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ORIGINAL ARTICLE

# Adverse adolescence experiences, feeling lonely across life stages and loneliness in adulthood

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**KEYWORDS**
Loneliness;
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Taiwan;
Ex post fact study

**Abstract**
*Background/Objective:* Loneliness is a mental health issue emerging over the life course. This study examines the latent structure of adult loneliness in a non-Western society and its association with adverse adolescence experiences (AAEs) as well as feeling lonely during middle school, high school, and college. Method: A cohort sample living in Northern Taiwan ($N = 2,289$) was analyzed from adolescence to adulthood. The de Jong Gierveld Loneliness Scale operationalized loneliness by a three-cluster model to present the latent structure of loneliness: emotional, serious emotional, and severe emotional/social loners. AAEs (e.g., abuse, neglect, and dysfunctional family) were measured by seven items. Multivariate multinomial logistic regression models were used to explore the longitudinal effects of AAEs and feeling lonely reported during middle school, high school, and college on adult loneliness. Results: AAEs and feeling lonely during adolescence were significantly associated with serious emotional loneliness and severe emotional/social loneliness during adulthood, even after adjusting for the individual's characteristics. Attendance at a 4-year college was associated with decreased odds of serious emotional loneliness and severe emotional/social loneliness. Conclusions: Adults with AAEs and feelings of loneliness over life stages are more likely to report loneliness in the emotional and social domains.


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**PALABRAS CLAVE**
Soledad;
Experiencias adversas en la adolescencia (EAA);
Transcurso de vida;
Taiwán;
Estudios *Ex post facto*

**Experiencias adversas en la adolescencia, sentirse solo en las etapas de la vida y soledad en la edad adulta**

**Resumen**
*Antecedentes/Objetivo:* La soledad es un problema de salud mental que emerge a lo largo de la vida. Se examina la estructura latente de la soledad de adultos en una sociedad no occidental y su asociación con experiencias adversas en la adolescencia (EAAs), además de sentirse solo durante la Secundaria y la Universidad.
*Método:* Se analizó una muestra de cohorte de Taiwán ($N = 2.289$) desde la adolescencia hasta la edad adulta. La *Jong Gierveld Loneliness Scale* operacionalizó la soledad mediante un modelo de tres grupos para presentar la estructura latente de la soledad: emocional, emocional grave y soledad emocional/social severa. Las EAAs (e.g., abuso, negligencia y familia disfuncional) se midieron con siete ítems. Se utilizaron modelos de regresión logística multinomial multivariante para explorar los efectos longitudinales de EAAs y sentirse solo informado durante la Secundaria y la Universidad sobre la soledad adulta.
*Resultados:* Las EAAs y sentirse solo durante la adolescencia se asociaron significativamente con soledad emocional grave y emocional/social severa durante la adultez, incluso después de ajustarse a las características del individuo. Asistir a la Universidad durante cuatro años se asoció con una disminución de las probabilidades de soledad emocional grave y emocional/social severa.
*Conclusiones:* Adultos con EAAs y sentimientos de soledad durante las etapas de la vida tienen más probabilidades de informar soledad en ámbitos emocional y social.


Loneliness refers to a condition wherein a person suffers from emotional distress due to a feeling of being rejected by or isolated from other individuals, and/or is lacking a social partner for desired activities (McWhirter, 1990; Perlman & Peplau, 1981). Recent research has underscored the importance of loneliness as one of the most commonly encountered mental health problems during young adulthood (Pitman, Mann, & Johnson, 2018) and it has been shown to often seriously affect other mental health problems, the quality of life of individuals and their families (Cacioppo & Cacioppo, 2018; Johnson, Dupuis, Clayborne, & Colman, 2018). Yet, only a handful of studies have paid attention to loneliness in emerging adulthood (Arnett, Žukauskienė, & Sugimura, 2014), and such studies remain even rarer in an East Asian society such as Taiwan.

Traumatic experiences before age 18 have been demonstrated to have significant and profound effects on a wide range of mental health measures (Kim, Kim, Chartier, Wike, & McDonald, 2019; Racine, Madigan, Plamondon, McDonald, & Tough, 2018). For example, most previous studies have shown that early traumatic or adverse experience is strongly related to depression or psychiatric problems (e.g., suicidality) (Merrick, Ports, Ford, Afifi, Gershoff, & Grogan-Kaylor, 2017; Rytila-Manninen, Haravuori, Frojd, Marttunen, & Lindberg, 2018). Belsky's developmental hypothesis (Belsky, 1993) provided a theoretical background for this relation and argued that the accumulation of various personal adversities throughout an individual's life will synergistically create poor health consequences in later years. In regard to loneliness, some have attributed the rise in emotional loneliness among young people to a developmental process and as contributing to early-life experiences (Cacioppo, Hawkley et al., 2006). Similarly, some studies suggest that adverse experiences, including exposures to abuse, violence, and neglect in both family and school environments, may render some individuals particularly vulnerable to emotional loneliness during emerging adulthood (Belsky, 1993; Hyland et al., 2019). However, to our knowledge, there has been no empirical research that has explored adverse experiences during adolescence and their association with subsequent loneliness during adulthood, including both social and emotional loneliness.

The Belsky developmental model (1993) posits that early-life adversities are more likely than other events to be associated with poor mental health because this particular group continues to disproportionately experience a wide range of adversities, perceived stressors, throughout their lives. Accordingly, negative emotional during early life and is accumulation may be another important source of adversity. Prior studies had found that early memories or experience of negative emotions were associated with psychiatric illnesses in community populations (Doering et al., 2019; Lempinen, Junttila, & Sourander, 2018). Hence, feelings of loneliness at important life stage (e.g., middle and high school), accompanied by other adversities, may play an influential, albeit a different role, in the experience of loneliness during emerging adulthood. Chen and Qin (2019) analyzed a sample of 569 Chinese adolescents with the 16-item Children's Loneliness Scale (Asher, Hymel, & Reshaw, 1984) and found an association between feelings of loneliness social anxiety in addition to the early experience of emotional abuse. However, this study did not include measures that assessed

feelings of loneliness at different life stages and the measure of abuse was limited to emotional abuse.

As a result of the knowledge gaps in the literature, investigations of the effects of feelings of loneliness over life stages have not clearly distinguished these emotional feelings from other adverse experiences. Furthermore, there has been scant research on the relationships between adverse adolescence experiences (AAEs) and adulthood loneliness in non-Western societies. Using a cohort sample in Northern Taiwan, this paper examined whether AAEs contribute to the structure of loneliness during adulthood, and assessed whether their effect is independent of important confounders. Furthermore, an additional gap in the literature is whether feelings of loneliness over life stages are related to a longitudinal association between AAEs and loneliness during adulthood once confounders are included. Thus, we have conceptually separated a single-item measure of a feeling of loneliness during middle school, high school, and college by testing its association with the results of the 6-item de Jong Gierveld Loneliness Scale (DJGS) (de Jong Gierveld & Van Tiburg, 2010) to determine whether or not a single item, a feeling of loneliness, captures some aspects of the latent structure of loneliness.

## Method

### Participants and procedure

The dataset was drawn from the Taiwan Youth Project (TYP), conducted by the Institute of Sociology, Academia Sinica, Taiwan. The TYP surveys were designed to collect longitudinal information over two phases. The first phase began in 2000 and included annual interviews for 9 years. The second phase then recruited participants who had responded to the last surveys of the first phase in 2011, 2014, and 2017. The TYP did not apply the 6-item DJGS until 2014. Participants were approaching 30 years old and older in 2017, at which time Taiwanese participants will have been completing their education. The response rate for the 2017 survey was 79% and the attrition rate was 6.10% compared to the 2014 survey. The adult sample flow is shown in Figure 1.

Attrition is of particular importance to longitudinal research because adolescents with AAEs are typically in poorer mental health than their counterparts, making them the most difficult to retain over the complete study period. We assessed differences in individual background and socioeconomic status between continuing participants and dropouts across waves (the results not tabled). The analyses indicated that AAEs were the major cause of the decline in sample size.

We restricted our analysis to participants with complete responses in both phases for the major measures, yielding a final sample of 1,092 females (47.71%) and 1,197 males (52.29%) (see Figure 1). A logistic regression of missing data status was used to assess whether missing responses were random by considering individual background characteristics as independent variables. The non-significant results indicated no apparent systematic origins of missing responses. Most of the variables used in the present study emerged from the participants via self-reporting, though some adverse experiences were derived from parental reports. The TYP dataset is publicly available for research with the approval of Academia Sinica in Taiwan (www.typ.sinica.edu.tw). All TYP participants gave informed written consent at the start of their interviews. The present study protocol was approved by the Research Ethics Committee of National Yang-Ming University (Taipei, Taiwan) (IRB Number: YM106103E-2).

### Measures

Loneliness in emerging adulthood was measured by the six-item de Jong Gierveld Short Scale (DJGS; de Jong Gierveld & Van Tiburg, 2010). This scale included two distinct domains of loneliness: Social and Emotional loneliness (Weiss, 1973). Each item was recoded into two categories: not lonely (coded 0) or lonely/extremely lonely (coded 1). Latent class analysis (LCA) is used to assess the underlying structure of loneliness. Based on the model fit indices (AIC and BIC) along with interpretability, the LCA analysis yields three mutually exclusive categories (Chiao, Chen & Yi, 2019; Hyland et al., 2019): emotional loners (the reference group), serious emotional loners, and severe emotional/social loners. The use of this 6-item DJGS as a measure of loneliness has been validated for Chinese version, but this validation involved an older population from Hong Kong (Leung, de Jong Gierveld, & Lam, 2008). The total score on social domain ranged from 0 to 3 and yielded very good internal consistency and reliability ($\alpha = .77$). The other three DJGS items in the emotional domain had a total score ranging from 0 to 3 with Cronbach $\alpha$ of .51.

Adverse adolescence experiences (AAEs), our major predictor, is based on Centers for Disease Control and Prevention Research and Related Studies (CDC; Clements-Nolle & Waddington, 2019). AAEs include abuse, neglect and household dysfunction. Abuse includes both physical abuse (1 question) and verbal abuse (1 question). We took an average of responses regarding paternal and maternal behavior and converted this into the closest integer; then, we dichotomized each item into either experiencing abuse (1) if the computed score fell into *almost always* and *always*; while all other results were coded as no (0). Household dysfunction includes parental divorce or separation (1 question), parental addiction (1 question), parental mental illness (3 questions), and criminal justice system involvement in the household (1 question). Respondents were deemed to have experienced parental mental illness, if the one parent suffered from any of three SCL-90-R (Derogatis, 2000) symptoms. The remaining household dysfunctionality item was also dichotomized and those who experiencing such events received a score of 1 (yes). Finally, emotional neglect (1 question) was based on adolescents' self-reporting of family social support as ''no support'' and ''not enough.'' The total score for AAEs ranged from 0 to 7.

The measures used to assess feelings of being lonely when attending middle school (age 15), high school (age 17-18) and college (age 20-22) were identical, using the same coding scheme, assessed emotional loneliness at each stage. Adolescents were asked whether or not they had felt lonely during the past two weeks and was dichotomized based on the suggestions from prior studies (de John-Gierveld & van Tilburg, 1999; Holi, 2003): ''feelings of being lonely (coded as 1)'', including slightly serious, serious, and very serious

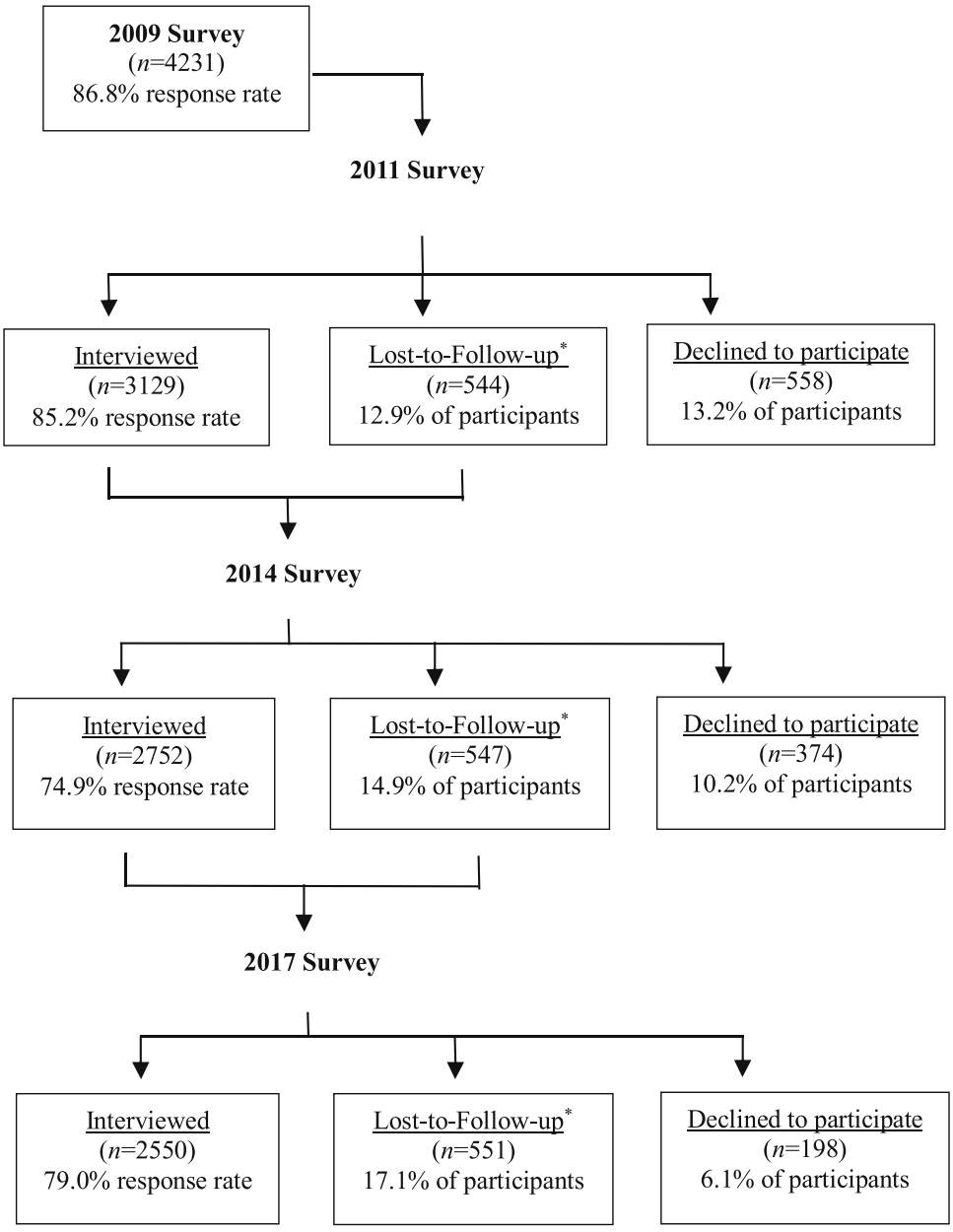


**Figure 1** Participants in the serial surveys that form the Taiwan Youth Project (TYP) from 2009 to 2017.
*Note*: ''LFU'' indicates lost-to-follow-up, which was mainly due to moving and thus being unable to be interviewed.

feelings of loneliness, while ''no feelings of being lonely (coded as 0).''

Individual and socio-demographic characteristics were assessed at age 15 and controlled for. Among these individual characteristics were early sexual maturation and lack of sleep. Early sexual maturation was assessed using a pubertal developmental scale that summed three items for females and four items for males (Petersen, Crockett, Richards, & Boxer, 1988). The summed score across all items was standardized and it was gender and age specific. Those individuals who were one standard deviation above the mean were grouped into the ''early maturation'' group, while the others were grouped into the reference group (Chiao & Ksobiech, 2015; Sun, Mensah, Azzopardi, Patton, & Wake, 2017). Lack of sleep was based on the individual's self-reported sleep hours and was dichotomized into a lack of sleep (daily sleep hours < 6 hours) and adequate sleep (Lin & Yi, 2015). The socio-demographic characteristics of age, gender, residential location (Taipei County, Yilan County, and Taipei City) and parental education were measured by the standard procedures used in survey research. College attendance and number of siblings (only child or not) reflect the expansion of education that occurred in Taiwan during the 1970s.

## Data analysis

We aimed to examine whether AAEs are longitudinally associated with the latent structure of loneliness during

adulthood. Multinomial logistic regression modeling with progressive adjustments was applied. Model 1 explored the effects of AAEs together with feeling lonely during middle school, while controlling for all the covariates. Feelings of loneliness during late adolescence (middle school and high school) were added to Model 2, and Model 3 was adjusted to include feeling lonely during emerging adulthood (in college). All regression analyses adjusted for sample clustering and used STATA 15.0. Given the effect of multiple comparison on possible spurious positive results, we set the significant level of $\alpha$ up to .001.

We conducted two approaches to evaluate this relationship (see Appendix 1). Firstly we adopted exploratory factor analyses (EFA) along with parallel analysis (Fabrigar & Wegener, 2012) and screet plot to determine the factor structure. The results supported a two-factor solution: emotional loneliness, specifically feeling lonely and the three emotional loneliness items from DJGS, and social loneliness. These two latent factors explained about 58% of the variance. The second part of the analysis involved carrying out a confirmatory factor analysis (CFA) based on the EFA findings. For this analysis, we used three indices with specified cut-offs (Hu & Bentler, 1999) as benchmarks to evaluate the model. The CFA results showed acceptable fit, and confirm the EFA model. These two sets of results were able to provide evidence that supports the hypothesis that the single item identified above is able to capture an individual's loneliness or at least that that person's emotional loneliness domain.

## Results

Table 1 presents the descriptive characteristics of the study sample. Seven per cent of the participants were identified as severe emotional/social loners while 40% were serious emotional loners and 53% were slight emotional loners. Over the subjects' life course, about 46% of the adolescents reported feeling lonely in middle school, 49% in high school, and about 64% during college. On the other hand, the mean score for AAE was less than 1 ($M = 0.81$; $SD = 0.95$); and 46% of the participants had not experienced any of the assessed AAEs. The ages of the subjects ranged 30–35 years, and more than three-quarters (83%) had attended a 4-year college.

The multivariate multinomial logistic regression models with progressive adjustments were shown in Table 2. Model 1 demonstrated that adults who reported experiencing adversity during adolescence were more likely to be severe emotional/social loners rather than emotional loners (the reference group) (RRR = 1.42, 95% CI: 1.23–1.63). Feelings of loneliness during middle school were found to be important even 15 years later because this feeling lonely increased the odds of being either a serious emotional loner (RRR = 1.66, 95% CI: 1.39–1.98) or a severe emotional/social loner during young adulthood (RRR = 2.27, 95% CI: 1.72–3.00) compared to the reference group. In contrast to the AAE impact on adulthood loneliness, the fact that the subject had attended a 4-year college reduced the odds of being a serious emotional loner (RRR = 0.69, 95% CI: 0.54–0.87) or a severe emotional/social loner (RRR = 0.64, 95% CI: 0.41–1).

Model 2 added feeling lonely during high school to Model 1. The association of AAEs and feeling lonely during middle school with adulthood loneliness showed no significant change, although the magnitude slightly decreased. Like feeling loneliness during middle school, feeling lonely during high school was also more likely to result in the subject becoming either a serious emotional loner (RRR = 1.91, 95% CI: 1.61–2.27) or a severe emotional/social loner (RRR = 1.98, 95% CI: 1.40–2.81), as compared to the reference group. Model 3 showed that feeling lonely during college also

**Table 1** Descriptive characteristics of the sample of young adults used in this study [percent or mean (SD)].

| Variable | Percent or mean (*SD*) |
|---|---|
| Age (range: 30-35) | 31.32 (1.15) |
| Male (%) | 52.29 |
| Being only child (%) | 3.89 |
| Attendance in 4-year college (%) | 82.61 |
| Parental education (range: 1-6) | 3.03 (1.23) |
| Individual characteristics in early adolescence (at aged 15) | |
| Adverse adolescence experience (AAE) (range: 0-6) | 0.81 (0.95) |
| Abuse | |
| Physical abuse (including hitting, beating and spanking with an object by a parent) | 10.70 |
| Verbal abuse (including yelling with intense anger by a parent) | 5.40 |
| Household dysfunction | |
| Parental divorce or separation | 6.70 |
| Parental alcohol or gambling problems | 8.80 |
| Parental severe depressive symptomatology | 18.30 |
| Household member imprisoned for a crime | 1.90 |
| Neglect | |
| Emotional aspect | 29.70 |
| No adverse experience | 46.31 |
| Early maturation with regard to pubertal timing (%) | 10.48 |
| Lack of sleep: average sleep hours are less than 6 hours (%) | 37.70 |
| Residence (%) | |
| Taipei City | 37.27 |
| Taipei county | 36.87 |
| Yilan county | 25.86 |
| Feelings of loneliness (%) | |
| During middle school | 45.78 |
| During high school | 48.71 |
| During college | 63.95 |
| Loneliness clustering among young adult (%) | |
| Emotional loners | 52.51 |
| Serious emotional loners | 40.24 |
| Severe emotional/social loners | 7.25 |
| *N* | 2,289 |

*Note*: *SD* = Standard deviation. Percentages may not sum to 100 owing to rounding.

**Table 2** Multivariate multinomial logistic regression results for loneliness cluster among young adults, TYP 2000-2017 (N = 2,289).

| | Loneliness Cluster/Class Contrast | | | | | |
|---|---|---|---|---|---|---|
| | RRR (95%)/Ref = Emotional Loners | | | | | |
| | Model 1 | | Model 2 | | Model 3 | |
| | Serious Emotional Loners | Severe Emotional & Social Loners | Serious Emotional Loners | Severe Emotional & Social Loners | Serious Emotional Loners | Severe Emotional & Social Loners |
| *Individual characteristics in early adolescence (at aged 15)* | | | | | | |
| Adverse adolescence experience (AAE) | 1.07 (0.98, 1.17) | 1.42 (1.23, 1.63)*** | 1.05 (0.95, 1.15) | 1.38 (1.20, 1.60)*** | 1.04 (0.94, 1.15) | 1.36 (1.18, 1.57)** |
| Early maturation (ref = Others) | 1.27 (0.96, 1.68)§ | 1.19 (0.79, 1.79) | 1.27 (0.97, 1.66)§ | 1.19 (0.79, 1.79) | 1.22 (0.94, 1.60) | 1.12 (0.73, 1.71) |
| Short sleep (ref = Others) | 1.06 (0.84, 1.34) | 0.77 (0.55, 1.09) | 1.03 (0.82, 1.29) | 0.75 (0.53, 1.06) § | 1.04 (0.82, 1.32) | 0.77 (0.54, 1.09) |
| Feeling of loneliness | | | | | | |
| During middle school | 1.66 (1.38, 1.98)*** | 2.27 (1.72, 3.00)*** | 1.41 (1.18, 1.68)*** | 1.91 (1.41, 2.60)*** | 1.32 (1.10, 1.57)** | 1.72 (1.26, 2.36)*** |
| During high school | | | 1.91 (1.61, 2.27)*** | 1.98 (1.40, 2.81)*** | 1.69 (1.42, 2.02)*** | 1.62 (1.11, 2.37)* |
| During college | | | | | 1.67 (1.37, 2.02)*** | 2.45 (1.63, 3.67)*** |
| *Covariates* | | | | | | |
| Age | 0.99 (0.89, 1.09) | 1.04 (0.90, 1.21) | 1.02 (0.92, 1.13) | 1.08 (0.93, 1.24) | 1.01 (0.91, 1.11) | 1.06 (0.93, 1.22) |
| Male | 0.99 (0.85, 1.15) | 0.98 (0.71, 1.37) | 1.04 (0.89, 1.23) | 1.04 (0.75, 1.44) | 1.06 (0.90, 1.26) | 1.07 (0.77, 1.47) |
| Attendance at a 4-year college | 0.69 (0.54, 0.87)*** | 0.64 (0.41, 1.00)* | 0.66 (0.52, 0.83)*** | 0.62 (0.39, 0.96)* | 0.63 (0.50, 0.81)** | 0.58 (0.37, 0.91)* |
| Being an only child | 0.82 (0.53, 1.26) | 0.47 (0.20, 1.14)§ | 0.78 (0.50, 1.22) | 0.45 (0.19, 1.10)§ | 0.72 (0.46, 1.16) | 0.42 (0.17, 1)* |
| Parental educational level | 1.05 (0.98, 1.14)§ | 1.15 (1.00, 1.32)* | 1.04 (0.96, 1.13) | 1.14 (0.99, 1.30)§ | 1.05 (0.96, 1.14) | 1.14 (0.99, 1.32)§ |
| Residence during early adolescence (ref = Taipei City) | | | | | | |
| Taipei county | 0.89 (0.70, 1.13) | 0.92 (0.71, 1.18) | 0.89 (0.70, 1.14) | 0.92 (0.72, 1.18) | 0.89 (0.70, 1.13) | 0.92 (0.72, 1.18) |
| Yilan county | 0.90 (0.66, 1.22) | 0.84 (0.61, 1.16) | 0.89 (0.66, 1.20) | 0.83 (0.61, 1.14) | 0.89 (0.65, 1.22) | 0.85 (0.60, 1.20) |

*Note*: RRR = relative risk ratio; CI = confidence interval; All models adjust for sample clusters; §$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

**Table 3** Multivariate logistic regression results for the likelihood of feeling lonely among young adults, TYP 2000-2017 ($N = 2,289$).

| | AOR (95% CI) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Basic Model | | Model 1 | | Model 2 | | Model 3 | |
| Individual characteristics in early adolescence (at aged 15) | | | | | | | | |
| Adverse adolescence experience (AAE) | 1.17 | (1.07, 1.26)*** | 1.11 | (1.03, 1.19)** | 1.08 | (1.00, 1.16)* | 1.07 | (0.99, 1.15) |
| Early maturation (ref = Others) | 1.17 | (0.88, 1.55) | 1.15 | (0.89, 1.48) | 1.14 | (0.89, 1.46) | 1.07 | (0.84, 1.37) |
| Short sleep (ref = Others) | 0.98 | (0.78, 1.24) | 0.93 | (0.73, 1.17) | 0.90 | (0.70, 1.15) | 0.91 | (0.71, 1.18) |
| Feelings of loneliness | | | | | | | | |
| During middle school | | | 2.05 | (1.67, 2.53)*** | 1.72 | (1.40, 2.12)*** | 1.56 | (1.26, 1.93)*** |
| During high school | | | | | 2.03 | (1.71, 2.41)*** | 1.68 | (1.41, 2.01)*** |
| During college | | | | | | | 2.38 | (1.98, 2.85)*** |
| Covariates | | | | | | | | |
| Age | 1.02 | (0.96, 1.10) | 1.00 | (0.94, 1.07) | 1.04 | (0.97, 1.11) | 1.02 | (0.96, 1.09) |
| Male | 0.71 | (0.56, 0.92)** | 0.77 | (0.60, 0.98)* | 0.81 | (0.64, 1.03)§ | 0.82 | (0.64, 1.05) |
| Attendance at 4-year college | 0.97 | (0.76, 1.24) | 0.96 | (0.74, 1.24) | 0.92 | (0.71, 1.20) | 0.88 | (0.66, 1.17) |
| Being an only child | 0.87 | (0.53, 1.43) | 0.90 | (0.54, 1.53) | 0.87 | (0.53, 1.43) | 0.80 | (0.47, 1.35) |
| Parental educational level | 1.04 | (0.93, 1.16) | 1.03 | (0.91, 1.16) | 1.01 | (0.90, 1.14) | 1.02 | (0.90, 1.15) |
| Residence in early adolescence (ref = Taipei City) | | | | | | | | |
| Taipei county | 1.03 | (0.81, 1.32) | 1.02 | (0.80, 1.29) | 1.02 | (0.81, 1.29) | 1.03 | (0.82, 1.30) |
| Yilan county | 0.60 | (0.44, 0.83)** | 0.60 | (0.43, 0.82)** | 0.59 | (0.43, 0.81)** | 0.59 | (0.43, 0.81)** |

*Abbreviations*: AOR = adjusted odds ratio; CI = confidence interval; All models adjust for sample clusters; §$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

increased the odds of being either a serious emotional loner (RRR = 1.67, 95% CI: 1.37–2.02) or a severe emotional/social loner (RRR = 2.45, 95% CI: 1.63–3.67), even after adjusting for individual and demographic characteristics. Finally, as compared to the reference group, the odds of being a serious emotional loner or a severe emotional/social loner significantly decreased if the adult attended a 4-year college.

In order to further validate the application of the single item of loneliness, we used this single item loneliness as an outcome variable together with the same explanatory variables that examined the AAE effect with progressive adjustments as shown in Table 3. Basic Model demonstrated that adults who reported experiencing adversity during adolescence were more likely to report feeling of loneliness in emerging adulthood (AOR = 1.17, 95% CI: 1.07–1.26). Results were similar to those in Table 2: people who reported adversities during adolescence were also more likely to experience emotional loneliness (AOR = 1.11, 95% CI 1.03-1.19) (Model 1). This significant result was observed even after controlling for various covariates, as well as feelings of being lonely during middle school and high school (AOR = 1.08, 95% CI 1.00-1.16) (Model 2) but not college (AOR = 1.07, 95% CI 0.99-1.15) (Model 3). Feelings of being lonely when attending middle school, high school and college reduced the association between AAE and feeling of loneliness in emerging adulthood by 8.50%. That is, if those with AAEs experienced the same level of emotional loneliness as others, the difference in feeling of loneliness between these two groups would be about 8.50% smaller than the observed difference, net of the individual's characteristics. The measures of feeling lonely across life stages consistently produced significant effects and it would seem that a more recent feeling of being lonely had a stronger effect than an earlier feeling of being lonely.

## Discussion

The main purpose of this study was to explore AAEs and their longitudinal association with loneliness during young adulthood using a large community cohort sample from a non-Western society. Consistent with the Belsky developmental model, our analysis found that AAEs had a profound impact on severe emotional/social loneliness during emerging adulthood, and this adversity effect was only reduced slightly after adjusting for other important individual risk factors and feeling lonely at various life stages. In addition, feelings of loneliness across important life stages resulted in a greater risk of becoming a serious emotional loners or severe emotional/social loners. The risk factors during early life consistently showed a significant longitudinal influence across each life stage. We also found that AAEs and feelings of loneliness across life stages ''work'' together additively, which may in turn shape the vulnerabilities of individuals, resulting in severe mental health problems later, such as loneliness during emerging adulthood.

Our results further extend the available current literature on the negative effects of adverse experiences during

early life on an individual's health later in life by showing how these affect loneliness during adulthood and its relationship with adolescence adversities (Merrick et al., 2017; Sheikh, 2017). Given that loneliness has negative effects on both physical (Leigh-Hunt et al., 2017) and mental health (Cacioppo & Cacioppo, 2018), preventing children and adolescents from having such adverse experiences is warranted. It can be seen from the many and varied adverse experiences described in the original CDC-Kaiser ACE study (Felitti et al., 1998) and by WHO (World Health Organization, 2012) that a significant number of such experiences are family related. Thus reducing family adversity is crucial to promoting the mental health of children, adolescents and adults. Parenting skill training, for example, should help to reduce conflict and abuse in the home, and when this is employed it potentially ought to prevent the occurrence of such adversities in a family context (Center for Disease Control and Preventing, 2019a, 2019b).

Furthermore, our findings indicate that the effects of early negative experience can be profound and complex. External negative experiences, such as AAEs, appear to work in an additive manner with internal negative experiences such as feeling lonely, increasing the likelihood of the individual developing severe emotional and social loneliness. On the other hand, there may be a cascade effect, whereby external AAEs trigger internal negative emotions that together might lead to serious mental health problems during adulthood. We conducted an additional analysis showing that AAEs were significantly associated with both feelings of loneliness in middle and high school (results not shown), which in turn were related to serious loneliness during emerging adulthood.

In addition, this study also showed that the one-item measure of feelings of loneliness is a significant predictor of the loneliness construct. The results of the EFA suggest that the 1-item loneliness feeling loads on the latent structure of ''emotional loneliness'' along with the original three items of the emotional domain from the DJGS (Appendix 1), which CFA corroborated. These findings, along with our findings from the regression models, suggest that this single item of feeling lonely may be a valid measure for emotional loneliness. To further support this conclusion, we conducted additional series of analyses to valid this possibility. Suggested by prior studies (Davey, Barratt, Butow, & Deeks, 2007), our analysis showed that this single item of feeling lonely was positively associated with alcohol use and low self-esteem (results not shown).Therefore, our results not only suggest that this single item may be a valid indicator of emotional loneliness, but that it also echoes the suspicions of Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006 that loneliness and depressive symptomatology are often conflated together because this single item is derived from the depressive symptoms scale (Derogatis, 2000).

Our results further confirm previous research showing the benefit of education by the decreased risk of Taiwanese adults becoming severe emotional/social loners when they had a 4-year college degree. Prior research largely explored the effect of educational disparities on mental health, mostly depression (Shen, 2020; Todd & Teitler, 2019), and our study extends these results to loneliness among young people. In addition to the effect of attending a 4-year college, our analysis showed that parental education also had a marginal effect. Parents with higher levels of education had reduced risks of their children becoming emotional/social loner. Furthermore, as suggested by earlier studies, parental control has a negative effect on loneliness, which may act as the mechanism whereby the level of parental education affects long-term mental health in this non-Western society (Chiao et al., 2019).

The present study provides significant new insights on AAEs and their longitudinal association with loneliness during adulthood. However, the results need to be interpreted with care because of the limitations of this study. First, the TYP data is based on self-reported recall of AAEs and loneliness, raising the issue of recall bias. In addition, self-report measures of AAEs and loneliness may also suffer from shared method variance rather than the constructs the measures are hypothesized to represent. The measure of AAEs is not comprehensive; however, given that the significant effects of the AAEs we identified are consistent with prior studies of adverse childhood experiences (ACEs) (Kim et al., 2019; Suglia et al., 2018), we are confident more comprehensive measures of AAEs would not yield appreciably different results. Moreover, several AAE items were adopted from the reports of parents rather than adolescent children. The bias of social desirability is possibly limited. When the 6-item DJGS was measured by asking young adults to identify with their loneliness status, it may have had a stigma attached. However, the 6-item DJGS was validated in both Western and non-Western participants (Chiao et al., 2019; de Jong Gierveld, & Van Tiburg, 2010; Leung et al., 2008). Second, to present our results more concisely, we limited our analysis to feelings of loneliness across various life stages and its effects on adult loneliness by adjusting for individual and demographic characteristics as covariates. However, the Belsky developmental model proposes that it should be possible to distinguish the cumulative effects of feeling lonely across all life stages. Future research is needed to specifically identify the complex effects of cumulative negative emotions and how adverse experiences during early life may influence the development of loneliness during later life. Third, while prior studies have suggested that the influence of family dynamics and friendship are important in relation to loneliness (Rico-Uribe, Caballero, Olaya, Tobiasz-Adamczyk, & Koskinen, 2016), such information was not available in the present investigation. Fourth, attrition is always a matter of great concern when using a panel sample. In the present context, the participants with missing data are more likely to be suffering from mental health problems.

Nevertheless, to our knowledge this is the first report exploring AAEs and their longitudinal association with the latent structure of loneliness during emerging adulthood in a non-Western society. This study extends the existing literature by showing that AAE is associated with loneliness during adulthood. In addition, we employed a life-course perspective to examine feeling lonely across various life stage (middle school, high school, and college) and found them to be related additively to the development of both emotional and social loneliness during emerging adulthood. Furthermore, the validation analysis of the use of a single item as an outcome afforded us a better insight into the conceptual

separation when using the single item for loneliness versus the 6-item DJGS.

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## Appendix 1. Exploratory factor analysis (EFA) of the 6-item de Jong Gierveld Short Scale and a single item of feeling lonely that was used by the TYP (*N* = 2,289)

| | EFA[1]: factor loading | |
|---|---|---|
| | Emotional | Social |
| 6-item de Jong Gierveld short scale | | |
| 1. There are plenty of people I can rely on when I have problems. | .11 | .71 |
| 2. There are many people I can trust completely. | .08 | .81 |
| 3. There are enough people I feel close to. | .11 | .66 |
| 4. I experience a general sense of emptiness. | .77 | .10 |
| 5. I miss having people around. | .34 | -.01 |
| 6. I often feel rejected. | .44 | .19 |
| A single item of loneliness | | |
| 7. I feel lonely | .55 | .15 |
| Model fit[2] | | |
| CFI | .99 | |
| TLI | .97 | |
| SRMR | .03 | |
| RMSEA | .04 | |
| Correlation between latent factors | .39 | |

*Note*: [1]EFA after varimax rotation produced two factors extracted with eigen values of 2.50 and 1.55 for the emotional and social domains, respectively. These two factors explained 57.90% of the variance. [2The] CFA results included three correlated errors (DJ-item4 with DJ-item5; DJ-item5 with DJ-item6; Single item loneliness with DJ-item5).

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