Vicious circle of family dysfunction and adolescent internet addiction: Do only child and non-only child exhibit differences?

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Abstract

The primary aim of the current study was to probe the longitudinal relationships between family dysfunction (FD) and adolescent Internet addiction (IA), as well as the group difference between only child and non-only child. Data were from a three-wave longitudinal data of 1301 Chinese adolescents, collected when adolescents were at Grade 7, Grade 8, and Grade 9. FD and IA were assessed via adolescent self-reported questionaries of Chinese Family Assessment Instrument and Internet Addiction Test. Cross-lagged panel model was constructed to estimate possible associations between FD and adolescent IA after controlling for demographic variables. Our results suggest that adolescents might get stuck in a vicious cycle of dysfunctional family and addictive Internet use: adolescents who lived in a dysfunctional family showed increased risk in IA in the subsequent year; in turn, adolescent IA further increased the possibility of FD. Moreover, multigroup comparison analysis revealed that the vicious cycle between FD and adolescent IA could be applied to both the only child and the non-only child. The findings may enrich the application of the Developmental Contextualism Theory and contribute to the identification of the starting points for intervention strategies of adolescent IA.

Keywords Family dysfunction · Internet addiction · Adolescents · Cross-lagged analysis · Longitudinal study

Introduction

According to the China Internet Network Information Center (CNNIC) survey, the number of adolescent internet users (10 to 19 years old) was approximately 141.9 million in June 2022, constituting nearly 13.5% of total internet users in China (CNNIC, 2022). The high internet popularity rate brings adolescents a series of Internet misconduct (e.g., cyber pornography, cyberbullying) (Wang et al., 2021b; Yu & Chao, 2016). As one of the Internet-related problematic behaviors, Internet addiction (IA) is characterized by excessive and unlimited usage of the Internet (Young, 1998), which is highly prevalent among various age groups, especially adolescents (Lam, 2014). Recent studies have reported that the prevalence of IA widely range from 15.3% to 32.5% among Chinese adolescents (Chi et al., 2020a; Tan et al., 2016; Xu et al., 2020). Adolescents who were involved in uncontrolled internet use often suffered from more interpersonal difficulties (Milani et al., 2009), experienced poorer academic performance (Mohamed & Bernouss, 2020), and demonstrated a higher rate of sleep problems (Park et al., 2018), loneliness (Ostovar et al., 2016), and depression (Lau et al., 2018). In addition, IA has also been reported to be associated with a range of high-risk behaviors such as substance abuse (Bousoño Serrano et al., 2017), gambling (Beutel et al., 2012), and even suicide attempts (Peng et al., 2021).

With the concern of the adverse impact of IA on adolescents' psychosocial development, a number of risky

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and protective factors have been studied (Bağatarhan & Siyez, 2020; Rachubińska et al., 2021) (Peng et al., 2019; Shek et al., 2019; Zhou et al., 2018a, b). Among these influencing factors, a family factor — family dysfunction — is particularly linked to the risk of IA issues among adolescents (Li et al., 2014). Family dysfunction (FD), one of the basic indicators of family assessment, is often characterized by the family system not implementing appropriate functioning such as active communication, sufficient support, and emotional warmth among family members (Mousavi, 2004; Zhou et al., 2018a, b). Previous studies have demonstrated that FD is highly correlated with adolescents' addictive behaviors such as IA problems (Doba & Nandrino, 2010; Tafa & Baiocco, 2009). For example, Li et al. (2014) summarized 42 studies regarding family correlates of IA in Chinese youth, showing that FD, including family alienation and inadaptability, parent–child conflict, and inter-parental conflict, was significantly associated with a higher risk of youth IA.

However, the influence direction between FD and adolescent IA is still inconsistent and inconclusive. A large body of researches have demonstrated that FD could result in adolescent IA (Chi et al., 2020a; Yu & Shek, 2013), while other studies have showed that adolescent IA might also contribute to FD and thus construct a bidirected relationship (Ko et al., 2015). It is still unknown whether there exist dynamically reciprocal effects between FD and adolescent IA at multiple time points. Therefore, the prime aim of this study was to probe how FD may influence, and/or be influenced by, adolescent IA in a longitudinal sample of Chinese adolescents. Additionally, due to the one-child policy that lasted for more than 30 years in China, there exist a large number of one-child families, which showed distinct characteristics from those multiple-child families (Chi et al., 2020c; Guo et al., 2015). However, whether there is a difference between an only child and non-only child in the longitudinal relationship between FD and adolescent IA has also not been well-documented. Thus, we attempted to examine the different interaction patterns between only child and non-only child. Clarifying such longitudinal associations and potential group differences would have implications for developing more effective and targeted early intervention strategies.

Directional effect between family dysfunction and adolescent IA

In terms of the direction of the effect between FD and adolescent IA, there were three common perspectives: FD influencing adolescent IA, adolescent IA influencing FD, and the reciprocal relationship between them. On the basis of the Compensatory Internet Use Theory (Gao & Chen, 2006), scholars posit that a dysfunctional family could significantly increase the risk of adolescent IA. A family with

full of conflicts and indifference could hardly meet adolescent basic psychological needs (Li et al., 2016), and would induce a series of negative emotions in adolescents (Chi et al., 2020b). These may lead adolescents to turn to the Internet (e.g., indulging in online social interaction or activities) to escape from quarreling and unconcerned families, obtain psychological satisfaction, and avoid or relieve the pain of emotion (Kardefelt-Winther, 2014), ignoring whether these activities and social support were adaptive or maladaptive. Empirical studies have supported that FD is predictive of adolescents' differences in IA. For example, using cross-sectional data from 2059 middle school students, Chi et al. (2020a) found that adolescents who lived in dysfunctional families (especially families with poorer communication and higher conflict among family members) were prone to report a higher level of IA. There was also longitudinal evidence suggesting that poor family function was an important contributor to the risk of subsequent adolescent IA. For example, Yu and Shek (2013) and Gong et al. (2021) using three-wave longitudinal data of 3074 Hong Kong adolescents and 1301 mainland Chinese adolescents, respectively, both found that adolescents' perceptions of family functioning at baseline could significantly predict their IA two years later. However, the Compensatory Internet Use Theory and the above empirical investigation mainly focus on the predictive effect in which FD influences adolescents' subsequent IA but ignore the possible opposite relation, namely, that FD could also affected by adolescents' prior IA.

Built off the "below" pressure hypothesis (Grolnick, 2003), others assumed that adolescent problematic Internet use or IA hinder the whole family from functioning well. "Below" pressure refers to pressure from adolescent maladjustment, including emotional and behavioral problems, which could have an effect on their surrounding context (e.g., family environment). In terms of this meaning, adolescent IA may act as one kind of "below" pressure that highly possibly impacts family mutuality, family communication, as well as family harmony. Actually, there have been some empirical studies that suggested adolescent problem behaviors (e.g., problematic alcohol use, delinquent behavior and aggressive behavior) could serve as predictors of ensuing negative parenting and excessive parental control in families (Reitz et al., 2016; Van der Vorst et al., 2006). Furthermore, these effects were also revealed for behavioral problems on FD. For example, a recent study found that adolescent externalizing problems could significantly predict a decline in family cohesion six months later (Mastrotheodoros et al., 2019). As a prevalent behavioral disorder in adolescents, uncontrolled or addictive Internet use might also increase the likelihood of FD. In the review of Li et al. (2014), except for just one study, the remaining studies consistently reported greater FD among IA youth than among non-IA youth. Adopting a two-wave longitudinal

study, Koning et al (2018) found that excessive Internet use would lead to a lower frequency and poorer quality of parent–child conflict communication. In China, there were also several empirical studies demonstrated that adolescents with IA often posed great challenges to their parents, introduced a series of parenting stress (Liu et al., 2022), and resulted in incessant family conflict through the parent-adolescent subsystem (Wang et al., 2011). Thus, from the perspective of the "below" pressure hypothesis and related empirical research, adolescent IA might impair or deteriorate family function, leaving the family system more vulnerable to getting into dysfunctional state.

The two above-mentioned perspectives centering on the unidirectional relationship between adolescent IA and FD have drawn considerable attention to the question of "who comes first". In recent years, with the rise of the Developmental Contextualism Theory (Lerner, 2006), a third perspective, that is, FD and adolescent IA are reciprocally affected, has caught scholars' attention. It breaks through the limitations of the unidirectional mode between contextual factors and individual development. From the viewpoint of the Developmental Contextualism Theory, the developmental situation (e.g., dysfunctional family) and the adolescent response (e.g., being indulged in the Internet) might dynamically interact, and in particular, the direction of such effects may change when considering the temporal dimension (Lerner, 2006; Sorell et al., 2007). A small body of studies have employed the reciprocal model to examine the link between family factors and adolescents' problem behaviors. For example, empirical evidence has supported that adolescents' family function has significant influences on adolescents' aggressive behavior, which in turn, subsequently influences their perceived family function in the later stages of development. Similar circular effects have also appeared in the relation between maternal psychological control and children's bullying/victimization (Wu et al.), peer victimization and children's internalizing problems (Guo et al., 2017), as well as family function and adolescent depressive symptoms (Wang et al., 2021a). However, studies examine the reciprocal effects between adolescents' excessive usage of the Internet and their dysfunctional family are very limited.

To our knowledge, the only study of Ko et al. (2015) has discovered such bidirectional relationships among adolescents, revealing that adolescent IA and family factors could both act as antecedents and outcomes. Nevertheless, this research only used two-wave data with a time interval of 12 months and just adopted the logistic regression method and performed repeated-measure ANOVA, thus the dynamic nature of the relationship between family factors and IA has not been fully exhibited. To evaluate such dynamic linkage precisely, multi-wave longitudinal data with a longer time interval and more advanced analysis method are needed.

Auto-regressive cross-lagged model analysis may help find the cross-lagged relations between variables and how these relations change over time also could be shown, after controlling for the auto-regressive effect (Rogosa & David, 1980). Thus, it is necessary to examine the dynamic relationship between FD and adolescent IA using auto-regressive cross-lagged models with three-wave longitudinal data or above, and the results may challenge the findings of Ko et al. (2015).

Difference between only child and non-only child

In China, the one-child policy started in 1979 and terminated in 2015. It had been implemented for more than 30 years so that nowadays a family with one child is still the mainstream model in China (Hao, 2010; Tan & Zhang, 2016). The developmental difference between adolescents from single-child families and multiple-child families has attracted considerable attention of researchers (Chi et al., 2020a, b, c; Guo et al., 2015). Empirical studies have demonstrated confounding results that having siblings may/may not be a factor related to FD or adolescent IA. Regarding the FD, mixed findings were reported, with some studies identifying healthier family function among Chinese adolescents coming from only-child families (Liang et al., 2018; Wang et al., 2013), while other studies discovering adolescents or youth of single-child families at greater risk for FD (Tan & Wang, 2017) or no significant difference (Li & Ting, 2017). In terms of IA, the results of previous studies are also inconsistent. For instance, in the research of Chen et al. (2016) and Zhang et al. (2021), the authors found that only-child students were more prone to get indulged into the Internet. Dong et al. (2019) and Yu et al. (2017a, b) surveys, however, revealed that the IA rate of adolescents without siblings (the only-child) was significantly lower than that of adolescents with siblings. In another study, Chi et al. (2020a) discovered that whether adolescents came from a single-child family or not was not significantly correlated with IA.

According to the resource dilution model, a rise in the number of children in a family reduces the amount of resources available to each child (Blake, 1981). That is, due to limited family resources, the more children there are in a family, the fewer family resources each child can share. As a result, non-only child families are forced to allocate family resources among multiple children, inevitably reducing resources for each child (Kalmijn & van de Werfhorst, 2016). For adolescents, having multiple children may not only dilute family resources but also bring a chain of changes in interactions among members within a family system, which might make family factors have different influences on mental health among only child versus non-only child. For example, Xiao et al.'s (2017) study revealed that, compared to their non-only child counterparts, only

child students were more likely to develop depressive symptoms because of mother–child conflict during adolescence. However, knowledge about how and whether being an only child moderates the relationship between FD and IA is still unclear, and especially, evidence from longitudinal studies is especially insufficient. Identifying possible between-group differences would contribute to the development of more precisely targeted intervention techniques. Therefore, in the present study, it is also necessary to take the potential impact of only child or non-only child into consideration in the longitudinal process wherein family function is associated with adolescent IA.

The present study

In the current study, we anticipated to expand previous research on the linkage between FD and adolescent IA based on a longitudinal survey of Chinese adolescents. This longitudinal design using three-wave data could provide a more thorough understanding of dynamic real-world phenomena than studies focusing solely on one or two measurement points. We expected that FD and adolescent IA mutually influence each other following a dynamic process. Specifically, we supposed that FD influences adolescent IA, which is subsequently linked to increased FD, and thus becoming trapped in a vicious circle. Another purpose of this study is to examine whether these longitudinal relationships show significant group differences between only child and non-only child. Understanding the dynamic linkage between FD and adolescent IA and the potential differences have important implications for identifying the starting points of family-based interventions for adolescents with IA.

Method

Participants and procedure

We randomly selected five middle schools in Shenzhen and invited Grade 7 students to participate in our study. The data collection was conducted in October 2016 (T1; 1st semester of Grade 7), October 2017 (T2; 1st semester of Grade 8) and October 2018 (T3; 1st semester of Grade 9). During the data collection, research assistants provided information about the test to adolescents and their primary caregiver. After having adolescents and their parents' informed consent for voluntarily participating in this study, research assistants distributed questionnaires to participants. Adolescents were guided to respond to the paper-and-pencil questionnaire in the classroom. In the first wave survey, 1544 adolescents with a mean age of 12.46 years old (SD = 0.63) participated in the investigation. In the second wave and third wave, the numbers of participants were 1,511 and 1,480, respectively.

In total, 1301 adolescents (666 boys and 621 girls, 14 students fail to report their gender) who participated in all three assessments make up the final sample. We used an a-priori sample size calculator for structural equation models to determine the proper sample size for the data analyses. The analysis revealed that a sample size of 403 would be needed to achieve statistical significance at p < 0 0.05 when the average effect size was set as 0.20 with a power of 0.80. Thus, our final sample size (n = 1301) conformance to this requirement. The study was conducted with the approval of both the Human Research Ethics Committee of the corresponding author and the administrative committees of the investigated schools.

Measures

Chinese Family Assessment Instrument (CFAI)

The simplified version of the Family Assessment Instrument, which was developed by Shek et al. (2013), was adopted to measure FD. The Family Assessment Instrument includes three sub-scales (mutuality, communication, and conflict) with 3 items for each. An example is "We have a lot of friction". Participants were asked to respond to these items on a 5-point Likert-type scale, which ranged from 1 ("very dissimilar") to 5 ("very similar"). In this study, after reversing the mutuality and communication sub-scale scores, we computed the means of the nine items. A higher score represents a high level of FD. With our sample in this study, McDonald's omega coefficients at Time 1, Time 2, and Time 3 were 0.86, 0.85, and 0.88, respectively.

Internet Addiction Test (IAT)

Adolescent IA was assessed using the Chinese version of Young's Internet Addiction Test, which was translated and modified specifically for Chinese adolescents (Shek et al., 2008). It consists of 10 items that participants answer "yes" or "no" on each statement to assess whether or not they had experienced the listed behavior in the past year. An example is "Have you repeatedly made unsuccessful efforts to control, cut back or stop Internet use". Participants who scored four or higher were considered to have been addicted to the Internet. In the current study, McDonald's omega coefficients for the IAT were 0.76 at Time 1, 0.75 at Time 2, and 0.82 at Time 3.

Covariates

Prior studies have found that demographic variables such as adolescents' age, gender, birthplace, only-child or not, parents' education level and family income were significantly related to FD and IA (Chen et al., 2016; Dong et al., 2019;

Shek, 2002, 2005; Wu et al., 2016). Thus, in statistical analyses, we controlled these variables to exclude their potential influence. Adolescents' sex was coded as 1 for boys and 2 for girls. The birthplace of adolescents was coded as 1 for rural area, 2 for Shenzhen and 3 for other cities. Whether adolescent was an only-child or not was coded as 1 for only-child and 2 for non-only child. Parents' education level was assessed by adolescents' reports (middle school or below coded as 1, high school or vocational college coded as 2, university coded as 3, above university coded as 4). family income was assessed based on per capita monthly in CNY (1 = <¥1000, 2 =¥ 1000 – ¥ 1999, 3 =¥ 2000 – ¥ 2999, 4 =¥ 3000 – ¥ 3999, 5 =¥ 4000 – ¥ 4999, 6 =¥ 5000 – ¥ 5999, 7 = >¥6000).

Data analysis

All data were input into SPSS 25.0 to conduct descriptive analyses and correlation analyses. Then we performed autoregressive cross-lagged (ARCL) analyses in Mplus 8.3. In the ARCL model, correlations between variables as well as their autoregressive effects and cross-lagged effects were contained. The ARCL model allowed us to test the potential effects of one variable (e.g., FD) measured at the prior time point on another variable (e.g., adolescent IA) at the subsequent measurement point (the cross-lagged effects), controlling for the regression of both variables on themselves (the auto-regressive effects). Covariates such as adolescent age, gender, birthplace, parental education level, family income were also included in the final cross-lagged model. Since the normed chi-square (χ^2/df) is susceptible to sample size and is a relatively unstable indicator, a series of other standard fit indices were also adopted to assess model fit, containing the Tucker-Lewis index (TLI), the comparative fit index (CFI), the root means square error of approximation (RMSEA) with 90% CI, and standardized root mean square residual (SRMR). We considered there is a good fit for the model if the CFI and TLI are both above 0.90, and RMSEA is below 0.08 (Kline, 2015). Furthermore, in order to test whether there were significant differences between

only child and non-only child in the ARCL model of FD and adolescent IA, multigroup comparison were constructed by whether adolescents come from only child families. The steps of the multigroup comparison model were as follows: (1) establish an unconstrained model in which all path coefficients were estimated freely; (2) establish a constrained model in which all path coefficients were equal between the only child group and non-only child group; and (3) compare the unconstrainted model with the constrained model by the change of normed chi-square ($\Delta\chi^2/\Delta df$). (4) use the Wald test to test the significant differences in terms of the specific path coefficient. In our study, we used the 0.05 significance level for all path coefficients.

Results

Descriptive statistics of family dysfunction and Internet addiction

The means and standard deviations of FD and IA at three time points and the correlations among these variables are reported in Table 1. As expected, FD at the three waves had positive relationships with each other (rs ranging from 0.25 to 0.43), and IA at the three waves was positively associated with each other (rs ranging from 0.21 to 0.39). Additionally, significant positive correlations were found between FD and IA, both cross-sectionally (rs ranging from 0.21 to 0.33) and across measurement waves (rs ranging from 0.06 to 0.23).

Analyses of the Autoregressive Cross-Lagged model

An ARCL model was constructed to analyze the possible patterns of influence between FD and IA among adolescents, In the ARCL model, we modeled FD and IA as latent variables. FD was defined by its sub-scales (mutuality, communication, and conflicts). As for IA, we followed the suggestions of Rogers and Schmitt (2004) that parceling could be used as indicators for uni-dimension variables to simplify their structures. Specifically, we used three sub-scales scores as

Table 1 Correlations of family dysfunction with adolescent Internet addiction

Variables	M ± SD	T1 FD	T2 FD	T3 FD	T1 IA	T2 IA	T3 IA
T1 FD	1.93 ± 0.77	1					
T2 FD	1.96 ± 0.79	0.26***	1				
T3 FD	1.83 ± 0.77	0.43***	0.25***	1			
T1 IA	1.55 ± 1.99	0.25***	0.07*	0.23***	1		
T2 IA	1.62 ± 1.99	0.16***	0.21***	0.13***	0.25***	1	
T3 IA	1.47 ± 2.13	0.18***	0.06*	0.33***	0.39***	0.21***	1

T1 Time 1 (Grade 7), *T2* Time 2 (Grade 8), *T3* Time 3 (Grade 9), *FD* Family Dysfunction, *IA* Internet Addiction.
*$p < 0.05$; ***$p < 0.001$.

manifest indicators of FD, and three parcels as manifest indicators of IA. Synchronous correlations among the two latent variables were allowed in the model. We also allowed the error correlation of the same observed variable at Waves 1, 2 and 3. Additionally, demographic factors, such as adolescents' sex, age, only-child or not, parental education level, and family income, were controlled in the cross-lagged panel model, such that the first wave FD and IA were regressed on these control variables. The ARCL model indices fitted well, with $\chi^2/df = 3.27$, $p < 0.001$, CFI = 0.95, TLI = 0.93, RMSEA = 0.04 (90% CI = [0.038, 0.045]), SRMR = 0.06. Figure 1 illustrates the standardized path coefficients. For the reason of simplifying the model, control variable is not exhibited in the figure.

The results showed that the predictive coefficients of gender ($\beta = -0.06$, $p < 0.05$), father education level ($\beta = -0.11$, $p < 0.05$), and family income ($\beta = -0.08$, $p < 0.05$) for FD at T1 were significant. The predictive coefficient of gender ($\beta = -0.09$, $p < 0.01$) for IA at T1 was significant. After controlling for the influence of demographic variables, the auto-regressive paths for FD and IA were all significant, with the auto-regressive coefficients ranging from 0.26 to 0.32, suggesting the temporal stability of the two study variables. In terms of cross-lagged paths, FD at Time 1 had a significant and negative longitudinal cross-lagged effect on adolescent IA at Time 2 ($\beta = 0.10$, $p < 0.01$), while the prediction of IA on FD during this period was not significant ($\beta = 0.01$, $p > 0.05$). From Time 2 to Time 3, adolescent IA significantly and negatively predicted FD ($\beta = 0.11$, $p < 0.01$), while the predictive coefficient of FD on adolescent IA was not significant ($\beta = 0.03$, $p > 0.05$).

Multigroup comparison of the autoregressive cross-lagged model

To test whether there were significant differences between only child and non-only child in the ARCL model of FD and adolescent IA, multigroup comparisons were constructed by whether adolescents come from only child family. Our results showed that the overall fit was acceptable for both unconstrained model ($\chi^2/df = 2.70$, $p < 0.001$, CFI = 0.92, TLI = 0.90, RMSEA = 0.05 (90% CI = [0.048, 0.055], and SRMR = 0.08), and constrained model ($\chi^2/df = 2.66$, $p < 0.001$, CFI = 0.92, $TLI = 0.90$, RMSEA = 0.05 (90% CI = [0.047, 0.054], and $SRMR = 0.08$). The results of the chi-square test showed that the differences between the unconstrained model and the constrained model were not significant ($\Delta\chi^2 = 3.93$, $\Delta df = 8$, $p > 0.05$), indicating that there were no significant differences in the ARCL model of FD and adolescent IA between the only child group and non-only child group.

Discussion

How are FD and adolescent IA related? In the current study, this important issue was addressed by testing whether FD was reciprocally linked to adolescent IA. Additionally, we take the differences between only child and non-only child into account and examine the existence of group differences. Our results suggested there exists a vicious circle between FD and adolescent IA, which enriches the application of the Developmental Contextualism Theory. Specifically, our results showed that FD at T1 predicted adolescent IA at T2,
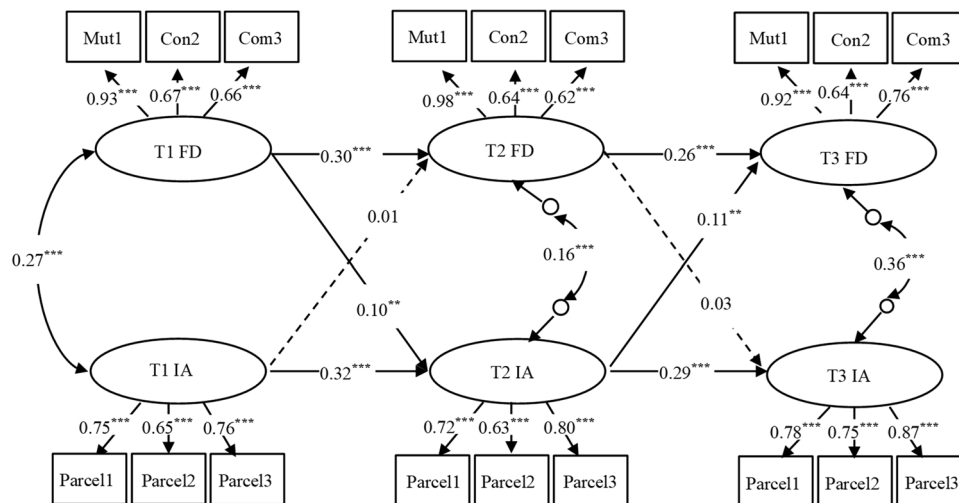

Fig. 1 The ARCL model of family dysfunction and adolescent Internet addiction. Note: All coefficients were standardized. Two latent constructs were assessed with three manifest indicators and three parcels, respectively. Control variable was not exhibited in the figure for the simplicity of the model. T1 = Time 1 (Grade 7); T2 = Time 2 (Grade 8); T3 = Time 3 (Grade 9). FD = Family Dysfunction; IA = Internet Addiction; Mut1 = mutuality; Con2 = conflict; Com3 = communication. Solid line = significant coefficient; Dotted line = non-significant coefficient. $^{**}p < 0.01$; $^{***}p < 0.001$

then adolescent IA at T2 predicted FD at T3. The present study demonstrated the dynamic interacting process between FD and adolescent IA, which might lead to a vicious circle, increasing the risk of adolescent IA as well as hindering the effective functioning of the whole family. In addition, the relations between FD and adolescent IA did not differ on account of whether or not adolescents came from only child families. Our findings provide inspiration for identifying the starting points of preventive and interventional strategies for adolescent IA.

The idea that FD may play a crucial role in the onset and deterioration of IA among adolescents has been the focus of substantial theorizing and empirical work over the past decades. Partially in line with a previous study (Chi et al., 2020a; Yu & Shek, 2013), this study showed that FD at T1 increased adolescent IA at T2, while FD at T2 could not predict adolescent IA at T3. According to prior researches, families that lack of close interactions or are full of conflict cannot provide adolescents with sufficient emotional warmth (Chng et al., 2015), but bring much stressful daily life experience to adolescents and arouse a series of negative emotions (Tompson et al., 2015; Wang et al., 2021a, b, c). Under an indifferent family atmosphere, in light of the Compensatory Internet Use Theory (Gao & Chen, 2006), the satisfaction of adolescents' basic psychological needs has been hampered, especially the acquisition of interpersonal closeness (Li et al., 2016). Since the virtual cyber world could provide a preferable place for adolescents to avoid distressed family conflicts, adolescents tend to indulge in online activities to satisfy their interpersonal needs and obtain emotional support. Thus, a dysfunctional family may contribute to adolescent IA. However, when adolescents get into later stage of junior school years (from Grade 8 to Grade 9), the predictive effect of FD on adolescent IA is insignificant. One possible explanation may be that the adolescents with IA may exhibit certain negative features (such as maladaptive cognition, low self-esteem and self-confidence, and poor emotional competence) (Baturay & Toker, 2019; Han et al., 2017; Yu et al., 2017a, b), which may also contribute to youth's vulnerability for being addictive into the Internet. Another potential reason is that when adolescents frequently engaged in online activities, they may 'attract' similar addictive peers, and the peer contagion effect may further lead to more problematic Internet use among adolescents (Zhou & Fang, 2015). In other words, during this period, adolescent IA may be more influenced by individual-level and peer-level correlates, that are no longer directly related to their dysfunctional family, which needs to be verified in the future research.

Conversely, adolescent IA at T1 could not predict FD at T2, while adolescent IA at T2 demonstrated a trend toward increased FD at T3. Our findings were also partially consistent with prior research (Li et al., 2014; Luo and Peng, 2008; Wang et al., 2011). The potential reason may be that at the

early stage of middle school (from Grade 7 to Grade 8), with relatively lower academic pressure of adolescents (Liu, 2016), parents are inclined to allow their children to use the Internet freely and will be relatively loose in supervising their children on Internet usage. Moreover, when addicted to the Internet, adolescents might conceal some of their problematic Internet use from their family—especially when they live in a dysfunctional family that usually could not meet their psychological needs but brings a series of negative mood. Therefore, the impact of adolescent IA on family functioning is less pronounced. While during the late middle school year (from Grade 8 to Grade 9), especially as the entrance examination for secondary school gets closer and closer, adolescents' academic burden becomes increasingly heavier (Liu, 2016). Parents are more likely to realize that their children get indulged into the Internet, thus they may implement more restrictive rules under this "below" pressure (Koning et al., 2018). However, parental overregulation could provoke adolescent disobedience, especially in Grade 8 (Lin et al., 2021; Wang & Zhang, 2004), which would further contribute to more frequent and sharper parental-adolescent conflict. Besides, during the implementation of restrictive regulation, inter-parental relations might be prone to deteriorate and their contradiction might spill over into the whole family system (Ko et al., 2015). All of these would make adolescents perceive worse family relations and poorer family communication patterns. Thus, FD might be prominently provoked by adolescent IA.

Our study indicated that the association between FD and adolescent IA got caught in a vicious cycle. FD, such as conflict, and hostile family relationships, is a risk factor for adolescent IA, while the effect of adolescent IA on FD seems to also be also another link in the transactional chain. Our results suggested that FD and adolescent IA show a trend to deteriorate each other in the long term. From these results, we were inclined to consider the unhealthy family as the starting point of the vicious circle between FD and adolescent IA. Developmental Contextualism (Lerner, 2006; Sorell et al., 2007) offers a theoretical framework for obtaining a full picture of the dynamic process between FD and adolescent addictive Internet use. Empirical research testing these effects, however, has been very limited, with only a slim body of studies examining the bidirectional relationship between them using two-wave data (Ko et al., 2015). Using three-year longitudinal data, our results enrich the Developmental Contextualism Theory by discovering the vicious cycle between dysfunctional families and adolescents' misbehavior. Although previous research using the Developmental Contextualism Theory has been centered on dynamic processes between individuals and contexts, our results show that dynamic processes can also be applicable to the field of Internet misconduct, thus occurring between FD and children' IA. This phenomenon has been suggested

by several studies that showed a circular effect of family factors, such as family function (Wang et al., 2021a), and parent control (Wu et al., 2021), and it could also be extended to peer factors such as peer victimization (Guo et al., 2017) and adolescent problem behavior. The dynamic nature of family–adolescent relations was alarming in terms of IA. Our results imply that adolescents could get "caught" into the reinforcing patterns of dysfunctional family and adolescent IA that might become deteriorative over time. Such persistent deterioration is dangerous since it may bring about even more terrible consequences than episodic family problems or adolescent IA. If we could not break such a vicious cycle in time, it would result in a chain of negative influence on adolescents as well as their whole family system.

Additionally, our study revealed that there is no significant difference between only child and non-only child in the mutual relationship between FD and adolescent IA. In the Internet Age, the Internet is becoming increasingly popular and accessible due to its anonymity, convenience and escape, and using the Internet has become a convenient way for recreation and entertainment in modern society (CNNIC, 2022). Although there exist differences in the reasons for being addictive to the online space for only child and non-only child, such that only child lack sibling companionship while non-only child lack full parental love(Xiao et al., 2017), both of them spend time on the Internet to alleviate negative feelings and seek emotional support when they get trapped into a poorly functioning family, which has become an important solution adolescents choose to compensate for some of their needs in the real world, and may eventually result in IA. For instance, prior studies have suggested that only child and non-only child do not show significant differences in IA (Zhang et al., 2021). Moreover, for both only child and non-only child, the overreliance on the Internet inevitably brings about family conflicts and reduces parent-adolescent communication. Thus, it may bring about the same level of impairment for family function. Therefore, the dynamic relationship between FD and adolescent IA was not different based on whether only child or not. The results also implicated that when a family is in a disorganized state, the number of children in the family may not significantly affect the relationship between the FD and IA of a particular child.

There are several limitations that need to be acknowledged in our current study. Firstly, family dysfunction is a very complex phenomenon related to both family structure and characteristics. In this study, we only assessed family dysfunction characterized by worse family mutuality, more conflicts and less communication among family members, all of which were perceived by adolescents. Future research should further measure family functioning from other perspectives and adopt more comprehensive tools to validate the conclusion found in our research. Regarding adolescent IA, we also measured it by self-report questionnaires alone,

which may be influenced by recall bias and social desirability. Future researches incorporating objective measures (e.g., obtaining the information about Internet use by built-in software) or using data from different scources (e.g., parents, teachers or peers) are needed. Secondly, our sample included only middle school students from Shenzhen which is one of China's Special Economic Zones, therefore, cautious should be taken in generalizing the findings to all Chinese adolescents or beyond. Future studies should recruit adolescents from different cities or regions of China to further examine the association between FD and adolescent IA. Thirdly, the data of this study were gathered between 2016 and 2018, which is before the outbreak of COVID-19. Given that adolescent Internet usage and family functioning have changed substantially during the epidemic outbreak, future research appears warranted to explore whether the relationship between FD and adolescent IA changed before and after COVID-19. Fourthly, although our study adopted an ARCL model by a three-wave longitudinal survey design, it still cannot fully infer the causal relationship between FD and adolescent IA. In the future, a more rigorous method can be used to better draw the causal relation between them. Additionally, as suggested by prior studies, individual psychological resources (e.g., self-esteem) and emotional status (e.g., fear of missing out) may be crucial mediators between FD and adolescent IA (Sela et al., 2020; Shi et al., 2017). These individual factors need to be further tested within the cross-lagged models, as potential contributors between FD and adolescent IA.

Notwithstanding these limitations, the present study first discovered a circular effect between FD and adolescent IA in a group of Chinese junior school students with cross-lagged analysis at three time points. Our results extended the application of the Developmental Contextualism Theory and enriched existing literature on the relation between FD and adolescent IA. More importantly, our findings also provide enlightenment for practical work. Since the vicious circle between FD and adolescent IA is more likely to begin with unhealthy families, families should be taught to create a harmonious atmosphere for adolescents. Thus, it is crucial to offer parents with scientific guidance about family education and feasible ways of handling adolescents' problem behavior (e.g., Internet addiction behavior). When providing intervention for those who are getting indulged in problematic Internet use, counselors should also keep a watchful eye on the families to prevent the continual impairment of family function. Meanwhile, the circular effect between FD and adolescent IA also reflects that, to some extent, the role of adolescents themselves should not be ignored. Adolescents living in a conflicting and indifferent family should be taught skills and given appropriate emotional-regulation or interpersonal communication training to cope with the dysfunctional family or reduce its negative impacts. For those who

have already shown a certain degree of IA, educators and counselors should teach them with some practical self-control strategies and give psychological guidance to use Internet reasonably. In sum, our findings suggest that the prevention and intervention of adolescent IA should focus both the families and adolescents themselves. Thus, strengthening education and providing more assistance for families as well as adolescents is necessary. By doing so, both FD and adolescent IA could be alleviated, and the vicious cycle will be transformed into a virtuous cycle.

In conclusion, this study contributes to the developmental literature about Developmental Contextualism Theory by investigating longitudinal relationships between FD and adolescent IA with a three-wave longitudinal survey. We found a vicious cycle between FD and adolescent IA: adolescents who lived in a dysfunctional family showed an increased risk of IA in the subsequent year; in turn, adolescent IA further increased the possibility of FD. Moreover, this conclusion applies to both only children and non-only children. Taken together, these findings emphasize the potential importance of identifying the starting points for interventional strategies of adolescent IA.

Data availability The data are part of an ongoing project. For privacy or ethical restrictions, primary data are not publicly available. The data supporting the findings of this study are available from the corresponding author upon request.

Declarations

Conflicts of interest/Competing interests On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Bağatarhan, T., & Siyez, D. M. (2020). Rumination and Internet addiction among adolescents: The mediating role of depression. *Child and Adolescent Social Work Journal, 39*, 209–218. https://doi.org/10.1007/s10560-020-00715-y

Baturay, M. H., & Toker, S. (2019). Internet addiction among college students: Some causes and effects. *Education and Information Technologies, 24*(5), 2863–2885. https://doi.org/10.1007/s10639-019-09894-3

Beutel, M., Dreier, M., Duven, E., Giralt, S., Mueller, K., & Woelfling, K. (2012). Gambling and internet addiction in adolescents: A representative survey of 4,000 German students. *Journal of Psychosomatic Research, 72*(6), 472–472.

Blake, J. (1981). Family size and the quality of children. *Demography, 18*(4), 421–442.

Bousoño Serrano, M., Al-Halabí, S., Burón, P., Garrido, M., Díaz-Mesa, E., Galván, G., García-Álvarez, L., Carli, V., Hoven, C., Sarchiapone, M., Wasserman, D., Bousoño, M., García-Portilla, M., Iglesias, C., Sáiz, P., & Bobes, J. (2017). Substance use or abuse, internet use, psychopathology and suicidal ideation in adolescents? *Adicciones, 29*(2), 97–104. https://doi.org/10.20882/adicciones.811.

Chen, Y., Kang, Y. W., Gong, W. Z., He, L. P., Jin, Y. L., Zhu, X. Y., & Yao, Y. S. (2016). Investigation on Internet addiction disorder in adolescents in Anhui, People's Republic of China. *Neuropsychiatric Disease and Treatment, 12*, 2233–2236. https://doi.org/10.2147/ndt.S110156

Chi, X., Hong, X., & Chen, X. (2020a). Profiles and sociodemographic correlates of Internet addiction in early adolescents in southern China. *Addictive Behaviors, 106*. https://doi.org/10.1016/j.addbeh.2020.106385.

Chi, X., Liu, X., Huang, Q., Huang, L., Zhang, P., & Chen, X. (2020b). Depressive symptoms among junior high school students in southern China: Prevalence, changes, and psychosocial correlates. *Journal of Affective Disorders, 274*, 1191–1200. https://doi.org/10.1016/j.jad.2020.05.034

Chi, X. L., Huang, L. Y., Wang, J., & Zhang, P. C. (2020c). The prevalence and socio-demographic correlates of depressive symptoms in early adolescents in China: Differences in only child and non-only child groups. *International Journal of Environmental Research and Public Health, 17*(2), 438. https://doi.org/10.3390/ijerph17020438.

CNNIC. (2022). *The 50th China statistical report on Internet development*. Retrieved October 17, 2022, from http://www.cnnic.net.cn/n4/2022/0401/c88-1131.html.

Chng, G. S., Li, D. D., Liau, A. K., & Khoo, A. (2015). Moderating effects of the family environment for parental mediation and pathological Internet use in youths. *Cyberpsychology Behavior and Social Networking, 18*(1), 30–36. https://doi.org/10.1089/cyber.2014.0368

Doba, K., & Nandrino, J.-L. (2010). Is there a family typology of addictive behaviors? Critical review of the literature in the families of adolescents with an eating disorder or with a substance-dependence. *Psychologie Francaise, 55*(4), 355–371. https://doi.org/10.1016/j.psfr.2010.10.001

Dong, B., Zhao, F., Wu, X. S., Wang, W. J., Li, Y. F., Zhang, Z. H., & Sun, Y. H. (2019). Social anxiety may modify the relationship between Internet addiction and its determining factors in Chinese adolescents. *International Journal of Mental Health and Addiction, 17*(6), 1508–1520. https://doi.org/10.1007/s11469-018-9912-x

Gao, W. B., & Chen, Z. Y. (2006). A study on psychopathology and psychotherapy of Internet addiction. *Advances in Psychological Science, 14*(4), 596–603.

Gong, N., Huang, Q. M., Zhang M. S., Liu C. F., & Chi X. L. (2021). A three-year longitudinal study on Internet addiction among junior students in Shenzhen City. *Chinese Journal of School Health, 42*(12), 1833–1837. https://doi.org/10.16835/j.cnki.1000-9817.2021.12.018.

Grolnick, W. S. (2003). *The psychology of parental control: How well-meant parenting backfires*. Lawrence Erlbaum Associates.

Guo, H. Y., Chen, L. H., Ye, Z., Pan, J., & Lin, D. H. (2017). Characteristics of peer victimization and the bidirectional relationship between peer victimization and internalizing problems among rural-to-urban migrant children in China: A longitudinal study. *Acta Psychologica Sinica, 49*(3), 336–348.

Guo, Y. F., Zhang, J. P., & Zhang, N. (2015). Character strengths and their influencing factors among nursing students in Changsha, China: The only-child versus non-only-child. *Archives of Psychiatric Nursing, 29*(6), 365–371. https://doi.org/10.1016/j.apnu.2015.06.008

Han, P. G., Wang, P., Lin, Q. N., Tian, Y., Gao, F. Q., & Chen, Y. M. (2017). Reciprocal relationship between Internet addiction and Network-related maladaptive cognition among Chinese college freshmen: A longitudinal cross-lagged analysis. *Frontiers in Psychology, 8*. https://doi.org/10.3389/fpsyg.2017.01047.

Hao, K. M. (2010). *An empirical study on China's only child group*. Guangdong Education Press.

Kalmijn, M., & van de Werfhorst, H. G. (2016). Sibship size and gendered resource dilution in different societal contexts. *PLoS One, 11*(8), e0160953. https://doi.org/10.1371/journal.pone.0160953.

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior, 31*, 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). The Guilford Press.

Ko, C.-H., Wang, P.-W., Liu, T.-L., Yen, C.-F., Chen, C.-S., & Yen, J.-Y. (2015). Bidirectional associations between family factors and Internet addiction among adolescents in a prospective investigation. *Psychiatry and Clinical Neurosciences, 69*(4), 192–200. https://doi.org/10.1111/pcn.12204

Koning, I. M., Peeters, M., Finkenauer, C., & van den Eijnden, R. (2018). Bidirectional effects of Internet-specific parenting practices and compulsive social media and Internet game use. *Journal of Behavioral Addictions, 7*(3), 624–632. https://doi.org/10.1556/2006.7.2018.68

Lam, L. T. (2014). Risk factors of Internet addiction and the health effect of internet addiction on adolescents: A systematic review of longitudinal and prospective studies. *Current Psychiatry Reports, 16*(11), 508. https://doi.org/10.1007/s11920-014-0508-2

Lau, J. T., Walden, D. L., Wu, A. M., Cheng, K.-M., Lau, M. C., & Mo, P. K. (2018). Bidirectional predictions between Internet addiction and probable depression among Chinese adolescents. *Journal of Behavioral Addictions, 7*(3), 633–643. https://doi.org/10.1556/2006.7.2018.87

Lerner, R. M. (2006). Developmental science, developmental systems, and contemporary theories of human development. In: Lerne, W. D. R. M. (Ed.), *Handbook of Child Psychology, Vo1.1: Theoretical models of human development* (6 th ed., pp. 1–17, 43–61,542–548). Wiley.

Li, D. P., Zhou, Y. Y., Zhao, L. Y., Wang, Y. H., & Sun, W. Q. (2016). Cumulative ecological risk and adolescent internet addiction: The mediating role of basic psychological need satisfaction and positive outcome expectancy. *Acta Psychologica Sinica, 48*(12), 1519–1537.

Li, S. L. & Ting, Y. (2017). Alienation, family function and self-esteem in Hainan medical students. *China Journal of Health Psychology, 25*(8), 1187–1190. https://doi.org/10.13342/j.cnki.cjhp.2017.08.019.

Li, W., Garland, E. L., & Howard, M. O. (2014). Family factors in Internet addiction among Chinese youth: A review of English- and Chinese-language studies. *Computers in Human Behavior, 31*, 393–411. https://doi.org/10.1016/j.chb.2013.11.004

Liang, Y. H., Zhang, D. J., Hu, T. Q., Liang, Y. L., & Su. Z. Q. (2018). The effect of family functioning on the psychological quality of middle and upper elementary school students: the mediating role of friendship quality. *Journal of Southwest University (Social Sciences Edition), 37*(5), 98–104. https://doi.org/10.13718/j.cnki.xdsk.2018.05.012.

Lin, Y., Liu, Q. X., Yu, S., & Zhou, Z. K. (2021). The relationship between parents' neglect and online gaming addiction among adolescents: The mediating role of hope and gender difference. *Psychological Development and Education, 37*(1), 109–119. https://doi.org/10.16187/j.cnki.issn1001-4918.2021.01.14.

Liu, S., Wang, X., Zou, S., & Wu, X. (2022). Adolescent problematic Internet use and parental involvement: The chain mediating effects of parenting stress and parental expectations across early, middle, and late adolescence. *Family Process.* https://doi.org/10.1111/famp.12757

Liu, Z. H. (2016). On the effect of secondary school students' academic stress on their learning engagement: The mediating effect of

academic resilience. *Chinese Journal of Special Education,6*(12), 68–76. https://doi.org/10.16187/j.cnki.issn1001-4918.2021.01.14.

Luo, H., & Peng, Y. (2008). Relationship of Internet addiction and family environment and attachment of the youth. *Chinese Journal of Clinical Psychology, 16*(3), 319–321.

Mastrotheodoros, S., Canário, C., Cristina Gugliandolo, M., Merkas, M., & Keijsers, L. (2019). Family functioning and adolescent internalizing and externalizing problems: Disentangling between-, and within-family associations. *Journal of Youth and Adolescence, 49*(4), 804–817. https://doi.org/10.1007/s10964-019-01094-z

Milani, L., Osualdella, D., & Di Blasio, P. (2009). Quality of interpersonal relationships and problematic Internet use in adolescence. *Cyber Psychology & Behavior, 12*(6), 681–684. https://doi.org/10.1089/cpb.2009.0071

Mohamed, G., & Bernouss, R. (2020). A cross-sectional study on Internet addiction among Moroccan high school students, its prevalence and association with poor scholastic performance. *International Journal of Adolescence and Youth, 25*(1), 479–490. https://doi.org/10.1080/02673843.2019.1674165

Mousavi, A. S. (2004). *Functional family therapy with a systemic approach.* Alzahra University Press.

Ostovar, S., Allahyar, N., Aminpoor, H., Moafian, F., Nor, M. B. M., & Griffiths, M. D. (2016). Internet addiction and its psychosocial risks (depression, anxiety, stress and loneliness) among Iranian adolescents and young adults: A structural equation model in a cross-sectional study. *International Journal of Mental Health and Addiction, 14*(3), 257–267. https://doi.org/10.1007/s11469-015-9628-0

Park, M.-H., Park, S., Jung, K.-I., Kim, J. I., Cho, S. C., & Kim, B.-N. (2018). Moderating effects of depressive symptoms on the relationship between problematic use of the Internet and sleep problems in Korean adolescents. *BMC Psychiatry, 18*(1), 1–8. https://doi.org/10.1186/s12888-018-1865-x

Peng, C., Wang, M., Cheng, J., Tan, Y., Huang, Y., Rong, F., Kang, C., Ding, H., & Yu, Y. (2021). Association between internet addiction and suicidal ideation, suicide plans, and suicide attempts among Chinese adolescents with and without parental migration. *Computers in Human Behavior, 125*, 106949. https://doi.org/10.1016/j.chb.2021.106949.

Peng, W., Li, D., Li, D., Jia, J., Wang, Y., & Sun, W. (2019). School disconnectedness and Adolescent Internet Addiction: Mediation by self-esteem and moderation by emotional intelligence. *Computers in Human Behavior, 98*, 111–121. https://doi.org/10.1016/j.chb.2019.04.011

Rachubińska, K., Cybulska, A., Szkup, M., & Grochans, E. (2021). Analysis of the relationship between personality traits and Internet addiction. *European Review for Medical and Pharmacological Sciences, 25*(6), 2591–2599. https://doi.org/10.26355/eurrev_202103_25422.

Reitz, E., Deković, M., Meijer, A. M., & Engels, R. C. M. E. (2016). Longitudinal relations among parenting, best friends, and early adolescent problem behavior. *Journal of Early Adolescence, 26*(3), 272–295. https://doi.org/10.1177/0272431606288591

Rogers, W. M., & Schmitt, N. (2004). Parameter recovery and model fit using multidimensional composites: A comparison of four empirical parceling algorithms. *Multivariate Behavioral Research, 39*(3), 379–412. https://doi.org/10.1207/s15327906mbr3903_1

Rogosa, & David. (1980). A critique of cross-lagged correlation. *Psychological Bulletin, 88*(2), 245-258.

Sela, Y., Zach, M., Amichay-Hamburger, Y., Mishali, M., & Omer, H. (2020). Family environment and problematic internet use among adolescents: The mediating roles of depression and Fear of Missing Out. *Computers in Human Behavior, 106*, 106226. https://doi.org/10.1016/j.chb.2019.106226.

Shek, D. T., Tang, V. M., & Lo, C. Y. (2008). Internet addiction in Chinese adolescents in Hong Kong: Assessment, profiles, and

psychosocial correlates. *The Scientific World Journal, 8*, 776–787. https://doi.org/10.1100/tsw.2008.104

Shek, D. T., Zhu, X., & Dou, D. (2019). Influence of family processes on internet addiction among late adolescents in Hong Kong. *Frontiers in Psychiatry, 10*. https://doi.org/10.3389/fpsyt.2019.00113.

Shek, D. T. L. (2002). Chinese adolescents' perceptions of family functioning: Personal, school-related, and family correlates. *Genetic Social and General Psychology Monographs, 128*(4), 358–380.

Shek, D. T. L. (2005). A longitudinal study of perceived family functioning and adolescent adjustment in Chinese adolescents with economic disadvantage. *Journal of Family Issues, 26*(4), 518–543. https://doi.org/10.1177/0192513x04272618

Shek, D. T. L., Leung, H., & Lu, S. (2013). Perceived family life quality in junior secondary school students in Hong Kong. *Social Indicators Research, 117*(3), 757–775. https://doi.org/10.1007/s11205-013-0397-5

Shi, X. X., Wang, J., & Zou, H. (2017). Family functioning and Internet addiction among Chinese adolescents: The mediating roles of self-esteem and loneliness. *Computers in Human Behavior, 76*, 201–210. https://doi.org/10.1016/j.chb.2017.07.028

Sorell, G. T., SoRelle-Miner, D. A., & Pause, C. J. (2007). Moving on: The challenges of dynamic systems perspectives. *Human Development, 50*(2–3), 160–164. https://doi.org/10.1159/000100945

Tafa, M., & Baiocco, R. (2009). Addictive behavior and family functioning during adolescence. *American Journal of Family Therapy, 37*(5), 388–395. https://doi.org/10.1080/01926180902754745

Tan, Y., Chen, Y., Lu, Y., & Li, L. (2016). Exploring associations between problematic internet use, depressive symptoms and sleep disturbance among southern Chinese adolescents. *International Journal of Environmental Research and Public Health, 13*(3), 313. https://doi.org/10.3390/ijerph13030313

Tan, Z. B., & Zhang, X. B. (2016). The mental health cost of the one-child policy. *Economic Research Journal, 51*(02), 168–180.

Tan, X. J., & Wang, A. Q. (2017). An investigation on family function in different groups. *Journal of Psychiatry, 30*(3), 209–212.

Tompson, M. C., O Connor, E. E., Kemp, G. N., Langer, D. A., & Asarnow, J. R. (2015). Depression in childhood and early adolescence: Parental expressed emotion and family functioning. *Annals of depression and anxiety, 2*(7), 1070.

Van der Vorst, H., Engels, R. C. M. E., Meeus, W., Dekovic, M., & Vermulst, A. (2006). Parental attachment, parental control, and early development of alcohol use: A longitudinal study. *Psychology of Addictive Behaviors, 20*(2), 107–116. https://doi.org/10.1037/0893-164x.20.2.107

Wang, E. N., Zhang, J. J., Peng, S. Y., & Zeng, B. (2021a). The association between family function and adolescents' depressive symptoms in China: A longitudinal cross-lagged analysis. *Frontiers in Psychiatry, 12*, 744976. https://doi.org/10.3389/fpsyt.2021.744976.

Wang, H., Wang, X., Geng, J., Zeng, P., Gu, X., & Lei, L. (2021b). Does peer alienation accelerate cyber deviant behaviors of adolescents? The mediating role of core self-evaluation and the moderating role of parent-child relationship and gender. *Current Psychology*. https://doi.org/10.1007/s12144-021-01471-7.

Wang, H., Zhou, X. L., Lu, C. Y., Wu, J., Deng, X. Q., & Hong, L. Y. (2011). Problematic Internet use in high school students in Guangdong province, China. *Plos One, 6*(5), e19660. https://doi.org/10.1371/journal.pone.0019660.

Wang, H. T., Li, H., & Pu, K. H. (2013). Family function and social adaptability of middle school students. *China Journal of Health Psychology, 21*(1), 120–122. https://doi.org/10.13342/j.cnki.cjhp.2013.01.019.

Wang, Q., Peng, S., & Chi, X. (2021c). The relationship between family functioning and internalizing problems in Chinese adolescents: A moderated mediation model. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.644222.

Wang, X. P., & Zhang, J. P. (2004). The formational cause and the educational tactics of "The phenomenon of junior middle school students in grade two." *Journal of Chendu College of Education, 8*(8), 68–70.

Wu, W., Ding, W., Xie, R., Tan, D., Wang, D., Sun, B., & Li, A. W. (2021). Bidirectional longitudinal relationships between maternal psychological control and bullying/victimization among father-absent left-behind children in China. *Journal of Interpersonal Violence*, 08862605211022062. https://doi.org/10.1177/08862605211022062.

Wu, X. S., Zhang, Z. H., Zhao, F., Wang, W. J., Li, Y. F., Bi, L., Qian, Z. Z., Lu, S. S., Feng, F., Hu, C. Y., Gong, F. F., & Sun, Y. H. (2016). Prevalence of Internet addiction and its association with social support and other related factors among adolescents in China. *Journal of Adolescence, 52*, 103–111. https://doi.org/10.1016/j.adolescence.2016.07.012

Xiao, X., Liu, L. S., Xu, L.Y., & Li, Y. F. (2017). Marital conflict, parent-child relationship and adolescents' depression in Chinese only and non-only child family. *Psychological Development and Education, 33*(4): 468–476. https://doi.org/10.16187/j.cnki.issn1001-4918.2017.04.11.

Xu, D.-D., Lok, K.-I., Liu, H.-Z., Cao, X.-L., An, F.-R., Hall, B. J., Ungvari, G. S., Lei, S.-M., & Xiang, Y.-T. (2020). Internet addiction among adolescents in Macau and mainland China: Prevalence, demographics and quality of life. *Scientific Reports, 10*(1), 16222. https://doi.org/10.1038/s41598-020-73023-1

Young, K. S. (1998). Internet addiction: The emergence of a new clinical disorder. *CyberPsychology & Behavior, 11*(1), 237–244.

Yu, L., & Shek, D. T. L. (2013). Internet addiction in Hong Kong adolescents: A three-year longitudinal study. *Journal of Pediatric and Adolescent Gynecology, 26*(3), S10–S17. https://doi.org/10.1016/j.jpag.2013.03.010

Yu, L., Shek, D. T. L., Chak, Y. L. Y., Wu, F. K. Y., & Ngai, J. T. K. (2017a). The role of emotional competence in the relationship between Internet addiction and psychological adjustment among Hong Kong adolescents: A cross-sectional study. *Journal of Behavioral Addictions, 6*, 61–61.

Yu, Q. L., Zhang, L., Wu, S., Guo, Y. F., Jin, S. H., & Sun, Y. (2017b). The influence of juvenile preference for online social interaction on problematic Internet use: The moderating effect of sibling condition and the moderated moderating effect of age cohort. *Computers in Human Behavior, 68*, 345–351. https://doi.org/10.1016/j.chb.2016.11.026

Yu, T.-K., & Chao, C.-M. (2016). Internet misconduct impact adolescent mental health in Taiwan: The moderating roles of internet addiction. *International Journal of Mental Health and Addiction, 14*(6), 921–936. https://doi.org/10.1007/s11469-016-9641-y

Zhang, W. B., Chen, C. M., Zhu, Y., Zhuang, W. X., Zhu, Y. 2. & Cai, J. (2021). Correlation between Internet addiction and life style of junior middle school students in Shanghai. *China Journal of Health Psychology, 29*(02), 282–287. https://doi.org/10.13342/j.cnki.cjhp.2021.02.026.

Zhou, J., Hu, F., Wu, J., Zou, Z. Y., Wang, Y. X., Peng, H. C., Vermund, S. H., Hu, Y. F., & Ma, Y. H. (2018a). Subjective well-being and family functioning among adolescents left behind by migrating parents in Jiangxi province, China. *Biomedical and Environmental Sciences, 31*(5), 382–388. https://doi.org/10.3967/bes2018.049

Zhou, N., Cao, H., Li, X., Zhang, J., Yao, Y., Geng, X., Lin, X., Hou, S., Liu, F., Chen, X., & Fang, X. (2018b). Internet addiction, problematic internet use, nonproblematic internet use among Chinese adolescents: Individual, parental, peer, and sociodemographic correlates. *Psychology of Addictive Behaviors, 32*(3), 365–372. https://doi.org/10.1037/adb0000358

Zhou, N., & Fang, X. Y. (2015). Beyond peer contagion: Unique and interactive effects of multiple peer influences on Internet addiction

among Chinese adolescents. *Computers in Human Behavior, 50*, 231–238. https://doi.org/10.1016/j.chb.2015.03.083