

Familial, Environmental, and Personal Predictors of Adolescent Drinking: A Bio-ecological Perspective

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Alcohol abuse by college students has become a major social issue. Numerous studies have identified factors associated with adolescent drinking. However, from a human ecological perspective, alcohol use, like other behaviors, occurs in interaction between person and environment. Therefore, numerous types of contextual factors need to be incorporated in examining alcohol use. The current study, based on an IRB approved online survey, examined parental, environmental and personal factors associated with drinking among young adults ($N=1,208$; aged 18 to 25). Paternal and maternal drinking, perceived parenting quality, residential safety, personality traits, and older siblings were included as ecological factors. SPSS was used for quantitative analyses and AMOS was used for structural equation modeling (SEM). More than 80% of the participants reported drinking alcohol; nearly 60% began before age 18, and 45.9% engaged in weekly drinking. The younger the age of alcohol initiation, the more frequent their drinking. An association between parental and children's drinking was significant. Conversely, perceived parental quality contributed to delayed alcohol initiation. Further, SEM analysis revealed that residential safety contributed to higher parenting quality, which predicted delayed alcohol initiation while parental drinking predicted earlier alcohol initiation. Gender differences were revealed in effects of personal and parental characteristics on adolescent alcohol initiation. Same-gender effects suggest that father's and mother's drinking are likely to influence sons and daughters uniquely. These findings imply that gender, both that of child and parent, needs to be taken into account in dealing with underage drinking. Parental factors, both positive and negative, as well as other environmental factors, deserve further study.


Key Words: adolescent, environment, safety, alcohol, personality, siblings, structural equation modeling

Introduction

Alcohol use among college students has become an important health issue and is a major contributing factor to alcohol-related morbidity and mortality (Beets et al., 2009; Zambonga et al., 2009). Nearly 77% of all college students have reported drinking alcohol monthly (Johnston, O'Marrley, Bachman, & Schulenberg, 2006) and over 40% of college students engaged in binge drinking within the past month (Office of Applied Studies, 2007). Grucza, Norberg, and Bierut (2009) examined the prevalence of binge drinking among youths and young adults in the past three decades and found that while overall risk of binge drinking decreased, risk of alcohol abuse among college students remains unchanged and risk among female college students has increased. College students' alcohol consumption is positively affected by frequency and quantity of alcohol use in high school (Mason et al., 2012). The National Survey on Drug Use and Health reported the average age of alcohol initiation to be 15.9 years (Substance Abuse and Mental Health Services Administration, 2012). Risk factors associated with early alcohol initiation included parents' alcohol use norms, maternal alco-

hol dependency (AD), paternal AD, and parental divorce. Additional predictors of adolescent alcohol initiation include smoking, adults drinking in the home, underage drinking, and peer drinking (Fisher, Miles, Austin, Camargo, & Colditz, 2007; Gossrau-Breen, Kuntsche, & Gmel, 2011). Numerous studies have identified factors associated with multiple facets of adolescent drinking (e.g. Camargo, & Colditz, 2007; Martens, Pederson, Smith, Stewart, & O'Brien, 2011; Norberg, Norton, Olivier, & Zvolensky, 2010). Yet, little is known how residential environmental characteristics may be associated with adolescent drinking; a comprehensive, integrated understanding that illustrates interrelatedness among multiple levels of influential factors on adolescent drinking seems to be lacking.

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The current study, based on a bio-ecological framework, uses structural equation modeling to gain a better understanding of interactions among multilevel environmental factors on adolescent alcohol initiation and subsequent drinking patterns among college students ($N = 1,208$).

Literature Review

The late teens to 20 years of age are typified by changes in multiple domains and a period of continued neurological, cognitive, and social maturation (Schulenberg & Maggs, 2002). Psychosocial changes during this period including weakened parental monitoring, greater autonomy and increased peer involvement make adolescents vulnerable to engaging in risky behaviors including smoking, reckless driving, unprotected sex and heavy drinking (Brown et al., 2008).

Heavy drinking by college students has been related to academic difficulties, property damage, fighting, alcohol poisoning, and death (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). Alcohol use and abuse has contributed to physical dating violence in college students and adolescents (Foshee et al., 2011; McCauley, Ruggiero, Resnick, Conoscenti, & Kilpatrick, 2009; McDonnell, Ott, & Mitchell, 2010), risky sexual behavior (Murry, Simons, Simons, & Gibbons, 2013), binge eating, and shoplifting (Benjamin and Wulfert, 2005). Calendar events (Beets et al., 2009) such as spring break (Lee, Lewis, & Neighbors, 2009) and 21st birthdays (Lewis et al., 2012), have become common venues for binge episodes. An attempt has been made to apply an ecological perspective to examine the effects of multi-level contextual factors on adolescent drinking, the results of which indicated an association between neighborhood factors and adolescent drinking (Ennett et al., 2008).

Bronfenbrenner's Bio-Ecological Model

Undoubtedly multiple factors shape developmental process outcomes. Ecological perspectives pay attention specifically to multiple levels of environmental factors (microsystem, mesosystem, exosystem and macrosystem) that either directly or indirectly impact development (Bronfenbrenner, 1989); Bronfenbrenner emphasized that development is a function of the person and the environment, $D = f(PE)$. Subsequently, Bronfenbrenner and Morris (1997) expanded the previous ecological theory to better illustrate interactions between biological and environmental factors that shape development; in this bio-ecological model, development refers to stability and change in the biopsychological characteristics of human beings over the life course. Four basic components of the bio-

ecological model include: person (biological characteristics), proximal processes (particular forms of interaction between organism and environment), environmental contexts (both immediate and remote), and chronosystem (time factor- period in which the proximal processes take place).

Person Factors: Personality and Gender

Personality, considered a stable attribute of personhood, has been examined in relation to alcohol use and consumption patterns. Alcohol abuse has been associated with higher levels of impulsivity and urgency (Martens, Pederson, Smith, Stewart, & O'Brien, 2011), disinhibition (Carlson, Johnson, & Jacobs, 2010), higher levels of social anxiety for women, and a protective effect of social anxiety for men (Norberg, Norton, Olivier, & Zvolensky, 2010). Rush, Becker, and Curry (2009), sampling college students, found that binge drinking correlated with neuroticism, conscientiousness and distress. Shin, Hong, and Jeon (2012) found that urgency and sensation-seeking contributed to alcohol abuse. Overall, young adult alcohol consumption has been related to the impulsivity and anxiety, neuroticism, conscientiousness, sensation-seeking and has been examined for relationships to parent and child extraversion.

Gender also influences drinking behavior (e.g., Bacio, Mays & Lau, 2013; Shih, Miles, Tucker, Zhou, & D'Amico, 2012). For instance, men with high social anxiety tended to drink less than their counterparts with low social anxiety while the opposite was true of women (Norberg, Norton, Olivier, & Zvolensky, 2010). Parental monitoring, a protective factor in substance use, tends to be higher for girls than for boys (Strunin et al., 2013).

Proximal Processes and Microsystem: Family Factors

Parenting effects. Baumrind (1991) posited that parenting characterized by commitment and balance of demandingness and responsiveness promoted adolescent competence as well as protected adolescents from problematic drug use. Paternal parenting and maternal parenting had different effects on adolescent socio-emotional maturity, self-esteem (Hakoyama, Griffore, & Phenice, 2014), and health behaviors (Hakoyama & MaloneBeach, 2016). Child's gender also influences perception of parenting quality (Hakoyama, 2014).

Strunin et al. (2013) surveyed 49,481 Mexican high school and college students and found a relationship between parental monitoring and risky behavior. They found that students with higher levels of parental monitoring were less likely to drink heavily; younger women with less monitoring were particular-

ly vulnerable to engagement in risky drinking. A study of 411 African American adolescent males found that harsh and inconsistent parenting, particularly from mothers, increased susceptibility to involvement with substance using friends and with substances (Murry et al., 2013). These findings are not inconsistent with those based on Caucasian samples, and they provide evidence to support Baumrind's earlier findings. Caring and supportive parenting, high expectations and participation in family responsibility all contribute to psychosocial well-being in children. Parental monitoring, open parent-child communication, high-quality parent-child relationships, and balanced parental demandingness and responsiveness, had protective effects on adolescent risky behavior as well as for selecting friends who are not substance-users (Cheng & Lo, 2009; Strunin, et al., 2013). Fisher et al. (2007) found that eating family dinner at home every day had a buffering effect on alcohol initiation among girls. Sampling Latino immigrants to the U.S., Bacio, Mays, and Lau (2013) found that more recent immigrant adolescents were less vulnerable to alcohol initiation and continued use than those who were third generation in the U.S; they suggested that parental influence waned as acculturation increased, leaving adolescents more reliant on peers and the cultural environment for guidance regarding alcohol use. Good family management practices have been related to lower levels of drinking in Caucasian, Mexican, and African American adolescents (Murry et al., 2013; Strunin, et al., 2013). Overall, parental monitoring, supervision, and open communication deter their children from involvement in high-risk behavior.

Conversely, parenting styles can have negative effects on adolescent's drinking. McKay, Sumnall, Goudie, Field, and Cole (2011) examined problematic drinking among teenagers in Northern Ireland and found that ambiguous guidance and/or strict parental rules on drinking and less parental trust predicted problematic drinking. Parent-child communication was unrelated to initiation of drinking or smoking (Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001). Like Murry et al. (2013), Lamis, Malone, Lansford and Lochman (2012) found that mothers' harsh discipline also contributed to the initiation of alcohol use. Cheng and Lo (2009) found that parental drinking showed no significant impact on adolescent's alcohol use. Trucco, Colder, and Wiczorek (2011) found that neither parental warmth nor control had a moderating effect on adolescent vulnerability to peer influence in alcohol initiation. However, Handley & Chassin (2013) found that alcohol specific disclosures by parents seemed to encourage alcohol consumption by their children. Strycker, Duncan, and Pickering, (2003) reported that a majority of their

participants were with their parents when they had their first drink. These mixed results indicate that parental effects on alcohol use by their children remain unclear.

Siblings. Older siblings' influence on adolescent drinking has been reported (Fisher et al., 2007); its effect was greater when the sibling was the same gender and closer in age (Trim, Leuthe, & Chassin, 2006), that is, older siblings of the same gender who drink appear to act as encouragement to the younger sibling to initiate drinking. Further, Gossrau-Breen, Kuntsche and Gmel (2011), based on a national sample of 3,725 Swiss youth, found that risky drinking was associated with having an older sibling who overused alcohol; this relationship was significantly stronger in the presence of more lax parental supervision.

Exosystem: Environmental Factors

Research on social contexts of alcohol initiation found that many adolescents were at home or hanging out at parties when they first tried alcohol (Strycker et.al., 2003). The influence of neighborhood characteristics on drinking behavior indicates that living in a high socioeconomic status neighborhood was associated with increased parental drinking, which, in turn, had effects on increased alcohol use by their adolescent children (Chuang, Ennett, Bauman, & Foshee, 2005). However, greater community support was associated with lower rates of adolescent alcohol use (Mills & Bogenschneider, 2001). When they have moved away from home, Zamboanga et al. (2009) found that female college students living in residence hall-style housing engaged in higher levels of heavy alcohol use than did their counterparts living in house-style arrangements. Boyd, McCabe, and d'Arcy (2004) also found that binge drinking was higher among students residing in residence halls and highest for students living in fraternity and sorority houses. Each of these settings may create its own standard for acceptable levels of alcohol consumption and risky behavior.

Chronosystem: Adolescence as a period of molting

Along with dramatic physical changes, teenagers experience qualitative changes socially, psychologically, and emotionally and report lower levels of interaction and emotional closeness with their parents (McKay et al., 2011). Concurrently, different areas of the teenage brain keep developing at different paces, which influences behaviors. For instance, teenagers' logical reasoning abilities may reach adults levels, yet, judgment, decision making, impulse control and ability to resisting peer pressure remain immature (Casey, Tottenham, Liston, & Burston, 2005; Stein-

berg, 2007). This leaves adolescents vulnerable to risky behaviors including alcohol use and abuse.

Aims of the Study

Numerous studies have examined adolescent drinking in relation to parental factors, environmental influences or personality factors. Yet, these factors are assumed to interact in influencing adolescent drinking. The current study, guided by a bio-ecological perspective and applying Structural Equation Model (SEM), attempts to provide an integral picture of interrelatedness among these factors. Factors considered in our bio-ecological model include the following: person factors (personality and gender), proximal processes (parenting quality and parental drinking), microsystem (older sibling), exosystem (residential safety), and chronosystem (adolescence), see Figure 1. SEM examines complex path models combined with latent variables that illustrate directional effects (Hox & Bechger, 1998).

The main aims of the current study are to examine: 1) influences of perceived parenting quality on adolescent alcohol initiation and subsequent drinking, 2) effects of paternal and maternal drinking behaviors on adolescent alcohol initiation and subsequent drinking, 3) impact of residential environments on parenting quality and adolescent alcohol initiation, 4) role of personality traits in alcohol initiation, 5) siblings effects on alcohol initiation age, 6) effects of alcohol initiation age on subsequent drinking, 7) effects of children’s gender on the influences of parental quality, paternal and maternal drinking, personality, and having an older sibling on adolescent alcohol initiation and subsequent drinking.

Based on previous empirical evidence, we hypothesized that personality traits (extraversion and agreeableness), parental drinking, and having an old-

er sibling promote adolescent alcohol initiation. Conversely, high parenting quality, safer residential environment, and conscientiousness contribute to delaying adolescent alcohol initiation. Second, lower age of alcohol initiation predicts higher subsequent drinking frequency, Figure 2.

Further, parental and adolescent genders are expected to have an effect on adolescent alcohol initiation; assuming parental gender role model effects, as mothers drink more, their daughters will initiate drinking younger, drink more frequently, and consume more per drinking event. Fathers will have more influence on sons’ drinking habits than mothers.

Method

Procedure

An invitation to an IRB approved anonymous online survey with an option to earn extra credit was sent to students in a midsize, Midwestern university. Students were given several days to complete the survey. To receive extra credit and to maintain anonymity, participants provided the necessary grading information on a separate webpage. While there was no time limit to completing the survey, it generally took 40 to 60 minutes to complete the survey.

Participants

Participants were 1,208 undergraduate students aged 25 and under, $M = 19.22$, $SD = 1.33$. Nearly 78.0% were women and 88.5% were Caucasian. A majority of the participants was freshmen (55.3%), followed by sophomores (21.3%). More than 95% were fulltime students, approximately one third of whom had part time jobs.

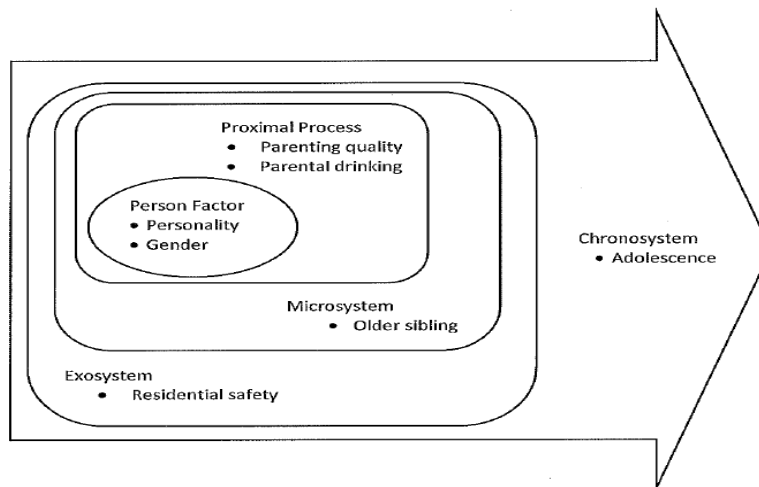


Figure 1. Hypothesized bio-ecological conceptual model of adolescent alcohol use

Instruments

A survey was developed to assess relationships among college students' psychosocial development, academic performance, behavioral habits, personal characteristics, parental effects, and environmental conditions. Participants' retrospective evaluation of their parents was assessed in three stages: childhood (up to age 12), adolescence (age 12-18), and young adulthood (beyond age 18). Retrospective accounts, especially when focused on interactions of one's family of origin, tend to be reliable and accurate (Brewin, Andrews, & Gotlib, 1993). The survey posed questions related to the participants' drinking behaviors, their fathers' and mothers' drinking behaviors, parenting quality, sibling effects, and their residential environments.

Parenting quality. Any single definition of a good father will not necessarily be appropriate for all the participants (Sanders, 1986), thus, participants were first asked to describe what it means to be a good father, which was followed by a 7-point scale (1 = *Not at all good*, 7 = *Very good*) rating of their father. The same procedure was used for describing a good mother. Similarly, participants' perceptions of how similar their fathers and mothers were in parenting views and practices were also assessed in a 7-point scale (1 = *Not at all similar*, 7 = *Very much the same*) (Author, 2014; Sanders & Trygstad, 1993).

Drinking behaviors. Questions also tapped the participants' drinking status (drinker or nondrinker), alcohol initiation age, drinking frequency, and heavy drinking episodes. Questions related to parental drinking included fathers' and mothers' drinking status, drinking frequency, and overdrinking frequency (perceived as drunk by children).

Residential safety. Participants' residential environment while growing up was assessed with four items that asked about neighborhood safety, neighborhood peacefulness, and high school safety using 4-point rating scales (1 = *Strongly disagree*, 4 = *Strongly agree*).

Personality. The Ten Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann Jr., 2003) assessed respondents' big five personality traits (extraversion, agreeableness, conscientiousness, neuroticism [emotional stability], and openness), with two items for each trait. One item described one pole of the trait and the other the opposite pole. For example, two items for conscientiousness included "Dependable, self-disciplined" and "Disorganized, careless." A 7-point scale (1 = *Disagree strongly*, 7 = *Agree strongly*) was used for assessing each item. TIPI has shown high validity (Furnham, 2008) and acceptable test-retest reliability (mean $r = .72$), which can be replaced as reasonable proxies with a longer, more

complex instrument such as the 44-item Big-Five instruments for latent variable modeling (Gosling et al., 2003).

Analysis

SPSS was used for descriptive and inferential statistics, which included correlation, Chi-square cross-tabulation, independent t-test, and ANOVA. AMOS was used for structural equation modeling (SEM) utilizing maximum likelihood estimation. Due to a small number of missing cases (0 - 1%) for the variables included in the SEM, listwise deletion was used for missing data (Takahashi, 1998).

Results

Students' Drinking Behavior

Of 1,208 participants, 972 (80.5%) reported that they engage in drinking. No gender difference was found in drinking status (drinker or nondrinker), $X^2(1, N = 1,208) = 1.80, p = \text{n.s.}$ Of the drinkers ($N = 972$), 4.1% began drinking at age 13 or younger, 8.2% at age 14, 14.5% at age 15, 22.7% at age 16, 19.7% at age 17, 21.4% at age 18, and 9.4% at age 19 or older ($M = 16.51, SD = 1.77$). No significant difference was found between men ($M = 16.62, SD = 1.80$) and women ($M = 16.48, SD = 1.77$) in alcohol initiation age, $t(970) = .958, p = \text{ns.}$

Of the 972 drinkers, 56.8% reported drinking once a week or oftener, 16.9% reported drinking once per month or less ($M = 69.10$ times per year, $SD = 54.78$). Men ($M = 77.89$ times per year, $SD = 58.51$) engaged in drinking significantly more frequently than women ($M = 66.49, SD = 52.06$), $t(970) = 2.73, p = .006, 95\% \text{ CI } [3.21, 19.59]$. More than half of the drinkers (56.9%) reported that they drank 4 or more drinks per episode while only 20.6% reported to drink 2 or less ($M = 4.17$ drinks per episode, $SD = 1.96$). Men ($M = 5.39$ drinks, $SD = 2.22$) were significantly more likely to consume more drinks per episode than women ($M = 3.80, SD = 1.72$), $t(297.62) = 9.75, p < .001, 95\% \text{ CI } [1.27, 1.91]$.

More than a third (38.8 %) of the drinkers reported that they drank heavily (4 drinks per episode for females; 5 for males per episode) once a week or more often; 38.5% reported to do so once a month or less ($M = 47.75$ per year, $SD = 51.80$). Men ($M = 57.48$ per year, $SD = 54.57$) engaged in heavy drinking more often than women ($M = 45.02, SD = 50.70$), $t(314.34) = 2.955, p = .003, 95\% \text{ CI } [4.16, 20.76]$. Further, significant correlations were found between alcohol initiation age, drinking frequency, and heavy drinking frequency for both men and women, Tables 1 and 2.

Parental Drinking

Approximately three quarters of the students (73.6%) reported that both of their parents were drinkers while only 7.5% of the students reported that both were nondrinkers; 14.3% of the fathers were nondrinkers and 29.6% were regular drinkers (3 or more times per week); 19.6% of the mothers were nondrinkers and 15.1% were regular drinkers; 14.3% of the participants reported that their fathers got drunk once a week or more often while 41.3% reported that their fathers never got drunk; 6.0% of the participants reported that their mothers got drunk once a week or more often while 50.2% reported that their mothers never got drunk. Of the drinking parents, fathers ($M = 117.75$ days per year, $SD = 120.2$) engaged in drinking more frequently than did mothers ($M = 73.78$ days per year, $SD = 94.61$), $t(748) = 9.42, p < .001, 95\% CI [34.80, 53.13]$.

Parenting Quality

A 7-point rating scale (1 = *Not at all good*, 7 = *Very good*) assessed participants' perceptions of their parents' parenting quality based on their own definition of a good father and mother. Nearly two thirds (61.5%) rated their fathers' parenting quality during adolescence (age 12-18) as good (rating of 6 or higher) while 11.2% rated 2 or lower ($M = 5.43, SD = 1.79$). Three quarters (77.3%) of the participants rated their mothers' parenting quality during adolescence as good (rating of 6 or higher) while only 3.1% rated 2 or lower ($M = 6.10, SD = 1.29$).

Participants' views of parental consistency (similarities in their parenting views and practices between their fathers and mothers) were assessed in a 7-point scale (1 = *Not at all similar*, 7 = *Very similar*); 47.4% of the participants rated 6 or higher while 13.6% rated 2 or lower ($M = 4.93, SD = 1.79$). No difference was found between the men ($M = 5.02, SD = 1.74$) and women students ($M = 4.91, SD = 1.81$), $t(1,206) = .85, p = n.s., 95\% CI [-.14, .35]$.

Table 1. Adolescent drinking, Parenting factors and residential conditions (Female): Correlations and Descriptive Statistics ($N = 750$)

Variables	1	2	3	4	5	6	7	8	9	10	11
1 Alcohol initiation age	-										
2 Drinking frequency	-.35**	-									
3 Heavy drinking frequency	-.39**	.81**	-								
4 Father's drinking frequency	-.13**	.15**	.12**	-							
5 Father's overdrinking frequency	-.14**	.08*	.12**	.56**	-						
6 Mother's drinking frequency	-.11**	.12**	.12**	.28**	.09	-					
7 Mother's overdrinking frequency	-.16**	.09*	.12**	.09*	.14**	.52**	-				
8 Father quality (adolescence)	.12**	-.06	-.09*	-.11**	-.29**	-.04	-1.0**	-			
9 Mother quality (adolescence)	.12**	-.02	-.03	.06	-.03*	-.01	-.07	.24**	-		
10 Parenting consistency	.14**	-.05	.09*	-.10**	-.24**	-.02	.08*	.61**	.27**	-	
11 Residential environment	.09*	.02	.01	-.01	-.09*	-.01	-.06	.18**	.16**	.17**	-
Variables	1	2	3	4	5	6	7	8	9	10	11
<i>M</i>	16.48	66.49	45.02	101.05	25.61	63.84	11.16	5.32	6.07	4.89	13.73
<i>SD</i>	1.77	53.06	50.70	118.93	65.47	93.51	36.03	1.84	1.31	1.82	2.13

* $p < .05$, ** $p < .01$

Table 2. Adolescent drinking, parenting factors and residential conditions (Male): Correlations and Descriptive Statistics ($N = 222$)

Variables	1	2	3	4	5	6	7	8	9	10	11
1 Alcohol initiation age	-										
2 Drinking frequency	-.20**	-									
3 Heavy drinking frequency	-.21**	.67**	-								
4 Father's drinking frequency	-.19**	.15*	.15*	-							
5 Father's over-drinking frequency	-.20**	.11	.05	.54**	-						
6 Mother's drinking frequency	-.10	.12	.25**	.32**	.08	-					
7 Mother's over-drinking frequency	-.09	.12	.19**	.18**	.27**	.61**	-				
8 Father quality (adolescence)	.16*	.07	-.02	-.04	-.25**	.03	.04	-			
9 Mother quality (adolescence)	.17**	-.08	-.16*	.05	-.03	-.03	-.10	.20**	-		
10 Parenting consistency	.18**	-.04	.01	-.07	-.21**	.03	.07	.56**	.33**	-	
11 Residential environment	.12	-.01	.05	-.04	.05	-.00	-.07	.20**	.10	.16*	-
Variables	1	2	3	4	5	6	7	8	9	10	11
<i>M</i>	16.61	77.89	57.48	105.11	31.93	55.27	14.40	5.71	6.10	4.96	13.19
<i>SD</i>	1.80	59.51	54.57	118.00	70.27	82.43	44.87	1.61	1.27	1.74	2.50

* $p < .05$, ** $p < .01$

Residential and School Environment

Safety of the participants' environment in which they grew up was assessed on a 4-point scale (1 = *Strongly disagree*, 4 = *Strongly agree*) and included neighborhood safety ($M = 3.59$, $SD = .67$), neighborhood peacefulness ($M = 3.38$, $SD = .70$), high school safety ($M = 3.51$, $SD = .69$), and neighborhood friendliness ($M = 3.06$, $SD = .86$).

Older Sibling

A third of the respondents had one older brother, 13.7% had two or more older brothers; 31.7% had one older sister; 10.9% had two or more older sisters; 36.6% had no older sibling.

Adolescent Drinking and Associated Factors

Parental drinking status (drinker or non-drinker) was associated with children's drinking, $X^2(2, N = 1,207) = 39.20$, $p < .001$. Among the participants with non-drinking parents, 64.4% of the participants engaged in drinking; 73.8% of the participants engaged in drinking when one of the parents was a drinker, and

86.0% engaged in drinking when both parents were drinkers.

Among participants identified as drinkers, ANOVA revealed a significant main effect for parental drinking on the children's alcohol initiation age, $F(2, 968) = 9.40$, $p < .001$. When both parents were drinkers, participants' alcohol initiation age was younger ($M = 16.33$ years, $SD = 1.63$) than their counterparts who had one drinking parent ($M = 16.94$ years, $SD = 2.20$), or no drinking parent ($M = 17.04$, $SD = 1.86$), 95% CIs [-1.13, -.17], [-.85, -.26], [-1.13, -.17], respectively. Further, adolescent alcohol initiation, drinking frequency, and heavy drinking frequency were significantly correlated with parental drinking, perceived parenting quality, and residential environment, see Tables 1 and 2.

Having an older sibling was not associated with the participants' drinking status (drinker or nondrinker). However, among female participants who reported to be drinkers, having an older sister was significantly associated with alcohol initiation age, $t(545.86) = 2.01$, $p = .045$, 95% CI [.01, .57]; those who had an older sister initiated alcohol use at a younger age ($M = 16.27$, $SD = 1.92$) than their counterparts who had no older sister ($M = 16.56$, $SD =$

1.67). Having an older sibling was not associated with the alcohol initiation age among male students.

Personality Traits and Adolescent Alcohol Initiation

Gender differences in personality traits were found in relation to alcohol initiation age and drinking frequency among drinkers. Among men, neuroticism (emotional stability) was correlated with alcohol initiation age, $r(222) = .17, p = .012$; the more stable emotionally, the older the alcohol initiation age. Among women, extraversion was correlated with alcohol initiation age, $r(750) = -.17, p < .001$, and drinking frequency, $r(750) = .14, p < .001$; the more extraverted, the younger the alcohol initiation age and the more frequently one drank.

Bio-ecological Model

SEM was applied to examine interrelatedness of multiple levels of bio-ecological factors that influence adolescent drinking. Gender differences in predictors of drinking behaviors were observed, but categorical variables tend to violate SEM assumptions (Gallini, 1983). Also, the sample size difference was significant between the men and women. Thus, men and women were examined separately. Predictors of female adolescent alcohol initiation age are illustrated in the path diagram, see Figure 3. Six latent variables (parental quality, paternal drinking behavior, mater-

nal drinking behavior, community safety, child alcohol initiation age, and child drinking behavior) were incorporated in the model. Parental quality was measured by father quality during adolescence, mother quality during adolescence, and consistency in parental views and practices between the parents; paternal drinking behavior was measured by the father’s drinking and overdrinking frequency; maternal drinking behavior was measured by the mother’s drinking and overdrinking frequency; community safety was measured by neighborhood safety, high school safety, neighborhood peacefulness, and neighborhood friendliness; child alcohol initiation was measured by age of alcohol initiation; child drinking behavior was measured by child’s report of drinking and heavy drinking frequency, Figure 2.

In reporting SEM results, a model fit is indicated by a range of fit indices (Hox & Bechger, 1998). A good model fit can be indicated by an insignificant ($p > .05$) Chi-square test result; a model is acceptable when Root Mean Square Error of Approximation (RMSEA) is smaller than .08 and considered a good fit when .05 or below; a model also shows a good fit when Goodness of Fit Index (GFI) exceeds .95, Adjusted Goodness of Fit Index (AGFI) exceeds .90, Comparative Fit Index (CFI) of .95 or higher, and Non-Normed Fit Index (NNFI), also known as Tucker-Lewis Index (TLI), of .95 or higher. These fit indices indicate that the data fit the proposed model well, Table 3.



Figure 2. Hypothesized SEM diagram of adolescent alcohol use

Table 3. Fit Statistics for the Model Tested.

	X^2	df	p	HOELTER (.05)	RMSEA	PCLOSE	GFI	AGFI	NFI	TLI	CFI
Female (N=741)	158.78	80	.000	475	.04[.03, .05]	.997	.97	.96	.95	.97	.97
Male (N=218)	72.23	47	.010	193	.05[.03, .07]	.480	.95	.92	.91	.95	.97

Note. RMSEA = root mean square error of approximation; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; NFI = normed fit index; TLI =Tucker Lewis index; CFI = comparative fit index.

All the significant variances, coefficients and covariances remained in the model ($p < .05$), see Table 4. Standardized coefficients in the female model indicate that higher parenting quality contributed to delayed alcohol initiation age whereas paternal and maternal drinking contributed to early alcohol initiation. The influence of maternal drinking was slightly greater than that of paternal drinking. Maternal drinking had direct effects on adolescent subsequent drinking behavior. Being extraverted contributed to the

early alcohol initiation age. Younger onset of alcohol initiation contributed to more active engagement in drinking when in college. Safer living environment contributed to higher parenting quality. Sibling effect was incorporated in the initial model because the t -test indicated a significant association to alcohol initiation age among women. However, it was removed from the final model as it failed to be a significant predictor ($p = .059$).

Table 4. Unstandardized, Standardized, and Significance Levels for Model in Figure 3 ($N = 741$).

Parameter Estimate			Unstandardized	Standardized	p
Safe_Com	→	Pare_Qual	.87	.39	.00
Mo_Drink_Beh	→	Alco_Ini	-.00	-.15	.00
Fa_Drink_Beh	→	Alco_Ini	-.00	-.13	.01
Pare_Qual	→	Alco_Ini	.48	.23	.00
StExtrave	→	Alco_Ini	-.22	-.17	.00
Alco_Ini	→	St_Dr_Beh	-10.68	-.39	.00
Mo_Drink_Beh	→	St_Dr_Beh	.07	.09	.05
Safe_Com	→	NeighPeac_1	1.54	.89	.00
Pare_Qual	→	Mo_QualAdo	.75	.49	.00
Mo_Drink_Beh	→	Mo_DriFre	1.00	.64	
Fa_Drink_Beh	→	Fa_DrinFre	1.00	.75	
Fa_Drink_Beh	→	Fa_DrunkFre	.52	.72	.01
Pare_Qual	→	Pare_View_Simi	1.11	.52	.00
Pare_Qual	→	Fa_QuaAdo	1.00	.47	
Safe_Com	→	NeighSafe_1	1.26	.77	.00
Safe_Com	→	High_S_Saf	.84	.50	.00
Safe_Com	→	NeiBKnew_1	1.00	.46	
Alco_Ini	→	StAgeDrink	1.00	1.00	
St_Dr_Beh	→	StDrinFre	.93	.85	.00
Mo_Drink_Beh	→	StDrinFre	.48	.79	.00
St_Dr_Beh	→	StBingFre	1.00	.95	
E1	↔	E2	.07	.29	.00
E5	↔	E7	1.10	.45	.00
E9	↔	E5	-13.97	-.20	.00
E8	↔	E10	2494.82	.45	.00
E9	↔	E11	176.11	.18	.01

Notes: Safe_Com = Safe community, Mo_Drink_Beh = Mother's drinking behavior, Fa Drink_Beh = Father's drinking behavior, Pare_Qual = Parenting quality, StExtrave = Extraversion, Alco_Ini = Child's alcohol initiation age, St_Dr_Beh = Child's drinking behavior, NeighPeac_1 = Peaceful neighborhood, Mo_QualAdo = Mothering quality during adolescence, Mo_DriFre = Mother drinking frequency, Fa_DrinFre = Father drinking frequency, Pare_View_Simi = Parenting consistency between father and mother, Fa_QuaAdo = Fathering quality during adolescence, NeighSafe_1 = Safe neighborhood, High_S_Saf = Safe high school, NeiBKnew_1 = Friendly neighborhood, StAgeDrink = Child's alcohol initiation age, StDrinFre = Child drinking frequency, Mo_DrunkFre = Mother overdrinking frequency, StBingFre = Child heavy-drinking frequency.

Table 5. Unstandardized, Standardized, and Significance Levels for Model in Figure 4 (N = 218).

Parameter Estimate			Unstandardized	Standardized	p
Safe_Com	→	Pare_Qual	.49	.39	.00
Fa_Drink_Beh	→	Alco_Ini	-.01	-.25	.00
Pare_Qual	→	Alco_Ini	.68	.32	.02
Alco_Ini	→	St_Dr_Beh	-5.88	-.25	.00
Fa_Drink_Beh	→	Fa_DrinFre	1.00	.73	
Safe_Com	→	NeighPeac_1	1.00	.92	
Pare_Qual	→	Fa_QuaAdol	1.00	.56	
Pare_Qual	→	Pare_View_Simi	.81	.40	.00
Pare_Qual	→	Mo_QualAdo	.57	.38	.01
Fa_Drink_Beh	→	Fa_DrunkFre	.63	.76	.00
Safe_Com	→	NeiBKnew_1	.59	.45	.00
Safe_Com	→	NeighSafe_1	.85	.75	.00
Safe_Com	→	High_S_Saf	.82	.72	.00
St_Dr_Beh	→	StDrinFre	1.07	.77	.00
St_Dr_Beh	→	StBingFre	1.00	.81	
Alco_Ini	→	StAgeDrink	1.00	1.00	
E5	↔	E7	.91	.45	.00
E1	↔	E2	.11	.42	.00
E7	↔	E6	.40	.21	.01
E9	↔	E5	-18.91	-.32	.00

Notes: Safe_Com = Safe community, Fa_Drink_Beh = Father’s drinking behavior, Pare_Qual = Parenting quality, Alco_Ini = Child’s alcohol initiation age, St_Dr_Beh = Child’s drinking behavior, NeighPeac_1 = Peaceful neighborhood, Mo_QualAdo = Mothering quality during adolescence, Fa_DrinFre = Father drinking frequency, Pare_View_Simi = Parenting consistency between father and mother, Fa_QualAdo = Fathering quality during adolescence, NeighSafe_1 = Safe neighborhood, High_S_Saf = Safe high school, NeiBKnew_1 = Friendly neighborhood, StAgeDrink = Child’s alcohol initiation age, StDrinFre = Child drinking frequency, StBingFre = Child heavy-drinking frequency.

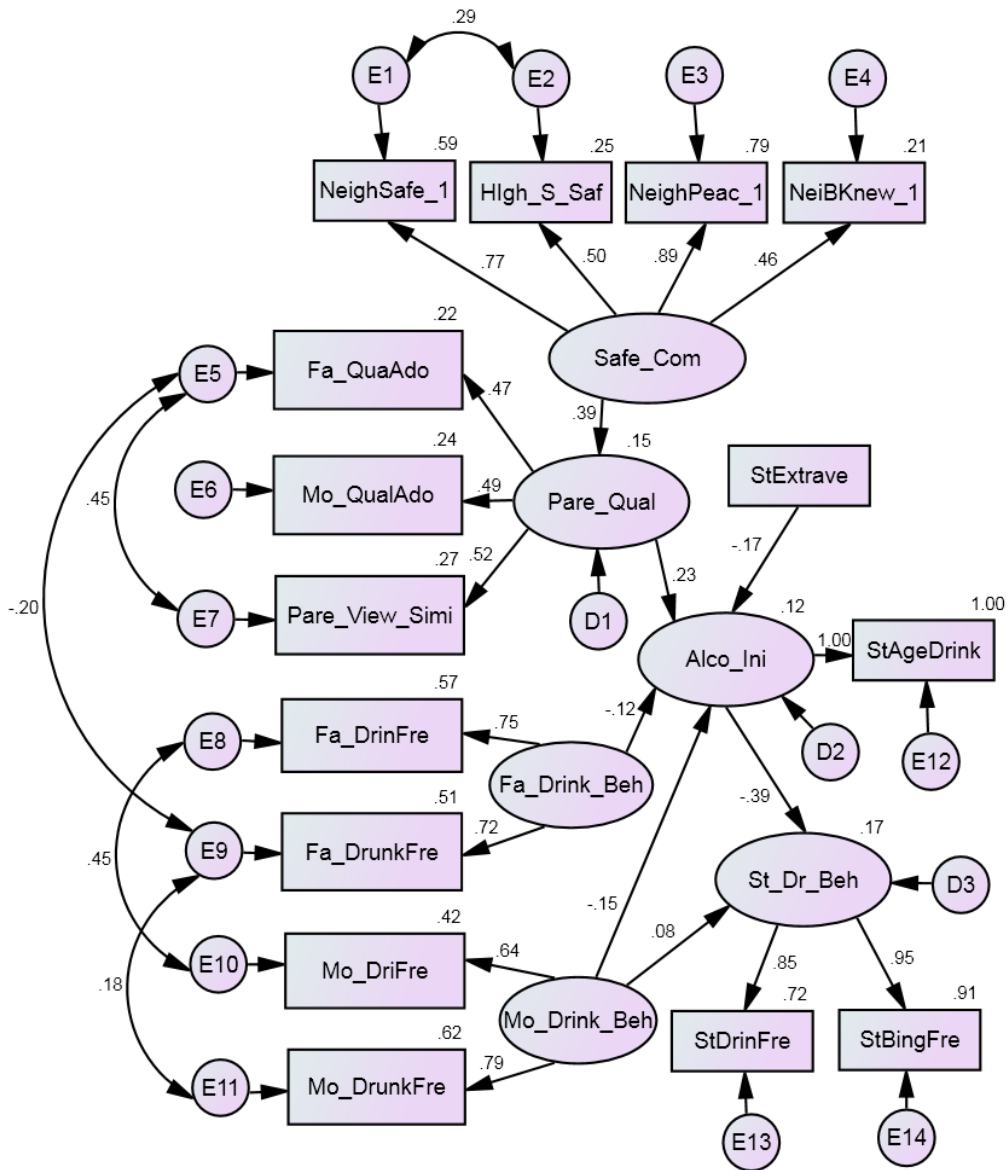


Figure 3. Path diagram (Women). NeighSafe_1 = Safe neighborhood, High_S_Saf = Safe high school, NeighPeac_1 = Peaceful neighborhood, NeiBKnew_1 = Friendly neighborhood, Fa_QuaAdo = Father quality adolescence, Mo_QualAdo = Mother quality adolescence, Pare_View_Simi = Parenting view consistency, Fa_DrinFre = Father drinking frequency, Fa_DrunkFre = Father over drinking frequency, Mo_DriFre = Mother drinking frequency, Mo_DrunkFre = Mother overdrinking frequency, StExtrave = Child extraversion, StAgeDrink = Child alcohol initiation age, StDrinFre = Child drinking frequency, StBingFre = Child heavy-drinking frequency, Safe_Com = Safe community, Pare_Qual = Parenting quality, Fa_Drink_Beh = Father drinking behavior, Mo_Drink_Beh = Mother drinking behavior, Alco_Ini = Child alcohol initiation age, St_Dr_Beh = Child drinking behavior, All the coefficients and covariances shown in the model were significant ($p < .05$).

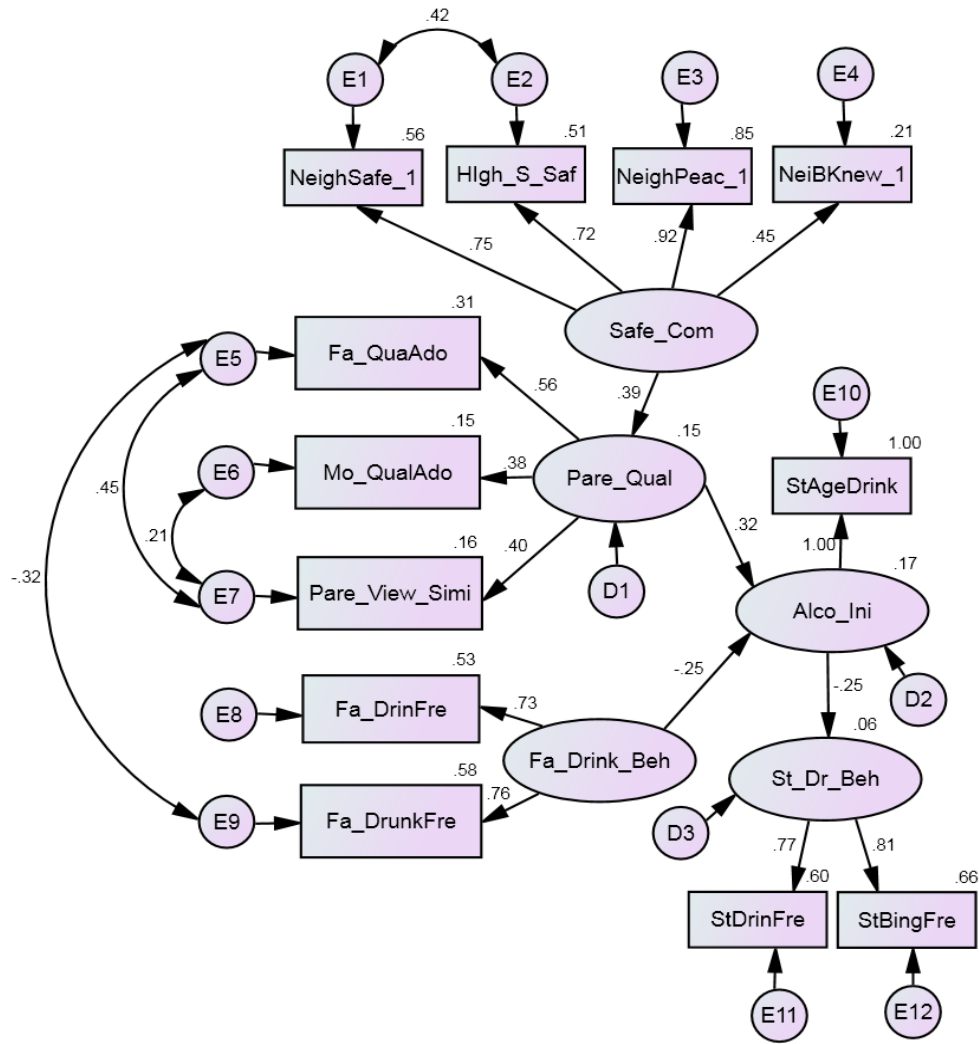


Figure 4. Path diagram (Men). NeighSafe_1 = Safe neighborhood, High_S_Saf = Safe high school, NeighPeac_1 = Peaceful neighborhood, NeiBKnew_1 = Friendly neighborhood, Fa_QuaAdo = Father quality adolescence, Mo_QualAdo = Mother quality adolescence, Pare_View_Simi = Parenting view consistency, Fa_DrinFre = Father drinking frequency, Fa_DrunkFre = Father over drinking frequency, StAgeDrink = Child alcohol initiation age, StDrinFre = Child drinking frequency, StBingFre = Child heavy-drinking frequency, Safe_Com = Safe community, Pare_Qual = Parenting quality, Fa_Drink_Beh = Father drinking behavior, Alco_Ini = Child alcohol initiation age, St_Dr_Beh = Child drinking behavior. All the coefficients and covariances shown in the model were significant ($p < .05$). All the coefficients shown in the model were significant ($p < .05$).

Male participants' path diagram illustrates predictors of male adolescent alcohol initiation age, see Figure 4. Similar to the female model, parental quality and paternal drinking predicted male adolescent alcohol initiation age, which, in turn, predicted their subsequent drinking behavior. In addition, living environment safety predicted parental quality. None of the personality traits or maternal drinking predicted male adolescent alcohol initiation age. Multiple fit indices

indicate that the data fit the proposed path model well, see Table 3.

Generally, an insignificant ($p > .05$) Chi-square indicates a good model fit. However, because Chi-square analysis is sensitive to sample size, it often results in significance ($p < .05$) when the sample size is large (Hox & Bechger, 1998), as is the case for these models. The model is yet considered acceptable provided that the sample size is larger than

HOELTER as in the case for both male and female models here. The other indices also support a good fit for both models, see Table 3.

All the coefficients and covariances in the male model were significant ($p < .05$), Table 5. Further, the standardized coefficients indicated that higher parental quality contributed to delaying alcohol initiation while paternal drinking contributed to the early onset of alcohol initiation. Younger onset of alcohol initiation contributed to more frequent engagement in drinking subsequently. Living environment safety contributed to higher parenting quality, Figure 4.

Discussion and Conclusion

Even though the majority of the participants were under the legal drinking age (M age = 19.22 years), A great majority began drinking at the age of 17 or younger. Girls were as likely to initiate drinking at a younger age as boys were. More than 80% reported drinking, which is higher than Johnston et al.'s (2006) report that by 12th grade 72% of adolescents had experience with drinking alcohol. The mean alcohol initiation age among drinkers in the current study (16.5 years) was slightly higher than previously reported (15.9 years, Substance Abuse and Mental Health Services Administration, 2012); this may be because all participants were in college. While no gender difference was found in alcohol initiation age, men were significantly more likely to engage in alcohol consumption.

Extraversion in women was a predictor of early alcohol initiation. Mixed findings have been reported on the influence of parental drinking; inconsistent with the findings of Cheng and Lo (2009) but consistent with others (Fisher et al., 2007), ANOVA revealed that parental drinking was associated with younger adolescent alcohol initiation age. Inconsistency between the current study and that of Cheng and Lo (2009) could be attributed to their higher risk sample.

Further, this study assumed a bio-ecological perspective to examine interrelatedness among environmental influences, personality traits, and young adult drinking behaviors. SEM was used to determine the direction of effects among variables that have been related to drinking behaviors in earlier research. Factors considered in applying SEM include parental (perceived parenting quality and parental drinking), personal (personality and gender), and environmental (residential safety and having an older sibling). While multiple analyses indicated gender differences, to avoid violating SEM assumptions (Gallini, 1983), gender was not incorporated into the model; instead models were developed separately for each gender. Multiple goodness-of-fit indices suggested that the

data for women and for men both fit the model well.

Residential safety was expected to have a direct effect on adolescent alcohol initiation (Ennett et al., 2008), however, for both gender models, interestingly, community safety had no direct effect on adolescent alcohol initiation; instead it contributed to higher parental quality, which, in turn, impacted the delays in alcohol initiation. Younger alcohol initiation predicted subsequent heavier drinking. Gender differences became apparent in the influence of parental drinking; among women, both maternal and paternal drinking influenced younger onset of alcohol initiation. Maternal influence was slightly greater than paternal influence; maternal drinking also had a direct effect on adolescent drinking behavior. On the other hand, paternal but not maternal drinking influenced male adolescent alcohol initiation. These results indicate a same-gender effect; maternal behavior has a greater impact on daughters than sons. Further, while multiple personality traits were hypothesized to influence adolescent alcohol initiation, being extraverted was the only predictor of alcohol initiation and only for female adolescents. SEM analysis also revealed that environment safety had indirect effects on alcohol initiation age and subsequent drinking behavior for both genders.

Previous studies suggested that harsh, disadvantaged neighborhoods are related to poorer parenting quality (Chung & Steinberg, 2006); in more stable neighborhoods, the impact of low parental monitoring did not contribute to adolescent behavioral problems (Beyers, Bates, Pettit, & Dodge, 2003). Controversial findings have been reported on the relationships between neighborhood conditions and parenting quality (Trucco et al., 2011). The results of the current study suggested that safer residential and school environments contributed to high parenting quality, which, in turn, contributed to delayed adolescent alcohol initiation.

The current study illustrated the influence of multilevel ecological factors on adolescent alcohol initiation and subsequent drinking behaviors (drinking and heavy drinking frequency). The results of ANOVA and SEM both indicated the influence of parental drinking on adolescent alcohol initiation age and how gender influenced adolescent alcohol initiation, clarifying previous inconsistent findings. In addition, the effects of high parenting quality on delaying adolescent alcohol initiation confirm previous findings (Murry et al., 2013; Strunin, et al., 2013). The relationship was significant for both gender models, yet its effect was greater for men than for women while the effect of alcohol initiation on subsequent drinking was greater for women than men, indicating that delaying alcohol initiation could shape subsequent drinking among women more.

Ecological studies have illustrated influences of multiple environmental factors on adolescent drinking (e.g., Chuang et al., 2005; Ennett et al., 2008). However, the current study, by applying the bio-ecological model, incorporated personal, environmental and proximal processes in a single model. SEM analysis illuminated the relative and directional influences of multiple personal, familial, and environmental factors on adolescent drinking in a single model. Furthermore, alcohol initiation mean age of 16.5 years indicated that a great majority of the participants began drinking when they were still in high school residing with their parents. This implies that, while abusive drinking among college students often attracts attention of researchers and college administrators, it is not college life that prompts students to initiate alcohol use; instead most young people come to college already familiar with drinking.

This study's important implications are, therefore, (a) Early alcohol initiation is a risk factor for subsequent drinking behavior; efforts to delay alcohol use by high school students contribute to preventing alcohol misuse in college, (b) Parental drinking may send an unspoken message to adolescent children that it is OK to engage in drinking, (c) Parental drinking, especially maternal drinking, has a direct influence on early alcohol initiation among adolescent girls, (d) Being extraverted increases the risk of early alcohol initiation for girls, (e) Good parenting contributes to delaying adolescent alcohol initiation, (f) Safe residential and school environments contribute to higher parenting quality— an unsafe environment has an adverse effect on parenting quality, which, in turn, influences adolescent alcohol initiation. Moreover, considering the pre-college alcohol engagement for the majority, parental efforts to prevent their children's alcohol consumption should be encouraged. However, parent-child communication specific to tobacco and alcohol use was ineffective in preventing adolescents from engaging in smoking or drinking (Handley & Chassin, 2013; Reimuller, Husong, & Ennett, 2011). According to Miller-Day (2008), an effective strategy that impacts adolescent drug (alcohol, tobacco or marijuana) use seems to be a *No tolerance rule* combined with a consensual communication: open family communication and children's compliance with parental authority.

Limitations and Future Research

The current study explained gender differences in how the identified predictive factors influence adolescent alcohol initiation. However, due to ethnic homogeneity of the sample, a similar study will be needed before generalizing the findings to ethnic mi-

norities and to a wider range of socioeconomic statuses. Also, future studies that incorporate other potentially influential factors (e.g., liquor store proximity, peers, religion, and media) in examining alcohol initiation and drinking behavior among diverse adolescents are warranted to clarify unanswered variances in the intertwined factors that influence adolescent drinking.

Further, the nature of cross-sectional data limits the degree to which the results indicate causal relationships. Yet, use of SEM and path diagrams presented eloquently illustrated directional and relative effects that multilevel variables have on young adults' drinking behavior. The effects of gender of both parents and adolescents can be an inspiring force to further explore more detailed pictures of relationships among the bio-ecological factors associated with adolescent drinking.

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