

# Reliability and Validity of the Korean Version of the Lifespan Sibling Relationship Scale

Hyeonseok S Jeong<sup>1</sup>, Eu Jin Jeong<sup>2</sup>, Si Young Yu<sup>2</sup>, Younghyun C Lyoo<sup>3</sup>,  
Jooyeon J Im<sup>1</sup>, Sujin Bae<sup>4</sup> and Jieun E Kim<sup>2\*</sup>

<sup>1</sup>*Interdisciplinary Program in Neuroscience, Seoul National University College of Natural Sciences, Seoul 151-747,*

<sup>2</sup>*Department of Brain & Cognitive Sciences, Ewha Womans University, Seoul 120-750,*

<sup>3</sup>*Department of Public Administration, Yonsei University, Seoul 120-749, Korea,*

<sup>4</sup>*Department of Psychiatry, Utah University School of Medicine, Salt Lake City 84112, USA*

The sibling relationship and its potential impact on neurodevelopment and mental health are important areas of neuroscientific research. Validation of the tools assessing the quality of the sibling relationship would be the first essential step for conducting neurobiological and psychosocial studies related to the sibling relationship. However, to the best of our knowledge, no sibling relationship assessment tools have been empirically validated in Korean. We aimed to evaluate the psychometric properties of the Korean version of the Lifespan Sibling Relationship Scale (LSRS), which is one of the most commonly used self-report questionnaires to assess the quality of the sibling relationship. A total of 109 adults completed a series of self-report questionnaires including the LSRS, the mental health subscale of the Medical Outcomes Study-Short Form 36 version 2 (SF36v2), the Satisfaction with Life Scale (SLS), and the Marlowe-Crowne Social Desirability Scale (MC-SDS). The internal consistency, subscale intercorrelations, one-week test-retest reliability, convergent validity, divergent validity, and the construct validity were assessed. All six subscale scores and the total score of the LSRS demonstrated good internal consistency (Cronbach's  $\alpha=0.85-0.94$ ) and good test-retest reliability (intraclass correlation coefficient=0.77-0.92). Correlations of the LSRS with the SF36v2 mental health score ( $r=0.32$ ,  $p=0.01$ ) and with the SLS ( $r=0.27$ ,  $p=0.04$ ) supported the good convergent validity. The divergent validity was shown by the non-significant correlation of the LSRS with the MC-SDS ( $r=0.15$ ,  $p=0.26$ ). Two factors were extracted through factor analysis, which explained 78.63% of the total variance. The three Adult subscales loaded on the first factor and the three Child subscales loaded on the second factor. Results suggest that the Korean version of the LSRS is a reliable and valid tool for examining the sibling relationship.

**Key words:** sibling relationships, validity, reliability, lifespan sibling relationship scale, psychometrics

## INTRODUCTION

Although sibling relationships have received relatively less attention compared to parent-child relationships or marital relationships, they are considered increasingly important for the following reasons [1]. First of all, sibling relationships are very common in the general population [2]. According to the national survey conducted in South Korea in 2009 [3], 74.4% of married

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\* To whom correspondence should be addressed.  
TEL: 82-2-3277-6932, FAX: 82-2-3277-6932  
e-mail: kjieun@ewha.ac.kr

women had two or more children. Secondly, sibling relationships last longer than parent-child relationships [4]. It has been reported that siblings tend to maintain their fellowships throughout their lives [5]. A United States national survey showed that 50% of adults contacted or met with their siblings at least once a month, and two thirds of them considered their siblings as one of their best friends [6]. Moreover, as the average human lifespan lengthens, the duration of these sibling relationships would last longer. Lastly, siblings spend a lot of time together in childhood, which may play a critical role in the developmental process [7]. As the number of working parents has been increasing, siblings spend more time with each other than with their parents and parents often leave the older siblings to take care of the younger ones [8].

Sibling relationships have huge impact on one's behavioral and psychological development not only during childhood but throughout the lifespan [1]. The experiences of teaching and caregiving between siblings in childhood have positive effects on both the older and younger siblings' cognitive, linguistic, social, and psychological development, and give a better understanding of other people's feelings and perspectives [9]. In general, adolescents have a tendency to escape from the influence of their parents, but siblings still provide advice about life plans and personal problems during this period [10]. In fact, adolescents considered siblings more important in terms of companionship, intimacy, and nurturance than parents [11]. It has also been reported that the quality of sibling relationships in adolescence is closely related to friendship and self-esteem [12]. During adulthood, siblings can advise each other on life's major events, assist in making decisions, and help to increase morale [5]. Even when the frequency of contact decreases due to responsibilities for their own families, intimacy tends to be maintained in most cases [5]. Contacts between siblings would become frequent again when their children grow up and become independent. In old age, siblings are someone to rely on, supporting each other practically and psychologically [13, 14], and many choose siblings as the first person to ask for help [5]. People who had more interactions with siblings in old age felt a greater degree of control of their lives [15], and people whose siblings are still alive reported higher motivation than people whose siblings have died [16].

Evidence that sibling relationships are closely related to mental health and adaptation throughout the entire life has accumulated. A meta-analysis of 34 studies about children and adolescents indicates that more warmth and less conflict in sibling relationships are associated with less internalizing and externalizing problems [17]. According to a longitudinal study conducted over a span of 30 years, poor sibling relationship in childhood was a risk factor for major depressive disorder in

adulthood [18]. Adults with good sibling relationships had a lesser degree of loneliness and depression, and had high self-esteem and satisfaction with their lives [19]. In a research on older individuals, even in a case of low frequency of sibling interactions, qualitative aspects of the interaction predicted mental health [20].

Early life experiences have been reported to have a significant impact on the brain development [21]. In a postmortem study, it was noted that individuals who had been exposed to child abuse had a decreased mRNA expression of glucocorticoid receptor and an altered pattern of DNA methylation [22]. These epigenetic changes may induce alterations in brain chemistry and morphology [23, 24]. Using structural magnetic resonance (MR) imaging, decreased volume of corpus callosum has been found in maltreated children with post-traumatic stress disorder (PTSD) [25]. In a study using proton MR spectroscopy, abused children with PTSD showed a decrease in the ratio of N-acetylaspartate to creatine, indicating a decreased level of neuronal viability [26]. Positive experiences, as well as negative ones, have also been reported to affect the neurodevelopmental process [27]. Maternal support and warmth in early childhood was positively correlated with larger hippocampal volumes at school age [27]. Given these findings, the sibling relationship, one of the most important social experiences early in life, is likely to be a critical modulator of the brain development, although there have not yet been studies specifically investigating these relationships.

Although the sibling relationship is considered as an important research topic in the field of psychiatry, psychology, and neuroscience as detailed above, the number of quantitative tools that measure the quality of sibling relationships is limited [28-30]. Moreover, none of them have been formally validated in Korean. Among the questionnaires to assess the sibling relationship [28-30], the Lifespan Sibling Relationship Scale (LSRS) [30] by Riggio, is one of the most widely used self-report tools which has an advantage of comprehensively measuring all aspects of the quality of and attitudes towards sibling relationships during both childhood and adulthood, with established reliability and validity [30]. In addition, this scale has useful characteristics such as short administration time. The current study sought to evaluate psychometric properties of the Korean version of the LSRS, which can be used as a tool to measure the quality of sibling relationships for neuroscientific and psychosocial research.

## MATERIALS AND METHODS

### *Participants*

Adults over 18 years of age were recruited through advertisements. All participants voluntarily provided informed consent.

They were asked to fill out information about their socio-demographic characteristics including age, gender, marital status, and the number of siblings along with a series of self-report questionnaires. In addition, participants had to choose one sibling who has had the greatest impact on them either in a positive or negative way. The average time spent on the questionnaire was 30 minutes. Participants received small gifts that worth about 4 US dollars in compensation. To check the test-retest reliability, 19 participants completed the LSRS twice within an interval of a week. This study was conducted after the approval of Ewha W. University Bioethics Committee.

### **Instruments**

#### **Lifespan Sibling Relationship Scale (LSRS)**

The LSRS, developed by Riggio [30], is a self-report tool that measures one's attitude towards sibling relationships in childhood and adulthood. For consistency, only one sibling was chosen to respond to the question items [30]. The degree of agreement or disagreement with 48 statements was rated using a 5-point Likert scale. The LSRS includes 6 subscales, each consisting of 8 items. Subscales of Child Affect and Adult Affect measure emotional aspects in childhood and in adulthood, respectively (love, affection, pleasure, etc.), and subscales of Child Behavior and Adult Behavior measure the degree of interactions through behaviors (phone call, visit, sharing secret, etc.) in their respective stages. Subscales of Child Cognitions and Adult Cognitions measure aspects of belief in sibling relationships (closeness and importance of the relationship) in their respective stages. Six subscale scores and the total score are calculated; the higher the score, the more positive attitudes they have toward sibling relationships.

#### **Medical outcomes study-short form 36 version 2 (SF36v2)**

The SF36v2 [31] is a self-report tool that assesses one's level of physical and mental health in the last 4 weeks. Among 8 subscales of the SF36v2, we chose the mental health subscale to measure the convergent validity of the LSRS, based on the reports indicating positive associations between the quality of sibling relationships and mental health [30].

#### **Satisfaction with life scale (SLS)**

The SLS [32], a self-report tool consisted of 5 items that measures one's cognitive judgment of satisfaction with life in integrated aspects, was used to evaluate the convergent validity of the LSRS. Participants had to select the degree of agreement or disagreement with each statement, using a 7-point Likert scale (1: strongly disagree, 7: strongly agree). The total score was calculated by adding each item score.

#### **Marlowe-crowne social desirability scale (MC-SDS)**

The MC-SDS, a self-report tool that measures one's tendency to act in a socially desirable way [33], was used to evaluate the divergent validity of the LSRS [30]. Participants had to answer either yes or no for a total of 33 items, of which 18 items were 'socially desirable but unlikely to occur' behaviors and the remaining 15 items 'socially undesirable and likely to occur' behaviors.

#### **Statistical analysis**

Cronbach's  $\alpha$  was calculated for each subscale score and the total score as a measure of internal consistency. Pearson correlation coefficient between each subscale score and the total score was also calculated. The intraclass correlation coefficient (ICC) was calculated for the subscale scores and the total score to examine the test-retest reliability.

To test the convergent validity, Pearson correlation coefficients between the mental health subscale score of the SF36v2 and the LSRS total score, and between the SLS total score and the LSRS total score were calculated. Pearson correlation coefficient between the MC-SDS total score, which is known to be unrelated to the quality of, or attitude towards sibling relationships [30], and the LSRS total score was also calculated to test the divergent validity.

Validity of the LSRS was further examined in a 2x2 ANOVA model which included the participant sex, chosen sibling sex, and their interaction term as independent variables, and LSRS adult subscale score as a dependent variable.

Kaiser-Meyer-Olkin test of sampling adequacy [34] and Bartlett's test of sphericity [35] were performed to decide whether the data are adequate for factor analysis, and principal component analysis with varimax rotation was performed to examine the factor structure of the LSRS. The number of factors was decided based on the criterion of eigenvalue  $\geq 1.0$  [36] and the scree plot test [37]. The data were analyzed using STATA version 12.1 (StataCorp., College Station, TX, USA). Two-tailed test with alpha level  $< 0.05$  was used.

### **RESULTS**

A total of 109 participants were enrolled in the study. The general socio-demographic characteristics of participants and their siblings are shown in Table 1. The total scores of the self-report questionnaires are shown in Table 2.

The Cronbach's  $\alpha$  coefficient for each subscale score of the LSRS and the total score are shown in Table 3. Intercorrelations between the subscale scores and the total score are shown in Table 4. The correlations between each subscale score and the total LSRS score

were all statistically significant, coefficient  $r$  ranging from 0.68 to 0.79.

The ICC of the total score was 0.92, and those of subscale scores ranged from 0.77 to 0.88.

The total LSRS score was significantly correlated with mental health subscale score of the SF36v2 ( $r=0.32, p=0.01, n=62$ ), and

with the SLS total score ( $r=0.27, p=0.04, n=62$ ). The total LSRS score was not correlated with the total MC-SDS score ( $r=0.15, p=0.26, n=62$ ) (Table 5).

Women had higher adult subscale score relative to men ( $F=13.27, p<0.001$ ). The participant sex by chosen sibling sex interaction effect was also significant ( $F=10.71, p=0.002$ ). Specifically, men reporting on sisters showed the lowest adult subscale total score ( $74.93\pm 15.33$ ), while men reporting on brothers reported higher score ( $83.83\pm 17.61$ ). Women reporting on brothers recorded slightly higher score ( $84.90\pm 14.58$ ), while women reporting on sisters reported the highest adult subscale total score ( $94.94\pm 11.75$ ).

The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.69

**Table 1.** Characteristics of study participants and chosen siblings<sup>a</sup>

Characteristics	Mean±SD or n (%)
Study participants	
Age (year)	27.17±8.60
Sex, men	54 (49.54)
Marital status	
Married	12 (11.01)
Unmarried	97 (88.99)
Birth order <sup>b</sup>	
First born	55 (51.40)
Second born	37 (34.58)
Third or later born	15 (14.02)
Number of siblings <sup>b</sup>	
One	73 (68.22)
Two	19 (17.76)
Three or more	15 (14.02)
Chosen siblings <sup>b</sup>	
Sibling selected	
Older	57 (53.27)
Younger	50 (46.73)
Sex	
Male	45 (42.06)
Female	62 (57.94)
Dyad types <sup>c</sup>	
Sister-sister	33 (30.84)
Sister-brother	21 (19.63)
Brother-sister	29 (27.10)
Brother-brother	24 (22.43)
Birth order	
First born	41 (38.32)
Second born	59 (55.14)
Third or later born	7 (6.54)

<sup>a</sup>Participants were instructed to choose one sibling who has had the greatest impact on their lives. <sup>b</sup> $n=107$ . <sup>c</sup>Between the participant and the chosen sibling.

**Table 2.** Subscale and total scores of the Lifespan Sibling Relationship Scale

Scale	Mean±SD
LSRS <sup>a</sup>	
Adult Affect	30.12±5.41
Adult Behavior	24.81±7.03
Adult Cognitions	30.06±6.14
Child Affect	29.72±5.78
Child Behavior	26.76±6.25
Child Cognitions	26.33±5.57
LSRS total	167.79±26.55

LSRS, Lifespan Sibling Relationship Scale. <sup>a</sup>There were no missing data for this scale.

**Table 3.** Cronbach's alpha for the Lifespan Sibling Relationship Scale

LSRS	$\alpha$
Adult Affect	0.87
Adult Behavior	0.88
Adult Cognitions	0.89
Child Affect	0.86
Child Behavior	0.86
Child Cognitions	0.85
LSRS total	0.94

LSRS, Lifespan Sibling Relationship Scale.

**Table 4.** Lifespan Sibling Relationship Scale subscale intercorrelations

LSRS	AA	AB	AC	CA	CB	CC
AA	-					
AB	0.64 <sup>b</sup>	-				
AC	0.73 <sup>b</sup>	0.66 <sup>b</sup>	-			
CA	0.42 <sup>b</sup>	0.16	0.25 <sup>b</sup>	-		
CB	0.24 <sup>a</sup>	0.29 <sup>b</sup>	0.24 <sup>a</sup>	0.59 <sup>b</sup>	-	
CC	0.36 <sup>b</sup>	0.33 <sup>b</sup>	0.42 <sup>b</sup>	0.64 <sup>b</sup>	0.79 <sup>b</sup>	-
LSRS total	0.76 <sup>b</sup>	0.72 <sup>b</sup>	0.75 <sup>b</sup>	0.68 <sup>b</sup>	0.71 <sup>b</sup>	0.79 <sup>b</sup>

AA, Adult Affect; AB, Adult Behavior; AC, Adult Cognitions; CA, Child Affect; CB, Child Behavior; CC, Child Cognitions; LSRS, Lifespan Sibling Relationship Scale. <sup>a</sup> $p<0.05$ . <sup>b</sup> $p<0.01$ .

**Table 5.** Scores of self-report questionnaires and their associations with the total LSRS score

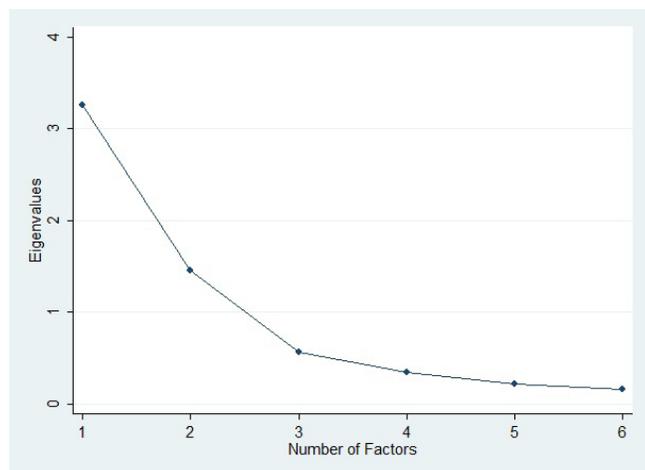
Scale	Mean±SD	Statistics <sup>a</sup>	
		r	p
SF36v2 mental health score	50.14±7.07	0.32	0.01
SLS total score	25.65±5.25	0.27	0.04
MC-SDS total score	19.16±5.08	0.15	0.26

MC-SDS, Marlowe-Crowne Social Desirability Scale; SF36v2, Medical Outcomes Study-Short Form 36 version 2; SLS, Satisfaction with Life Scale. <sup>a</sup>Pearson correlation analyses were performed to test the associations of the total LSRS score with each scale score.

**Table 6.** Results from factor analysis of the Lifespan Sibling Relationship Scale

Subscale	Factor 1	Factor 2
Adult Affect	0.86	0.22
Adult Behavior	0.86	0.12
Adult Cognitions	0.89	0.17
Child Affect	0.15	0.82
Child Behavior	0.11	0.89
Child Cognitions	0.26	0.88
Eigenvalue	3.26	1.46
Percentage of variance	39.47	39.16

Factor loadings over 0.60 [45] appear in bold.



**Fig. 1.** Scree plot for factor analysis. Eigenvalues are plotted against the number of factors. Factors are shown in order of decreasing eigenvalues. The plot demonstrates that 2 factors account for the majority of the variance.

and the Bartlett’s test of sphericity indicated that the correlation matrix is not an identity matrix ( $p < 0.01$ ), showing adequacy of the data for factor analysis [38]. Based on the predefined criterion and the scree plot (Fig. 1), a two factor solution was yielded. The results of confirmatory factor analysis are shown in Table 6. The factors explained the cumulative variance of 78.63%. Adult Affect, Adult Behavior, and Adult Cognitions scores were loaded on the first factor, while scores of Child Affect, Child Behavior, and Child Cognitions on the second factor.

**DISCUSSION**

The LSRS has a number of advantages over other scales which have been used to evaluate the sibling relationship [28-30]. Compared to the questionnaires with only a few items which were designed to simply assess the overall quality of the sibling relationship, the LSRS comprehensively assesses the affective,

cognitive, and behavioral components of the relationship [30]. Moreover, majority of scales assess the sibling relationship of particular periods. For example, the widely used Adult Sibling Relationship Questionnaire [29] was designed to assess the sibling relationship of adulthood only. Using the LSRS, on the other hand, the quality of, and the attitude toward sibling relationship during both childhood and adulthood can be assessed [30].

To the best of our knowledge, this is the first study that evaluated the reliability and validity of the Korean version of the LSRS. In the present study, the Korean version of the LSRS showed good psychometric properties in adults. The reliability was demonstrated by satisfactory internal consistency and test-retest reliability. The validity was shown by measures of the convergent validity and divergent validity.

Women have been documented to report higher quality of and positive attitude toward adulthood sibling relationship [29, 30]. Our study also showed this sex difference in the attitude toward sibling relationship, women reporting higher adult subscale scores. Same-sex siblings evaluated their sibling relationship quality and their attitude toward the sibling relationship during adulthood more favorably, compared to different-sex siblings. This finding is also consistent with that in the prior report [29, 30].

Two-dimensional structure was supported by the findings, as was in Riggio’s study [30], with both the scree plot and Kaiser criterion suggesting the two-factor solution. Three subscales measuring the sibling relationship quality during adulthood loaded on the first factor, which could be labeled as ‘adulthood sibling relationship quality.’ The other three subscales measuring the quality of the sibling relationship during childhood loaded on the second factor, which could be labeled as ‘childhood sibling relationship quality.’ This two-factor construct of the scale is conceptually meaningful, underlying dimensions being consistent with the original conceptual model [30].

The LSRS has not been translated and validated in other

languages, which partly reflects the lack of research that examines the role of sibling relationship. For this reason, it was not possible to compare the current results to other validation work in different languages. Compared with the results reported in the original development and validation paper of the LSRS by Riggio [30], our results were similar overall.

There are limitations of this study that should be considered interpreting the results. Participants were mainly young adults in their 20s, limiting the generalizability of the findings. Young adults in their 20s experience rapid changes in their sibling relationships [29]. Going to college, siblings share less moments and communicate with each other less frequently [29]. Experiencing this transition period with regard to the sibling relationship, this age group can barely be representative to other age groups. Thus further studies are needed to examine whether our results also hold in other age groups. Relatively modest sample size also warrants caution in generalizing the findings. Due to the lack of validated sibling relationship assessment questionnaire in Korean, comparison between the Korean version of the LSRS and other sibling relationship assessment questionnaires of the Adult Sibling Relationship Questionnaire [29] or Sibling Relationship Questionnaire [28] could not be performed. Although the Sibling Relationship Questionnaire [28] has been used as an assessment tool [39, 40] in dissertations, the formal standard validation process was not performed.

The validated Korean version of the LSRS with good psychometric properties as shown in the present study, would be useful in many future studies. Important psychosocial studies that examine the associations of the quality of, and the attitudes toward the sibling relationship with temperament and character [41], parental divorce and remarriage [42], and psychological maltreatment in childhood [43] could be replicated in a Korean population. For individuals with serious and persistent mental health problems such as autism spectrum disorders and schizophrenia, the support level of their siblings is one of the most important factors associated with the prognosis [44]. Evaluating the attitude toward the sibling relationship of the brothers/sisters of the mentally-ill and its impact on patient's prognosis would be an important research topic, which has not yet been studied. Information from such studies would also be used for the proper clinical care of the patients with mental disorders. This validated scale would also be used as an essential tool in research investigating the neurobiological mechanisms underpinning the associations of the quality of the sibling relationship during childhood with later mental health problems and social adaptation.

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## REFERENCES

1. Cicirelli VG (1995) Sibling relationships across the life span. Plenum Press, New York, NY.
2. Milevsky A (2011) Sibling relationships in childhood and adolescence: Predictors and outcomes. Columbia University Press, New York, NY.
3. Kim SK, Kim YK, Cho AJ, Kim HR, Lim SE (2009) The 2009 national survey on fertility, family health and welfare in Korea. Korea Institute for Health and Social Affairs, Seoul.
4. White L (2001) Sibling relationships over the life course: a panel analysis. *J Marriage Fam* 63:555-568.
5. Cicirelli VG (1991) Sibling relationships in adulthood. *Marriage Fam Rev* 16:291-310.
6. White LK, Riedmann A (1992) Ties among adult siblings. *Soc Forces* 71:85-102.
7. Sanders R, Campling J (2004) Sibling relationships: theory and issues for practice. Palgrave Macmillan, Basingstoke.
8. Van Volkom M (2006) Sibling relationships in middle and older adulthood: a review of the literature. *Marriage Fam Rev* 40:151-170.
9. Brody GH (2004) Siblings' direct and indirect contributions to child development. *Curr Dir Psychol Sci* 13:124-126.
10. Tucker CJ, Barber BL, Eccles JS (1997) Advice about life plans and personal problems in late adolescent sibling relationships. *J Youth Adolesc* 26:63-76.
11. Lempers JD, Clark-Lempers DS (1992) Young, middle, and late adolescents' comparisons of the functional importance of five significant relationships. *J Youth Adolesc* 21:53-96.
12. Yeh HC, Lempers JD (2004) Perceived sibling relationships and adolescent development. *J Youth Adolesc* 33:133-147.
13. Connidis IA (1994) Sibling support in older age. *J Gerontol* 49:S309-S317.
14. Gold DT (1987) Siblings in old age: something special. *Can J Aging* 6:199-216.
15. Cicirelli VG (1980) Relationship of family background variables to locus of control in the elderly. *J Gerontol* 35:108-114.
16. Lee TR, Mancini JA, Maxwell JW (1990) Sibling relationships in adulthood: contact patterns and motivations. *J Marriage Fam* 52:431-440.

17. Buist KL, Deković M, Prinzie P (2013) Sibling relationship quality and psychopathology of children and adolescents: a meta-analysis. *Clin Psychol Rev* 33:97-106.
18. Waldinger RJ, Vaillant GE, Orav EJ (2007) Childhood sibling relationships as a predictor of major depression in adulthood: a 30-year prospective study. *Am J Psychiatry* 164:949-954.
19. Milevsky A (2005) Compensatory patterns of sibling support in emerging adulthood: variations in loneliness, self-esteem, depression and life satisfaction. *J Soc Pers Relat* 22:743-755.
20. Ishii-Kuntz M (1990) Social interaction and psychological well-being: comparison across stages of adulthood. *Int J Aging Hum Dev* 30:15-36.
21. Korosi A, Naninck EF, Oomen CA, Schouten M, Krugers H, Fitzsimons C, Lucassen PJ (2012) Early-life stress mediated modulation of adult neurogenesis and behavior. *Behav Brain Res* 227:400-409.
22. McGowan PO, Sasaki A, D'Alessio AC, Dymov S, Labonté B, Szyf M, Turecki G, Meaney MJ (2009) Epigenetic regulation of the glucocorticoid receptor in human brain associates with childhood abuse. *Nat Neurosci* 12:342-348.
23. Siegmund KD, Connor CM, Campan M, Long TI, Weisenberger DJ, Biniszkievicz D, Jaenisch R, Laird PW, Akbarian S (2007) DNA methylation in the human cerebral cortex is dynamically regulated throughout the life span and involves differentiated neurons. *PLoS One* 2:e895.
24. Lister R, Mukamel EA, Nery JR, Urich M, Puddifoot CA, Johnson ND, Lucero J, Huang Y, Dwork AJ, Schultz MD, Yu M, Tonti-Filippini J, Heyn H, Hu S, Wu JC, Rao A, Esteller M, He C, Haghghi FG, Sejnowski TJ, Behrens MM, Ecker JR (2013) Global epigenomic reconfiguration during mammalian brain development. *Science* 341:1237905.
25. De Bellis MD, Keshavan MS, Clark DB, Casey BJ, Giedd JN, Boring AM, Frustaci K, Ryan ND (1999) Developmental traumatology part II: brain development. *Biol Psychiatry* 45:1271-1284.
26. De Bellis MD, Keshavan MS, Spencer S, Hall J (2000) N-acetylaspartate concentration in the anterior cingulate of maltreated children and adolescents with PTSD. *Am J Psychiatry* 157:1175-1177.
27. Luby JL, Barch DM, Belden A, Gaffrey MS, Tillman R, Babb C, Nishino T, Suzuki H, Botteron KN (2012) Maternal support in early childhood predicts larger hippocampal volumes at school age. *Proc Natl Acad Sci U S A* 109:2854-2859.
28. Furman W, Buhrmester D (1985) Children's perceptions of the qualities of sibling relationships. *Child Dev* 56:448-461.
29. Stocker CM, Lanthier RP, Furman W (1997) Sibling relationships in early adulthood. *J Fam Psychol* 11:210-221.
30. Riggio HR (2000) Measuring attitudes toward adult sibling relationships: the lifespan sibling relationship scale. *J Soc Pers Relat* 17:707-728.
31. Ware JE Jr, Kosinski M, Dewey JE (2000) How to score version 2 of the SF-36® Health Survey. Quality Metric Incorporated, Lincoln, RI.
32. Diener E, Emmons RA, Larsen RJ, Griffin S (1985) The satisfaction with life scale. *J Pers Assess* 49:71-75.
33. Crowne DP, Marlowe D (1960) A new scale of social desirability independent of psychopathology. *J Consult Psychol* 24:349-354.
34. Kaiser HF (1970) A second generation little jiffy. *Psychometrika* 35:401-415.
35. Bartlett MS (1950) Tests of significance in factor analysis. *Br J Stat Psychol* 3:77-85.
36. Kaiser HF (1960) The application of electronic computers to factor analysis. *Educ Psychol Meas* 20:141-151.
37. Cattell RB (1966) The scree test for the number of factors. *Multivariate Behav Res* 1:245-276.
38. Dziuban CD, Shirkey EC (1974) When is a correlation matrix appropriate for factor analysis? Some decision rules. *Psychol Bull* 81:358-361.
39. Park YY (1995) Relationship between childrearing behavior and sibling relationships and children's self-esteem. Unpublished manuscript. Korea University, Seoul.
40. Song HJ (1998) The effects of couple relationship, parents-child relationship on the handicapped children's sibling relationship. Unpublished manuscript. Sookmyung Women's University, Seoul.
41. Neale CW (2000) Perceived sibling compatibility and the effects of personality. Unpublished manuscript. James Madison University, Harrisonburg, VA.
42. Riggio HR (2001) Relations between parental divorce and the quality of adult sibling relationships. *J Divorce Remarriage* 36:67-82.
43. Collier LC (2011) Psychological maltreatment and adult attachment: the protective role of the sibling relationship. Unpublished manuscript. University of North Texas, Denton, TX.
44. Kline P (1994) An easy guide to factor analysis. Routledge, London.