

# Reciprocal Prediction between Impulsivity and Problematic Internet Use among North Korean Refugee Youths in South Korea by Gender and Adverse Childhood Experience

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**Objective** North Korean refugee youths are at higher risk of developing a wide array of psychosocial sequelae, including increased impulsivity and problematic internet use. We aimed to identify reciprocal temporal relationships by performing autoregressive cross-lagged modeling and to examine how these relations differ by gender and adverse childhood experience.

**Methods** We used the follow-up data of 108 North Korean refugee youths in South Korea over a 1-year period. The Barratt Impulsivity Scale-Brief and Young's Internet Addiction Test were used to assess impulsivity and problematic internet use, respectively.

**Results** Autoregressive effects were significant across all groups, indicating that impulsivity and problematic internet use were stable across time; however, prospective prediction of problematic internet use from impulsivity was not significant across all groups. Problematic internet use at baseline positively predicted impulsivity at after 1 year of follow up in only males and individuals with adverse childhood experience.

**Conclusion** Our findings suggest that the negative effect of problematic internet use (i.e., increased impulsivity) among North Korean refugee youths may be more profound in males and those with adverse childhood experience. We present possible explanations for these findings and discuss the implications for targeted interventions.

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**Key Words** North Korean refugee youth, Internet addiction, Impulsivity, Gender difference, Adverse childhood experience, Autoregressive cross-lagged modeling.

## INTRODUCTION

The number of North Korean refugees resettling in South Korea has increased over the last two decades. According to an annual investigation by the Ministry of Unification of South Korea, the North Korean refugee population was only 947 before 1998, and this has grown steeply each year to reach 33,022 as of March 2019.<sup>1</sup> The number of adolescents and young adults aged 10–29 years among these is 13,045, constituting almost 40% of the population. Although all North Korean refugees require a wide range of support, including practical and

psychological support for resettlement, there is a need for heightened care of North Korean refugee youths (NKRYs).

NKRYs may have often been exposed to traumatic events while in North Korea or when defecting.<sup>2</sup> They may also experience difficulties adapting to unfamiliar cultures where they resettle,<sup>3</sup> possibly due to language, social, and political differences, as well as prejudice in South Korea.<sup>4</sup> Moreover, NKRYs could simultaneously experience the significant physical and emotional changes of youth (e.g., forming a self-identity) and specific difficulties with adjustment (e.g., lacking academic skills or having academic or peer maladjustment).<sup>5</sup> This may be further compounded by their parents experiencing problems adapting to South Korea due to lower educational levels, occupational instability, and economic difficulties.<sup>6</sup> In extreme cases, family breakup and reorganization during the defection can lead to a loss of primary guardians to provide physical and emotional support.<sup>7</sup> These factors combine to place NKRYs under much greater environmental disadvantages and at higher risk of a wide range of difficulties

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and psychological problems. For instance, previous studies on psychosocial adaptation in this group have revealed poorer academic performance and greater deficits in social relations (i.e., social withdrawal and lower social functioning) compared with South Korean youths.<sup>8</sup> They also show higher rates of clinically significant psychological problems, such as depression,<sup>8-10</sup> suicidal ideation and suicide attempts,<sup>9-11</sup> and post-traumatic stress symptoms.<sup>12,13</sup>

It has been suggested that externalizing problems, such as aggressiveness and delinquency, are less severe than internalizing problems in NKRYs.<sup>8,14,15</sup> Nevertheless, a significant correlation between the two indicates a heightened risk for externalizing problems,<sup>16</sup> with support evidenced by the consistently higher prevalence rates for health-risk behaviors (e.g., drinking, smoking, and substance use) in NKRYs than in South Korean youths.<sup>9</sup> Such behaviors are closely associated with impulsivity-related personality traits, such as sensation seeking, lack of premeditation, lack of perseverance, and positive or negative urgency.<sup>17-19</sup> Impulsivity is a core characteristic of externalizing problems, and internet addiction may reflect such behavioral problems in NKRYs. South Korean society is highly dependent on the internet; in 2018, the use rate was 91.5%, peaking at 99.9% in the 10–30 year age bracket, with the average time spent on internet use being 16.5 hours per week.<sup>20</sup> The prevalence of internet addiction among South Korean youths ranges from 10% to 30%,<sup>21-23</sup> which is higher than the global estimate of 6%.<sup>24</sup> Living in South Korea, NKRYs may not be free from problematic internet use. Importantly, in a study in which internet use was directly explored among NKRYs, this cohort showed significantly higher scores than South Korean youths on Young's Internet Addiction Test.<sup>25</sup> In this study, childhood traumatic experiences were positively associated with symptoms of internet addiction in NKRYs, but not in South Korean counterparts.

Many studies have reported a bidirectional relationship between internet addiction and impulsivity. Specifically, individuals with higher impulsivity (e.g., a lack of perseverance) may be more likely to indulge in internet use.<sup>26,27</sup> This increased usage, in turn, may be a risk factor for developing greater impulsivity, as evidenced by an increase in psychological problems related to impulse control in internet addicts (e.g., attention-deficit/hyperactivity disorder).<sup>28</sup> Nevertheless, there is a paucity of research in which the longitudinal relationship between the two was directly examined, precluding identification of longitudinal and causal effects between two variables.

We aimed to investigate the longitudinal reciprocal relationship between impulsivity and internet addiction using 1-year follow-up data from NKRYs. In addition, given that externalizing problems can be represented differently by gender<sup>16,29</sup> and childhood experiences,<sup>30</sup> we examined how this

relationship differed with gender and adverse childhood experiences.

## METHODS

### Participants

NKRYs were recruited from two alternative schools for North Korean defectors who have resettled in Seoul, South Korea. They were preparing for the qualification examinations for middle- or high-school graduation. Both schools volunteered to participate in a mental health screening program. Of the total 184 NKRY recipients registered in the program, 174 (59 males and 115 females) agreed to participate in the present study by providing informed consent and completing all the scales. Among them, 66 (17 males and 49 females) could not be followed up with as they exited the schools (e.g., graduation or transfer to other schools) after the baseline assessment or refused to participate again. As a result, 108 completed a one-year follow-up questionnaire (attrition rate: 37.9%) and were ultimately included in this study. All scales were answered at baseline (T1) and after 1 year (T2) so that we could explore the longitudinal relationship among variables. Although the Framework Act on Youth of South Korea defines youths as the age 9 to 24 years, there is no definitive age range for adolescence and youth among North Korean refugees. In North Korea, the term 'youth' could encompass the ages 6–13 years when receiving an education, whereas it could also encompass the ages 14–27 years when engaging in political and social activities.<sup>31</sup> Given this spectrum defined by South and North Korea, we defined NKRYs as those aged 12–27 years.

This study was reviewed and approved by the Institutional Review Board of the National Center for Mental Health [No. 116271-2017-11].

### Measures

Participants were asked to report their year of birth, gender, and residential status (i.e., whom they live with). The Barratt Impulsivity Scale-Brief (BIS-Brief)<sup>32</sup> was used to measure impulsivity. The BIS-Brief is a unidimensional scale that includes eight items of the Korean version of the BIS-11, for which reliability and validity have been evaluated.<sup>33</sup> Participants were asked to respond to each item on a 4-point Likert scale from 1 ("rarely/never") to 4 ("almost always/always") depending on the degree to which each item matched their usual way of thinking or behaving. The total score ranged from 8 to 32, with higher scores indicating higher impulsivity.

Young's Internet Addiction Test (IAT) is one of the most frequently used questionnaires to screen for and measure internet addiction. The IAT comprises 20 items that cover the de-

gree to which a respondent's internet usage affects their daily life, including productivity, social life, and feelings. Each item is rated on a 5-point Likert scale from 1 ("rarely") to 5 ("always"), with the total score ranging between 20 and 100 and higher scores indicating greater addiction.<sup>34</sup>

The Adverse Childhood Experience (ACE) questionnaire was developed by the ACE Study group from the Centers for Disease Control and Prevention in an attempt to assess ACE and its relationship to extensive outcomes of health and social well-being.<sup>35</sup> This questionnaire enquires about adverse experiences associated with abuse (emotional, physical, and sexual), neglect (emotional and physical), and household dysfunction (battered mother, parental discord/divorce, or having substance-abusing, mentally ill, or incarcerated members in the household) in childhood. The questionnaire includes a list of 17 ACEs for which participants are required to indicate whether they have ever experienced during the course of development. In this study, individuals with at least one experience from the list were deemed to have had an ACE.

### Statistical analysis

To study the longitudinal relation between internet addiction and impulsivity across two assessment waves, we performed autoregressive cross-lagged modeling (ACLM), a structural equation modeling for longitudinal data. ACLM is based on the notion that scores at a given time ( $t$ ) are adequately explained by the scores at a previous time ( $t-1$ ).<sup>36</sup> Given that ACLM estimates both the relationships within same variables at different time points (i.e., autoregressive effects) as well as the longitudinal causal relationship between different variables (i.e., cross-lagged effects), it has been traditionally considered useful for estimating reciprocal causation.<sup>37</sup> Based on the known bidirectional association between internet addiction and impulsivity, we used ACLM to define the most compelling pathways accounting for their relationship. The regression equations for the models can be represented as follows:

$$\text{Internet addiction}_i[t] = \beta_1 \cdot \text{Internet addiction}_i[t-1] + \beta_2 \cdot \text{Impulsivity}_i[t-1] + e_i[t]$$

$$\text{Impulsivity}_i[t] = \gamma_1 \cdot \text{Impulsivity}_i[t-1] + \gamma_2 \cdot \text{Internet addiction}_i[t-1] + r_i[t]$$

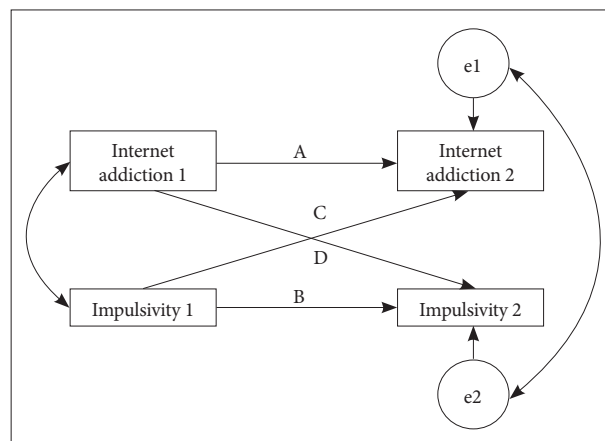
"Internet addiction<sub>*i*</sub>[ $t$ ]" and "Impulsivity<sub>*i*</sub>[ $t$ ]" represent the scores for outcome variables for an individual  $i$  at time  $t$ , while "Internet addiction<sub>*i*</sub>[ $t-1$ ]" and "Impulsivity<sub>*i*</sub>[ $t-1$ ]" are the scores at time  $t-1$ .  $\beta_1$  and  $\gamma_1$  are autoregressive coefficients for the effects of scores at time  $t-1$  on the same variables at time  $t$ .  $\beta_2$  and  $\gamma_2$  are the cross-lagged coefficients for the longitudinal prediction of one variable at time  $t-1$  on the other variable at

time  $t$ , controlling for the autoregressive effect of the variable from itself at time  $t-1$ . The values  $e_i[t]$  and  $r_i[t]$  are the residuals for individuals  $i$  at time  $t$ .

A path diagram for the main ACLM model is presented in Figure 1. Although this usually requires that the assumptions of invariance of measurements, paths, and error covariance are satisfied, we could not examine these assumptions because of the 1-year-follow-up period. In addition, we also performed multigroup ACLM to explore how the autoregressive and cross-lagged effects differed by gender and ACE. In most cases, the potential differences in structural parameters (labeled A-D in Figure 1) are explored by comparing model fit indices of a non-constrained model with those of subsequent models in which each estimated parameter is constrained consecutively. If the difference in  $\chi^2$  between two models is significant, the parameter constrained in that model is considered significantly different across groups. However, comparisons of model fit indices are not presented in the present study, because the model was saturated in each study group (i.e., 0 degree of freedom, with the number of free parameters being equal to the number of known values). Instead, we tested a difference in parameters from two groups using critical ratios for differences between parameters (CRDP), assuming that a value  $>1.96$  indicates that a significant difference exists between two parameters at the  $p < 0.05$ . We used IBM SPSS version 20 for the descriptive analyses and SPSS AMOS version 20 for conducting ACLMs.

## RESULTS

We included data for 108 NKRYs (66 females and 42 males) aged 15–27 years (Table 1). The average age was  $19.6 \pm 2.39$  years at T1 and did not differ significantly by gender ( $t = 0.47$ ,



**Figure 1.** Representation of the bivariate autoregressive cross-lagged model. Boxes indicate observed variables; circles indicate error ( $e$ ) terms. Numbers 1 and 2 indicate the time points when the variables were answered. Paths A and B indicate autoregressive predictions and paths C and D represent cross-lagged predictions.

p=0.64). There were also no significant differences in the BIS-Brief or IAT at T1 by either gender (t=0.53, p=0.60 and t=1.11, p=0.27, respectively) or ACE (t=0.42, p=0.67 and t=0.69, p=0.49, respectively). As shown in Table 2, the main variables showed positive and significant correlations across time, except for the association between impulsivity at T1 and internet addiction at T2.

Parameter estimates for all participants are presented in Figure 2. The autoregressive effects of both internet addiction and impulsivity were significant. Although the cross-lagged prediction from internet addiction at T1 to impulsivity at T2 was significant (b=0.25, p<0.01), the prospective prediction of impulsivity on internet addiction was not significant (b=0.04, p=0.15).

**Table 1.** Characteristics of study participants

Characteristics	N=108
Gender (females), N (%)	66 (61.1)
Age (years), mean (SD)	19.57 (2.30)
Residential type, N (%)	
Living with their families	52 (48.1)
Living alone or with their friends	53 (49.1)
Living in facilities such as group home	3 (2.8)
Birthplace	
North Korea	47 (43.5)
China	61 (56.5)
Paternal country of origin	
North Korea	44 (40.7)
China	60 (55.6)
Non-response/don't know	4 (3.7)
Maternal country of origin	
North Korea	107 (99.1)
Non-response/don't know	1 (0.9)
Having experienced one or more ACE, N (%)	63 (58.33)
Internet addiction (T1), mean (SD)	40.69 (15.94)
Internet addiction (T2), mean (SD)	39.87 (15.50)
Impulsivity (T1), mean (SD)	18.70 (3.52)
Impulsivity (T2), mean (SD)	18.81 (3.79)

ACE: adverse childhood experience, SD: standard deviation, T1: at baseline, T2: after 1 year of follow-up

**Table 2.** Correlations between main variables

	Internet addiction (T1)	Internet addiction (T2)	Impulsivity (T1)
Internet addiction (T1)	-		
Internet addiction (T2)	0.60**	-	
Impulsivity (T1)	0.26**	0.19	-
Impulsivity (T2)	0.37**	0.37**	0.56**

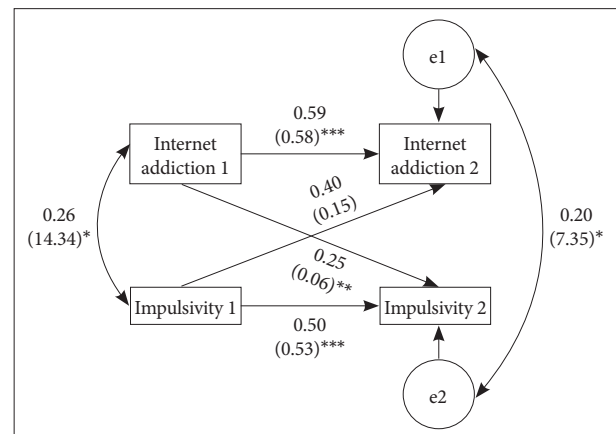
\*\*p<0.01. T1: at baseline, T2: after 1 year of follow-up

Parameter estimates by gender are presented in Figure 3. In both groups, the autoregressive effects of two variables were significant, but the cross-lagged effects of impulsivity at T1 on internet addiction at T2 were not significant. Cross-lagged prediction of internet addiction at T1 on the impulsivity at T2 was significant in males (b=0.07, p<0.01) but not in females (b=0.05, p=0.08). However, the difference between the two estimates was not statistically significant (CRDP=-0.60).

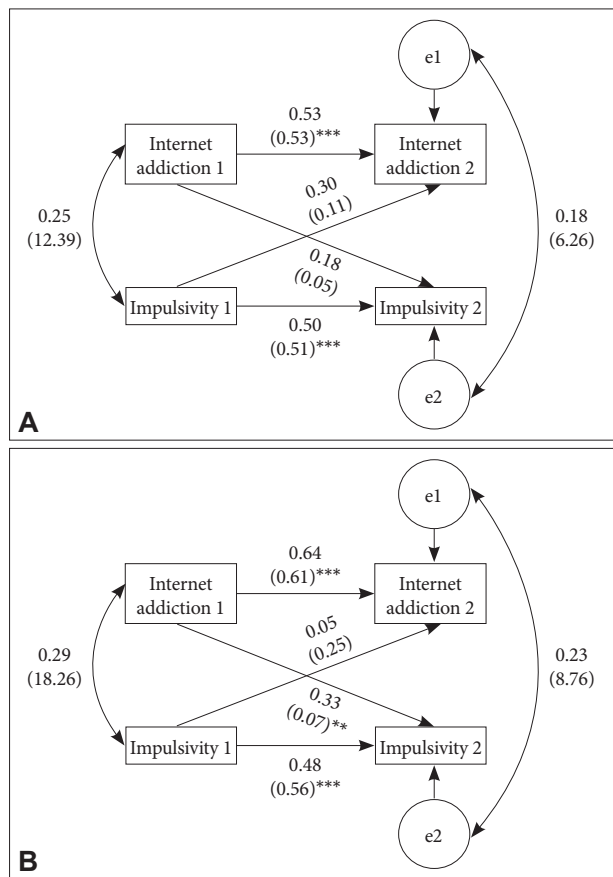
Parameter estimates by ACE are presented in Figure 4. In groups with and without ACE, autoregressive predictions were significant, but cross-lagged predictions of internet addiction at T2 from impulsivity at T1 were not. Cross-lagged prediction of impulsivity at T2 from internet addiction at T1 was significant only in those with ACE. However, there was no statistically significant difference between the two parameter estimates (CRDP=-0.97).

## DISCUSSION

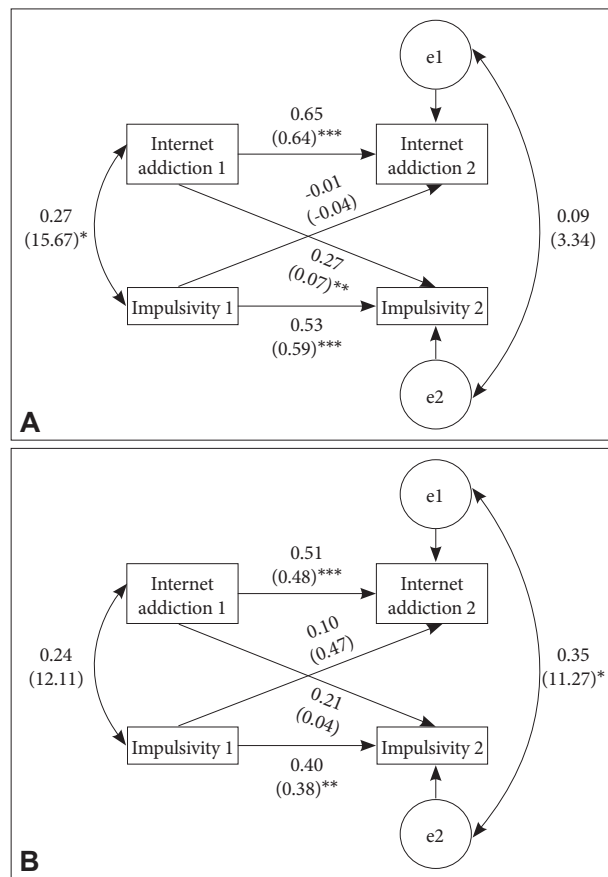
The present study used ACLM to explore the longitudinal reciprocal relationship between internet addiction and impulsivity in NKRYs, and multigroup comparison to examine how this relationship differs by gender and ACE. This analysis revealed significant autoregressive effects in all groups, indicating that problematic internet use and impulsivity were stable across times. By contrast, the cross-lagged effects between impulsivity and internet addiction were somewhat dif-



**Figure 2.** Model estimates for all participants (N=108). \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.



**Figure 3.** Model estimates for females and males. A: Females (N=66). B: Males (N=42). \*\*p<0.01, \*\*\*p<0.001.



**Figure 4.** Model estimates for participants with and without ACE. A: Participants with ACE (N=63). B: Participants without ACE (N=45). \*p<0.05, \*\*p<0.01, \*\*\*p<0.001. ACE: adverse childhood experience.

ferent among groups.

Participants' ages and the proportion of males to females in the present study were similar to a study by Noh et al.<sup>38</sup> (mean age 19.9±2.4 years, female 61.0%), who enrolled participants from alternative schools for North Korean adolescent refugees, local Hana Centers, and communities. However, our participants were older and had a higher proportion of females compared to a study by Lee et al.<sup>8</sup> (mean age 16.39±2.36 years, female 33.3%), wherein the participants were students of one middle and high school for North Korean adolescent refugees, and a study by Kim et al.<sup>39</sup> (mean age 15.8±1.9 years, female 37.9%) that used data from the Korea Youth Risk Behavior Web-Based Survey.

Overall, higher problematic internet use significantly predicted, though smaller in power than autoregressive predictions, an increase in impulsivity, even after controlling for prior impulsiveness. This result is consistent with previous findings of the negative ramifications of internet addiction. For instance, it has been consistently observed that online gaming, which is one type of internet addiction, can have negative effects on aggressiveness, self-regulation, and impulsivity.<sup>40</sup> On a more fundamental level, problematic internet use may have

negative effects on cognitive processes similar to those of other physiological and behavioral addictions. For instance, individuals with problematic internet use or addiction have showed significantly impaired executive control function<sup>41</sup> and response inhibition,<sup>42</sup> as evidenced by varied behavioral, neuropsychological, and neurophysiological test results. Heightened impulsivity could put individuals at greater risk of psychosocial maladjustments by making them resort more to activities that offer instantaneous gratification or engage thoughtlessly in reckless behaviors.

Regarding gender differences, the cross-lagged effect of internet use on impulsivity was only significant for males, indicating that more problematic internet use can heighten impulsivity in male NKRYs. This may, in part, reflect the disparity in patterns of problematic internet use between genders. According to a research that categorized participants into different groups depending on their primary internet use (e.g., gamers, browsers, communicators, workers, and downloaders), males were more likely to be gamers than females.<sup>43</sup> Similarly, another research showed that more males were reported to use the internet for entertaining purposes (e.g., accessing

pornography or gaming sites).<sup>44</sup> By contrast, problematic internet use in females tended to focus on social networking (e.g., Facebook).<sup>45</sup> While internet addiction centered on excessive use of social media is associated with depression, anxiety, and lower life satisfaction,<sup>46</sup> online gaming and sexual content seem to have a greater exacerbating effect on impulsivity.<sup>47</sup> Nonetheless, this hypothesis cannot be corroborated in this study because participants were not asked about for what purpose they used the internet. Future studies need to consider how males and females differ in their patterns of problematic internet use to elucidate these possible gender differences.

The prospective prediction from problematic internet use to impulsivity was only significant for individuals with ACE. This supports the finding that ACEs place a person at greater risk of externalizing problems, such as heavy drinking and self-reported alcoholism.<sup>48</sup> Furthermore, previous studies on the outcomes of ACE have consistently reported that cumulative ACEs could contribute to the formation of maladaptive internalized schemas and also increase reliance on maladaptive coping strategies (e.g., problem avoidance and social withdrawal), both of which may act as a pervasive vulnerability to general psychosocial problems.<sup>47,49</sup> As such, the traumatized individuals with increased vulnerability are more susceptible to the pathological effects (i.e., heightened impulsivity) of problematic internet use. The conspicuous nature of traumas in North Korea or during defection means that ACEs may go unnoticed in NKRYs. However, childhood experiences of family and external violence, not the pre-flight trauma related to war or human right violations are known to be associated with poorer quality of life in refugees.<sup>50</sup> Given this fact, researchers and practitioners need to give more attention to ACEs and try to enhance possible protective factors that could buffer against the negative ramifications of ACEs to prevent psychosocial maladaptation in NKRYs.

Interestingly, impulsivity did not predict later internet use in NKRYs longitudinally, which contradicts a previous research in which the cross-lagged effect of impulsivity on problematic internet use was significantly positive and problematic internet use did not significantly predict later impulsivity.<sup>51</sup> However, there are several differences between the two studies that may account for this disparity. First, the previous study utilized only motor impulsivity as a measure of impulsivity when analyzing the cross-lagged effect, thereby ignoring functional impairments or lifestyle changes due to problematic internet use. As such, reciprocal relationships between impulsivity and internet addiction could have been estimated differently. Second, NKRYs may differ from other youth in their internet use given their psychosocial characteristics. According to a previous study, internet gaming disorder, the most frequently researched type of problematic internet use, can be

classified into subtypes based on similarity in primary reason for internet use and relevant clinical features.<sup>52</sup> According to a comparative study between NKRYs and South Korean youths (SKYs),<sup>25</sup> NKRYs reported a significantly higher number of early traumatic experiences as well as a higher level of internet addiction symptoms. Furthermore, in NKRYs, negative automatic thoughts completely mediated the association between early traumas and internet addiction symptoms, whereas the mediating effect was not significant in SKYs.<sup>25</sup> These findings indicate the possibility that different causes or mechanisms may affect the development and maintenance of internet addiction in NKRYs and SKYs and most NKRYs would be typically considered an emotionally vulnerable type given the higher prevalence of traumatic experiences, emotional difficulties, and social deficits. NKRYs may therefore predominantly resort to internet use to escape from a stressful reality and adverse mood, with that escapism often leading to a worsening of pre-existing emotional difficulties if the internet addiction goes untreated. This may also explain why impulsivity has no prospective prediction on internet addiction, as is the case with the impulsive/aggressive type. Instead, internet addiction in NKRYs could pose a vulnerability to additional psychological problems (i.e., impulsivity).

This study had several limitations. First, we did not include control groups for comparison; to confirm the significance of our results, future studies should include a direct comparison group (e.g., South Korean or other multicultural family youths). Second, data collection was at two time points with an interval of 1 year, which may be unsatisfactory to investigate the distal relationship between the variables. As such, future studies need to include data from more than two time points, perhaps over a longer period, and also consider other relevant factors potentially associated with problematic internet use or impulsivity (e.g., personality traits). Such changes would facilitate more elaborate longitudinal analyses such as longitudinal mediation or latent growth modeling, which could corroborate our findings and contribute to the identification of possible mechanisms involved. Finally, a modest sample size in the study might have reduced its statistical power. In particular, as we split 108 participants into two groups for group comparisons, the nonsignificant result might have been due to a lack of statistical power. Thus, replication studies with a larger sample will be necessary to establish the results found in the present study.

In conclusion, our results suggest that a specific unhealthy coping strategy to pre-existing adverse mood (i.e., internet addiction) could expedite a worsening of externalizing problems (i.e., impulsivity and related problems) in NKRYs in South Korea, particularly for males and those with ACEs. This may point to a need for the patterns of internet use (e.g., time

spent, and contents mainly used) by males to be examined and for therapists to provide targeted guidance on internet use during psychological interventions. In doing so, we could minimize the possible negative effects of problematic internet use on comorbid externalizing problems. Our results also point to the importance of addressing childhood issues, such as neglect, abuse, or other household problems in research and treatment for NKRYs. The existence of ACEs could indicate higher vulnerability to impulse control issues in response to excessive internet use. Given that NKRYs are at increased risk of suicide<sup>11</sup> and that impulsivity is an important predictor of suicide attempts,<sup>53</sup> examining ACEs in the NKRY population could contribute to identification of, and provision of prompt intervention for highly vulnerable group.

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### Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

### Author Contributions

Conceptualization: all authors. Data curation: all authors. Formal analysis: Eun-Sun Lee, Minji Lee. Methodology: Eun-Sun Lee, Minji Lee, Subin Park. Writing—original draft: Eun-Sun Lee. Writing—review and editing: Eun-Sun Lee, Subin Park. Approval of final manuscript: all authors.

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