



Longitudinal psychosocial factors related to symptoms of Internet addiction among adults in early midlife



Chenshu Zhang^a, Judith S. Brook^{a,*}, Carl G. Leukefeld^b, David W. Brook^a

^a Department of Psychiatry, New York University School of Medicine, New York, NY 10016, USA

^b Department of Behavioral Sciences, University of Kentucky, Lexington, KY 40506-9983, USA

HIGHLIGHTS

- A conflictual parent-child relationship predicted later symptoms of IA.
- Alcohol/substance use problems had the greatest total effects on symptoms of IA.
- Affective disorders mediated between psychosocial factors and symptoms of IA.

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ABSTRACT

In this longitudinal study, we applied structural equation modeling (SEM) to examine the psychosocial factors from adolescence to adulthood as related to symptoms of Internet addiction (IA) during early midlife. We gathered longitudinal data on a prospective cohort of community-dwelling men and women ($N = 548$) followed from adolescence to early midlife (mean age = 43; $SD = 2.8$). The findings supported a mediational model: adolescent (mean age = 16) conflictual parent-child relationship was associated with internalizing problem behaviors at mean age 21 in emerging adulthood ($b = 0.13$, $p < 0.01$), which, in turn, were associated with both alcohol/drug use problems at mean age 27–32 ($b = 0.24$, $p < 0.001$) and affective disorders at mean age 37 ($b = 0.29$, $p < 0.001$), which, ultimately, were associated with symptoms of IA in early midlife ($b = 0.23$, $p < 0.01$; $b = 0.21$, $p < 0.05$, respectively). In addition, alcohol/drug use problems were associated with affective disorders ($b = 0.22$, $p < 0.05$). Among the constructs, alcohol/drug use problems had the greatest total effects on symptoms of IA in early midlife ($b = 0.28$, $p < 0.001$). Findings suggest that family therapy focused on an increase in the affectionate relationship between the adolescent and his/her parents, cognitive-behavioral treatment of internalizing problem behaviors, and effective treatment of individuals who have alcohol/drug use problems may reduce the likelihood of having symptoms of IA in early midlife.

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1. Introduction

The Internet has dramatically changed the way people obtain information and communicate with others. Internet addiction (IA) (Young, 1998a), also known as problematic Internet use (Spada, 2014) or excessive Internet use (Hardie & Tee, 2007; Morrison & Gore, 2010), appears to be an expanding mental health problem worldwide (Cash, Rae, Steel, & Winkler, 2012; Griffiths, Kuss, Billieux, & Pontes, 2016; Kuss, Griffiths, Karila, & Billieux, 2014; Kuss, Van Rooij, Shorter, Griffiths, & van de Mheen, 2013; Müller, Glaesmer, Brähler, Woelfling, & Beutel, 2014; Young, 2015). The consequences of Internet addiction include physical illness, psychological distress, family/social problems, and low well-being (Cheung & Wong, 2011; Muusses, Finkenauer, Kerkhof, &

Billedo, 2014; Weinstein et al., 2015; Wu et al., 2014; Yuan et al., 2011). In addition, high comorbidity of IA with affective disorders, substance use disorders, attention deficit hyperactivity disorder, and compulsive buying have also been documented (Bozkurt, Coskun, Ayaydin, Adak, & Zoroglu, 2013; Ko, Yen, Yen, Chen, & Chen, 2012; Lee, Han, Kim, & Renshaw, 2013; Müller et al., 2011; Yen, Ko, Yen, Wu, & Yang, 2007; Weinstein et al., 2015).

Young (1998a) developed the first IA screening measure, the Internet Addiction Diagnostic Questionnaire (IADQ), which consisted of 8 items and was adapted from the DSM-IV criteria for pathological gambling. These 8 items included preoccupation, tolerance, withdrawal, loss of control, longer than intended use, functional impairment, denial, and escapism. Young (1998b) also developed the Internet Addiction Test (IAT), which consisted of 20 items that measured mild, moderate, and severe levels of IA. Both IADQ and IAT are reliable and have criterion-related validity (Lai et al., 2013; Jelenchick, Becker, & Moreno, 2012; Pawlikowski, Altstötter-Gleich, & Brand, 2013; Widyanto & McMurren,

* Corresponding author at: Department of Psychiatry, New York University School of Medicine, 215 Lexington Ave., 15th Floor, New York, NY 10016, USA.

E-mail address: judith.brook@nyumc.org (J.S. Brook).

2004; Young, 2015). Young (1998a) found parallels between compulsive gambling and IA.

Since the pioneer work by Young (1998a, 1998b), IA has been widely documented for adolescents and young adults in both Western and Eastern societies (Young, 2015). However, the reported prevalence rates of IA in these studies varied considerably (Shaw & Black, 2008). Using IADQ, Bakken, Wenzel, Götestam, Johansson, and Øren (2009) reported a 1.0% IA rate in a sample of Norwegian adults. In a sample of 1856 Iranian Internet users, 22.8% were found to be addicted to the Internet (Kheirkhah & Gouran, 2010). As of today, the appropriate classification of IA continues to be debated (Kuss et al., 2014). Many researchers consider IA as a behavioral addiction (Kuss et al., 2014; Robbins & Clark, 2015; Villella et al., 2011), because, in many respects, IA shares some features with other behavioral addictions, including pathological gambling (PG) and compulsive buying. Behavioral addictions also share some features with substance use disorders (Robbins & Clark, 2015). The acceptance of IA is evidenced by the recent inclusion of Internet Use Gaming Disorder in Section 1.3 of the DSM-V (American Psychiatric Association, 2013; Block, 2008; Robbins & Clark, 2015; Young, 2015).

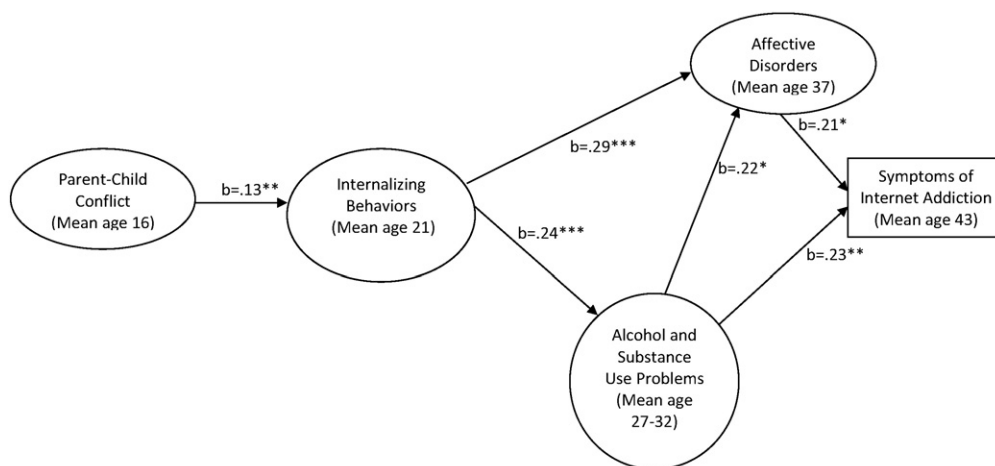
Early midlife is a unique developmental period when the consequences of many physical/mental health problems become more manifest (e.g., Bromberger, Schott, Kravitz, & Joffe, 2015; Case & Deaton, 2015). However, little is known about the etiology of IA among adults in early midlife. Furthermore, to our knowledge, no study has examined the psychosocial pathways from adolescence to early midlife as they relate to IA in early midlife. This study addresses this issue and fills an important research gap in the literature. Our study will aid in the identification of the longitudinal psychosocial factors for symptoms of IA in early midlife. Family Interaction Theory (FIT) was used as the theoretical framework for our study (Brook, Brook, Gordon, Whiteman, & Cohen, 1990). FIT is a multidimensional conceptual model, explaining the development of substance use and addiction over time by postulating a developmental sequence of influences from multiple domains on the individual's behavior. Our model hypothesizes domains and pathways consistent with FIT's premise of a developmental sequence of multi-factorial influences of which the family is paramount. Consistent with FIT and relevant findings in the literature (see below), we hypothesized that the following constructs predict symptoms of IA in early midlife: (1) a conflictual parent-child relationship in adolescence; (2) internalizing behaviors in emerging adulthood (i.e., depressive mood, anxiety, and interpersonal difficulty); (3) alcohol and/or substance use

problems at mean age 27–32, and (4) affective disorders at mean age 37 (i.e., Major Depressive Episode and General Anxiety Disorder). The hypothesized pathways linking these domains are presented in Fig. 1.

A conflictual parent-child relationship in adolescence may, in part, explain why individuals turn to virtual relationships as a substitute in later life for poor parental bonding (Kalaitzaki & Birtchnell, 2014; Hardie & Tee, 2007). The association between the adolescents' conflictual relationship with their parents and later IA may be mediated by other important psychosocial factors (Kalaitzaki & Birtchnell, 2014). According to FIT, children with a conflictual relationship with their parents are less likely to identify with and model parental pro-social behaviors and, therefore, may be at risk for internalizing problem behaviors (Brook et al., 1990). Often beginning in adolescence and extending to adulthood, internalizing problem behaviors are found to be associated with later substance use/problems (Khantzian & Albanese, 2008) and more severe mental health problems (e.g., affective disorders), which, in turn, may be associated with a higher likelihood of IA in early midlife (Ko et al., 2012; Young & Rogers, 1998).

Several studies have reported the positive association between substance use/problems and IA (Fisoun, Floros, Siomos, Geroukalis, & Navridis, 2012; Lee et al., 2013; Ko et al., 2008). However, it is still unclear whether substance use/problems are triggers for IA or vice versa, or whether there is a reciprocal association between IA and substance use/problems. IA and substance use may also serve as expression of other underlying factors or disorders.

Affective disorders, such as depression and anxiety, were noted to be the psychiatric disorders most possibly associated with IA (Ko et al., 2012; Yen et al., 2007). One possible explanation is that dysfunctional coping with problematic or stressful life events contributes to the development of IA (Brand, Laier, & Young, 2014). Another possible explanation of the associations is the self-medication hypothesis (Young & Rogers, 1998), which suggests that IA may act as a form of self-medication among individuals who are depressed or anxious. In addition, the association between substance use/problems and IA (see above) may also, in part, occur via affective disorders. Research has shown that substance use/problems are associated with later depression and anxiety (Volkow, Baler, Compton, & Weiss, 2014). Substance use may influence mood regulation by altering neurotransmitters, such as dopamine, thus resulting in long-term changes in the reward circuitry in the brain and an elevated risk for depression and anxiety. Individuals with elevated depression and anxiety may, in turn, rely on Internet use to at least temporarily gain relief from depression and/or anxiety.



Note: 1. * $p < .05$; ** $p < .01$; *** $p < .001$; 2. RMSEA=.03, CFI=.99; 3. Age and gender were statistically controlled.

Fig. 1. Standardized pathways (z-statistic) to symptoms of Internet addiction in early midlife (mean age = 43; N = 548). Note: 1. * $p < .05$; ** $p < .01$; *** $p < .001$; 2. RMSEA = 0.03, CFI = 0.99; 3. age and gender were statistically controlled.

1.1. Hypotheses

Based on the theoretical framework (i.e. FIT) and the empirical evidence, we hypothesized that: 1) conflictual parent-child relationships in adolescence (mean age = 16) are associated with internalizing problem behaviors at mean age 21 in emerging adulthood; 2) internalizing problem behaviors are associated with both alcohol/drug use problems at mean age 27–32 and affective disorders at mean age 37, which, ultimately, are associated with symptoms of IA in early midlife (mean age = 43); 3) the association between alcohol/drug use problems at mean age 27–32 and symptoms of IA in early midlife, in part, is mediated by affective disorders at mean age 37; and 4) there is a direct association between internalizing problem behaviors and symptoms of IA.

In sum, operating within a life-span developmental perspective, we applied a prospective longitudinal design and followed youngsters in a community sample from adolescence into early midlife. Born in 1970 on average, this cohort of participants had no prior history of Internet use in their childhood and adolescence, because the Internet did not exist at that time. Thus, this cohort of participants provide us with a unique opportunity to study how earlier psychosocial factors are associated with initiating and developing symptoms of a new psychiatric disorder (i.e., IA) at a later developmental period.

2. Methods

2.1. Participants and procedure

The participants were members of a community sample residing in one of two upstate New York counties (Albany and Saratoga) when the sample was selected in 1975, Time 1 (T1). At that time, their mothers were interviewed. At the time the data were collected, the sampled families were generally representative of the population of families in the two upstate New York counties. There was a close match of the participants on family income, maternal education, and family structure with the 1980 Census. With regard to ethnicity, the sample was 90% white. Forty nine percent of the participants were females.

Interviews of both the mothers and participants were conducted in 1983, called Time 2 (T2, N = 756), 1985–1986, Time 3 (T3, N = 739), and in 1992, Time 4 (T4, N = 750). Four more interviews of only the participants were conducted in 1997, Time 5 (T5, N = 749), in 2002, Time 6 (T6, N = 673), in 2005–2006, Time 7 (T7, N = 607), and in 2012–2013, Time 8 (T8, N = 548). Some of the participants who were not interviewed at some of the earlier time waves were interviewed at later waves. The present analysis (N = 548) is based on data from T8 of the longitudinal study. Table 1 presents the detailed history of this longitudinal study.

At T1–T7, extensively trained and supervised lay interviewers administered interviews in private. The T8 data collection involved an Internet-based self-administered questionnaire. Written informed consent was obtained from participants and their mothers in 1983, 1985–1986, and 1992, and from participants only in 1997, 2002, 2005–2006, and 2012–2013. The Institutional Review Board of the New York University School of Medicine authorized the use of human

subjects in this research study. Earlier waves of the study were approved by the Institutional Review Boards of the Mount Sinai School of Medicine and New York Medical College. Additional information regarding the study methodology is available in prior publications (Cohen & Cohen, 1996).

2.2. Measures

2.2.1. Symptoms of Internet addiction (IA) (mean age = 43)

We applied Young's IADQ (1998) to assess symptoms of IA at T8. The participants responded to 8 questions scored on a two-point scale [no (0) and yes (1); Cronbach's $\alpha = 0.91$; Young, 1998a]. Among these 8 items, 5 items relate to the tendency to use the Internet: (1) "Do you feel preoccupied with the Internet?" (2) "Do you feel the need to use the Internet with an increasing amount of time in order to achieve satisfaction?" (3) "Have you repeatedly made unsuccessful efforts to control, cut back, or stop the use of the Internet?" (4) "Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?" and (5) "Do you stay online longer than you originally intended?" There are 3 items that relate to the impairment in the individual's daily functioning due to excessive Internet use: (1) "Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of your use of the Internet?" (2) "Have you lied to family members, a therapist, or others to conceal the extent of your involvement in the Internet?" and (3) "Do you use the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?"

2.3. Affective disorders (mean age = 37)

The latent construct of affective disorders in the late 30s consisted of Major Depressive Episode (MDE) and Generalized Anxiety Disorder (GAD), which were assessed at T7 using adaptations of the respective measures of the University of Michigan Composite International Diagnostic Interview (UM-CIDI) (Kessler et al., 1994). The measures have good predictive validity and test-retest reliability (Wittchen & Kessler, 1994). We adapted these measures to make them consistent with the diagnoses presented in the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV) (American Psychiatric Association, 1994; see Table 2 for the diagnostic criteria for each disorder).

2.4. Other latent constructs

We also hypothesized the following latent constructs: (1) Conflictual parent-child relationship in adolescence (mean age = 16; two manifest variables reported by the participants' mothers, i.e., T3 child resistance to maternal control and T3 child resistance to paternal control [Schaefer & Finkelstein, 1975]; see Table 2 for the items in each scale); (2) Internalizing behaviors in emerging adulthood (mean age = 21; three manifest variables, i.e., T4 depressive mood, T4 anxiety, and T4 interpersonal difficulties [Derogatis, 1994]); (3) Alcohol and substance use problems at mean age 27–32 (two manifest variables, i.e., T5 alcohol and substance use problems and T6 alcohol and substance use problems [Original]; see Table 2 for the complete set of

Table 1
History of data collection.

Time Wave	Year of data collection	Sample Size	Mean age (standard deviation)	Male percentage
Time 1 (T1)	1975 (childhood)	973	5.0 (2.8)	51.1%
Time 2 (T2)	1983 (adolescence)	756	14.1 (2.8)	49.6%
Time 3 (T3)	1985–1986 (late adolescence)	739	16.3 (2.8)	50.0%
Time 4 (T4)	1992 (emerging adulthood)	750	22.3 (2.8)	49.6%
Time 5 (T5)	1997 (late 20s)	749	27.0 (2.8)	50.1%
Time 6 (T6)	2002 (early 30s)	673	31.9 (2.8)	47.4%
Time 7 (T7)	2005–2006 (late 30s)	607	36.6 (2.8)	45.6%
Time 8 (T8)	2012–2013 (early midlife)	548	43.0 (2.8)	45.0%

Table 2
Complete items for selected scales (or diagnoses).

Child resistance to maternal control (adolescence; mean age = 16) (Schaefer & Finkelstein, 1975) ^b
1. Does your child do what (he/she) wants to instead of what you tell (him/her)?
2. Does your child often break your rules?
3. Does your child try to see what (he/she) can get away with?
4. Does your child seldom follow your orders unless you insist?
5. Does your child seldom obey you unless you keep after (him/her)?
Alcohol and substance use problems (mean age = 27) ^a
1. How often had you had trouble at school or on the job/work because of your use of alcohol or drugs?
2. How often had you drove unsafely because of your use of alcohol or drugs?
3. How often had you had arguments/fights with family/friends because of your use of alcohol or drugs?
4. How often had you had trouble with the police because of your use of alcohol or drugs?
5. How often had you become depressed or lost interest in things because of your use of alcohol or drugs?
6. How often had you had health problems because of your use of alcohol or drugs?
7. How often had you got less work done than usual at school or on the job because of your use of alcohol or drugs?
Major depressive episode (mean age = 37) (American Psychiatric Association, 1994; Kessler et al., 1994)
Diagnosis: At least 5 of the following symptoms, including 1 and/or 2, must have been present during a period in the past 5 years:
1. Consistently depressed or down most of the day, nearly every day.
2. Markedly diminished interest or pleasure in all, or almost all, activities.
3. Significant weight loss when not dieting or weight gain.
4. Hypersomnia or insomnia nearly every day.
5. Psychomotor agitation or retardation.
6. Feeling tired nearly every day.
7. Feeling worthlessness or inappropriate guilt.
8. Problems concentrating.
9. Recurrent thoughts about death.
Generalized Anxiety Disorder (Mean age = 37) (American Psychiatric Association, 1994; Kessler et al., 1994)
Diagnosis: Criterion A and at least 5 of the following symptoms, including 1 and 2, must have been present during a 6-month period in the past 5 years:
A. Within the last 5 years, have you ever had a period lasting 6 months or more when you would worry excessively or were anxious about several things?
1. During this period of 6 months or more, were these worries present most days?
2. Was it difficult to control the worries or the worries interfered with your ability to focus on what you were doing?
3. During this period of 6 months or more in which you were anxious, did you most of the time...
a. Feel restless.
b. Feel tired or weak.
c. Feel tense.
d. Feel irritable.
e. Have sleep problems.
f. Difficulty concentrating.

Note:

^a The same items were also assessed for alcohol and substance use problems (mean age = 32).

^b The same items were also assessed for child resistance to paternal control (adolescence; mean age = 16).

Table 3
Psychosocial scales, number of items, sample items, and Cronbach's alpha.

Scale	Number of items	Sample item	Cronbach's alpha
Dependent variable			
Symptoms of Internet addiction (mean age = 43)	8	Do you feel preoccupied with the Internet?	0.70
Independent latent constructs and manifest variables			
Conflictual parent-child relationship (mean age = 16)			
Child resistance to maternal control	5	Does your child do what (he/she) wants to instead of what you tell (him/her)?	0.90
Child resistance to paternal control	5	Does your child do what (he/she) wants to instead of what his/her father tells (him/her)?	0.88
Internalizing behaviors (mean age = 21)			
Depressive mood	5	Over the last few years, how much were you bothered by feeling low in energy or slowed down?	0.78
Anxiety	4	Over the last few years, how much were you bothered by feeling fearful?	0.68
Interpersonal difficulty	6	Over the last few years, how much were you bothered by feeling easily annoyed or irritated with other people?	0.79
Alcohol and substance use problems (mean age = 27–32)			
Alcohol and substance use problems (mean age = 27)	7	How often have you had trouble with the police because of your use of alcohol or drugs?	0.79
Alcohol and substance use problems (mean age = 32)	7	How often have you had trouble with the police because of your use of alcohol or drugs?	0.85
Affective disorders (mean age = 37)			
Major Depressive Episode (MDE)	9	During the past five years, has there been a time during which you have been consistently depressed or down most of the day, nearly every day, for at least two weeks in a row?	N.A.
Generalized Anxiety Disorder (GAD)	8	During the past five years, have you ever had a period lasting six months or more when you worried excessively or were anxious about several things most of the days?	N.A.

items). Table 3 presents the sample questions, number of items, and the Cronbach's alpha for each manifest variable cited above.

2.5. Data analysis

There were no statistically significant differences between participants included in the analyses ($N = 548$) and those who did not participate ($N = 208$) with respect to T2 age and family socioeconomic status (SES, e.g. parental educational level and income of the family of origin). However, there was a greater percentage of female participants (55.1% vs. 39.9%; $\chi^2(1) = 14.72$, p -value < 0.001) among participants who were included in the analyses, as compared to those who did not participate.

A latent variable structural equation model (SEM) was used. To have more statistical power, we used the mean of the 8 items for symptoms of IA as the dependent variable in the present SEM analysis. To account

for the influences of the participant's gender and age at T8, we used a partial correlation matrix as the input matrix (see Table 4 for the partial correlation matrix). This was created by statistically partialing out (removing the effect of) the baseline measure of the variables cited above on each of the original manifest variables in the present analyses. Our proposed model was estimated using Mplus (Muthén & Muthén, 2010). The Mplus (Muthén & Muthén, 2010) default option was used (i.e., full information maximum likelihood approach; FIML) to treat missing data. The advantage of FIML is that the results are less likely to be biased even if the data are not missing completely at random (Muthén, Kaplan, & Hollis, 1987). To account for the non-normal distribution of the model variables, we used the Mplus maximum likelihood with robust standard errors (MLR) as the estimator. We chose two fit indices to assess the fit of the models: (1) the root mean square error of

Table 4
Partial Pearson's correlation matrix.

	Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8	Var9	Var10
Var1	1.0									
Var2	0.12**	1.0								
Var3	0.19***	0.37***	1.0							
Var4	0.18***	0.08	0.18***	1.0						
Var5	0.26***	0.06	0.17***	0.60***	1.0					
Var6	0.17***	0.17***	0.18***	0.14***	0.13***	1.0				
Var7	0.11*	0.13**	0.21***	0.17***	0.13**	0.71***	1.0			
Var8	0.15***	0.20***	0.18***	0.19***	0.19***	0.76***	0.74***	1.0		
Var9	0.08	0.07	0.08	0.02	0.11*	0.10*	0.03	0.12**	1.0	
Var10	0.12**	0.05	0.06	0.01	0.09*	0.12**	0.04	0.10*	0.73***	1.0

Note:

Var1 = symptoms of Internet addiction (mean age = 43); Var2 = major depressive episode (mean age = 37); Var3 = generalized anxiety disorder (mean age = 37); Var4 = alcohol and substance use problems (mean age = 27); Var5 = alcohol and substance use problems (mean age = 32); Var6 = depressive mood (mean age = 21); Var7 = anxiety (mean age = 21); Var8 = interpersonal difficulty (mean age = 21); Var9 = child resistance to maternal control (mean age = 16); Var10 = child resistance to paternal control (mean age = 21).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

approximation (RMSEA) and (2) Bentler's comparative fit index (CFI) (Bentler, 1990). Values between 0.90 and 1.0 on Bentler's CFI and values below 0.10 on the RMSEA indicate that the model provides a good fit to the data (Kelloway, 1998). We also calculated the standardized total effects, which equal the sum of the direct and the indirect effects of each latent or manifest variable estimated in the analysis on the dependent variable.

In addition, for comparison, we also used the indicator variable for IA as the dependent variable in the SEM analyses. While there is continued discussion of the appropriate cutoff score (e.g., 3 criteria or 5 criteria) in diagnosing IA (Dowling & Quirk, 2009; Young, 2015), as suggested by Dowling and Quirk (2009), the cutoff criterion score of 3 was used in diagnosing IA.

3. Results

3.1. Descriptive statistics

Table 6 presents the response ranges, means, and standard deviations of the dependent, independent, and control variables used in the SEM analyses. In the sample, 5.9% ($n = 32$) reported having 3 or more

of the 8 IA symptoms; 1.8% ($n = 10$) reported having 5 or more symptoms.

The SEM results using the indicator variable for IA (3 symptoms or more) were not appreciably different from the results of using the mean score of IA. We present the results from using the mean score.

3.2. Path analyses

For the measurement model, all factor loadings were significant ($p < 0.001$), showing that the indicator variables were satisfactory measures of the latent constructs (see Table 5 for the factor loadings). The RMSEA and the Bentler's CFI were 0.03 and 0.99, respectively, reflecting a satisfactory model fit. The obtained path diagram along with the standardized regression coefficients are depicted in Fig. 1.

Table 5
SEM Model: standardized factor loadings.

	Factor1	Factor2	Factor3	Factor4	Factor5
Var1	1.0				
Var2		0.51***			
Var3		0.71***			
Var4			0.72***		
Var5			0.84***		
Var6				0.85***	
Var7				0.83***	
Var8				0.90***	
Var9					0.85***
Var10					0.86***

Note:

1. Var1 = symptoms of Internet addiction (mean age = 43); Var2 = major depressive episode (mean age = 37); Var3 = generalized anxiety disorder (Mean age = 37); Var4 = alcohol and substance use problems (mean age = 27); Var5 = Alcohol and substance use problems (mean age = 32); Var6 = depressive mood (mean age = 21); Var7 = anxiety (mean age = 21); Var8 = interpersonal difficulty (mean age = 21); Var9 = child resistance to maternal control (mean age = 16); Var10 = child resistance to paternal control (mean age = 21);

2. Factor1 = symptoms of Internet addiction (mean age = 43); Factor2 = affective disorders (mean age = 37); Factor3 = alcohol and substance use problems (mean age = 27–32); Factor4 = internalizing behaviors (mean age = 21); Factor 5 = conflictual parent-child relationships (mean age = 16);

*** $p < 0.001$.

Table 6

Descriptive statistics of the dependent, independent, and control variables ($N = 548$).

Variables	Coding	Mean (SD) or %
Symptoms of Internet addiction (mean age = 43)	No (0)–yes (1)	0.08 (0.13)
Affective disorders (mean age = 37)		
◦ Major Depressive Episode (MDE)	No (0)–yes (1)	13%
◦ Generalized Anxiety Disorder (GAD)	No (0)–yes (1)	12%
Alcohol and substance use problems (mean age = 27–32)		
◦ Alcohol and substance use problems (mean age = 27)	Once or never (1)–five times or more (4)	1.31 (0.49)
◦ Alcohol and substance use problems (mean age = 32)	Once or never (1)–five times or more (4)	1.25 (0.46)
Internalizing behaviors (mean age = 21)		
◦ Depressive mood	Not at all (1)–extremely (5)	2.12 (0.70)
◦ Anxiety	Not at all (1)–extremely (5)	2.14 (0.71)
◦ Interpersonal difficulty	Not at all (1)–extremely (5)	2.08 (0.66)
Conflictual parent-child relationship (mean age = 16)		
◦ Resistance to maternal control	Not at all like my child (1)–very much like my child (4)	1.77 (0.7)
◦ Resistance to paternal control	Not at all like my child (1)–very much like my child (4)	1.64 (0.66)
Control variables		
Age	Years	43 (2.8)
Gender	Female (0)–male (1)	45% (male)

Table 7

Standardized total effects (z-statistic) and indirect effects (z-statistic) of independent latent constructs on symptoms of internet addiction in early midlife (mean age = 43; N = 548).

Independent constructs	Standardized total effects (z-Statistic)	Standardized indirect effects (z-Statistic)
Conflictual parent-child relationship (Mean age = 16)	0.02 (2.08)*	0.02 (2.08)*
Internalizing behaviors (mean age = 21)	0.13 (3.78)***	0.13 (3.78)***
Alcohol and substance use problems (mean age = 27–32)	0.28 (3.87)***	0.05 (1.72)
Affective disorders (mean age = 37)	0.21 (2.54)*	Not applicable

Note: 1. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

2. Age and gender were statistically controlled.

The results partially supported our major hypotheses. Specifically, adolescent (mean age = 16) conflictual parent-child relationship was associated with internalizing problem behaviors at mean age 21 in emerging adulthood ($b = 0.13$, $p < 0.01$). This, in turn, was associated with both alcohol/drug use problems at mean age 27–32 ($b = 0.24$, $p < 0.001$) and affective disorders at mean age 37 ($b = 0.29$, $p < 0.001$). Alcohol and substance use problems were associated with symptoms of IA in early midlife ($b = 0.23$, $p < 0.01$) and affective disorders were associated with symptoms of IA ($b = 0.21$, $p < 0.05$). In addition, alcohol/drug use problems were associated with affective disorders ($b = 0.22$, $p < 0.05$). The direct association between internalizing problem behaviors in emerging adulthood and symptoms of IA in early midlife was not statistically significant ($b = 0.05$, $p = 0.95$; data not shown in the figure).

3.3. Standardized total effects and indirect (mediation) effects

Table 7 presents the results of the total effects analyses. As shown in Table 7, each of the latent constructs had significant total effects ($p < 0.05$) on symptoms of IA in early midlife. Among the constructs, alcohol/drug use problems had the greatest total effects on symptoms of IA in early midlife ($b = 0.28$, $p < 0.001$). There was a significant mediational effect from internalizing behaviors in emerging adulthood on symptoms of IA via later alcohol/drug use problems and affective disorders ($b = 0.13$, $p < 0.001$).

4. Discussion

To our knowledge, this is the first longitudinal study to examine the psychosocial factors from adolescence to adulthood as related to symptoms of IA in early midlife. In contrast to prior mostly cross-sectional studies, this study included prospective data spanning six time points collected over the course of nearly 30 years. In accord with the results of studies on risk and resilience factors for IA (Kuss et al., 2014; Young, 2015), our research emphasized the roles played by social factors and psychological factors. More specifically, our investigation mapped a longitudinal sequence from early parent-child relationships to later internalizing behaviors, substance use problems, and affective disorders, which, ultimately, are associated with symptoms of IA in early midlife.

Consistent with FIT, a conflictual parent-child relationship in adolescence has a significant total effect on an individual's symptoms of IA in early midlife, such that individuals who had a greater conflictual parent-child relationship in adolescence may have more symptoms of IA in early midlife. In accord with FIT, the findings illuminate some of the mechanisms (i.e., later internalizing behaviors, substance use problems, and affective disorders) by which the earlier family relationship is related to symptoms of IA in early midlife. Internalizing behavior was an important mediator along this developmental pathway. It not only predicted more substance use problems, but also, a higher likelihood

of affective disorders in adulthood, which in turn, are related to symptoms of IA in early midlife. These findings are consistent with the results of Kalaitzaki and Birtchnell (2014), who found that early parental bonding had an indirect impact on adult IA, through mediators such as sadness in later life.

In accord with Lee et al. (2013), we found that among the latent constructs, substance use problems had the greatest total effects on symptoms of IA in early midlife. The evidence from studies of neurobiology suggests that IA is similar in its neurocircuitry to other addictions such as substance use disorders. Hong et al. (2013) found that male adolescents with IA have significantly decreased cortical thickness in the right lateral orbitofrontal cortex (OFC). The OFC is also considered as the most implicated frontal cortical areas in drug addiction (Volkow & Fowler, 2000). Kim et al. (2011) found that individuals with IA showed reduced levels of dopamine D2 receptors availability in subdivisions of the striatum. Similarly, reductions in dopamine D2 receptors have been observed in individuals addicted to cocaine, marijuana, or alcohol (Volkow, Fowler, Wang, Baler, & Telang, 2009). The development of an addictive syndrome, therefore, may place people with the syndrome at increased risk for their continuing addictive behaviors and for developing new addictive behaviors (Shaffer et al., 2004). Therefore, it is possible that both drug use and IA activate similar reward mechanisms, which involve immediate relief of stress, anxiety, and depression. Despite these possibilities, at present, the etiology of IA is not known, although as with other complex behavioral disturbances, it may have contributions from developmental, neurobiological, and cultural factors.

The association between earlier substance use problems and later symptoms of IA was partially mediated via its association with a higher likelihood of affective disorders. In this study, the latter served as the most proximal factor to symptoms of IA. The comorbidity between IA and a variety of psychiatric disorders, including depression and social anxiety has been widely documented (Bozkurt et al., 2013; Ko et al., 2012; Morrison & Gore, 2010; Weinstein et al., 2015; Young & Rogers, 1998). For example, Bozkurt et al. (2013) found high rates of psychiatric comorbidity, particularly behavioral, anxiety and mood disorders, in young people with IA. It is possible that affective disorders, such as depression, provoke and push an individual to reduce tension. Relief from this tension thus becomes a primary motivation for symptoms of IA.

4.1. Limitations

Some limitations should be noted. First, the present study relies on self-reported measures, which may be problematic in terms of their reliability and validity. However, many of the measures are reliable and have predictive validity. Second, earlier measures of symptoms of IA were not available. Third, this study is limited because the sample was comprised of predominantly white participants. Therefore, the findings may not be generalizable to racial/ethnic minority groups or individuals living in other parts of the country. Future research should examine the pathways in more diverse populations. Fourth, the construct of symptoms of IA consisted of one manifest variable. The study would benefit from multiple manifest variables. In addition, we only have information on generalized symptoms of IA, which cover a broad range of Internet-related activities. According to Montag et al. (2015), there exist distinct forms of specific IA, such as online gaming and pornography viewing. Future research should examine the potentially different pathways to generalized IA vs. specific IA. Fifth, some participants were lost due to attrition. Had these nonparticipants been included in the analyses, it might have resulted in greater variability, which may have strengthened the results. Sixth, IA is a relatively new phenomenon. Particularly, the pathway from earlier alcohol/substance use problems to later symptoms of IA might be an artifact due to the historical development of the Internet. If the availability of the Internet to the adolescent participants (born in 1970s) had been as it is today, it might well be that some individuals would have used the Internet excessively instead of (or before) using alcohol or drugs.

5. Conclusions

Despite these limitations, the results of this research emphasize the significance of taking a lifespan perspective when identifying the predictors of symptoms of IA. Our results are consistent with FIT which emphasizes the mediators between conflictual parent-child relationships and symptoms of IA. The mediators in this study include internalizing problem behaviors, alcohol/drug use problems, and affective disorders.

From an intervention perspective, family therapy focused on an increase in the affectionate relationship between the adolescent and his/her parents, cognitive-behavioral treatment of internalizing problem behaviors, and the effective treatment of individuals who have alcohol/drug use problems may reduce their likelihood of having symptoms of IA in early midlife.

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Contributors

Each of the authors certifies that the present submission represents valid work to which they substantially contributed. Dr. Chenshu Zhang conducted the statistical analysis, interpretation of results, creation of the figure and tables, and contributed to the writing of the article. Dr. Judith S. Brook contributed to the research design, writing, editing, and review of the article. Dr. Carl Leukefeld contributed to the writing, editing, and interpretation of the results and analysis. Dr. David W. Brook contributed to the research design, and the writing and editing of the article.

Conflict of interest

The authors have no conflicts of interest to report.

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