Reciprocal relationship between multicultural adolescents' depression and life satisfaction: a random intercept cross-lagged panel model for 3-wave panel data

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Abstract

Multicultural adolescents (MA) in Korea experience higher depression and lower life satisfaction compared to Korean native adolescents. To consider appropriate interventions, this study investigates the cross-lagged effect between life satisfaction and depression among these adolescents. Secondary data from the Multicultural Adolescents Panel Survey, which is a nationally representative sample, was analyzed. Data from the 3rd (T1, elementary school), 5th (T2, middle school), and 7th (T3, high school) waves (2013–2017) were used. Altogether, 1,239 MA were included in the sample for analysis; the mean age at T1 was 11.97 (± 0.36) years. The ten-item Depression Scale Questionnaire was used to measure depression, and the three-item Happiness Scale was used to measure life satisfaction. The random intercept cross-lagged panel model was conducted to estimate within-person autoregressive and cross-lagged effects. Life satisfaction and depression had a reciprocal relationship from T1 to T2, while only life satisfaction had a lagged effect from T2 to T3. Life satisfaction's lagged effect dominated that of depression. The cross-lagged effect size of depression from T1 to T2 was larger than that from T2 to T3, and that of life satisfaction from T2 to T3 was larger than that from T1 to T2. Low life satisfaction in MA continues over time. Depression is not persistent, but if experienced in elementary school, it leads to low life satisfaction in middle school and depression in high school. The findings suggest that early intervention for depression in elementary school can reduce its negative effect MA's life satisfaction.

Keywords Multicultural adolescents · Life satisfaction · Depression · Random intercept cross-lagged panel model

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Background

Recently, as the number of immigrants through marriage in Korea increased, so too has the proportion of births from multicultural (*damunhwa* in Korean) families, which are made up of foreign-born parents and their bicultural children. The proportion of births of bicultural children in South Korea steadily increased from 4.3% in 2009 to 5.9% in 2019 (Korean Statistical Information Service, 2019). Subsequently, 46,954 adolescents from multicultural families in 2012 were ethnic minorities, accounting for 0.8% of all South Korean students. In 2020, this increased to 147,378, accounting for 2.7% of all South Korean students (Ministry of Education, 2020). Existing knowledge from multicultural countries suggests that the phenomenon can lead to a disparity in the use of healthcare services (Elster et al., 2003) and health outcomes (Skogen et al., 2018; Wong & Fan, 2018). The disparity due to ethnicity may persist throughout a person's life, suggesting that greater attention should be paid to multicultural adolescents' (MA) health in the context of their everyday lives.

Life satisfaction is a subjective well-being's cognitive measure with an individual's life (Galinha & Pais-Ribeiro, 2012; Pavot & Diener, 1993) and has been considered to reflect overall subjective well-being or quality of life, including the physical, psychological, social, and educational domains (WHOQOL Group, 1995). Moreover, life satisfaction in adolescence, an indicator of well-being, is important because it reduces problem behavior (OECD, 2019; Proctor et al., 2009) and affects life in adulthood (Orben et al., 2020). In South Korea, the level of life satisfaction in the adolescent population has been reported to be below the average in Organisation for Economic Cooperation and Development (OECD) countries (OECD, 2019). MA tended to decrease their life satisfaction faster than native Korean adolescents in the middle school period (Yeon, 2017; Yang et al., 2018). In addition, they showed lower life satisfaction than native Korean adolescents after their third year of middle school. In previous studies, depression (higher), acculturative stress (higher), family support (lower), and social support (lower) negatively affected the life satisfaction of MA (Cho, & Park, 2020; In, 2017; Lee, 2019). Therefore, special attention needs to be paid to confirm the status of life satisfaction and its development over time for MA and identify related factors.

Compared with native Korean adolescents, MA in Korea is more likely to experience depression (Jang & Park, 2019). The level of perceived depression in MA has been increasing since 5th grade in elementary school, and it is a more prevalent problem in secondary school compared to elementary school (Yang et al., 2018). Depression in MA gained great interest in researchers because it can lead to risky health behaviors (Moon et al., 2020) and can be long-lasting or recurrent, significantly affecting an individual's life (WHO, 2020). During the growth and developmental process of adolescents, maladaptation leads to internalized problem behaviors such as depression (Achenbach & Edelbrock, 1978). According to Beck's cognitive theory, depression causes cognitive distortion such

as a negative view of reality (Sacco & Beck, 1995), which leads to lower subjective well-being and also reinforces negative emotions, leading to depression again (Moksnes et al., 2016; Zadow et al., 2017). In the other way around, the homeostasis theory of subjective well-being proposes that experiencing unfavorable life conditions lowers the level of life satisfaction, leading to depression (Cummins, 2000). MA are more likely to be placed in a vulnerable situation such as acculturative stress (Bae, 2020) and discrimination (Choi et al., 2021) and thus it is possible to negatively moderate the relationship between life satisfaction and depression. However, the magnitude of this association has not been sufficiently researched in the MA population.

Depression and life satisfaction can change over time, making it challenging to confirm the relationship at a specific point through cross-sectional studies. Adolescents have different developmental tasks as they grow up, and if these developmental tasks are not properly accomplished, they not only affect subsequent developmental tasks, but can also lead to negative health outcomes such as depression (Achenbach & Edelbrock, 1978). Therefore, the identification of adolescent health problems requires an approach that explores the interactions according to the adolescent stage. School environment is known to be a factor influencing adolescents' achievement of developmental tasks and their health. In Korea, in consideration of the developmental tasks of adolescents by stage, the curriculum goals are also different for each elementary school, middle school, and high school. Therefore, investigation should consider the different points in adolescents' life cycles.

This study targets MA and aims to confirm whether there is a reciprocal longitudinal effect between depression and life satisfaction based on elementary, middle, and high school data. The specific research objectives are to examine (1) the existence of a reciprocal causal relationship between depression and life satisfaction, (2) which variable is causally dominant, and (3) at which stage(s) the effect size of depression and life satisfaction among the elementary, middle, and high school stage of MA' growth is larger.

Methods

Design and sample

Secondary data from the Multicultural Adolescents Panel Survey (MAPS) were analyzed using the random intercept cross-lagged panel model (RI-CLPM). The MAPS conducted by the National Youth Policy Institute (NYPI) is the only large-scale nationwide panel survey for MA in Korea. The MAPS was initiated to track the developmental process of MA, identify differences from native Korean adolescents, and identify factors influencing these differences (Yang et al., 2011). To establish the panel, the Ministry of Education provided a list of all elementary schools where children from multicultural families were enrolled. Afterward, with the cooperation of each school, 4th-grade children and their multicultural families were identified. The target number of respondents for the panel was 1,600, and 1,502 MA were

recruited for the first panel. Data were collected using computer-assisted personal interviewing by experienced enumerators. The sample in this study included MA who participated in the 3rd (T1, 6th grade in elementary school), 5th (T2, 2nd grade in middle school), and 7th (T3, 1st grade in high school) waves of the MAPS. At T1, a total of 1,443 MA completed the depression and life satisfaction measures. Of those who participated at T1, 1,335 completed the same measures at T2 (92.51% of T1 sample), and then 1,239 completed the same measure at T3 (92.80% of T2 sample, 85.86% of T1 sample). Attrition analyses were conducted to examine whether the 1,239 remaining samples differed from those who dropped out at T3. The results showed that MA living in small or medium-sized cities and towns were less likely to participate in T3. However, there were no significant differences in depression ($p < 0.161$) and life satisfaction ($p < 0.065$) in participants who drop out at T3.

Measures

Depression

The Depression Scale Questionnaire was used to measure Depression (Lee et al., 2011). This tool was developed by the NYPI for a panel survey, and 13 items regarding depression in the Symptom Checklist-90-Revision (1984) were extracted, corrected, and revised. Responses are given on a four-point Likert scale from "not true at all (1) to "very true" (4). This tool involved ten items (e.g., "I feel lonely," "I think I want to die," and "I feel unhappy or sad and depressed."). A higher score means a higher level of depression among MA. Cronbach's alpha in our sample was 0.91 at T1, 0.90 at T2, and 0.91 at T3.

Life satisfaction

To measure life satisfaction, the Happiness Scale was used, which was developed by the NYPI as an index to measure the development of Korean adolescents (Kim et al., 2006). This measure included three items; "I enjoy living," "I have little to worry about," and "I think my life is happy.". This scale is on a four-point Likert scale (1 = "not true at all" and 4 = "very true"). A high score is interpreted as a high degree of life satisfaction. It had an acceptable Cronbach's alpha of 0.84 at T1, 0.86 at T2, and 0.77 at T3 in our sample.

Data analysis

This study used major research variables (depression and life satisfaction) from the T1, T2, and T3 waves of the MAPS and general characteristics (gender, age, regional scale, parents' country of origin, and parents' highest educational level) from the 3rd wave of the MAPS. The mean and standard deviation of the major variables were verified through descriptive statistics using SPSS 25.0 (IBM Corp., Armonk, NY, USA), and normality was verified by checking skewness and kurtosis. Additionally,

the relationship between the major variable was identified by a Pearson's correlation analysis. To estimate the autoregressive and cross-lagged effects between depression and life satisfaction, R studio (R Development Core Team, 2020) and lavaan package (Rosseel, 2012) that can perform the structural equation modeling were used. For handling missing data, Full Information Maximum Likelihood (FIML) was applied, and robust Maximum Likelihood Estimation (MLE) was included to explain the non-normal nature of variables.

CLPM is commonly used as a statistical method to estimate the cross-lagged effect that different variables mutually predict at time intervals in mutual directions between variables (Hamaker et al., 2015). CLPM implicitly assumes that there is no individual difference, such as time-invariant characteristics. Thus, CLPM does not demonstrate a real within-person relationship because the between-person and within-person differences are not separated. Consequently, these estimates may bias results, or conclusions about underlying causal patterns may be incorrect.

To deal with this problem, Hamaker (2015) suggested CLPM including the random intercept. Random intercepts act as a latent variable to control for individual differences (between-person stability). After controlling between-person stability with random intercepts, RI-CLPM allows for estimating within-person cross-lagged effects. In other words, RI-CLPM distinguishes within-person processes and between-person differences. Also, RI-CLPM can reduce the overestimating bias because of controlling between-person stability. Based on traditional indices (Hu & Bentler, 1999), model fit for the RI-CLPM models was determined, and the goodness of fit should be as follows: chi-square values > 0.05, comparative fit index (CFI) values > 0.95, Tucker-Lewis index (TLI) values > 0.95, root mean square error of approximation (RMSEA) values < 0.06, and standardized root mean square residual (SRMR) values < 0.08.

Results

The general characteristics of the sample based on the 3rd wave of MAPS are as follows (Table 1). As demonstrated, the mean age was 11.97 ($\pm$0.36) years, and 51.0% of the MA were girls. Most were living in a city (69.0%). The top three countries of origin among mothers were Japan (35.1%), the Philippines (26.0%), and Korean-Chinese (17.5%); for fathers, these were South Korea (96.7%), Japan (1.3%), and other (1.3%). Further, most parents' educational level was high school graduation (mothers 47.1% and fathers 51.9%).

Descriptive statistics and correlation

The average level of depression was 15.91 ($\pm$5.08) at T1, 16.83 ($\pm$5.28) at T2, and 17.38 ($\pm$5.51) at T3 (Table 2). The average level of life satisfaction was 9.93 ($\pm$1.69) at T1, 9.48 ($\pm$1.84) at T2, and 8.64 ($\pm$1.63) at T3. The skewness of the variables included in the model was less than 2, and the kurtosis was less than 7; therefore, the data can be considered normally distributed. Additionally, Table 2

Table 1 General characteristics of multicultural adolescents for T1 and their parents

Variables	Categories		N (%) / Mean(± SD)
Multicultural adolescents(N = 1,239)	Gender	Boys	607 (49.0)
		Girls	632 (51.0)
	Ages	11	93 (7.5)
		12	1,101 (88.9)
		13	40 (3.2)
		14	4 (0.3)
		15	1 (0.1)
			11.97 ± 0.36
	Region	Big city	313 (25.3)
		Small or medium city	542 (43.7)
		Town	384 (31.0)
Mothers(N = 1,239)	Country of origin	South Korea	39 (3.2)
		China (Han, etc.)	86 (7.0)
		Korean-Chinese	217 (17.5)
		Vietnam	29 (2.3)
		The Philippines	322 (26.0)
		Japan	435 (35.1)
		Thailand	51 (4.1)
		Other	60 (4.8)
	Educational level	Middle school	137 (11.1)
		High school	584 (47.1)
		College	321 (25.9)
		University	190 (15.3)
		Graduate school	7 (0.6)
Fathers(N = 1,182)	Country of origin	South Korea	1,143 (96.7)
		China (Han, etc.)	1 (0.1)
		Vietnam	2 (0.2)
		The Philippines	4 (0.3)
		Japan	16 (1.3)
		Etc.	15 (1.3)
		No response	1 (0.1)
	Educational level	Middle school	370 (31.3)
		High school	613 (51.9)
		College	75 (6.3)
		University	115 (9.7)
		Graduate school	9 (0.8)

Notes: *SD* standard deviation

Table 2 Descriptive statistics and correlation matrix of depression and life satisfaction for multicultural adolescents

	1	2	3	4	5	6
1. Depression T1	-					
2. Depression T2	0.410*	-				
3. Depression T3	0.359*	0.466*	-			
4. Life satisfaction T1	-0.616*	-0.337*	-0.245*	-		
5. Life satisfaction T2	-0.293*	-0.649*	-0.339*	0.386*	-	
6. Life satisfaction T3	-0.230*	-0.358*	-0.598*	0.304*	0.389*	-
Mean	15.91	16.83	17.38	9.93	9.48	8.64
SD	5.08	5.28	5.51	1.69	1.84	1.63
Skewness	0.58	0.44	0.34	-0.35	-.031	0.08
Kurtosis	-0.48	-0.32	-0.46	-0.21	0.02	0.53
Range	10–34	10–39	10–38	3–12	3–12	3–12
*$p < 0.001$						

Notes: *SD* standard deviation, *T1* Time 1 (6th grade in elementary school), *T2* Time 2 (2nd grade in middle school), *T3* Time 3 (1st grade in high school)

presents the bivariate correlations between depression and life satisfaction at each point in time. Statistically significant correlations were observed between depression and life satisfaction measured from T1 to T3, with time-to-time correlations ranging from -0.230 (depression T1 and life satisfaction T3) to -0.649 (depression T2 and life satisfaction T2).
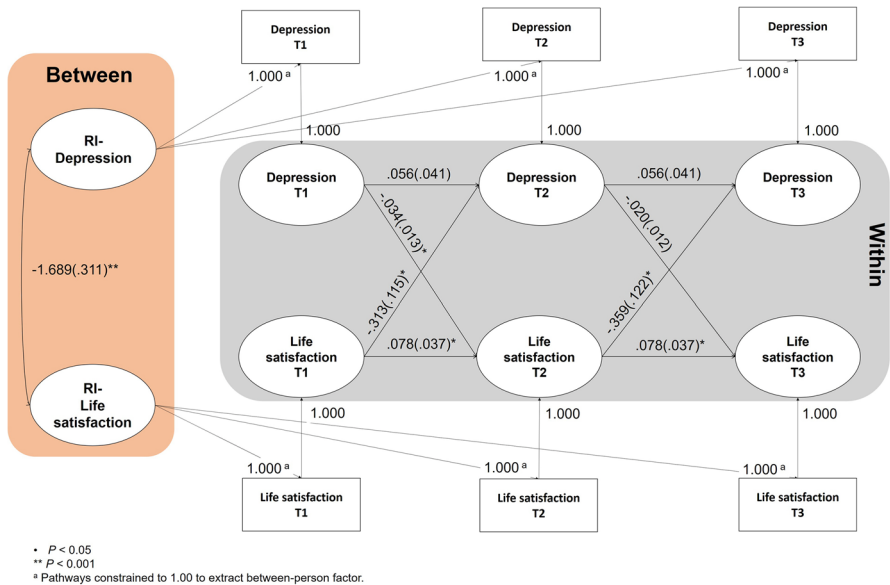

• $P < 0.05$
** $P < 0.001$
[a] Pathways constrained to 1.00 to extract between-person factor.

Fig. 1 Cross-lagged effect between depression and life satisfaction of multicultural adolescents

Reciprocal effects with the RI-CLPM

The RI-CLPM fit the data well according to the indicators of goodness of fit: chi-square = 5.26, $df = 3$, $p = 0.154$; CFI = 0.999; TLI = 0.996; RMSEA = 0.024; 90% confidence interval = 0.00—0.57; and SRMR = 0.010. Figure 1 illustrates the standardized lagged parameters estimated with the RI-CLPM. First, there were reciprocal, longitudinal relationships between depression and life satisfaction. There was a significant negative effect from depression to life satisfaction (ß = -0.034, $p < 0.05$) and life satisfaction to depression (ß = -0.313, $p < 0.05$) from T1 to T2. Further, the results from T2 to T3 demonstrate that life satisfaction had a significant negative effect on depression (ß = -0.359, $p < 0.05$) but depression had no significant negative effect on life satisfaction (ß = -0.020, $p = 0.095$). Second, the effect of life satisfaction on depression in subsequent years was much larger than that of depression on life satisfaction for MA (ß = -0.313, $p < 0.05$ vs. ß = -0.034, $p < 0.05$ between T1 and T2, ß = -0.359, $p < 0.05$ vs. ß = -0.020, $p = 0.095$, between T2 and T3). In other words, life satisfaction was causally dominant. Lastly, the cross-lagged effect size of depression to life satisfaction from T1 to T2 was slightly larger than that from T2 to T3 (ß = -0.034, $p < 0.05$ vs. ß = -0.020, $p = 0.095$), but there was no significant effect of depression from T2 to T3. The cross-lagged effect size of life satisfaction to depression from T2 to T3 was slightly larger than that from T1 to T2 (ß = -0.313, $p < 0.05$ vs. ß = -0.359, $p < 0.05$).

Discussion

There is an accumulated evidence showing that MA living in Korea have low life satisfaction and high depression, but there is still a lack of research on how to promote their health. Compared to other native Korean adolescents, MA living in Korea experience psychological problems due to socioeconomic factors (nationality and education level of their parents), family factors (parenting, relationship quality), social factors (discrimination), cultural factors (acculturative stress and bicultural acceptance) (Lee et al., 2019). Most existing studies conducted on MA explain depression and life satisfaction as one point and moving in one direction (Cho & Park, 2020; Zadow et al., 2017). However, according to the "Health 2020" framework of the WHO, life satisfaction is defined as an important variable that can identify risk signs of depression (Gigantesco et al., 2019), and because it is also affected by depression (Sacco & Beck, 1995; Cummins, 2000), the need for mutual influence between life satisfaction and depression is emphasized. Consequently, this study confirmed the relationship between depression and life satisfaction across time and attempt the continued influence of these health problems across adolescents' growth and development using the RI-CLPM. It is meaningful that this study was a first attempt to identify the effect of these variables for the MA population throughout the elementary, middle, and high school stages.

In this study, the depression scores among MA in each wave were 15.91 (T1), 16.83 (T2), and 17.38 (T3), increasing over time. In previous studies that measured depression among native Korean adolescents, it was 19.3 (second grade in

middle school) and 18.8 (first grade in high school), which were higher among native Korean adolescents than MA, but decreased over time (Sung, 2016). Additionally, the life satisfaction scores of MA decreased over time from 9.93 (T1) to 9.48 (T2) and further to 8.64 (T3). According to a study measuring life satisfaction among native Korean adolescents, life satisfaction increased from 8.46 in middle school to 8.64 in high school (Jung, Bong, & Hong, 2018). In other words, as compared to native Korean adolescents, depression increased, and life satisfaction decreased in MA over time. Therefore, for the healthy growth and development of MA, it is necessary to confirm their adolescent depression and life satisfaction.

The bidirectional associations between depression and life satisfaction were estimated in RI-CLPM. The life satisfaction of MA had a significant lagged effect on depression over time. However, while MA's depression at T1 was negatively associated with life satisfaction at T2, there was no significant effect of depression at T2 on life satisfaction at T3. In a previous study that confirmed the mediating effect of coping behaviors that increase the psychological well-being of elementary and middle school students, it was noted that only middle school students' coping ability increased their psychological well-being (Park & Kim, 2016). It can be inferred that as individuals grow and develop, their coping abilities improve, and their life satisfaction increases. Therefore, based on this study's results, it can be seen that attention should be paid to depression among elementary school students whose coping ability has not yet improved. Additionally, the effect of life satisfaction was stronger than that of depression. Although depression and life satisfaction have a cyclical relationship, it can be confirmed that life satisfaction has a stronger effect than depression, and the former precedes depression thereby affecting it. This evidence supports the WHO framework, which emphasizes that life satisfaction can predict mental health (Gigantesco et al., 2019). Previous studies have only confirmed the relationship between depression and life satisfaction in one direction and at one point in time, although the cross-lagged effect has been confirmed for the general adolescent population (Freire & Ferreira, 2018; Moksnes et al., 2016; Zadow et al., 2017). The results of this study are meaningful in confirming the within-person effect and the cross-lagged reciprocal causal relationship between depression and life satisfaction in MA at different time intervals. In particular, these results can support the health promotion of MA groups by drawing attention to depression and life satisfaction in early adolescence.

The autoregressive coefficient reflecting low life satisfaction in MA was stable over time, indicating that the low life satisfaction of MA is not temporary but a continuous phenomenon. As it has been confirmed that life satisfaction in adolescence persists into adulthood (Orben et al., 2020; Willroth et al., 2021), adolescents' life satisfaction should receive adequate attention. However, currently, the life satisfaction of South Korean adolescents is below the average among OECD countries, which reflects the need for strategies for improvement in this important aspect (OECD, 2019). Adolescents' low life satisfaction has been known to result from bullying, economic disadvantages, and lack of social support (among peers and family and in school) (Borraccino et al., 2018, 2020). This implies that the improvement of upstream factors, such as school and community environment and policies, should be implemented at the same time as taking a more personal approach.

It can be concluded that while depression in MA is not a phenomenon that persists across the growth and development trajectory, depression in the elementary school stage leads to low life satisfaction in middle school, which, in turn, leads to depression in high school. This implies the existence of a cyclical causal relationship. Therefore, the priority time point for intervention in depression in adolescence should be in the elementary school stage. Up to now, studies to identify factors related to the prevention of depression and interventions to reduce depression have focused mainly on middle school and above in the MA population (Espinosa, 2020; Park & Park, 2020; Umaña-Taylor et al., 2018). However, depressive mood increases rapidly as adolescence begins and then tends to persist (Song et al., 2020). This indicates the importance of resolving depression in adolescence, and the present study places further emphasis on the elementary school stage (Spilt et al., 2019). At this stage, MA's poor proficiency in the South Korean language, experiences of being victims of school violence, and experiences of discrimination are likely to influence depression levels (Byeon, 2017). In other words, schools should prioritize education to improve academic achievement for MA, who are typically elementary school students with low South Korean proficiency and should carefully monitor and prevent violence and discrimination in school through multicultural education (Scott et al., 2015). To enable early detection of depression in MA, parents of these adolescents should be educated on depressive symptoms and skills to improve communication with their children (Kim et al., 2016).

Despite its strengths, this study has certain limitations that must be noted. As this study analyzed MAPS data, the assessment of depression and life satisfaction was limited to the instruments used in the original study. To comprehensively understand the multidimensional domain of life satisfaction in MA, it is necessary to develop life satisfaction tools for this population that effectively consider their ethnic and cultural contexts (Proctor et al., 2009). In particular, MA experience health inequality due to discrimination, their differing ethnic background, and linguistic barriers (Cheikh Moussa et al., 2014; Trent et al., 2019). Therefore, in future studies, it is necessary to specifically consider these social determinants of health to identify ways to reduce depression and improve life satisfaction in MA. Additionally, the data used in this study were only collected from MA attending schools. Given that 1.03% of MA do not attend school (Ministry of Education, 2020), future studies must widen their scope to evaluate larger samples of MA. Furthermore, the results of the attrition analysis showed significant differences according to the residential area. However, FIML estimation used in this study can handle missing data under random assumptions, limiting the potential distortion of the estimation. Last, since a previous study (Gigantesco et al., 2019) reported a difference between depression and life satisfaction according to gender, further analyses should examine the lagged relationship by gender. As mentioned by Mulder and Hamaker (2021), a multi-group RI-CLPM in future studies might be applied, as gender has moderate effects that change the pathway in RI-CLPM.

Conclusion

This study's main contribution is in confirming the reciprocal cross-lagged causal relationship between depression and life satisfaction among MA population using the RI-CLPM. In particular, the low life satisfaction in MA indicates their health level and demonstrates that intervention is required on a personal level, in the community, and in terms of policy. In particular, early intervention at the elementary school stage can be expected to reduce depression and increase life satisfaction among MA, leading to a healthy life and supporting the efforts of parents and schools.

Authors' contributions Conceptualization: HL(Hyeyeon Lee), HL(Hyeonkyeong Lee); Methodology: HL(Hyeyeon Lee), HL(Hyeonkyeong Lee), CGP; Investigation: HL(Hyeyeon Lee), YK, ML; Data curation: HL(Hyeyeon Lee), YK, ML; Writing - original draft preparation: HL(Hyeyeon Lee); Writing - review and editing: HL(Hyeonkyeong Lee), YK, ML, CGP; Supervision: HL(Hyeonkyeong Lee), CGP; Project administration: HL(Hyeonkyeong Lee). All authors read and approved the final manuscript.

Data availability The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Code availability Not applicable.

Declarations

Conflicts of interest The authors declare that they have no conflicts of interest.

Ethics approval This study was approved by the Institutional Review Board of Yonsei University Health System (Y-2020-0197).

Consent to participate Informed consent was obtained from all subjects involved in the original survey (MAPS).

Consent for publication Informed consent was obtained from all subjects involved in the original survey (MAPS).

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