



Patterns of Problem Behaviors and Predictors of Class Membership among Adolescents in the Republic of Korea: A Latent Class Analysis

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Abstract

Objectives Although subgroups of adolescent problem behaviors (PBs) may exist and have different characteristics, most available studies have focused on exploring a single PB. Thus, we aimed to investigate latent classes of adolescent PBs and to identify important predictors of latent class membership.

Methods We analyzed nationally representative secondary data—Waves 4 and 5 of the Korean Children & Youth Panel Survey—obtained from the 2010 cohort of seventh graders and their parents. Specifically, using seven PBs (e.g., daily smoking, monthly drinking, and sexual intercourse) measured in Wave 5, we conducted a latent class analysis (LCA) to identify the model that best fit the data. In the next step, we conducted an LCA with covariates to investigate Wave-4 predictors of latent class membership.

Results In our study, a three-latent-class model best fit the data: the Low Risk class (78%) characterized by low probabilities of engagement in all PBs, Non-Habitual Alcohol Use class (14%), and Habitual Cigarette and Alcohol Use class (7%). In addition, successful predictors of latent class membership included gender, parental education, friendships, relationships with teachers, parental affection, abuse inflicted by parents, and aggression.

Conclusions Health professionals should develop interventions tailored to each homogeneous subgroups of PBs in order to obtain more effective outcomes. Additionally, when developing these interventions, they should consider multilevel characteristics (e.g., individual, peer, and parental factors) that differentiate these subgroups.

Keywords Adolescent · Delinquency · Problem behavior · Substance use · KCYPS

Adolescence is important because engagement in problem behaviors (PBs) increases sharply during this period (Jessor 1982). Adolescent PBs are defined as socially inappropriate or undesirable behaviors that deviate from norms, such as smoking, drinking, sexual intercourse, and delinquent behaviors (Jessor 1982, 2016). Indeed, substantial portions of adolescents worldwide have engaged in various PBs (Donovan and Jessor 2016; Jessor 1982). For example, lifetime prevalence of smoking, drinking, and sexual intercourse ranged from 32.3 to 63.2% in the U.S. (Kann

2016) and 4.6 to 38.8% in Korea (Ministry of Education and Korea Centers for Disease Control and Prevention 2016). The prevalence of delinquent behaviors was high as well. The past 12-month prevalence of physical fighting for males and females investigated in 20 countries was 47 and 26%, respectively (World Health Organization 2015); monthly or bimonthly stealing and past 12-month non-serious property offenses in the Netherlands and Korea ranged from 0.1 to 7.2% (Hwang et al. 2016; Junger-Tas et al. 2010). Considering greater risks of adverse health and social outcomes among adolescents engaging in PBs (Terzian et al. 2011), special attention should be paid to the sharp increase in adolescent involvement in PBs (Monahan et al. 2014; Palen et al. 2009).

Ample evidence has indicated that PBs tend to covary, revealing, for example, positive associations among PBs and negative associations between PBs and conventional behaviors, such as school performance and church involvement (Donovan et al. 2016). Jessor and Jessor (1977) define the positive associations as the problem behavior

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syndrome. Given the interrelations among PBs (Donovan et al. 2016; Gillmore et al. 1991; McGee and Newcomb 1992), adolescents engaging in a PB are more likely to engage in other PBs (Donovan et al. 2016; Gillmore et al. 1991; McGee and Newcomb 1992). Indeed, the percentages of adolescents simultaneously engaging in at least two PBs were found to be 52.8 and 74.5% in the U.S. and the U.K., respectively (Fox et al. 2010; Kipping et al. 2015); the percentages were 19.3% for males and 26.3% for females in Korea (Rhee et al. 2007).

Recently, researchers have emphasized the necessity of (a) identifying subgroups of adolescents depending on their engagement in PBs (Sullivan et al. 2010; Willoughby et al. 2004) and (b) providing intervention strategies tailored to each behavioral subgroups (Sullivan et al. 2010) for the following reasons. First, much of the meaningful variation in PBs still remains poorly explained by the problem behavior syndrome, and not all adolescents concurrently engage in multiple PBs (Willoughby et al. 2004). Second, subgroups of adolescent PBs may have different characteristics (Sullivan et al. 2010). Third, compared to adolescents engaging in a single PB, those with multiple PBs are more likely to experience negative consequences, such as health problems and school drop-out (Hair et al. 2009; Kokkevi et al. 2014).

However, most literature has focused on exploring a single PB, and thus currently little is known about subgroups of adolescent PBs (Yarnell et al. 2017). A recently developed person-centered analytical approach (latent class analysis [LCA]) has made it possible to investigate (a) homogeneous subgroups of individuals based on patterns of their characteristics and (b) factors that differentiate these subgroups (Collins and Lanza 2010). Previous studies investigating patterns of adolescent PBs (e.g., substance use and delinquency) have identified three or four latent classes (Assanangkornchai et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Thullen et al. 2016; Vaughn et al. 2014; Weden and Zabin 2005). Although caution is needed when comparing these studies due to the use of different PBs, three classes have consistently been identified: the low-risk class (not engaging in PBs), the moderate-risk class (engaging in a few PBs), and the high-risk class (engaging in multiple PBs).

Along with investigating latent classes of PBs, another important research question is to identify factors that differentiate the latent classes for a better understanding of their etiologies (Hasking et al. 2011). Bronfenbrenner (1979) explains that multiple environments surrounding adolescents (e.g., school, family, and peers) greatly affect adolescent development through their interactions. However, limited information is available in the current literature on predictors of latent class membership. More specifically, five previous LCA studies have investigated this research question using multilevel characteristics (Assanangkornchai

et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014). In general, these studies have found that a greater likelihood of belonging to moderate- and high-risk latent classes was strongly associated with poorer individual characteristics (e.g., depression and anxiety), more undesirable family characteristics (e.g., non-support from parents and non-engagement in family activities), more negative peer characteristics (e.g., friends' substance use and positive perception toward friends' PBs), and more undesirable teacher characteristics (e.g., non-support from teachers and poor relationships with teachers; Assanangkornchai et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014).

Given the paucity of research on patterns of adolescent PBs, further empirical studies using the LCA approach should be conducted to achieve a better understanding of this phenomenon (Hasking et al. 2011; Li and Lee 2010). Of the previous LCA studies investigating patterns of adolescent PBs, except for one study (Assanangkornchai et al. 2018), all studies were conducted among Western adolescents (Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Thullen et al. 2016; Vaughn et al. 2014; Weden and Zabin 2005). Among Asian adolescents, this phenomenon may differ due to differences in cultural values between Western and Eastern countries (Greenberger et al. 2000). Empirical evidence has indicated inconsistent findings regarding cultural differences in engagement in PBs between Western and Eastern cultures. For example, two studies found that levels of engagement in PBs were significantly higher in Western cultures than in Eastern cultures (Greenberger et al. 2000; Tisak et al. 2017), whereas one study failed to find the differences (Chen et al. 1998). Thus, we aimed to investigate latent classes of PBs among Korean adolescents and important predictors of latent class membership by analyzing nationally representative secondary data obtained from the Korean Children & Youth Panel Survey (KCYPS).

Method

Participants

We analyzed Waves 4 and 5 of the KCYPS data obtained from the 2010 cohort of seventh-grade students and their parents, and the students in Wave 4 were in grade 10. The number of participants for the current study was 2091 students and their parents, who completed a survey in Wave 5, and due to attrition over time, 88.9% of the participants in Wave 1 were included as our participants (National Youth Policy Institute 2015). Depending on the analytical approaches used in our study, the sample sizes differed. Specifically, when performing survey data analyses, we used data obtained from 2052 students and their parents due

Table 1 Sample characteristics ($N = 2091$)

Predictor	Frequency (%) ^a or Mean (SE) ^b
Gender ^c	
Male	1,036 (51.94)
Female	989 (48.06)
Parental education ^c	
High school graduation or lower	883 (42.83)
College graduation or higher	1,093 (57.17)
Annual household income (Unit: 10,000 Korean won)	4,829.63 (105.54)
Relationships with friends ^d	1.87 (0.01)
Relationships with teachers ^d	2.10 (0.02)
Parental affection ^d	2.02 (0.02)
Abuse inflicted by parents ^d	3.33 (0.02)
Aggression ^d	3.04 (0.01)
Depression symptoms ^d	3.13 (0.02)

The number of participants analyzed for each predictor could differ due to missing data on the predictor and clusters

^aUnweighted frequency and weighted percentage

^bWeighted mean and standard error

^cCases with missing values were excluded

^dAn agreement level was measured using a 4-point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree)

to missing data on clusters; when performing the LCA with covariates, we used data obtained from 1875 students and their parents due to missing data on clusters or covariates.

Approximately 52% of the students were male (Table 1), and 42.83% reported their parents' highest education level as "high school graduation or lower." The average score on good relationships with friends was 1.87, indicating that the students' agreement level was between "agree" and "strongly agree." The average score on the existence of depression symptoms was 3.13, indicating that the students' agreement level was between "disagree" and "strongly disagree." For more detailed information on sample characteristics, refer to Table 1. Table 2 presents the prevalence of seven PBs related to smoking, drinking, sexual intercourse, beating, and stealing in our sample. We found high levels of engagement in cigarette and alcohol use: During the past year, 9.49% smoked a cigarette at least once and 20.34% drank alcohol at least once. However, compared to smoking and drinking, levels of engagement in sexual intercourse, beating, and stealing were much lower, ranging from 0.09 to 1.45%.

Procedure

Our study was exempt from full international review board (IRB) review due to the use of de-identified secondary data (KHSIRB-17-037[EA]). We used the KCYPS data obtained from the 2010 cohort of seventh-grade students and their parents. The KCYPS data were annually collected for seven

Table 2 Prevalences of adolescent problem behaviors during the past year ($N = 2091$)

Indicator	Unweighted frequency (weighted %)
Smoking a cigarette during the past year	
No	1,862 (90.51)
Yes	229 (9.49)
Smoking a cigarette almost every day	
No	1,915 (92.75)
Yes	176 (7.25)
Drinking alcohol during the past year	
No	1,647 (79.66)
Yes	444 (20.34)
Drinking alcohol at least monthly	
No	1,927 (92.73)
Yes	164 (7.27)
Having sexual intercourse during the past year	
No	2,061 (98.55)
Yes	30 (1.45)
Beating others severely during the past year	
No	2,078 (99.39)
Yes	13 (0.61)
Stealing money or goods during the past year	
No	2,088 (99.91)
Yes	3 (0.09)

Weighted percentages were calculated using data obtained from 2052 students due to missing data on clusters

years from 2010 to 2016 (National Youth Policy Institute 2015). In the KCYPS, participants were chosen using a stratified multi-stage cluster sampling method: Strata and clusters were administrative divisions and schools, respectively. The aim of the KCYPS was to gain insight into diverse aspects of development and growth among Korean children and adolescents. To do so, the KCYPS collected data on adolescent development and characteristics of their developmental environments based on ecological systems theory (Bronfenbrenner 1979). For the current study, we secondarily analyzed Waves 4 and 5 of the KCYPS data obtained from the 2010 cohort of seventh graders and their parents. Waves 4 and 5 data collected in 2013–2014 included information on adolescent development (e.g., physical development, intellectual development, and PBs) and developmental environments (e.g., family, peer, and school environments; National Youth Policy Institute 2016).

Measures

Problem behaviors

Based on the literature (Jessor 1982, 2016), we selected seven PBs to investigate latent classes of PBs. We assessed two

smoking behaviors and two drinking behaviors by asking students about the following experiences during the past year: (a) past 12-month cigarette use (defined as smoking a cigarette at least once a year), (b) daily cigarette use (defined as smoking a cigarette almost every day), (c) past 12-month alcohol use (defined as drinking alcohol at least once a year), and (d) monthly alcohol use (defined as drinking alcohol at least once a month). Additionally, we assessed three PBs by asking students about their experiences of engaging in sexual intercourse, beating others severely, and stealing money or goods during the past year. The potential response to questions measuring the seven behaviors was either “yes” or “no.”

Predictors of latent class membership

Based on the literature (Assanangkornchai et al. 2018; Bronfenbrenner 1979; Connell et al. 2011; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014), we selected factors measured in Wave 4 to investigate factors significantly associated with latent class membership of PBs measured in Wave 5. Demographics used in our study included gender (male or female), parental education (“high school graduation or lower” or “college graduation or higher”), and annual household income (measured with a continuous variable). Regarding parental education and annual household income, we used information obtained from parents. Other factors were measured using multiple items: (a) five items for relationships with friends (e.g., getting along well with my friends and apologizing first after quarreling with my friends), (b) five items for relationships with teachers (e.g., feeling comfortable during conversation with teachers and greeting teachers pleasantly), (c) four items for parental affection (e.g., respecting my opinions and often complimenting me), (d) four items for abuse inflicted by parents (e.g., scolding excessively for my wrongdoing), (e) six items for aggression (e.g., being angry all day long and crying for no reason), and (f) 10 items for depression symptoms (e.g., thinking about suicide and feeling lonely).

For each multiple-item measure, students were directed to rate their agreement level using a 4-point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). We calculated the average score of multiple items for each measure, and higher scores indicated (a) poorer relationships with friends and teachers and (b) lower levels of parental affection, abuse inflicted by parents, aggression, and depression symptoms. Cronbach alpha values for the six multiple-item measures ranged from 0.64 to 0.89.

Data Analysis

We incorporated a complex sampling design (e.g., strata, clusters, and weights) into the entire data analysis process in

order to obtain findings generalizable to the study population (Chen and Gorrell 2008; Lanza et al. 2015). In particular, in the entire data analysis, we used attrition-adjusted weights in order to resolve the issue of attrition and thus maintain the representativeness of our sample (Kalton and Miller 1986; National Youth Policy Institute 2015).

First, we used descriptive statistics (frequencies or means) to investigate sample characteristics and levels of engagement in the seven PBs. Second, we conducted the LCA five times using one through five classes to identify the model that best fit the data (Collins and Lanza 2010). Specifically, each model was fit to the data 50 times using different starting values for model identification. To select the best model, we compared three criteria across the five models (Collins and Lanza 2010). The first criterion included five fit indices: the likelihood-ratio statistic G^2 , the Akaike information criterion (AIC), the Bayesian information criterion (BIC), entropy, and the log-likelihood value. Lower values of G^2 , AIC, BIC, and the log-likelihood and higher entropy values indicated a more optimal model fit. The other two criteria were model interpretability and parsimony: Classes identified in the model should be meaningful, and a simpler model is preferable.

After identifying the optimal model (three-class model in our study), we conducted an LCA with covariates to investigate Wave-4 predictors of latent class membership in Wave 5 (Collins and Lanza 2010). To this end, we included nine factors in the analysis: two categorical variables were dummy coded, and seven continuous variables were standardized. In addition, of the three latent classes identified in the final model, we used the “Low Risk” class as the reference class when investigating predictors of class membership.

Results

Latent Classes of Problem Behaviors Among Korean Adolescents

In Table 3, which presents the model fit statistics across one to five classes, either the three-class or four-class model fit the data best. Between the two models, we chose the three-class model due to (a) a relatively small difference in the values of G^2 , AIC, BIC, and the log-likelihood between the two models; (b) a greater entropy value in the three-class model; and (c) easier interpretability and greater parsimony in the three-class model. Furthermore, 96% of the 50 three-class models obtained using different seeds were well identified.

Table 4 presents the three-class latent model: Eleventh graders in our study were grouped into the Low Risk (LR) class (78%), the Non-Habitual Alcohol Use (NHAU) class (14%), and the Habitual Cigarette and Alcohol Use (HCAU) class (7%). Specifically, those in the LR class had

Table 3 Fit statistics for models with one through five latent classes ($N = 2052$)

Number of latent classes	G^2	Degree of freedom	AIC	BIC	Entropy	Log-likelihood
1	1,956.87	120	1,970.87	2,010.26	1.00	-2,995.72
2	361.28	112	391.28	475.68	0.95	-2,197.92
3	94.42	104	140.42	269.83	0.99	-2,064.49
4	26.70	96	88.70	263.12	0.97	-2,030.63
5	20.50	88	98.50	317.93	0.94	-2,027.53

Boldface type indicates the selected model

AIC Akaike's information criterion, BIC Bayesian information criterion

Table 4 Three-latent class model of adolescent problem behaviors during the past year ($N = 2052$)

Label	Latent class		
	Low risk	Non-habitual alcohol use	Habitual cigarette and alcohol use
Latent class prevalences	0.78	0.14	0.07
Item-response probabilities			
<i>Corresponding to a Yes^a response</i>			
Smoking a cigarette during the past year	0.01	0.11	1.00
Smoking a cigarette almost every day	0.00	0.00	0.99
Drinking alcohol during the past year	0.00	1.00	0.82
Drinking alcohol at least monthly	0.00	0.22	0.56
Having sexual intercourse during the past year	0.00	0.03	0.11
Beating others severely during the past year	0.00	0.01	0.05
Stealing money or goods during the past year	0.00	0.00	0.01

^aRecoded from original response categories

either zero or near zero probabilities of engagement in all PBs. Those in the NHAU class had a high probability of engagement in only one behavior: yearly drinking. Those in the HCAU class had high probabilities of engagement in all smoking- and drinking-related behaviors, including almost daily smoking and monthly drinking during the past year. In addition, although the probabilities of sexual intercourse, beating, and stealing were less than 0.5 in the HCAU class, probabilities of engagement in these three behaviors were highest in this class as compared to probabilities in the other two classes.

Predictors of Latent Class Membership

We found seven significant predictors of latent class membership (Table 5), implying different distributions of latent class membership across these factors. These predictors included gender, parental education, friendships, relationships with teachers, parental affection, abuse inflicted by parents, and aggression. Specifically, for females, the odds of being in the NHAU and HCAU classes relative to the LR class were lower than the corresponding odds for males (odds ratios [ORs] = 0.70 and 0.38, respectively). For those whose parental education level was higher than high school graduation, the odds of being in the HCAU class

relative to the LR class were lower than the corresponding odds for those whose parental education level was not (OR = 0.77). Poor friendship was associated with a decrease in the odds of being in the NHAU and HCAU classes relative to the LR class (ORs = 0.93 and 0.82, respectively). A poor relationship with teachers was associated with an increase in the odds of being in the HCAU class relative to the LR class (OR = 1.13). Lower parental affection was associated with an increase in the odds of being in the NHAU class relative to the LR class (OR = 1.07), whereas lower levels of abuse inflicted by parents and lower aggression were associated with a decrease in the odds of being in the HCAU class relative to the LR class (ORs = 0.90 and 0.81, respectively). In relation to predictors of class membership, other noteworthy findings were that (a) the number of statistically significant predictors was greater in the HCAU class than in the NHAU class and (b) predictors that were significant in both the HCAU and NHAU classes were more strongly associated with the HCAU class than with the NHAU class.

Discussion

We found three latent classes of PBs among Korean adolescents: (a) the LR class (78%), characterized by low

Table 5 Predictors of latent class membership ($N = 1875$)

Predictor	<i>p</i> -value	Non-habitual alcohol use		Habitual cigarette and alcohol use	
		OR	95% CI	OR	95% CI
Gender (reference = male)					
Female	<0.001	0.70	0.65, 0.75	0.38	0.34, 0.42
Parental education (reference = high school graduation or lower)					
College graduation or higher	<0.001	0.98	0.91, 1.06	0.77	0.69, 0.86
Annual household income ^a (Unit: 10,000 Korean won)	0.273	0.98	0.94, 1.02	0.95	0.90, 1.00
Relationships with friends ^a	<0.001	0.93	0.89, 0.98	0.82	0.77, 0.87
Relationships with teachers ^a	0.007	1.01	0.96, 1.06	1.13	1.07, 1.20
Parental affection ^a	0.020	1.07	1.03, 1.12	1.03	0.98, 1.09
Abuse inflicted by parents ^a	0.002	1.01	0.97, 1.06	0.90	0.86, 0.94
Aggression ^a	<0.001	0.96	0.92, 1.00	0.81	0.75, 0.87
Depression symptoms ^a	0.605	0.97	0.93, 1.01	1.03	0.96, 1.10

The reference class = Low risk

OR odds ratio, CI confidence interval

^aHigher scores represent (a) higher levels of household income and poorer relationships with friends and teachers and (b) lower levels of parental affection, abuse inflicted by parents, aggression, and depression symptoms

probabilities of engagement in all PBs; (b) the NHAU class (14%), characterized by non-habitual drinking; and (c) the HCAU class (7%), characterized by habitual smoking and drinking. Previous studies using LCA to investigate patterns of PBs have generally found three latent classes: adolescents characterized by (a) overall low probabilities of engagement in PBs, (b) high probabilities of engagement in a few PBs, and (c) high probabilities of engagement in a wide range of PBs, such as smoking, drinking, sexual intercourse, and stealing (Assanangkornchai et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Thullen et al. 2016; Vaughn et al. 2014; Weden and Zabin 2005). For example, an Australian study found three latent classes: adolescents at (a) low risk of PBs; (b) high risk of smoking, drinking, and minor delinquent behaviors (e.g., fighting and trespassing); and (c) high risk of smoking, drinking, and major delinquent behaviors (e.g., using weapons and setting fire; Hasking et al. 2011). Another U.S. study found four latent classes: those aged 18–20 years at (a) low risk of PBs; (b) high risk of smoking, unsafe sex, and no-exercise; (c) high risk of drinking and unsafe sex; and (d) high risk of various PBs, including smoking, drinking, and delinquency (Hair et al. 2009). Although caution is needed when comparing our study findings with those of previous studies due to the examination of different PBs across the previous studies, both our study and the literature have consistently identified the class of adolescents at low risks of engaging in PBs. In addition, the other two latent classes identified in our study seem similar to those identified in previous studies: moderate levels of

engagement in a few PBs in one class and high levels of engagement in various PBs in the other class.

In our study, we found different characteristics in the NHAU and HCAU classes. First, the NHAU class comprised past-year non-habitual drinkers. The existence of this class may be partly attributable to the permissive drinking culture in Korea (Choi et al. 2017; Namkoong et al. 2003). For example, Kang (2002) found that, compared to smoking, drinking was more prevalent among Korean high schoolers, and more than 60% of the high students drank alcohol at least once in their lifetime. As for the reasons for this phenomenon, Kang (2002) indicated Korean adolescents' easy access to alcohol and permissive drinking norms (e.g., drinking 100 days before the college entrance examination). Second, the HCAU class comprised habitual users of cigarettes and alcohol. This class of Korean adolescents is different from classes of Western adolescents engaging in various PBs: Specifically, levels of engagement in PBs, other than smoking and drinking, were very low in Korea, whereas the levels were relatively high in Western countries. This phenomenon may exist partly due to cultural differences. In Asian countries, more pronounced culture is collectivism (defined as social patterns comprising closely connected individuals who tend to be motivated by norms), whereas in Western countries, more pronounced culture is individualism (defined as social patterns comprising loosely connected individuals who tend to be motivated by their own preferences; Triandis 2018). Individuals dominated by collectivism are less likely to engage in socially disapproved behaviors because they are more attentive to

others; however, those dominated by individualism are more likely to engage in socially disapproved behaviors, such as physical aggression toward others and property violence (Greenberger et al. 2000). Consistent with this statement, cross-cultural studies on adolescent PBs have found greater risks of more overt and externalizing PBs in the U.S. than in Korea and China (Greenberger et al. 2000; Weine et al. 1995). In addition, despite rapid Westernization in Korea, Korean society is still under the influence of Confucianism, and thus adolescents are more likely to follow its conservative norms (i.e., not engaging in sexual intercourse; Kim 2001).

Regarding successful predictors of latent class membership, we found that females and those with poorer friendships had a lower probability of membership in both the NHAU and HCAU classes, relative to membership in the LR class. In addition, those with poorer relationships with teachers had a higher probability of membership in the HCAU class, relative to membership in the LR class, whereas those with higher parental education, lower levels of abuse inflicted by parents, and lower aggression had lower membership probabilities in the same class. Finally, those with lower parental affection had a higher probability of membership in the NHAU class, relative to membership in the LR class. First, females' lower probability of PB-related class membership found in our study is generally in line with results of previous LCA studies (Assanangkornchai et al. 2018; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014). One reason for this gender difference may be that adults, including parents, are more likely to monitor females than males, and adolescents' involvement in PBs mostly occurs in the absence of parental supervision (Akers 2009; Gottfredson and Hirschi 1990). Empirical studies conducted in Sweden and Korea have supported this statement, indicating that (a) female adolescents are under greater parental monitoring (Ministry of Gender Equality and Family 2014; Svensson 2003) and (b) poor parental monitoring was strongly associated with adolescent substance use (Svensson 2003). Another reason may be that the likelihood of exposure to deviant peers is greater among males than among females (Akers 2009; Loeber et al. 2008), and the influence of deviant peers is stronger among males than among females (Loeber et al. 2008). Empirical evidence has supported this statement, indicating males' greater exposure to deviant peers (Liu and Kaplan 1999; Svensson 2003), stronger effects of exposure to deviant peers on PBs among males (Svensson 2003), and the mediating effects of exposure to deviant peers on the gender difference in adolescent PBs (Liu and Kaplan 1999).

Second, a greater probability of PB-related class membership among those with lower parental education found in our study is in accordance with the literature, showing inverse associations between parental education and risks of

adolescent PBs (Conway et al. 2013; Kázmér et al. 2014; Small et al. 2014; Yáñez et al. 2017). This phenomenon may occur partly because parents are important role models for their children: Adolescents with low parental education are more likely to engage in PBs by observing their parents engaging in PBs and learning parental behaviors (White et al. 2000). Indeed, another empirical study supported our results, finding higher proportions of adolescent smokers among parents with lower education (Yáñez et al. 2017).

Third, we found positive associations between better friendships and greater PB-related class membership probabilities. This finding may be partly attributable to unique peer characteristics: In adolescence, close-knit peer groups (i.e., cliques) emerge, and group members share similar characteristics (Bergin and Bergin 2014). The literature indicates that two processes contribute to group members' similarity: peer socialization (being influenced by peers with whom an adolescent associates) and peer selection (affiliating with peers who are similar to an adolescent; Grusec and Hastings 2014). Thus, the effects of peer relationships can differ depending on peer characteristics. For example, when friends engage in, or have positive attitudes toward, PBs, better friendships (e.g., affiliations with these friends) can have adverse effects on adolescent development (Brendgen et al. 2000; Megens and Weerman 2012). Indeed, empirical studies have found positive associations between friends' PBs and PB-related latent class membership in adolescence (Hair et al. 2009; Monahan et al. 2014). Additionally, Monahan et al. (2014) found that less exposure to friends' PBs successfully predicted an adolescent's desistance from PBs.

Fourth, we found positive associations between poorer teacher–student relationships and a greater PB-related class membership probability. This finding is in line with the literature, indicating that negative and unhealthy relationships with teachers increased risks for adolescent PBs (Liljeberg et al. 2011; Rhee et al. 2007). In particular, Liljeberg et al. (2011) confirmed that poor teacher–student relationships successfully predicted students' engagement in PBs over time in a longitudinal study. This association could exist because teachers strongly influence students' norms, values, motivations, and behaviors through their frequent interactions with students (Hong et al. 2011; Zions et al. 2002). According to the literature, teachers' care, support, and trust significantly influence positive adolescent development: engaging in cooperative behaviors and developing affirmative attitudes (Kelly 2017; Lerner and Steinberg 2009). Thus, connectedness to school (including supportive teacher–student relationships) makes it possible for problematic students to seek help, which, in turn, reduces the likelihood of engagement in PBs (Dwyer and Osher 2000).

Fifth, we found positive associations between poorer parental affection and a greater PB-related class membership

probability. Consistently, unsupportive parent–adolescent relationships have been found to increase both the risks of engaging in PBs and probabilities of PB-related class membership (Fletcher et al. 2004; Kázmér et al. 2014; Vaughn et al. 2014). Parental knowledge about their offspring's activities and whereabouts seems to play an important role in understanding this association. Kerr and Stattin (2000) found lower risk of PBs among adolescents whose parents had sufficient knowledge about their children, and they suggested spontaneous adolescent disclosure as an important means of increasing parental knowledge about their children. In warm and supportive parent–adolescent relationships, adolescents tend to spontaneously share their personal information with parents, which will increase parental knowledge about their lives and, in turn, decrease the likelihood of adolescent PBs (Fletcher et al. 2004). Indeed, Fletcher et al. (2004) proved this mechanism in their empirical study, finding the significant mediating effect of parental knowledge on the association between parental warmth and adolescent substance use.

Sixth, we found that those with lower levels of abuse inflicted by parents had a lower PB-related class membership probability. This result is in accordance with previous studies, finding (a) greater PB-related class membership probabilities among female adolescents experiencing sexual abuse and childhood maltreatment (Shin et al. 2010) and (b) higher proportions of adolescents experiencing physical and sexual abuse inflicted by family members in PB-related latent classes (Thullen et al. 2016). As a potential reason for this phenomenon, Agnew (1992) indicates that abused adolescents are highly likely to engage in PBs in order to alleviate negative emotions (e.g., depression and anger) caused by negative stimuli (e.g., abuse and neglect). In addition, adolescents tend to use maladaptive means (e.g., involvement in PBs) as coping strategies because they often do not have the experience and support needed for effective coping, and they are often forced to remain under the influence of negative stimuli due to a lack of power to terminate or avoid the stimuli (Agnew 2004).

Finally, we found that less aggressive adolescents had a lower PB-related class membership probability. This result is consistent with previous studies, finding greater aggression among (a) adolescents who use a greater number of substances (Ernst et al. 2006), (b) co-users of alcohol and cigarettes (Chun and Chung 2013), and (c) those belonging to the most problematic PB-related latent class, compared to the other classes (Pilatti et al. 2013). Aggressive adolescents can be at greater risk of engaging in PBs through peer rejection (Fite et al. 2008; Rosenberg and Anthony 2001). Specifically, aggressive adolescents are highly likely to experience social isolation due to peer rejection, which would decrease their opportunities for developing communication skills and empathy through positive peer socialization (Bierman 2004). Therefore, they tend to affiliate with

aggressive peers who encourage engagement in PBs and reinforce positive norms toward PBs (Powers and Bierman 2013).

In addition, in relation to predictors of class membership, we found (a) a greater number of significant predictors (e.g., peer, teacher, and family characteristics, as well as individual characteristics) in the high-risk class (i.e., the HCAU class) than in the moderate-risk class (i.e., the NHAU class) and (b) stronger relationships of predictors with the high-risk class than with the moderate-risk class. Of five previous studies investigating predictors of class membership (Assanangkornchai et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014), four studies have found the same results (Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Vaughn et al. 2014). Our study finding is also in line with what Evans et al. (2013) explain: (a) as compared to exposure to a single risk factor, exposure to multiple risk factors (i.e., cumulative risk) more negatively affects adolescent development and (b) exposure to more risk factors is associated with more severe and detrimental developmental outcomes. Two empirical studies using a variable-centered approach consistently found strong negative associations between cumulative risk and greater risks of adolescent PBs (Appleyard et al. 2005; Gerard and Buehler 2004). The association between cumulative risk and the high-risk class of PBs can be attributable to the fact that adolescent development occurs through their interactions with diverse external environments, such as persons and objects (Bronfenbrenner and Evans 2000). Thus, with exposure to more risk factors, these interactions are more likely to be disrupted, and then desirable adolescent development can be interfered with (Evans et al. 2013).

Given evidence from our study and previous research (Assanangkornchai et al. 2018; Hair et al. 2009; Hasking et al. 2011; Sullivan et al. 2010; Thullen et al. 2016; Vaughn et al. 2014; Weden and Zabin 2005), health professionals should tackle issues of adolescent PBs using two-fold approaches: (a) identifying homogenous subgroups of adolescents based on their patterns of PBs and (b) providing interventions tailored to individual subgroups (Connell et al. 2010; Lane et al. 2013). Specifically, in order to identify patterns of PBs, health professionals should use a person-centered approach by assessing multiple PBs (Khayyati et al. 2016; Salas-Wright et al. 2015). In the next step, health professionals should provide interventions specific to each subgroups identified based on the patterns of PBs (Ahmadi-Montecalvo et al. 2019; Connell et al. 2010; Hair et al. 2009). For example, considering that those in the LR class found in our study had zero or near zero probabilities of engagement in all PBs, they should be given interventions aiming for continuous non-engagement in PBs. Considering that those in the NHAU class had a high probability

of yearly drinking, they should be given interventions aiming to prevent (a) progress towards more frequent drinking and (b) new engagement in other PBs. Considering that those in the HCAU class had high probabilities of almost daily smoking and monthly drinking, they should be given more intense interventions aiming to reduce levels of engagement in the two PBs.

As another strategy to tackle issues of adolescent PBs, Connell et al. (2010) and Evans et al. (2013) emphasize the importance of simultaneously targeting multilevel characteristics (e.g., individual, peer, and parental factors), given their significant impacts on adolescent development, including PBs (Bronfenbrenner 1979; Connell et al. 2010). Our study findings also support this statement: Specifically, we found strong relationships of individual and environmental characteristics (e.g., parents, friends, and teachers) with class membership of PBs.

Strengths, Limitations and Future Research Directions

The current study had three strengths. First, we analyzed nationally representative secondary data, and thus our findings could be generalizable to the Korean adolescent population. Second, we could enhance data accuracy. Ridolfo and Maitland (2011) indicate that the precision of adolescents' proxy reports of parental characteristics can vary depending on their age, race, and gender. Thus, we used information on parental characteristics (i.e., education and income) directly obtained from parents. Third, our study findings obtained using a person-centered approach added to the body of the current literature on the typology of adolescent PBs and one-year lagged factors significantly predicting latent class membership.

Despite these strengths, our study should be cautiously interpreted given the following two limitations. First, information on PBs provided by our participants might not be accurate because adolescents may underreport their socially undesirable behaviors when asked to self-report these behaviors (Kite and Whitley 2018). Second, although we used one-year lagged factors to predict latent class membership, causal inferences could not be drawn due to potential confounders (Lanza et al. 2013).

Future research on adolescent PBs must be directed toward addressing the following issues. First, further empirical research on Korean adolescents must be conducted. As far as we know, our study is the first to investigate PB patterns among Korean adolescents, and thus the replication of our findings should be investigated using another sample of Korean adolescents. Second, cross-cultural comparative research should be conducted to better understand the differences in PB patterns (Salas-Wright et al. 2015): For example, cross-cultural studies should be

conducted in order to compare this phenomenon between Western and Eastern countries. In addressing the two issues, a more rigorous research design should be used (Lanza et al. 2013): (a) the analysis of nationally representative longitudinal data and (b) the use of a wide range of potentially PB-related predictors (e.g., family, school, and physical environments as well as individual characteristics; Ahmadi-Montecalvo et al. 2019; Bronfenbrenner 1979).

Author Contributions S.P. designed the study, conducted data analysis, reviewed the literature, and wrote the manuscript. J.K. reviewed the literature and wrote the manuscript.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in our study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Our study was certified as exempt from full IRB review because we used de-identified secondary data.

Informed Consent Informed consent was not necessary for our study due to the analysis of de-identified secondary data.

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