Internet addiction patterns of rural Chinese adolescents: Longitudinal predictive effects on depressive symptoms and problem behaviors

Yadong Sun, Jingjin Shao, Jiamei Li and Yue Jiang

Abstract
Few studies have systematically investigated the internal heterogeneity of internet addiction to determine the longitudinal predictive effects on depressive symptoms and problem behaviors, especially among the rural adolescents. Via two waves of data collection, this study conducted a survey among 1,194 rural adolescents in China ($M_{age} = 14.53$, $SD = 0.72$). A latent profile analysis was conducted to explore the various patterns of behaviors and influential factors of internet addiction. These results were then used to predict the probability of depressive symptoms and problem behaviors. The findings are as follows: (1) According to the behavioral patterns uncovered, internet addiction among rural adolescents can be divided into four subgroups: normal internet use (41%), low internet addiction (39%), high internet addiction (9%), and overuse of online games (11%). (2) The distribution of internet addiction patterns among rural adolescents were significantly correlated with gender, deviant peer affiliation, and parental alienation. (3) Adolescents in the high internet addiction and overuse of online game categories generally had more depressive symptoms and problem behaviors than those in the normal-use category. These findings indicate considerable heterogeneity in internet addiction among rural adolescents in China. Specifically, gender, deviant peer affiliation, and parental alienation are the risk factors for the internet-addiction profiles.

Keywords
internet addiction, latent profile analysis, depressive symptoms, problem behaviors, longitudinal research

Received 29 August 2021; accepted 14 May 2022

Introduction
The popularity of the Internet has brought great convenience to both industries and consumers’ lives. However, internet addiction, especially among adolescents, has become an increasingly serious problem globally. Research has revealed that long-term internet addiction can lead to mental health issues, such as depressive symptoms and problem behaviors (Spada, 2014). Existing studies on internet addiction have mainly focused on urban Chinese adolescents (Pan et al., 2018; Wu et al., 2018), and research on internet addiction among rural Chinese adolescents is limited. However, a study on internet addiction among adolescents in South Korea showed that the tendency of internet addiction among rural adolescents was significantly higher than that of urban adolescents (Kim, 2011). Gur et al. (2015) also found that internet addiction among rural adolescents in Turkey was at a medium level. Rural adolescents differ from their urban counterparts in terms of limited recreational activities, monotonous lifestyles, and insufficient parental supervision, which increase the likelihood of internet addiction (Zheng, 2016). Moreover, past studies have mostly used variable-centered research methods and rarely explored the internal heterogeneity of internet addiction among rural adolescents or differences between subgroups. However, as a method to identify high-risk individuals effectively, intervention measures proposed by person-
centered research methods are more targeted. For example, Wartberg and others (2015) explored the prevalence of internet addiction among German adolescents by conducting a latent profile analysis of the German version of CIUS. A study on internet addiction among Iranian middle school students also found three categories with different response tendencies (low internet addiction risk group and high internet addiction risk group (Lin et al., 2018)). Therefore, it is more valuable to use person-centered research methods to explore the internet addiction of rural adolescents. This study chose rural adolescents as the target of research. However, the Chinese rural teenagers in this study are teenagers in school. Because of the high mobility of Chinese dropout teenagers, it is impractical to carry out effective follow-up research, and the heterogeneity of internet addiction was investigated to explore the influential factors, which were assumed to be based on two important micro-systems—family and peers. The investigation was further expanded to the role of internet addiction in predicting depressive symptoms and problem behaviors the year after the first survey.

Internet addiction among rural adolescents

Internet addiction has been found to negatively affect interpersonal communication as well as physical and mental health (Block, 2008); it may also lead to reduced academic performance among adolescents (Zhang & Li, 2011) while hindering their personality development (Ge, Deng, & Ji, 2018). There is evidence that internet addiction may damage brain structure and function in adolescents (Ge et al., 2016), and negatively affect individual’s attention, memory, knowledge, and social cognition to varying degrees (Firth et al., 2019). The growing awareness of this condition led to the inclusion of Internet Gaming Disorder (IGD) into the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA, 2013). Mak et al. (2014) tested Chinese adolescents using the Internet Addiction Test (IAT) and found that the detection rate of internet addiction is only as high as 10%. As the internet penetration rate in rural areas continues to increase, rural adolescents are provided more convenient conditions and technology to access the Internet. As such, the issue of internet addiction among rural adolescents has begun to attract increasing attention.

There are approximately 287 million young internet users in China, of which rural young internet users account for 27.6% (China Internet Network Information Center, 2015)—their number is estimated at nearly 80 million. In view of the universality of and harm caused by internet addiction, it is necessary to conduct in-depth research on the influential factors and adverse effects of internet addiction among rural adolescents.

Previous studies on internet addiction have mostly used variable-centered research methods, ignoring the heterogeneity within the adolescent group. Specifically, it is yet to be determined whether some rural adolescents suffer more from internet addiction than others. Therefore, this study utilized latent profile analysis (LPA), a person-centered approach, to explore the similarities and differences between individuals as well as the interrelationships between variables (Masyn, 2013). LPA is considered to address some of the limitations of variable-centered methods, such as identifying distinct subgroups of individuals (Masyn, 2013). In addition, measures extracted at the individual level usually have greater practical value. Although several studies on internet addiction have used person-centered approaches to examine different subgroups among corresponding adolescents, they have either concentrated on a specific type of addiction, such as excessive Facebook or video game use (Faulkner et al., 2015; Moreau et al., 2015), or aimed to identify a high-risk group for pathological internet use (Wartberg et al., 2015). There is a need to determine the patterns of internet addiction in general. To the best of our knowledge, this is the first study to employ a person-centered approach to identify the impact of internet addiction on various adolescent subgroups in China. Since existing studies (Faulkner et al., 2015; Moreau et al., 2015; Wartberg et al., 2015) have identified distinct profiles for specific types of internet addiction, this study assumed that there are heterogeneous subgroups with varied behavioral patterns among rural adolescents that suffer from internet addiction.

Potential factors in internet addiction profiles

Another important issue is the need to elucidate the roles of some potential factors in the different patterns of internet addiction in rural adolescents. Wichstrøm and others (2018) suggested that a comprehensive model of online game addiction should include demographic variables, parental factors, and peer factors. This provides an effective reference for us to investigate a comprehensive model of internet addiction. Moreover, it is of greater practical value to investigate the risk variables of adolescent internet addiction for protecting adolescents from the influence of internet addiction. Theorists have proposed that individual factors (e.g., gender) and microsystem risk factors (e.g., parental alienation, deviant peers) are important contributing factors for youth psychopathologies such as internet addiction (Fumero et al., 2018; Kushner & Kushner, 2015). Men have been found to be more prone to internet addiction than women (Li et al., 2014; Zhou et al., 2011). Li et al. (2014) found that the detection rate of internet addiction among males was 14.8% of their total sample population, which was significantly higher than that among females (7.0%). However, other studies found no gender differences in the propensity for internet addiction.
Internet addiction thus directly increases the likelihood of developing internet addiction and manifesting internet addiction behaviors. Existing studies (Li et al., 2016; Zhu et al., 2015) have found that deviant peer affiliation, therefore, a risk factor in internet addiction. In addition, peer pressure in favor of internet use is a key risk factor for adolescents, which increases the propensity to internet addiction (Zhou & Fang, 2015). Therefore, this study assumed that the internet addiction profiles among rural adolescents are related to deviant peer affiliation.

Internet addiction profiles: Depressive symptoms and problem behaviors

The impact of internet addiction on psychosocial adjustment has received increasing research focus in recent years. Important indicators of psychosocial adjustment include depressive symptoms and problem behaviors. Carli and others (2013) reviewed the relationship between IAD and psychopathology, and found that depression is one of the major comorbidities of internet addiction. Furthermore, internet addiction may trigger or exacerbate depressive symptoms among adolescents. When adolescents face life hurdles, they tend to seek social support, psychological satisfaction, and a sense of accomplishment through the Internet (Ko et al., 2009). Past studies have confirmed that online behaviors involving self-presentation can facilitate the acquisition of positive feedback and effectively reduce the severity of depressive symptoms among adolescents (Wang et al., 2014; Xie, Lei, & Niu, 2016). However, the Internet is a “double-edged sword,” as excessive use of the Internet significantly reduces communication with relatives and friends, thus affecting interpersonal relationships. Adolescents may lack social support in daily life and have a tendency to relapse into depressive symptoms (Kraut et al., 1998). In addition, the negative emotions, social comparisons, sleep disorder, and the envy triggered by content on the Internet indirectly increases the severity of depressive symptoms among adolescents (Alimordi et al., 2019; Lian et al., 2017).

Internet addiction may also lead to more problem behaviors among adolescents, who are yet to develop the ability to sufficiently apply self-control. Violent content on the Internet may, therefore, trigger deviant online behaviors for adolescents, which has a priming effect on problem behaviors in everyday life (Wang et al., 2010). Adolescents with a lack of self-control may face difficulties in effectively managing their own behavior, thereby manifesting undesirable behaviors. Sung et al. (2013) asserted that the more severe the internet addiction, the greater the probability of problem behaviors (e.g., smoking, drug abuse, and early sexual intercourse) developing among adolescents. Zhang et al. (2014) also found that the severity of internet addiction is positively correlated to physical aggression, indirect aggression, and violation of regulation.
and controls among adolescents. In addition, studies on online game addiction have found that disruptive behavior disorder, as a comorbidity of online game addiction, is the most frequently diagnosed disease among online game addiction patients with lower prosocial behavior and higher aggression (Wichström et al., 2018).

Thus, internet addiction may have immediate and long-term effects on the tendency to develop/manifest depressive symptoms and problem behaviors. However, existing studies in the field are mostly cross-sectional, and studies that explore the causal relationship between internet addiction, depressive symptoms, and problem behaviors are insufficient. Even fewer studies have explored such effects of internet addiction on rural adolescents. Therefore, determining the longitudinal impact of internet addiction on the development of depressive symptoms and problem behaviors among rural adolescents is an important supplement to the current research on internet addiction and its related problems in China (Li & Li, 2017). Therefore, in this study, it was assumed that rural adolescents with indications of high internet addiction are more likely to demonstrate more severe depressive symptoms and problem behaviors.

**The present study**

A person-centered research method was adopted to explore the heterogeneity of internet addiction among rural adolescents to identify subgroups with specific and generalizable behavioral patterns. Ecological system theory was referred to in systematically analyzing the roles of gender, parental alienation, and deviant peer affiliation in predicting internet addiction profiles and their influence on each internet addiction subgroup. Finally, a longitudinal research design was adopted to examine the relationship between internet addiction profiles and depressive symptoms and problem behaviors in the following year. The hypotheses are as follows:

**H1:** There are heterogeneous internet addiction behavioral patterns among rural adolescents in China.

**H2:** Compared to girls, boys would be more likely to correspond to profiles characterized by higher levels of internet addiction in rural China.

**H3:** Compared to adolescents with low levels of parental alienation, adolescents with high levels of parental alienation would be more likely to correspond to profiles characterized by higher levels of internet addiction in rural China.

**H4:** Compared to adolescents with low levels of deviant peer affiliation, adolescents with high levels of deviant peer affiliation would be more likely to correspond to profiles characterized by higher levels of internet addiction in rural China.

**H5:** Rural adolescents with high internet addiction are more likely to demonstrate depressive symptoms and problem behaviors the following year.

**Methods**

**Participants**

The data used in this study were obtained from the second and third waves of an ongoing longitudinal study exploring the psychological adjustment of rural adolescents in China. The participants were recruited from six rural middle schools from four provinces in central China (Henan, Shanxi, Sichuan, and Guizhou) using cluster sampling. The first survey (T1) was conducted in April 2017 with 1,420 participants, and the second survey (T2) was conducted one year later, April 2018. Two hundred twenty-six participants from T1 did not participate in T2; therefore, the final sample included 1,194 participants, among which 541 were males (45.31%) and 653 were females (54.69%). The average age was 14.53 years (SD = 0.72). All participants were from two-parent families, and none suffered chronic or acute diseases. Most of the parents of the sample students were manual workers (e.g., construction workers) and farmers. An independent sample t-test was performed on the main variables of T1 and T2, and the results showed that the missing samples had no apparent effect on the overall study ($p > .05$).

**Procedures**

The research protocols were approved by the Research Ethics Committee of the corresponding author’s institution. Prior to initiation of the study, all students and their guardians were informed that their participation was completely voluntary and that they had the right to opt out at any time. Informed consent was obtained from all the subjects and their guardians at each data collection phase. Data were collected by the group, with the survey administered in the participants’ classrooms at a prearranged time. Trained research assistants guided the administration with standardized instructions. The entire survey lasted approximately 40 min., and the participants received a small gift upon completion of the questionnaire.

**Measures**

**Internet addiction.** At T1, 10 items adapted from Young’s (1996) Internet Addiction Diagnostic Questionnaire (Li et al., 2010) were used to measure internet addiction. The questionnaire contained 10 items (e.g., “Do you feel the need to use the Internet for an increasing time to achieve satisfaction?”). A six-point Likert scale was used to rate the items ($1 = $totally disagree, $6 = $totally agree).
A higher rating indicated more severe internet addiction. The internal consistency coefficient ($\alpha$) of the questionnaire was 0.89.

**Parental alienation.** At T1, the “parent attachment scale” of the simplified version (Wang, 2007) of the Inventory of Parent and Peer Attachment Scale (Armsden and Greenberg, 1987) was used to measure the relationship between the participants and their parents. The scale involved for items (e.g., “I don’t get much attention from my father/mother”). A five-point Likert scale was used to rate the items (1 = totally disagree, 5 = totally agree). A higher rating indicated greater parental alienation. The internal consistency coefficient ($\alpha$) of the questionnaire was 0.84.

**Deviant peer affiliation.** At T1, the Adolescent Deviant Peer Affiliation Scale (Li et al., 2013a) was used to measure the proportion of the participants’ friends that had engaged in deviant behaviors in the past 12 months. The scale included eight items which measured deviant behaviors such as drinking, stealing, and truancy. A five-point Likert scale was used to rate the items (1 = none, 5 = almost all). A higher rating indicated a greater proportion of peers with deviant behaviors. The internal consistency coefficient ($\alpha$) of the questionnaire was 0.81.

**Problem behavior.** The Child Problem Behavior Scale (Shen, 2009) was used to assess participants’ engagement in problem behaviors over the preceding year. The scale included 12 items adapted from the Children Behavior Checklist (Achenbach & Edelbrock, 1987; Fang & Li, 1996). Examples of problem behavior included “truancy” and “stealing.” Participants were required to indicate their agreement with the statement using a four-point scale (1 = never, 4 = frequently). A higher rating indicated that the participant had more frequent problem behaviors. The internal consistency coefficients ($\alpha$) of the questionnaire were 0.81 and 0.69.

**Depressive symptoms.** The Depression Self-rating Scale for Children, developed by Birleson (1981) and revised by Su et al. (2003), was used to measure the level of depressive symptoms of the participants. The revised scale has been proven to have good reliability and validity among Chinese participants. The scale has 18 items (e.g., “I think life isn’t worth living” and “I feel so sad I can hardly stand it”). A three-point Likert scale was used to rate each item (0 = never, 1 = sometimes, and 2 = mostly). A higher rating indicated more severe depressive symptoms. The internal consistency coefficients ($\alpha$) of the questionnaire were 0.76 and 0.77.

**Data analysis**

Mplus 7.4 was employed for the LPA. The data analysis involved three steps: First, the LPA was performed for internet addiction for all participants. The initial model assumed that only one category existed in the sample. Then, the number of categories was gradually increased until an optimal fit was achieved. The following indices were selected to evaluate the models with an increasing number of profiles (Nylund, Asparouhov, & Muthén, 2007): Akaike information criterion (AIC), Bayesian information criterion (BIC), sample-size adjusted BIC (a-BIC), Lo–Mendell–Rubin likelihood ratio test (LMRLRT), and entropy. Next, a robust three-step method was used to establish a regression mixed model, and the latent profiles obtained in the first step were used as dependent variables. Gender, deviant peer affiliation, and parental alienation were used as independent variables and SES was used as a control variable. The goal was to illustrate the impact of these independent variables on the latent profiles. In the third step, a BCH method was used to establish a regression mixed model, and the internet addiction profiles were used as independent variables. Depressive symptoms and problem behaviors were used as dependent variables, and gender and SES were used as the control variables. The goal was to understand the relationship between internet addiction and depressive symptoms and problem behaviors.

**Results**

**Descriptive statistics**

The descriptive statistics (mean and standard deviation) and Pearson’s correlation for the main variables are presented in Table 1. It can be seen that deviant peer affiliation, parental alienation, problem behavior, and depressive symptoms at T1 were significantly correlated with internet addiction, and problem behavior and depressive symptoms at T2 were significantly correlated with internet addiction. Moreover, deviant peer affiliation, parental alienation, problem behavior, and depressive symptoms were significantly correlated with one another.

**Identifying the internet addiction profiles**

Models with one to five profiles were established. The fit indices for the models are presented in Table 2. It is evident that, as the number of categories increased, the values of AIC, BIC, and aBIC reduced. However, the differences between the five-profile and four-profile models were not substantial, indicating that the model was not significantly improved when the number of categories increased from four to five. Therefore, a four-profile model was determined as sufficiently optimal. The entropy value of the four-profile model was .876, indicating...
a high classification accuracy. The first profile (with the lowest reported internet addiction) was named normal internet use (n = 493, 41%). The second profile (with higher reported internet addiction than the first profile yet lower than the third and fourth profiles) was named low internet addiction (n = 460, 39%). The third profile (with the highest internet addiction, but not the highest in terms of economic investment) was named high internet addiction (n = 108, 9%). The fourth profile represented the second highest level of addiction but involved the highest money costing in the addiction; considering that the scale was adapted from the Internet Addiction Test and not compiled according to the diagnostic criteria of Internet Game Disorder in DSM-5 in this study, it could not determine whether participants were addicted to online games. However, considering that Chinese online games mostly involve value-added services (Gao & Li, 2012), such as paying for all kinds of virtual props, the fourth profile was named overuse of online games (n = 133, 11%).

### Correlation between profiles and gender, deviant peer affiliation, and parental alienation

We used the robust three-step to examine the association between gender (females were used as the control group), deviant peer affiliation, and parental alienation, and internet addiction profiles and SES were regarded as the control variables. Table 3 shows the results for the multinomial logistic regression analysis. Compared to the normal internet use group, males were more likely than females to be included in the high internet addiction group (B = .83, p < .01) and the overuse of online games group (B = 1.42, p < .001). Compared to the low internet addiction group, males were also more likely to be included the overuse of online games group (B = 1.08, p < .001). Moreover, adolescents with substantial deviant peer affiliation and parental alienation were more likely to be included in the low internet addiction group (B = 1.06, p < .001; B = .39, p < .001), high internet addiction group (B = 1.65, p < .001; B = .66, p < .001), and overuse of online games group (B = 1.59, p < .001; B = .67, p < .001). In addition, these adolescents were more likely to be included in the high internet addiction group (B = .59, p < .01; B = .26, p < .01) and overuse of online games group (B = .53, p < .01; B = .28, p < .01) as opposed to the low internet addiction group. No other significant associations were found.

### Influence of internet addiction profiles on depressive symptoms and problem behaviors

We used the BCH method to examine the association between internet addiction profiles and problem behaviors, depressive symptoms at T2. The problem behaviors at T1, and depressive symptoms at T1 and SES, were regarded as the control variables, respectively (Table 4 and Figures 1 and 2). The results revealed that one year after the initial investigation, the problem behaviors (x2 [3, 1194] = 104.20, p < .001) and depressive symptoms (x2 [3, 1194] = 28.94, p < .001) of the participants from different profile groups were significantly different. The post-hoc comparison showed that participants from the low internet addiction, high internet addiction, and overuse of online games groups revealed more problem behaviors than those from the normal internet-use group (p < .001).

### Table 1. Mean, standard deviations, and correlations of the main variables

| PROFILE | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------|---|----|---|---|---|---|---|---|---|
| Deviant peer affiliation T1 | 1.84 | .58 | 1 |  |  |  |  |  |  |
| Parental alienation T1 | 5.00 | 1.67 | .20*** | 1 |  |  |  |  |  |
| Internet addiction T1 | 2.46 | 1.03 | .37*** | .37*** | 1 |  |  |  |  |
| Problem behaviors T1 | 1.06 | .25 | .50*** | .30*** | .43*** | 1 |  |  |  |
| Depressive symptoms T1 | .72 | .27 | .23*** | .32*** | .26*** | .28*** | 1 |  |  |
| Problem behaviors T2 | 1.04 | .25 | .42*** | .21*** | .32*** | .56*** | .20*** | 1 |  |
| Depressive symptoms T2 | .74 | .27 | .18*** | .24*** | .16*** | .20*** | .60*** | .28*** | 1 |

Note. T1 = Time 1, T2 = Time 2; ***p < 0.001, *p < 0.05; n = 1194.

### Table 2. Fit statistics for the latent profile analysis

| PROFILE | AIC | BIC | aBIC | Entropy | LMR | BLRT | Proportions Min |
|---------|-----|-----|------|---------|-----|------|-----------------|
| 1       | 42956.01 | 43057.71 | 42994.18 | 1 |  |  |  |  |
| 2       | 39481.24 | 39638.88 | 39540.41 | 0.891 | 0.0000 | 0.0000 | 39.20% |
| 3       | 38527.72 | 38741.29 | 38607.88 | 0.873 | 0.0006 | 0.0000 | 12.50% |
| 4       | 38061.08 | 38330.58 | 38162.24 | 0.876 | 0.0383 | 0.0000 | 9.05% |
| 5       | 37651.10 | 37976.54 | 37773.25 | 0.893 | 0.1390 | 0.0000 | 3.52% |

**Journal of Pacific Rim Psychology**
Participants from the high internet addiction (p = .009) and overuse of online games groups (p < .001) showed more problem behaviors than those from the low internet addiction group. No other significant differences were found among the variables. In addition, participants from the low internet addiction (p < .001), high internet addiction (p < .001), and overuse of online games groups (p = .001) had more severe depression than those from the normal internet-use group. No other significant differences were found between the variables.

### Discussion

The current findings identified four internet addiction profiles among rural Chinese adolescents: normal internet use, low internet addiction, high internet addiction, and overuse of online games. Additionally, the results indicated that gender, deviant peer affiliation, and parental alienation have significant roles in differentiating distinct patterns of internet addiction in rural Chinese adolescents. Furthermore, these profiles can predict problem behaviors. Our findings add to the literature by revealing valuable insights about the heterogeneity and diversity within adolescent internet addiction in the context of rural China, and confirmed that some adolescents are more vulnerable to internet addiction whereas others are more resilient.

#### Internet addiction profiles

The LPA revealed four internet addiction subgroups that differed in number and response patterns. These results confirmed that internet addiction among rural adolescents was heterogeneous and had unique characteristics. The first three groups were classified by levels of internet addiction. Specifically, participants from the normal internet-use group had the lowest level of internet addiction, followed by those from the low internet addiction group, while participants from the high internet addiction group demonstrated the highest level of internet addiction. It is worth noting that about 20% of the investigated rural adolescents belong to the high internet addiction and overuse of online games groups, which was close to the overall detection rate of internet addiction in China (Gamito et al., 2016; China Internet Network Information Center, 2020). As mentioned above, this is likely due to the fact that rural adolescents have fewer entertainment activities, less social communication, and a more closed living environment compared to their urban counterparts. For these reasons, the Internet has become a medium to satisfy their psychological needs, such as information, social interaction, and entertainment needs, and offers them an escape outlet (Lowry, Gaskin, & Moody, 2015). These factors indicate potential problematic internet use. In addition, compared to the high internet addiction group, although participants from the overuse of online games group reported overall shorter duration of internet use, their usage required greater economic investment. Due to the ubiquitous consumption-inducing content in Chinese online games, adolescents who spend real-world money are able to obtain enhancements and upgrades in the game faster than they would if they were to play at a regular pace. This is consistent with the view that most adolescents who are addicted to the Internet generally begin with an addiction to online games (Ge, Deng, & Ji, 2018).

#### Predictors of internet addiction

The results indicated that the internet addiction profiles of rural adolescents differed with respect to gender. As hypothesized, females outnumbered males in the normal internet-use (versus high internet addiction and overuse of online games) and low internet addiction profiles (versus overuse of online games profile). These results support previous studies that males are more likely to be vulnerable to internet addiction. The reasons could be that males experience more difficulty with gaining the trust and support of their significant others than females (Van et al., 1998) and are more inclined to use social avoidance strategies (Öngen, 2006). This makes males more inclined to seek social support through the Internet to obtain opportunities to interact with people with the same interests. In addition, males are more inclined to pursue a sense of accomplishment and social interaction via the Internet than females. The upgrades and enhancement elements of online games allowed this group to develop a sense of accomplishment and improve their self-image (Ko et al., 2005). In addition, online games use a differentiated range of diversified and customized designs. The majority of existing games are customized for male players and therefore may not effectively meet the psychological needs of female players (Wei et al., 2014). This could also be one of the reasons the overuse of online games profile had more male participants.
The results revealed that rural adolescents with a higher level of parental alienation and deviant peer affiliation were more likely to develop a higher level of internet addiction. Hence, deviant peer affiliation and parental alienation are risk factors for internet addiction among rural adolescents. These findings support the view of ecological systems theory that family and peers are two important microsystem factors that affect the growth and development of individuals (Bronfenbrenner & Morris, 2006). According to attachment theory, the attachment object serves as a haven and base of safety that provides children with a sense of emotional support and psychological safety (Bowlby, 1982). When adolescents perceive that they are alienated from their parents, they feel a lack of trust and are unable to effectively communicate with them, and thus are unable to receive effective emotional support or help from their parents; as a result, their emotional needs for family are insufficiently satisfied, and they are likely to turn to the Internet for psychological compensation, possibly leading to internet addiction. Moreover, parental alienation tends to create a more negative living environment for the adolescents. According to compensatory internet-use theory, individuals may use internet-connected devices excessively to cope with their real-life problems in the hope of alleviating their negative emotional states (Kardefelt-Winther, 2014). In this regard, rural adolescents that suffer from more parental alienation are highly susceptible to internet addiction.

Furthermore, adolescents are generally closer to their peers, while communication with parents correspondingly reduces, leading to a gradual increase in peer influence (Glynn, 1981). The findings of this study confirmed that rural adolescents with higher deviant peer affiliation were more likely to suffer a high level of internet addiction. The likely reasons are follows: First, social learning theory states that deviant peers may become role models for bad behaviors, which may subsequently lead to increased problematic internet use. Adolescents are likely to manifest similar behaviors by observing and imitating the addictive behaviors of their peers. In addition, such behaviors are maintained or even developed by the normative reinforcement of peer groups (Bandura, 1978), resulting in an increase in internet addiction among rural adolescents. Second, according to the theory of the
influence of peer norms, the norms formed through the attitudes and behaviors of deviant peer groups may cause pressure on group members, which, in turn, may lead to an increase in the severity of internet addiction (Blanton & Burkley, 2008).

Correlations between internet addiction profiles, and depressive symptoms and problem behaviors

This study found that in the year after the first survey, the levels of depressive symptoms and manifestation of problem behaviors of rural adolescents from different internet addiction profiles were significantly different. Specifically, participants from the overuse of online games, high internet addiction, and low internet addiction groups showed more severe depressive symptoms than those from the normal internet-use group, indicating that internet addiction triggers or aggravates the development of depressive symptoms among rural adolescents. This finding supports previous studies (Amorosi et al., 2012; Dalbudak et al., 2013). Adolescents who frequently use the Internet and communicate through the Internet have reduced real-life communication; hence, their interpersonal relationships and social support are reduced. Although online relationships may replace actual relationships, the bonds tend to be weaker (Kraut et al., 1998), and online acquaintances are unlikely to provide effective life support. Finally, internet addiction also has a negative impact on the academic performance of adolescents. The reduction in social support and the decline in academic performance are subsequently likely to trigger the onset of depressive symptoms.

This study found that in the year after the first survey, the manifestation of problem behaviors of rural adolescents from different internet addiction profiles was significantly different. Specifically, it was found that rural adolescents with more severe internet addiction were likely to manifest more problem behaviors during the following year. In addition, there was no significant difference in problem behavior between participants in the overuse of online games groups and those from the high internet addiction group. These results support the cognitive behavior model of Davis (2001) and the general aggression model of Anderson and Bushman (2002), both of which emphasize the arousal effect of external stimuli and negative perceptions. Adolescents who use the Internet more frequently are more likely to access harmful content, such as that involving violence and pornography. The negative information in the virtual world leads to an increase in online deviant behaviors, which could in turn lead to an increase in problem behaviors in real life (Wang et al., 2010). Some studies have found that online chatting, browsing pornographic websites, online games, and online gambling are all related to aggressive behavior (Ko et al., 2009). In addition, online games are mostly violent games, which may lead to confusion between the real and virtual worlds among adolescents, as well as arouse their internal aggressiveness and weaken their ability to apply self-control. As such, the Internet may not only satisfy the vanity and sense of control of individuals, but also arouse their implicit aggressiveness (Lu & Yun, 2013); hence, adolescents with either high internet addiction or online gaming addiction are more likely to manifest problem behaviors.

Practical implications

The results of this study are of significance for research on problem behaviors and depressive symptoms. First, this study adopted a person-oriented rather than variable-oriented approach and investigated internet addiction...
profiles using the variables of gender, deviant peer affiliation, and parental alienation. The results confirmed that there was heterogeneity in internet addiction, and this was affected by gender, parental alienation, and deviant peer affiliation. These findings suggested that more targeted measures should be designed to treat adolescents with different internet addiction profiles and genders.

It is recommended that families and schools work together to tackle the issues of internet addiction. Especially in China’s current implementation of the “Notice on further strict management to prevent minors from indulging in online games,” minors’ online gaming time is greatly limited. In this context, parents need to strengthen supervision to prevent minors from using adult identity information for online games. Schools need to strengthen education and guidance to help minors’ compliance with legal provisions. Above all, families and schools should unite to develop extracurricular activities, such as comprehensive practice and art and sports activities, which can effectively enrich the daily life of rural teenagers, make them return to reality from the Internet, and reduce the incidence of internet addiction.

Based on this study, more specific measures are as follows: First, parents are expected to provide emotional as well as material support, while schools should reinforce student management to reduce contact with deviant peers and help them establish a healthier approach to making friends. Second, internet addiction profiles were found to be correlated to depressive symptoms and problem behaviors, suggesting that internet addiction is a key risk factor in depressive symptoms and problem behaviors among Chinese rural adolescents. Therefore, it is suggested that parents and schools strengthen their control over adolescents’ internet use and identify internet addiction promptly, implementing appropriate interventions. Targeted measures based on gender should be developed to reduce internet addiction behavior and to avoid the further development of problem behaviors, while promoting healthy growth and development.

Nevertheless, this study has the following limitations: First, this study used a self-reporting questionnaire to collect the data. Due to factors such as social expectations and recall errors, the accuracy of the data might be affected. Future studies should collect data from various sources (such as from parents, teachers, and peers) to improve the reliability and validity of the research. Second, using a short-period longitudinal study with only two waves of data collection, this study was unable to uncover the development trajectory of internet addiction among rural adolescents. Future research is expected to adopt a longer-period longitudinal approach to explore the changes in internet addiction over time. Third, this study did not investigate the parental alienation of either father or mother individually. Alienation of the mother or father may have different effects on internet addiction among adolescents. Future studies should explore the differences in the effects of the two types of parental alienation.

Data availability statement
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of conflicting interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Humanity and Social Science Youth foundation of Ministry of Education of China (grant number 17YJC880128).

ORCID iD
Yadong Sun https://orcid.org/0000-0002-4931-9173

References
Achenbach, T. M., & Edelbrock, C. (1987). Manual for the child behavior checklist (2nd ed.). University of Vermont.
Birleson, P. (1981). The validity of depressive disorder in childhood. Journal of Child Psychology and Psychiatry, 22(1), 73–88. https://doi.org/10.1111/j.1469-7610.1981.tb00533.x
Blanton, H., & Burkley, M. (2008). Deviance regulation theory: Applications to adolescent social influence. In M. J. Prinstein...
& K. A. Dodge (Eds.), Understanding peer influence in children and adolescents (pp. 94–121). Guilford Press.

Block, J. J. (2008). Issues for DSM-V: Internet addiction. American Journal of Psychiatry, 165(3), 306–307. https://doi.org/10.1176/appi.ajp.2007.07101556

Bogenschneider, K., Wu, M., Raffaelli, M., & Tsay, J. C. (1998). Parent influences on adolescent peer orientation and substance use: The interface of parenting practices and values. Child Development, 69(6), 1672–1688. https://doi.org/10.1111/j.1467-8624.1998.tb06184.x

Bowlby, J. (1982). Attachment and loss: Retrospect and prospect. American Journal of Orthopsychiatry, 52(4), 664–678. https://doi.org/10.1037/h0054556

Bronfenbrenner, U., & Morris, P. A. (2006). The biocological model of human development. In R. M. Lerner & H. Stattin (Eds.), Theoretical models of human development: Vol. 1. Handbook of child psychology (6th ed., pp. 793–828). Wiley.

Carli, V., Durkee, T., Wasserman, D., Hadlaczyk, G., Despains, R., Kramarz, E., Wasserman, C., Sarchiapone, M., Hoven, C. W., Brunner, R. (2013). The association between pathological internet use and comorbid psychopathology: A systematic review. Psychopathology, 46(1), 1–13. https://doi.org/10.1159/000337971

Chen, W., Li, D., Bao, Z., Yan, Y., & Zhou, Z. (2015). The impact of parent–child attachment on adolescent problematic internet use: A moderated mediation model. Acta Psychologica Sinica, 47(5), 611–623. https://doi.org/10.3724/SP.J.1041.2015.00611

Children Internet Network Information Center (CNNIC) (2015). Research report on Chinese youth online behavior. http://www.cnnic.net.cn

China Internet Network Information Center (CNNIC) (2020). Research report on internet use of minors in China in 2019. http://www.cnnic.net.cn

Dalbudak, E., Evren, C., Aldemir, S., Coskun, K., Ugurlu, H., & Yildirim, F. (2013). Relationship of internet addiction severity with depression, anxiety, and alexithymia, temperament and character in university students. Cyberpsychology Behavior and Social Networking, 16(4), 272–278. https://doi.org/10.1089/cyber.2012.0390

Davis, R. A. (2001). A cognitive-behavioral model of pathological internet use. Computers in Human Behavior, 17(2), 187–195. https://doi.org/10.1016/S0747-5632(00)00041-8

Deng, L., Fang, X., & Yan, J. (2013). The relationship between interparental relationship, parent–child relationship and adolescents’ internet addiction. Chinese Journal of Special Education, 2009, 71–77. https://doi.org/10.1007/s11469-014-9501-6

Fang, X., & Li, X. (1996). A study of adolescent smoking and its related factors. Chinese Mental Health Journal, 10(2), 77–80. https://doi.org/10.3321/j.issn:1000-6729.1996.02.012

Paulkner, G., Irving, H., Adlaf, E. M., & Turner, N. (2015). Subtypes of adolescent video gamers: A latent class analysis. International Journal of Mental Health and Addiction, 13(1), 1–18. https://doi.org/10.1007/s11469-014-9501-6

Firth, J., Torous, J., Stubbs, B., Firth, J. A., & Sarris, J. (2019). The “online brain”: How the Internet may be changing our cognition. World Psychiatry: Official Journal of the World Psychiatric Association (WPA), 18(2), 119–129. https://doi.org/10.1002/wps.20617

Fumero, A., Marrero, R. J., Voltes, D., & Peñate, W. (2018). Personal and social factors involved in internet addiction among adolescents: A meta-analysis. Computers in Human Behavior, 86, 387–400. https://doi.org/10.1016/j.chb.2018.05.005

Gailliot, M. T., Mead, N. L., & Baumeister, R. F. (2008). Self-regulation. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), Handbook of personality psychology: Theory and research (3rd ed., pp. 472–491). Guilford Press.

Gamito, P. S., Morais, D. G., Oliveira, J. G., Brito, R., Rosa, P. J., & De Matos, M. G. (2016). Frequency is not enough: Patterns of use associated with risk of internet addiction in Portuguese adolescents. Computers in Human Behavior, 58, 471–478. https://doi.org/10.1016/j.chb.2016.01.013

Gao, B., & Li, D. (2012). Research on the operation countermeasures to maximize the profits of manufacturers under the free business model—Taking the online game industry as an example. Macroeconomics, 62(11), 25–31, 78. https://doi.org/10.16304/j.cnki.11-3952/f.2012.11.005

Ge, Y., Chen, W., Xie, X., & Zhang, J. (2016). ERP Study of internet addiction in adolescents: Based on meta-analysis. Journal of Southwest University (Natural Science Edition), 38(2), 126–134. https://doi.org/10.13718/j.cnki.xdzk.2016.02.020

Ge, Y., Deng, L., & Ji, L. (2018). The relationship between left-at-home internet addicted urban children’s personality traits, internet self-efficacy and sense of meaning in life. Chinese Journal of Special Education, 25(2), 89–96. https://doi.org/10.1007/s11469-018-02-016

Glynn, T. J. (1981). From family to peer: A review of transitions in influence among drug-using youth. Journal of Youth and Adolescence, 10(5), 363–383. https://doi.org/10.1007/BF02088939

Gur, K., Yurt, S., Buldук, S., & Atagöz, S. (2015). Internet addiction and physical and psychosocial behavior problems among rural secondary school students. Nursing & Health Sciences, 17(3), 331–338. https://doi.org/10.1111/nhs.12192

Jiang, Y., Zhang, W., Yu, C., Bao, Z., & Liu, S. (2015). Peer rejection and alcohol use in early adolescence: The mediating effects of peer victimization and deviant peer affiliation. Psychological Development and Education, 31(6), 738–745. https://doi.org/10.16187/j.cnki.sunn1001-4918.2015.06.13

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(31), 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Kim, K. S. (2011). An comparative analysis of ecological variables affecting internet addiction tendency of adolescents between metropolitan and rural areas. Korean Journal of Social Issues, 12(1), 121–156. https://doi.org/10.7400/0001-12.101.1.002

Ko, C., Yen, J., Chen, C., Yeh, Y., & Yen, C. (2009). Predictive values of psychiatric symptoms for internet addiction in adolescents: A 2-year prospective study. Archives of Pediatrics & Adolescent Medicine, 163(10), 937–943. https://doi.org/10.1001/archpediatrics.2009.159

Ko, C. H., Yen, J. Y., Chen, C. C., Chen, S. H., & Yen, C. F. (2005). Relationship of internet addiction severity with depression, anxiety, and alexithymia, temperament and character in university students. Cyberpsychology Behavior and Social Networking, 8(3), 272–278. https://doi.org/10.1089/cyber.2005.0390

Ko, C. H., Yen, J. Y., Chen, C. C., Chen, S. H., & Yen, C. F. (2005). Relationship of internet addiction severity with depression, anxiety, and alexithymia, temperament and character in university students. Cyberpsychology Behavior and Social Networking, 8(3), 272–278. https://doi.org/10.1089/cyber.2005.0390

Ko, C., Yen, J., Chen, C., Yeh, Y., & Yen, C. (2009). Predictive values of psychiatric symptoms for internet addiction in adolescents: A 2-year prospective study. Archives of Pediatrics & Adolescent Medicine, 163(10), 937–943. https://doi.org/10.1001/archpediatrics.2009.159

Ko, C. H., Yen, J. Y., Chen, C. C., Chen, S. H., & Yen, C. F. (2005). Gender differences and related factors affecting online gambling addiction among Taiwanese adolescents. Journal of Nervous & Mental Disease, 193(4), 273–277. https://doi.org/10.1097/01.nmd.0000158373.85150.57
internet users. *Addictive Behaviors, 39*(3), 744–747. https://doi.org/10.1016/j.addbeh.2013.12.010

Van, M. J. C., Valentine, J. C., & Cooper, H. (1998). Effect of students’ after-school activities on teachers’ academic expectations. *Contemporary Educational Psychology, 25*(2), 167–183. https://doi.org/10.1006/ceps.1998.0999

Wang, J., Jackson, L. A., Gaskin, J., & Wang, H. (2014). The effects of social networking site (SNS) use on college students’ friendship and well-being. *Computers in Human Behavior, 37*, 229–236. https://doi.org/10.1016/j.chb.2014.04.051

Wang, L., Zhou, H., Ren, L., & Me, R. (2010). The relationship between adolescents’ internet addiction, internet deviant behavior and general problem behavior. *Chinese Journal of Special Education, 17*(8), 74–79. https://doi.org/10.3969/j.issn.1007-3728.2010.08.015

Wang, S. (2007). *Individual characteristics and family factors in university students ego identity formation* [Doctoral dissertation, Beijing Normal University]. https://doi.org/CNKI:CDMD:1.2007.101685.

Wartberg, L., Kriston, L., Kammerl, R., Petersen, K., & Thomasius, R. (2015). Prevalence of pathological internet use in a representative German sample of adolescents: Results of a latent profile analysis. *Psychopathology, 48*(1), 25–30. https://doi.org/10.1159/0003635095

Wei, H., Zhou, Z., Niu, G., & He, C. (2014). The relationship between customization, character attachment and loyalty in online games. *Journal of Psychological Science, 37*(2), 420–424. https://doi.org/CNKI:SUN:XLKX.0.2014-02-028

Wichstrom, L., Stenseng, F., Belsky, J., von Soest, T., & Hygen, B. (2018). Symptoms of internet gaming disorder in youth: Predictors and comorbidity. *Journal of Abnormal Child Psychology, 47*(1), 13. https://doi.org/10.1007/s10802-018-0422-x

Wu, S., Yang, Y., Wang, C., Fan, Y., Qin, F., & Lu, Y. (2018). The path analysis on the predisposing factors of suicidal ideation of network addicts. *Chinese Journal of Behavioral Medicine and Brain Science, 27*(3), 216–221. https://doi.org/10.3760/cma.j.issn.1674-6554.2018.03.006

Xie, X., Lei, L., & Niu, G. (2016). Adolescents’ online self-disclosure and depression: Gender effect of social support. *Journal of Psychological Science, 39*(5), 1144–1150. https://doi.org/10.16719/j.cnki.1671-6981.20160519

Young, K. S. (1996). Internet addiction: The emergence of a new clinical disorder. In paper presented at the 104th annual meeting of the American psychological association, Toronto, Ontario, Canada.

Zhang, Q., Wang, Y., Yuan, C., Zhang, X., & Li, Y. (2014). The gender effect on the relationship between internet addiction and emotional and behavioral problems in adolescents. *Chinese Journal of Clinical Psychology, 22*(6), 1004–1009. https://doi.org/CNKI:SUN:ZLCY.0.2014-06-011

Zhang, Z., & Li, F. (2011). An investigation on the status quo of university students’ internet addiction. *Teacher Education Research, 23*(2), 44–48. https://doi.org/10.13445/j.cnki.t.e.r.2011.02.012

Zheng, W. (2016). Causes and strategies of internet addiction in left-behind children in rural. *Journal of Shaanxi Xueqian Normal University, 32*(4), 86–89. https://doi.org/10.11995/j.issn.2095-770X.2016.04.001

Zhou, C., Li, L., Dai, W., Shi, J., Xu, Z., & Luo, X. (2011). Investigation of adolescents with internet addiction disorder in Nantong and analysis of related factors. *Journal of Clinical Psychiatry, 21*(5), 305–307. https://doi.org/CNKI:SUN:LCJS.0.2011-05-013

Zhou, N., & Fang, X. (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

Zhu, J., Zhang, W., Yu, C., & Bao, Z. (2015). Early adolescent internet game addiction in context: How parents, school, and peers impact youth. *Computers in Human Behavior, 50*, 159–168. https://doi.org/10.1016/j.chb.2015.03.079

Zuo, B., & Ma, H. (2010). Situation study of adolescent online game addiction: Based on survey of ten provinces. *Journal of Central China Normal University, 56*(4), 117–122. https://doi.org/10.3969/j.issn.1000-2456.2010.04.018