and Bootstrapped Likelihood Ratio Test (BLRT) were used to compare models by increasing the number of latent classes. The *p*-value of BLRT was significant in all the numbers of latent classes, but the *p*-values of LMR LRT and VLMRT were not significant when the number of latent classes was increased to 5. The entropy value, which indicates the quality of classification, was 0.8 or higher when the number of latent classes was two or three. Based on the above criteria, a model with three latent classes was adopted as a result of comprehensively considering the practical usefulness of classification and the possibility of interpreting the results.

After the number of latent classes was determined as three, the depression trajectory of each class was examined (Table 4; Figure 1). The first class had a relatively lower intercept value for depression (intercept = 13.34, $p < .001$), compared to the other classes. Since only this class had the decreasing slope over time (slope = -0.07, $p < .001$), it was named the 'low-decreasing' class, and 37.9% (479 people) of the sample belonged to the 'low-decreasing' class. As for the second class, the intercept value for depression was a relatively moderate level (intercept = 17.76, $p < .001$), and the value of the slope increased over time (slope = 0.41, $p < .001$), so the second class was named the 'moderate-increasing'

class. The multicultural youth that belonged to this class took up 47.6% (602 people) of the total participants. The third class was named the 'high-increasing' class because it had the highest intercept value for depression (intercept = 23.22, $p < .001$) and its slope increased over time (slope = 0.44, $p < .001$). The multicultural adolescents belonging to this class accounted for 14.5% (183 people) of the total participants.

Influencing factors for each latent class

Multinomial logistic regression analysis was performed to identify influencing factors for the distinct latent classes according to the trajectories of depression in multicultural adolescents in middle and high school, and the results are shown in Table 5. The results of tests for detecting multicollinearity indicated that there was no multicollinearity. The first class (Class 1), the 'low-decreasing' class, was used as the reference group, and significant variables that affect the classification of the comparison groups were identified.

Table 4. Trajectory of Depressive Symptoms by Each Classes (N=1,264)

Classes	Initial intercept Mean (p)	Slope Mean (p)
Class 1 (Low-decreasing)	13.34 (< .001)	-0.07 (< .001)
Class 2 (Moderate-increasing)	17.76 (< .001)	0.41 (< .001)
Class 3 (High-increasing)	23.22 (< .001)	0.44 (< .001)

As a result, it was found that among multicultural adolescents, male gender (OR = 0.56, $p < .001$), greater age of the mother (OR = 1.04, $p = .038$), a higher level of acculturation stress (OR = 1.09, $p < .001$), a higher level of social withdrawal (OR = 1.14, $p < .001$), a lower level of self-esteem (OR = 0.89, $p = .016$), a lower level of life satisfaction (OR = 0.88, $p = .017$), and a lower level of family support (OR = 0.95, $p = .046$) were linked to a higher likelihood of belonging to Class 2, the 'moderate-increasing' class.

In addition, among multicultural adolescents, male gender (OR = 0.28, $p < .001$), living in a town (OR = 2.07, $p = .006$), a higher level of acculturation stress (OR = 1.09, $p = .008$), a higher level of social withdrawal, (OR = 1.27, $p < .001$), a lower level of self-esteem (OR = 0.83, $p = .014$), a lower level of life satisfaction (OR = 0.67, $p < .001$), a lower level of family support (OR = 0.92, $p = .024$), and a lower level of friend support (OR = 0.91, $p < .001$) were associated with a higher likelihood of belonging to Class 3, the 'high-increasing' class.

Discussion

This study was conducted using the six-year data collected from 2014 to 2019 among the datasets of the first panel of the MAPS. This study estimated the patterns of developmental trajectories of depression in 1,264 multicultural adolescents that included middle and high school students in the first year of middle school

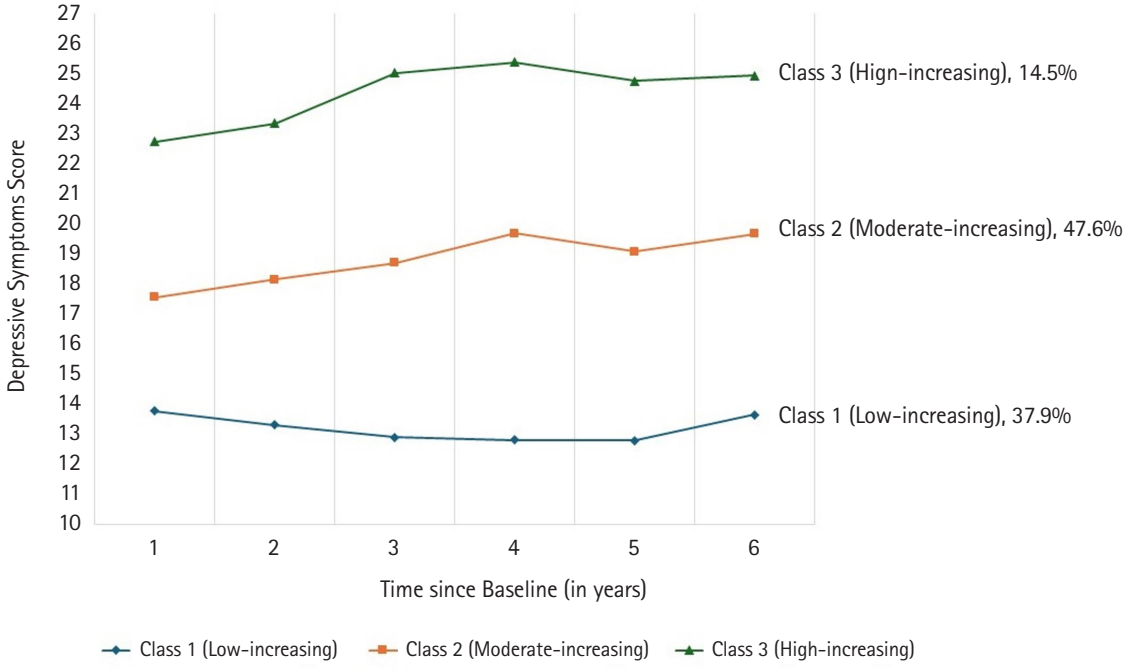

Figure 1. Depression trajectories for each latent class (N=1,264).

Table 5. Results of Multinomial Logistics Regression Analysis (*N*=1,264)

Characteristics	Categories	Class 2† (n=479, 37.9%)		Class 3‡ (n=183, 14.5%)	
		ref. Class 1§			
		OR	95% CI	OR	95% CI
Gender (ref. boy)		0.56	0.419-0.737	0.28	0.177-0.440
Region of residence (ref. metropolitan)	Medium-sized city	0.71	0.489-1.043	1.05	0.569-1.928
	Small town	1.29	0.930-1.789	2.07	1.227-3.496
Monthly income		1.00	0.999-1.001	1.00	0.998-1.002
Father's age		1.00	1.002-1.070	0.98	0.977-1.081
Mother's age		1.04	0.959-1.036	1.03	0.923-1.036
Father's education level (ref. college or higher)	Middle school	0.95	0.784-2.129	0.84	0.982-4.372
	High school	1.09	0.640-1.170	1.18	0.802-2.087
Mother's education level (ref. college or higher)	Middle school	1.29	0.597-1.522	2.07	0.394-1.783
	High school	0.87	0.723-1.636	1.29	0.610-2.272
Acculturation stress		1.09	1.037-1.140	1.09	1.024-1.167
Bi-cultural acceptance attitude		1.00	0.953-1.042	1.05	0.980-1.132
Body satisfaction		1.05	0.981-1.132	1.08	0.960-1.211
Self esteem		0.89	0.803-0.978	0.83	0.712-0.962
Self-resilience		1.02	0.988-1.055	1.01	0.960-1.065
Life satisfaction		0.88	0.792-0.977	0.67	0.568-0.786
Social withdrawal		1.14	1.096-1.192	1.27	1.175-1.362
Family's support		0.95	0.912-0.999	0.92	0.854-0.989
Friend's support		0.99	0.948-1.025	0.91	0.862-0.959
Teacher's support		1.00	0.966-1.035	1.01	0.958-1.066

†Class 2 = Moderate-increasing class; ‡Class 3 = High-increasing class; §Class 1 = Low-decreasing class; OR = Odds ratio; CI = Confidence interval.

to the third year of high school, and identified distinctive latent classes and their characteristics. In addition, this study attempted to identify influencing factors for the classification of the trajectories of depression among multicultural adolescents in middle and high school, and derive empirical implications of the research results.

This study analyzed the depression levels in multicultural adolescents using the MAPS data on the first panel. The mean scores for depression in multicultural adolescents were 16.85±5.29 points for first-year middle school students and 18.20±5.71 points for third-year high school students, showing a pattern of the increasing level of depression with advancing grade levels, and the mean value for the slope of the developmental trajectories of depression was 0.24. These results are similar to the findings of the study by Han [19], which analyzed factors affecting depression in multicultural adolescents, and found that the level of depression showed a tendency to gradually increase. However, in the study by Han [19], which analyzed the data collected over 5 years from the 5th grade of elementary school to the 3rd year of middle school, the slope of the developmental trajectories of depression was reported as 0.03, but the slope was 0.24 in this study. These findings indicate that the level of depression increases more rapidly between middle school and high school than between elementary school and middle school. These results are supported by a study by Song et al. [34], which expanded the scope of the participants by one year by including first-year high school students, compared to the study by Han [19]. Song et al. [34] reported that the depression level in multicultural adolescents was found to increase with a slope of 0.33. In addition, the study by Kim [51], which used the data of middle school students from the Korea Children and Youth Panel Survey (KCYPS), found that there was no significant change in the developmental trajectories of depression among the participants. Moreover, the study by Park [52] used the data from general middle and high school students and reported that the slope of the developmental trajectories of depression was 0.03, which is lower than the slope value in this study. These differences in the research results between this study and previous studies are thought to be related to the fact that multicultural adolescents are affected by a combined impact of factors such as changes due to physical and mental development during adolescence, immigration background, and school life. In this respect, the results of this

study indicate that the mental health of multicultural middle and high school students is relatively more vulnerable, and therefore more active support for their mental health is needed.

This study analyzed the data on multicultural middle and high school students, and in this study, the developmental trajectories of depression in multicultural adolescents were classified into three classes: 'low-decreasing,' 'moderate-increasing,' and 'high-increasing'. The mean scores of depressive symptoms in all multicultural adolescents showed that the level of depression is increasing over time, but when the participants were divided into subgroups in terms of the patterns of change in depression and the trajectories of depression over time for each subgroup were analyzed, the subgroups showed different patterns. For the 'low-decreasing' class, the intercept value was 13.34 points, the slope tended to decrease by 0.07 per year, and this class was evaluated as a class with a relatively low level of depression. On the other hand, in the 'moderate-increasing' and 'high-increasing' classes, the slope of the trajectory of depression increased by 0.41 and 0.44 per year, respectively. In particular, for the 'high-increasing' class, which accounted for 14.5% of the total participants, the intercept value was 23.22 points, which is higher than the mean intercept value, and the level of depression showed a tendency to increase somewhat more rapidly compared to the 'moderate-increasing' class. These results suggest that there is a need for a differentiated approach through the identification of high-risk groups for depression to prevent the development and worsening of depressive symptoms among multicultural adolescents. Similar analysis results were reported by a study that analyzed the data of the period from the 5th grade of elementary school to the 1st year of high school from the MAPS 1 [34] and a study that expanded the scope of the analysis to the 3rd year of high school [28]. These two studies also reported that the trajectories of depression in multicultural adolescents were divided into three classes. However, although the two previous studies also identified the 'moderate-increasing' and 'high-increasing' classes as the two types of latent classes of depression, they analyzed the 'low-stable' class as one of the three latent classes, differently from this study [28,34]. This difference in the research results seems to be due to the difference in the participants between this study and previous studies. In other words, although the above-mentioned previous studies included elementary school students among the participants, this study was conducted only with middle and high school students, and found that the latent classes of depression also included the 'low-decreasing' class along with the 'moderate-increasing' and 'high-increasing' classes. In this regard, a study of Korean middle and high school students [53] and a study of American multicultural high school students [15,16] also reported that depression levels tended to decrease over time among the participants. Therefore, although it is required to implement mental health promotion programs for adolescents who show a tendency of gradually increasing levels of depression, there is also a need to consider customized programs that provide proactive diagnosis and preventive interventions through periodic mental health checkups in order to prevent the transition of the adolescents with a tendency of gradually decreasing depression levels into the class with a gradually increasing level of depression.

The common influencing factors for the 'moderate-increasing' and 'high-increasing' classes, which showed a higher level of depression than the reference group referred to as the 'low-decreasing' class, were males, high levels of acculturation stress and social withdrawal, and low levels of self-esteem, life satisfaction, and family support. In particular, it is noteworthy that except for 'greater age of the mother', all the factors increasing the likelihood of belonging to Class 2 named as the 'moderate-increasing' class were also included in the factors associated with a higher likelihood of belonging to Class 3 referred to as the 'high-increasing' class. Although there are differences in the level of depression between the 'moderate-increasing' and the 'high-increasing' classes, the influencing factors associated with both the classes vulnerable to depression can be seen as the areas to which top priority should be given in performing assessments and active interventions.

In this study, males were found to be more likely to belong to the classes with a higher level of depression. These results are in contrast with the general perception that females are more vulnerable to depression. Actually, the findings of this study are not in agreement with the results of the 'Youth Health Behavior Online Survey 2017-2019', which was conducted during a period similar to the data collection period of the MAPS data used in this study. According to the 'Youth Health Behavior Online Survey 2017-2019', the level of depression was found to be higher among female adolescents. However, in this connection, Sharp et al. [54] claimed that the influencing factors differ depending on gender, and stated that while female adolescents are influenced by relational characteristics, male adolescents are influenced by status characteristics that are not easily changed, such as their social positions. In view of the research results of Sharp et al. [54], a higher level of depression in male adolescents in this study may be attributed to the fact that depression levels in the participants were influenced by their social characteristics of being multicultural adolescents. Meanwhile, in this study, relatively higher age

of the mother was found to be a factor increasing the likelihood of belonging to Class 2, and this finding is supported by a previous study [55] showing that the mother's age higher than 39 years was associated with the increased likelihood of the occurrence of depression in children. In addition, this study found that living in a town increases the likelihood of belonging to Class 3, and these results corroborate the findings of a previous study [29] showing that adolescents living in non-metropolitan areas showed a higher level of depression than those living in metropolitan areas.

With respect to variables related to multiculturalism and individual characteristics, high acculturation stress, high social withdrawal, and low self-esteem were identified as factors increasing the likelihood of belonging to Classes 2 and 3. In this connection, it has been reported that self-esteem may be decreased with the increase of acculturation stress, and that the accumulation of such experiences may lead to social withdrawal [56], and cause emotional problems such as depression and anxiety [57]. These findings of previous studies are considered to support the results of this study. In addition, low life satisfaction was also shown to be a factor increasing the likelihood of belonging to Classes 2 and 3. In this regard, a previous study [58] reported that low life satisfaction during adolescence is a major predictor of depression, and that depression in turn decreases life satisfaction. These findings support the results of this study regarding life satisfaction.

Regarding environmental variables, a lower level of family support was found to be linked to a higher likelihood of belonging to Classes 2 and 3. These results are indirectly in agreement with the findings of Jo et al. [59], which found that a low level of family support acts as a moderator variable for depression and acculturation stress, and not only decreasing life satisfaction but also increasing depression. Also, the results of this study are consistent with the results of previous studies [37,60] which found that parental support, which is similar to family support, acts as a protective factor against depression and social withdrawal. In addition, this study also found that a lower level of friend support was associated with a higher likelihood of belonging to Class 3, the 'high-increasing' class. These results are supported by the results of a prior study reporting that friend support was the most important protective factor against depression [60] and a previous study showing that social support including friend support had a negative impact on depression and social withdrawal [61].

With respect to the main outcomes of this research, this study presented an increased understanding of the characteristics of multicultural adolescents in middle and high school, and identified the developmental trajectories and influencing factors of depression according to the characteristics of the trajectories of depression. These research results will serve as basic data for a more active psychosocial approach when providing interventions that reflect the current situation as our society has become a multicultural society. In addition, if rapid interventions and preventive support for reducing depressive symptoms in multicultural adolescents in middle and high school are provided by taking into account their characteristics, such measures will help the multicultural adolescents to spend their remaining adolescence and future adulthood in a healthier way.

However, this study has some limitations. First, as various questions were included in the surveys to collect the MAPS data used in this study, a shortened version of a scale was used or only some part of a scale was used in many cases. Therefore, in follow-up studies, it is required to obtain and use the data collected by using all the items of the relevant scales in order to more meticulously analyze and identify the factors affecting the latent classes and growth models of depression among multicultural adolescents, and it is also necessary to apply additional procedures for the verification of validity and reliability. In addition, in this study, statistically significant results were obtained only when we conducted classification of latent classes for depressive symptoms among middle and high school students. Considering that the MAPS data is a panel data from surveys that followed adolescents over the period from the fifth grade of elementary school to early adulthood, it is suggested that future studies should expand the scope and include various variables to derive meaningful insights from data analyses.

Conclusions

This study investigated the general characteristics and depression levels of multicultural adolescents in middle and high school by using the 2014-2019 data from the surveys on the first panel of the Multicultural Adolescents Panel Study. In addition, this research classified the developmental trajectories of depression into latent classes, and identified factors influencing each latent class. The analysis results revealed that the level of depression changed over time among multicultural middle and high school students, and the developmental trajectories of depression were divided into three classes: 'low-decreasing', 'moderate-increasing', and 'high-increasing' classes. Regarding the influencing factors for the moderate-increasing class, male gender, greater age of the mother, a higher level of acculturation stress, a higher level of social withdrawal, a lower level of self-esteem, a lower level of life satisfaction, and a lower level of family support were associated

with a higher likelihood of belonging to the 'moderate-increasing' class among multicultural adolescents. As for the influencing factors for 'high-increasing' class, male gender, residing in a town, a higher level of acculturation stress, a higher level of social withdrawal, a lower level of self-esteem, a lower level of life satisfaction, and lower levels of family support and friend support were linked to a higher likelihood of belonging to the 'high-increasing' class among multicultural adolescents. These findings suggest that when assessing depression among multicultural adolescents in middle and high school and performing interventions to reduce depression among them, it is required to identify the latent classes for depression to which the adolescents belong, and take note of the fact that the main influencing factors may differ depending on the latent class. In particular, for middle and high school students who have the factors identified as the influencing factors for both the 'moderate-increasing' and 'high-increasing' classes, more active interventions are required to help them maintain healthy mental health into adulthood. Although depression among multicultural adolescents in middle and high school is considered a chronic problem, this problem has not yet been properly addressed. The results of this study will hopefully help to gain a deeper understanding of depression among multicultural adolescents, and thereby contribute to the development of mental health programs tailored to the characteristics of depressive symptoms among multicultural adolescents.

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Conflict of interest

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Authors' contributions

Sujin Lee contributed to conceptualization, data curation, formal analysis, methodology, visualization, and writing - original draft, review & editing. Soo Jin Lee contributed to conceptualization, formal analysis, project administration, methodology, writing - original draft, review & editing and supervision. Hyanglan Kim contributed to conceptualization, methodology, and writing - original draft, review & editing.

Data availability

Please contact the corresponding author for data availability.

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