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Place-based characteristics, alcohol advertising, and adolescent alcohol use behaviors in Taiwan: A mixed methods approach

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Abstract

Place-based characteristics, alcohol advertising, and adolescent alcohol use behaviors in Taiwan: A mixed methods approach

By: Yen-Tyng Chen

An emerging line of research indicates that place-based characteristics and alcohol advertising are associated with underage drinking. Few studies have examined this relationship in non-Western contexts. In this dissertation, quantitative and qualitative methods were used to examine relationships of place-based characteristics and alcohol advertising to underage drinking in Taipei, Taiwan. The quantitative phase used a longitudinal school-based study to capture individual-level characteristics and administrative data and Google Street View virtual audit data to capture district-level characteristics. The qualitative phase involved 8 focus group discussions on alcohol marketing and alcohol access among vocational high school students in Taipei, Taiwan.

The first paper examined the associations of place-based characteristics and alcohol advertising to adolescent alcohol initiation and continuation. For alcohol-naïve adolescents, lower district-level economic disadvantage, greater spatial access to betel nut kiosks, and exposure to television-based alcohol advertising were associated with alcohol initiation. For alcohol-experienced adolescents, greater spatial access of off-premises alcohol outlets, and lower access to metro rapid transportation and to temples were associated with alcohol continuation.

The second paper investigated the associations of place-based characteristics and alcohol advertising to drinking intentions. Greater spatial access to on-premises alcohol outlets was more strongly associated with drinking intentions for boys than girls, while greater spatial access to off-premises alcohol outlets was more strongly associated with drinking intentions for girls than boys. Greater exposure to television-based alcohol advertising more strongly predicted drinking intentions for girls than boys. Greater exposure to non-television-based alcohol advertising more strongly predicted drinking intentions for boys than girls.

The third paper used qualitative methods to explore Taiwanese adolescents' perspectives on alcohol marketing for alcopops and regular beer, and analyzed how these marketing efforts influence adolescents' drinking experience. Packaging design and television alcohol advertising were the marketing strategies that influence adolescents' choice of alcopops vs. regular beer.

This dissertation extended previous research on the association of place-based characteristics and alcohol advertising to adolescent alcohol use in a non-Western context. The findings may inform interventions to reduce underage drinking, suggesting that district-level and policy-level efforts are important to restrict alcohol access, strengthen local resources, and exposure to global alcohol marketing to youth.

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Chapter 1: Introductory Literature Review

Introduction

Adolescent alcohol use is a significant public health problem. According to the World Health Organization (WHO), alcohol use is the greatest contributor to disability and mortality among individuals aged 10-24 years (Gore et al., 2011; Rehm et al., 2006). In Taiwan, alcohol is the most frequently used substance among adolescents and creates vulnerability to a range of harmful consequences (Chen and Storr, 2006; Chen et al., 2009b). An emerging line of research indicates that adolescent alcohol use varies significantly by social contexts such as place-based characteristics and exposure to alcohol advertising. Understanding the relationships of place-based characteristics and alcohol advertising to adolescent alcohol use is an important step for planning adolescent alcohol use interventions and policies to strengthen communities, especially when adolescents spend more time outside the home interacting with the broader social environment and social media (Bryden et al., 2012; Bryden et al., 2013; Casswell, 2012; Jackson et al., 2014; Jernigan, 2010).

Studies on the effects of place-based characteristics and alcohol advertising in non-Western countries are needed. In particular, there is a lack of prospective and qualitative studies that help to shed light on the causal relationships of place-based characteristics and alcohol advertising to adolescent alcohol use in non-Western countries, and on local meanings of the environments. Findings from Western contexts might not be generalizable to Asian contexts, where the prevalence of alcohol use, social relationships, and cultural values are profoundly different from those in Western contexts (Dell'Orto, 2002; Read, 2012).

As a fundamental step toward addressing these gaps, this dissertation advances research on the relationships of place-based characteristics and perceived alcohol advertising to adolescent alcohol use by utilizing a mixed methods approach that combines multilevel analyses of prospective data with focus group discussions among adolescents in Taiwan.

This dissertation research examines two domains of influence on adolescent alcohol use: place-based characteristics and perceived alcohol advertising. The primary aims of this mixed methods study are as follows:

Aim 1: To examine the associations of place-based (i.e., district-level) characteristics and perceived alcohol advertising with *alcohol initiation and continuation* in early adolescence in the Taipei Metropolitan Area, Taiwan.

Aim 2: To examine the associations of place-based characteristics and perceived alcohol advertising with *drinking intentions* among adolescents in the Taipei Metropolitan Area, Taiwan.

Aim 3: To explore Taiwanese adolescents' perspectives of and responses to alcohol marketing for alcopops and regular beer, and analyze how these marketing efforts influence adolescents' drinking experience.

Adolescent Alcohol Use as a Significant Public Health Problem

Alcohol use has been ranked worldwide as the greatest contributor to disability and mortality among adolescents and young adults aged 10-24 years (Gore et al., 2011). The Monitoring the Future national survey in the United States reported that in 2011, 70% of 12th graders had used alcohol in their lifetime, 64% had used in the past year, 40% in the

past month, 22% reported binge drinking in the past month (Johnston et al., 2012). In Taiwan, alcohol consumption is socially acceptable and culturally embedded. Even though the legal age for alcohol purchase is 18 or older, alcoholic beverages are commonly provided to adolescents in family, social, and entertainment settings as a social facilitator to enhance interpersonal interaction or cheerfulness (Chen et al., 2008). According to the Taiwan Youth Health Behavior Survey, the percentage of lifetime alcohol consumption among middle school students increased ten percentage points in just 4 years, from 55% in 2006 to 65% in 2010 (Health Promotion Administration, 2006, 2010). In addition, based on the National Survey of Illegal Drug Use among Adolescents (NSIDA) in Taiwan, the incidence rate of alcohol consumption among middle school students also increased from 14% in 2004 to 18% in 2005 (Chen et al., 2009b).

A large body of research indicates that adolescent alcohol use creates vulnerability to a range of harmful physical, social, and academic consequences, including alcohol-related violence, injuries, driving under the influence, truancy, increased risk for using other drugs, and risky sexual behaviors (Donovan, 2014; Gore et al., 2011; Gruber et al., 1996; Hingson et al., 2003; National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2004; Windle and Windle, 2005; World Health Organization, 2014). Furthermore, exposure to alcohol in adolescence may increase the risk of developing an alcohol use disorder in adulthood. Early alcohol use may pose harms to healthy cognitive and neural function development, and thus could be the basis of cognitive and behavioral impairments (Witt, 2010). In Taiwan, a population-based study demonstrated that adolescents who had used alcohol in the past month were more likely to experience a

poorer level of health-related quality of life especially in the domains of emotional problems, bodily pains, and general health (Chen and Storr, 2006).

Place-based Determinants of Adolescent Alcohol Use

As a developmental transition stage, adolescence is a period of change and of increased exposure to new contexts outside the home (Leventhal and Brooks-Gunn, 2000). There is increasing public health concern about how adolescent alcohol use may be influenced by place-based characteristics (Allison et al., 1999; Brenner et al., 2011; Chuang et al., 2005; Ennett et al., 1997; Huckle et al., 2008; Lambert et al., 2004; Livingston et al., 2008; Reboussin et al., 2010; Scheier et al., 1999; Song et al., 2009; Tobler et al., 2009; Truong and Sturm, 2009; van Praag et al., 2009). From a public health perspective, adolescent alcohol prevention programs can be more cost-effective and beneficial if they combine educational initiatives with environmental changes (Bryden et al., 2012; Bryden et al., 2013; Calabria et al., 2011; Kelly-Weeder et al., 2011). Furthermore, the 2007 Surgeon General's Call to Action emphasized environmental contributions, including creating a safer environment and limiting alcohol access, to preventing and reducing underage drinking (Office of the Surgeon General, 2007). Understanding the influences of place-based environments on adolescent alcohol use is an emerging area of research and is an important step for planning adolescent alcohol use interventions and policies to strengthen communities. The studies in the literature review here and throughout are based on Western contexts, unless otherwise specified.

Place-based Social Environments

Based on Social Disorganization Theory, social disadvantage (e.g., economic disadvantage, violent crime) is associated with diminished social integration resulting in increased problem behaviors (Shaw and McKay, 1942). Findings on the association between place-based economic disadvantage and adolescent alcohol use have been mixed (Bryden et al., 2013; Jackson et al., 2014; Karriker-Jaffe, 2011). These inconsistent findings may be in part due to differences in measures of place-based economic disadvantage and in the outcome studied (Bryden et al., 2013; Karriker-Jaffe, 2011). Some studies have found that place-based economic disadvantage is positively associated with a higher level of adolescent alcohol use (Huckle et al., 2008; Vinther-Larsen et al., 2013). The positive association between place-based economic disadvantage and adolescent alcohol use may be explained by the Stress Process, which posits that the environmental characteristic of highly deprived areas may activate psychological stress, which in turn leads to risky behaviors (Stimpson et al., 2007). In contrast, other studies indicated that *lower* place-based economic disadvantage was positively associated with adolescent alcohol use (Chuang et al., 2005; Ennett et al., 1997; Reboussin et al., 2010; Snedker et al., 2009; Song et al., 2009; Trim and Chassin, 2008). One explanation for the increased risk of alcohol use among adolescents in more affluent areas is that adolescents in these areas face greater academic and extracurricular achievement pressures (Luthar and Becker, 2002). In addition, adults in upper middle-class families often provide relatively less after-school supervision; the lack of supervision in these economically advantaged neighborhoods may lead to increased risk of adolescent alcohol use (Reboussin et al., 2010).

Place-based social disorder (e.g., violence crime, safety around neighborhoods) may be another important social environment influencing adolescent alcohol use (Allison et al., 1999; Beyers et al., 2004; Byrnes et al., 2007; Duncan et al., 2002; Ennett et al., 1997; Mrug and Windle, 2009; Reboussin et al., 2010; Scheier et al., 1999; Tucker et al., 2013; Winstanley et al., 2008). A recent review indicated that studies of area-level social disorder have generated mixed findings, but in general adolescent alcohol use appears to be higher in areas with a higher level of social disorder (Bryden et al., 2013). Neighborhood social disorder can be linked to adolescent problem behaviors because it increases the occurrences of stressful life events in neighborhoods and adolescents are more likely to use alcohol as a coping mechanism (Leventhal and Brooks-Gunn, 2000; Scheier et al., 1999). Furthermore, neighborhood social disorder may undermine the parental supervision and monitoring for adolescents that is needed to establish healthy behaviors (Leventhal and Brooks-Gunn, 2000).

Place-based Alcohol Access Environments

Two recent reviews of alcohol access and alcohol use suggested that increases in alcohol outlet density in local communities may be associated with increased alcohol use and alcohol-related problems, and that this association is particularly strong among adolescents (Bryden et al., 2013; Popova et al., 2009). Literature focusing on alcohol outlets and adolescent alcohol use has gained attention only recently (Chen et al., 2010; Huckle et al., 2008; Kuntsche et al., 2008; Livingston et al., 2008; Paschall et al., 2014; Tobler et al., 2009; Treno et al., 2003; Truong and Sturm, 2009; Young et al., 2013). Density of alcohol outlets within the local environment surrounding schools or residential

areas have been shown to be positively associated with adolescent alcohol use (Bryden et al., 2012; Chen et al., 2010; Chen et al., 2009a; Gruenewald, 2008; Huckle et al., 2008; Komro et al., 2007; Kuntsche et al., 2008; Kuntsche and Kuendig, 2005; Livingston et al., 2008; Paschall et al., 2012; Tobler et al., 2009; Treno et al., 2003; Truong and Sturm, 2009; Young et al., 2013).

Most studies used off-premises alcohol outlets (e.g., liquor stores density) as the indicator of the local alcohol environment (Chen et al., 2010; Chen et al., 2009a; Chilenski, 2011; Tobler et al., 2009; Young et al., 2013). A recent study conducted in Taiwan found that spatial access to convenience stores surrounding schools was associated with alcohol use in the past 6 months (Wang et al., 2013). Previous studies have shown that individuals who "look" underage were able to purchase alcoholic beverages from retail off-premises alcohol outlets without showing identification 30-70% of the time (Britt et al., 2006; Toomey et al., 2008). In Taiwan, 20% of adolescent drinkers had ever purchased alcoholic beverages from commercial sources by themselves (Chen et al., 2011). The ease of accessing alcohol from local off-premises alcohol outlets may partially facilitate adolescent alcohol use (Chen et al., 2010; Chen et al., 2009a; Tobler et al., 2009; Wang et al., 2013; Young et al., 2013).

On-premises alcohol outlets may also influence drinking behaviors through social aggregation (Campbell et al., 2009). On-premises alcohol outlets could be the places for social gathering and are also generally regarded as one of the primary sources of alcohol access among adolescents (Kuntsche et al., 2008; Paschall et al., 2014; Truong and Sturm, 2009). It is likely that drinking behavior is directly visible only in on-premises

alcohol outlets, and this affects adolescents' perceptions of alcohol availability, which in turn influence adolescent alcohol use (Kuntsche et al., 2008).

According to Availability Theory, both on-premises and off-premises alcohol outlets make alcohol more accessible by reducing the "full price" of alcohol, including the real price of alcoholic beverages at retail markets and the cost of convenience to obtain them (Stockwell, 2004). In addition to the proximity effect mentioned in Availability Theory, researchers have suggested that alcohol outlets can be conceptualized as an indicator of social disorganization (Livingston et al., 2007). Alcohol outlets are more than places to purchase alcohol; alcohol outlets can often attract uninhibited drinkers, who may serve as sources of violence and other illegal behaviors (e.g., fighting, vandalism) and alcohol-related problems (Gruenewald, 2008). Both on-premises and off-premises alcohol outlets may have an "amenity effect" in which alcohol outlets affect the quality and characteristics of the surrounding environment within local neighborhoods (Graham, 2006; Livingston et al., 2007). In addition, previous studies suggested that the visibility of drinking in on-premises alcohol outlets might create an impression or expectation that adolescent alcohol use is common and socially endorsed (Kuntsche et al., 2008; Paschall et al., 2012). On-premises alcohol outlets may create a pro-alcohol environment though establishing normative expectations concerning underage drinking, which in turn influences adolescent alcohol use.

Place-based Institutional Resource Environments

A review of neighborhood effects on adolescent health has identified place-based institutional resources as a significant aspect of the local environment for adolescents

(Leventhal and Brooks-Gunn, 2000). Place-based institutional resources, which provide learning, social, and recreational activities, such as parks, libraries, community centers, medical facilities, schools, and employment opportunities in neighborhoods could influence adolescent health outcomes. Most of the research examining place-based institutional resources has focused on physical activity outcomes (Ding et al., 2011). A few researchers, however, have examined the influences of place-based institutional resources on adolescent alcohol use (Chilenski, 2011; Tobler et al., 2009; Tobler et al., 2011). A recent cross-sectional study conducted among adolescents in rural and small town school districts in the U.S. found that proximity to youth-serving organizations was inversely associated with adolescent problem behaviors, including alcohol use, after accounting for the school district-level and the census tract-level population density (Chilenski, 2011). Another large-scale study using a composite measure to assess perceived neighborhood strength (including neighborhood identity, resources, participation level of local activities, level of influence on decisions about local policies, and efforts in addressing alcohol use among teenagers) demonstrated that perceived neighborhood strength was negatively associated with adolescent alcohol use, but that the protective effect on adolescent alcohol use could be partially reduced if adolescents were exposed to increased alcohol access at home (Tobler et al., 2009). In Taiwan, the density of educational institutes near a school was inversely associated with children's alcohol-purchasing behaviors (Chen et al., 2011). These findings illustrate the importance of considering positive place-based factors as a means to prevent adolescent alcohol use and related problems.

Gender Differences in the Effects of Place-based Risk Factors

Place-based characteristics may influence boys and girls in different ways. An experimental study in which families used Moving To Opportunity (MTO) vouchers to move out of public housing to more affluent areas has shown strong evidence to support a differential response among girls and boys (Kling et al., 2007). A review suggested that parents and schools may treat boys and girls differently during adolescence (Leventhal and Brooks-Gunn, 2000). The decreased parental supervision and monitoring during adolescence may be more evident among boys than girls. Therefore, boys spend a greater amount of time outside of their homes, have more employment opportunities, and may be more easily influenced by the neighborhood characteristics than girls (Leventhal and Brooks-Gunn, 2000). Research exploring gender differences in the effects of exposure to a broad range of place-based factors is limited. There is a need for future studies to examine gender-specific contextual effects on adolescent health behaviors, including adolescent alcohol use (Karriker-Jaffe, 2013; Pinchevsky et al., 2013).

Alcohol Advertising

A substantial body of research has examined the influence of alcohol advertising on adolescent alcohol-related beliefs, attitudes, intentions, and consumption patterns (Anderson et al., 2009; Gordon et al., 2010a; Hastings et al., 2005; Meier, 2011; Nelson, 2011; Smith and Foxcroft, 2009; Unger et al., 2003). Two recent reviews have examined longitudinal studies of alcohol advertising exposure and adolescent drinking behaviors and suggested that alcohol advertising increases the risks of initiation of alcohol use and levels of alcohol use among adolescents who already used alcohol (Anderson et al., 2009;

Smith and Foxcroft, 2009). The overall research evidence from longitudinal studies demonstrated that alcohol advertising has a modest but contributory impact on adolescent drinking behaviors (Connolly et al., 1994; Ellickson et al., 2005; Gordon et al., 2010b; Grenard et al., 2013; Henriksen et al., 2008; McClure et al., 2006; Sargent et al., 2006; Stacy et al., 2004; Wills et al., 2009).

Recent studies of the relationship of alcohol advertising to adolescent drinking behaviors have pointed to the importance of understanding how these media messages influence adolescents' attitudes, expectancies of alcohol use, and decision to use (Austin et al., 2006; Austin and Meili, 1994; Chen et al., 2005; Chen, 2013; Fleming et al., 2004; Morgenstern et al., 2011; Scull et al., 2010). According to the Message Interpretation Process (MIP) model, adolescents process messages actively using both logical and emotional strategies (Austin et al., 2006; Austin and Johnson, 1997; Austin and Meili, 1994; Austin et al., 2000). Adolescents evaluate marketing messages logically and determine the extent to which the portrayals reflect personal experience or perceived norms. Although researchers have increasingly recognized the importance of incorporating cognitive and affective decision-making processes in the model of alcohol advertising and adolescent drinking behaviors (Jernigan, 2010), it is still in the early stage for researchers to disentangle the interpretive processes linking alcohol advertising to adolescent drinking behaviors.

Gender Differences in the Impact of Alcohol Advertising

Research suggests that alcohol advertising has different impacts on adolescent drinking behaviors for boys and girls (Austin et al., 2006; Connolly et al., 1994; Fisher et

al., 2007; Grenard et al., 2013; O'Hara et al., 2013; Saffer and Dave, 2006). A number of studies have suggested that boys are more susceptible to alcohol advertising than girls (Connolly et al., 1994; O'Hara et al., 2013). A longitudinal study showed that boys who had recalled more commercial broadcast alcohol advertisements at age 15 were more likely to drink larger quantities of beer at age 18 than boys who recalled fewer alcohol advertisements. However, this association was not observed among girls (Connolly et al., 1994). Other studies, however, have shown that girls are more susceptible and sensitive to alcohol advertising than boys (Fisher et al., 2007; Saffer and Dave, 2006). The reasons why gender differences exist in response to alcohol advertising are still unclear and future studies to examine the differences in detail are warranted.

Taiwan as an Emerging Alcohol Market

Taiwan opened its alcohol market to imports in 1987 and joined the World Trade Organization (WTO) in 2002 (Hsu et al., 2005). After the market opened to global beer and spirits industries, the retail price of alcoholic beverages has decreased gradually and global alcohol companies (e.g., Heineken, Anheuser-Busch) have expanded their domestic market share in Taiwan (Euromonitor International, 2014). In 2011, domestic alcoholic production accounted for 72% of the total alcoholic consumption, and imports accounted for 28% (Yeh et al., 2013). Alcohol is widely accessible in Taiwanese society (Chen et al., 2008). According to the "Tobacco and Alcohol Administration Act", neither on- or off-premises alcohol outlets in Taiwan are required to obtain licenses to sale alcoholic beverages (Taiwan Ministry of Finance, 2014). Only alcohol companies that

produce or import alcohol and pharmacies that sell alcohol for medical use are required to obtain licenses from the government (Taiwan Ministry of Finance, 2014).

In 1995, the Taiwanese government lifted the ban of alcohol advertising on television and in print media (Gao, 2005). According to the "Radio and Television Act" and "Satellite Broadcasting Act", alcohol advertisements on television and radio stations are restricted. Alcohol advertisements are only permitted from 9 pm to 6 am on television (Taiwan National Communications Commission, 2003, 2011). In terms of radio, during weekends and summer/winter breaks, alcohol advertisements are only permitted from 9:30 pm to 6 am; and during weekdays, alcohol advertisements are permitted from 9 am to 5 pm (Taylor and Raymond, 2000). In addition to the broadcast time restriction, alcohol companies are required to contain the warning: "excessive drinking harms health," on advertisements and television and radio stations are required to send advertisements to the National Communications Commission in Taiwan for censorship (Taiwan Ministry of Finance, 2014). Print advertisements are also required to contain the warning message with a size no smaller than 10% of the total size of the advertisement. Print alcohol advertisements on buses in Taipei are prohibited (Taiwan Ministry of Finance, 2014). However, the regulation is poorly enforced and compliance is low due to the weak role of self-regulation and limited budget to enforce the regulation (Gao, 2005). Although the Taiwanese government has posted some restrictions on alcohol advertising, the regulations are not comprehensive and have not been updated to keep pace with rapid expansion of marketing.

Gaps in the Literature

Despite the enormous implications for adolescent health, public health research on the association of place-based characteristics and alcohol advertising with adolescent drinking has failed to keep pace with the rapid expansion of global alcohol marketing into emerging markets outside the United States (Bryden et al., 2012; Bryden et al., 2013; Casswell, 2012; Gordon et al., 2010a; Jackson et al., 2014; Jernigan, 2010). Most research that has examined the impacts of place-based characteristics and alcohol advertising on adolescent drinking behaviors has been conducted in Western societies. As the alcohol industry expands and alcohol advertising becomes a global phenomenon, there is a need to extend the research beyond Western context to gain an understanding of how population groups from different cultures respond to alcohol marketing and place characteristics (Bryden et al., 2012; Bryden et al., 2013; Casswell, 2012; Jernigan, 2010; Meier, 2011).

To our knowledge, only two studies have investigated the effects of place-based environments on adolescent alcohol use behaviors in Taiwan (Chen et al., 2011; Wang et al., 2013). Chen et al. (2011) found that the institutional resources environments (i.e., density of educational institutes and public transportation) surrounding schools were inversely associated with alcohol purchase behaviors among children aged 10-12. Wang et al. (2013), using nationally representative sample of middle school and high school students, found that the weighted number of convenience stores within a kilometer buffer zone surrounding schools was positively associated with alcohol use in the past 6 months. However, both of these studies were cross-sectional and examined few aspects of the place-based environments, and neither assessed important attributes of the environments such as place-based social and institutional environments. Furthermore, only one study

has examined the prospective effect of perceived alcohol advertising on adolescent alcohol use in Taiwan (Chang et al., 2014). While the findings from this study shed light on alcohol advertising and adolescent alcohol use in Taiwan, there is much more to be learned about their impacts and the interpretative processes through which alcohol advertising affects adolescent alcohol use, especially in non-Western contexts.

Conceptual Model and Theoretical Framework

The conceptual framework guiding the proposed study is based on the Social Ecological Model (SEM) (Bronfenbrenner, 1979; Stokols, 1996) and Social Cognitive Theory (SCT) (Bandura, 2004). These models have been chosen because they seek to explain how higher-level environments influence individual health outcomes, including adolescent alcohol use outcomes (Chilenski, 2011; Ennett et al., 2008; Pasch et al., 2009; Petraitis et al., 1995). The SEM emphasizes that individual health outcomes are influenced by the surrounding community and societal factors (Bronfenbrenner, 1979; Stokols, 1996). The SCT asserts that environmental influences, such as social reinforcement, may interact with personal factors to affect health outcomes (Bandura, 2004; Petraitis et al., 1995). We also used Social Disorganization Theory to guide us select relevant constructs to assess the social environments and Availability Theory to help us explain the effects of alcohol access environments. We describe these theories in more detail in later chapters.

Figure 1 depicts the conceptual framework of the possible mechanisms through which place-based characteristics and perceived alcohol advertising may influence adolescent alcohol use behaviors. When applying SEM, this study is concerned with

individual, interpersonal, community, and societal factors. Although the primary focus of the proposed study is the higher-level influences (i.e., community and societal factors), it is important to also recognize lower-level factors that may be correlated with these higher-level factors (Karriker-Jaffe, 2011). When applying SCT, the proposed study will draw attention to how community and societal factors facilitate or inhibit adolescent alcohol use through alcohol access, exposure, and modeling (Petraitis et al., 1995).

Significance of the Research

This emerging area of research suggests that place-based characteristics and alcohol advertising are associated with adolescent alcohol use behaviors (Bryden et al., 2012; Bryden et al., 2013; Ennett et al., 2008; Vinther-Larsen et al., 2013). To better address the etiology of adolescent alcohol use and provide implications for policies to strengthen communities and alcohol control, additional studies on the effects of place-based social, alcohol access, and institutional resource environments and perceived alcohol advertising are needed, especially in non-Western countries (Bryden et al., 2012; Bryden et al., 2013; Gordon et al., 2010a). In particular, there is a lack of prospective and qualitative studies that help to shed more light on the causal relationships and local meanings of the environments, and provide possible explanations for the observed relationships (Bryden et al., 2012). This study will advance our understandings of associations of place-based characteristics and alcohol advertising with adolescent alcohol use by:

(1) Using a prospective study design to develop and test the conceptual framework by which place-based social, alcohol access, and institutional resource environments and

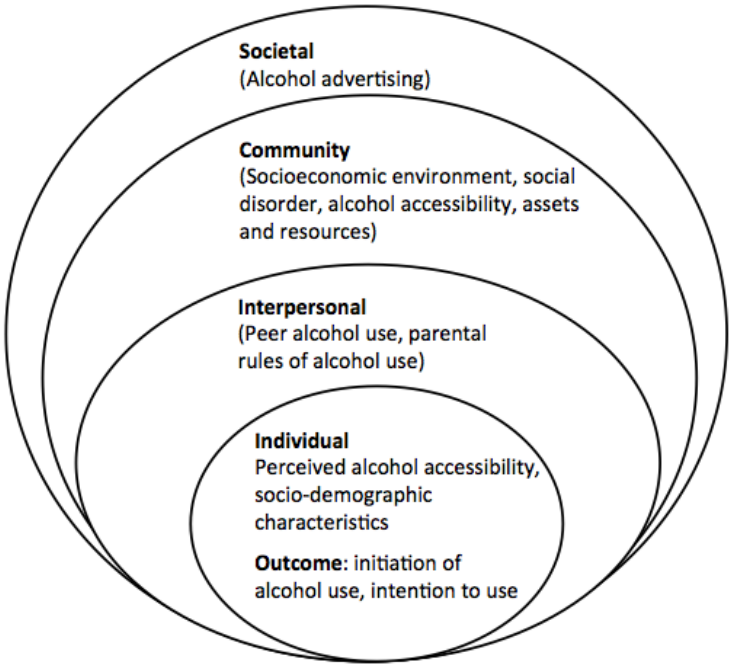
perceived alcohol advertising affect drinking experience in early adolescence in an Asian context.

(2) Providing a qualitative examination of how alcohol advertising influences early drinking experience from the perspectives of Taiwanese adolescents through focus group discussions.

Findings of this study can be used to inform policies focusing on alcohol advertising, alcohol outlets, and on strengthening communities in Taiwan. Additionally, the implications of the proposed study can inform the development of place-based interventions that take into account the economic development, social disorder, alcohol access, and institutional resources at local levels.

The remainder of this dissertation is organized into four chapters. In Chapter 2 we examined the associations of place-based social environments, alcohol access environments, and institutional resource environments and perceived alcohol advertising with adolescent *alcohol initiation and continuation*. Chapter 3 examined the prospective associations of place-based social environments, alcohol access environments, and institutional resource environments and perceived alcohol advertising with adolescent *drinking intentions*. In Chapter 4, we explored Taiwanese adolescents' perspectives on and responses to alcohol marketing for alcopops and regular beer, and how these marketing efforts influence adolescents' drinking experience. Lastly, we discussed the implications for future research and practice in the concluding chapter (Chapter 5).

Figure 1.1 The conceptual framework of the possible mechanisms that link place-based characteristics and alcohol advertising to adolescent alcohol use behaviors



Reference

Allison, K.W., Crawford, I., Leone, P.E., Trickett, E., Perez-Febles, A., Burton, L.M., Le Blanc, R., 1999. Adolescent substance use: Preliminary examinations of school and neighborhood context. Am J Community Psychol 27, 111-141.

Anderson, P., de Bruijn, A., Angus, K., Gordon, R., Hastings, G., 2009. Impact of alcohol advertising and media exposure on adolescent alcohol use: A systematic review of longitudinal studies. Alcohol Alcohol 44, 229-243.

Austin, E.W., Chen, M.-J., Grube, J.W., 2006. How does alcohol advertising influence underage drinking? The role of desirability, identification and skepticism. J Adolesc Health 38, 376-384.

Austin, E.W., Johnson, K.K., 1997. Effects of general and alcohol-specific media literacy training on children's decision making about alcohol. J Health Commun 2, 17-42.

Austin, E.W., Meili, H.K., 1994. Effects of interpretations of televised alcohol portrayals on children's alcohol beliefs. Journal of Broadcasting & Electronic Media 38, 417-435.

Austin, E.W., Pinkleton, B.E., Fujioka, Y., 2000. The role of interpretation processes and parental discussion in the media's effects on adolescents' use of alcohol. Pediatrics 105, 343-349.

Bandura, A., 2004. Health promotion by social cognitive means. Health Educ Behav 31, 143-164.

Beyers, J.M., Toumbourou, J.W., Catalano, R.F., Arthur, M.W., Hawkins, J.D., 2004. A cross-national comparison of risk and protective factors for adolescent substance use: the United States and Australia. J Adolesc Health 35, 3-16.

Brenner, A.B., Bauermeister, J.A., Zimmerman, M.A., 2011. Neighborhood variation in adolescent alcohol use: Examination of socioecological and social disorganization theories. J Stud Alcohol Drugs 72, 651-659.

Britt, H., Toomey, T.L., Dunsmuir, W., Wagenaar, A.C., 2006. Propensity for and correlates of alcohol sales to underage youth. Journal of alcohol and drug education 50, 25.

Bronfenbrenner, U., 1979. The ecology of human development. Harvard University Press, Cambridge, MA.

Bryden, A., Roberts, B., McKee, M., Petticrew, M., 2012. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. Health Place 18, 349-357.

Bryden, A., Roberts, B., Petticrew, M., McKee, M., 2013. A systematic review of the influence of community level social factors on alcohol use. Health Place 21, 70-85.

Byrnes, H.F., Chen, M.-J., Miller, B.A., Maguin, E., 2007. The relative importance of mothers' and youths' neighborhood perceptions for youth alcohol use and delinquency. J Youth Adolesc 36, 649-659.

Calabria, B., Shakeshaft, A.P., Havard, A., 2011. A systematic and methodological review of interventions for young people experiencing alcohol-related harm. Addiction 106, 1406-1418.

Campbell, C.A., Hahn, R.A., Elder, R., Brewer, R., Chattopadhyay, S., Fielding, J., Naimi, T.S., Toomey, T., Lawrence, B., Middleton, J.C., 2009. The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol

consumption and alcohol-related harms. American journal of preventive medicine 37, 556-569.

Casswell, S., 2012. Current status of alcohol marketing policy—an urgent challenge for global governance. Addiction 107, 478-485.

Chang, F.-C., Lee, C.-M., Chen, P.-H., Chiu, C.-H., Miao, N.-F., Pan, Y.-C., Huang, T.-F., Lee, S.-C., 2014. Using media exposure to predict the initiation and persistence of youth alcohol use in Taiwan. Int J Drug Policy.

Chen, C.-Y., Storr, C.L., 2006. Alcohol use and health-related quality of life among youth in Taiwan. J Adolesc Health 39, 752. e759-752. e716.

Chen, C.Y., Tang, G.M., Huang, S.L., Lee, C.M., Lew-Ting, C.Y., Hsiao, C.K., Chen, D.R., Chen, W.J., 2008. Transition from alcohol to other drugs among adolescents in Taiwan: the first drinking context matters. J Stud Alcohol Drugs 69, 378-387.

Chen, K.H., Chen, C.Y., Liu, C.Y., Lin, Y.C., Chen, W.J., Lin, K.M., 2011. Multilevel influences of school and family on alcohol-purchasing behaviors in school-aged children. Drug Alcohol Depend 114, 127-133.

Chen, M.J., Grube, J.W., Bersamin, M., Waiters, E., Keefe, D.B., 2005. Alcohol advertising: what makes it attractive to youth? J Health Commun 10, 553-565.

Chen, M.J., Grube, J.W., Gruenewald, P.J., 2010. Community alcohol outlet density and underage drinking. Addiction 105, 270-278.

Chen, M.J., Gruenewald, P.J., Remer, L.G., 2009a. Does alcohol outlet density affect youth access to alcohol? J Adolesc Health 44, 582-589.

Chen, W.J., Fu, T.-C., Ting, T.-T., Huang, W.-L., Tang, G.-M., Hsiao, C.K., Chen, C.-Y., 2009b. Use of ecstasy and other psychoactive substances among school-attending adolescents in Taiwan: National surveys 2004–2006. BMC Public Health 9, 27.

Chen, Y.-C., 2013. The effectiveness of different approaches to media literacy in modifying adolescents' responses to alcohol. J Health Commun 18, 723-739.

Chilenski, S.M., 2011. From the macro to the micro: A geographic examination of the community context and early adolescent problem behaviors. Am J Community Psychol 48, 352-364.

Chuang, Y.C., Ennett, S.T., Bauman, K.E., Foshee, V.A., 2005. Neighborhood influences on adolescent cigarette and alcohol use: mediating effects through parent and peer behaviors. Journal of Health and Social Behavior 46, 187-204.

Connolly, G.M., Casswell, S., ZHANG, J.F., Silva, P.A., 1994. Alcohol in the mass media and drinking by adolescents: A longitudinal study. Addiction 89, 1255-1263.

Dell'Orto, A., 2002. Places and spirit in Taiwan: Todi Gond in the stories, strategies and memories of everyday life. RoutledgeCurzon, New York, NY.

Ding, D., Sallis, J.F., Kerr, J., Lee, S., Rosenberg, D.E., 2011. Neighborhood environment and physical activity among youth: a review. American journal of preventive medicine 41, 442-455.

Donovan, J.E., 2014. The burden of alcohol use: Focus on children and preadolescents. Alcohol Research : Current Reviews 35, 186-192.

Duncan, S.C., Duncan, T.E., Strycker, L.A., 2002. A multilevel analysis of neighborhood context and youth alcohol and drug problems. Prev Sci 3, 125-133.

Ellickson, P.L., Collins, R.L., Hambarsoomians, K., McCaffrey, D.F., 2005. Does alcohol advertising promote adolescent drinking? Results from a longitudinal assessment. Addiction 100, 235-246.

Ennett, S.T., Flewelling, R.L., Lindrooth, R.C., Norton, E.C., 1997. School and neighborhood characteristics associated with school rates of alcohol, cigarette, and marijuana use. Journal of Health and Social Behavior 38, 55-71.

Ennett, S.T., Foshee, V.A., Bauman, K.E., Hussong, A., Cai, L., Reyes, H.L.M., Faris, R., Hipp, J., DuRant, R., 2008. The social ecology of adolescent alcohol misuse. Child Dev 79, 1777-1791.

Euromonitor International, 2014. Alcoholic drinks in Taiwan.

Fisher, L.B., Miles, I.W., Austin, S.B., Camargo Jr, C.A., Colditz, G.A., 2007. Predictors of initiation of alcohol use among US adolescents: findings from a prospective cohort study. Arch Pediatr Adolesc Med 161, 959.

Fleming, K., Thorson, E., Atkin, C.K., 2004. Alcohol advertising exposure and perceptions: links with alcohol expectancies and intentions to drink or drinking in underaged youth and young adults. Journal of Health Communication: Internaltional Perspectives 9, 3-29.

Gao, Z., 2005. Harmonious regional advertising regulation? A comparative examination of government advertising regulation in China, Hong Kong, and Taiwan. Journal of Advertising 34, 75-87.

Gordon, R., Hastings, G., Moodie, C., 2010a. Alcohol marketing and young people's drinking: What the evidence base suggests for policy. J Public Aff 10, 88-101.

Gordon, R., MacKintosh, A.M., Moodie, C., 2010b. The impact of alcohol marketing on youth drinking behaviour: A two-stage cohort study. Alcohol Alcohol 45, 470-480.

Gore, F.M., Bloem, P.J., Patton, G.C., Ferguson, J., Joseph, V., Coffey, C., Sawyer, S.M., Mathers, C.D., 2011. Global burden of disease in young people aged 10-24 years: A systematic analysis. Lancet 377, 2093-2102.

Graham, K., 2006. Isn't it time we found out more about what the heck happens around American liquor stores? Addiction 101, 619-620.

Grenard, J.L., Dent, C.W., Stacy, A.W., 2013. Exposure to alcohol advertisements and teenage alcohol-related problems. Pediatrics 131, e369-e379.

Gruber, E., DiClemente, R.J., Anderson, M.M., Lodico, M., 1996. Early drinking onset and its association with alcohol use and problem behavior in late adolescence. Prev Med 25, 293-300.

Gruenewald, P., 2008. Why do alcohol outlets matter anyway? A look into the future. Addiction 103, 1585-1587.

Hastings, G., Anderson, S., Cooke, E., Gordon, R., 2005. Alcohol marketing and young peoples drinking: a review of the research. J Public Health Policy 26, 296-311.

Health Promotion Administration, 2006, 2010. Taiwan Youth Health Behavior Survey report. Taiwan Ministry of Health and Welfare, Taipei.

Henriksen, L., Feighery, E.C., Schleicher, N.C., Fortmann, S.P., 2008. Receptivity to alcohol marketing predicts initiation of alcohol use. J Adolesc Health 42, 28-35.

Hingson, R., Heeren, T., Zakocs, R., Winter, M., Wechsler, H., 2003. Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. J Stud Alcohol 64, 23-31.

Hsu, C.C., Levy, D.T., Wen, C.P., Cheng, T.Y., Tsai, S.P., Chen, T., Eriksen, M.P., Shu, C.C., 2005. The effect of the market opening on trends in smoking rates in Taiwan. Health Policy 74, 69-76.

Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., Casswell, S., 2008. Density of alcohol outlets and teenage drinking: Living in an alcogenic environment is associated with higher consumption in a metropolitan setting. Addiction 103, 1614-1621.

Jackson, N., Denny, S., Ameratunga, S., 2014. Social and socio-demographic neighborhood effects on adolescent alcohol use: A systematic review of multi-level studies. Soc Sci Med 115, 10-20.

Jernigan, D.H., 2010. The extent of global alcohol marketing and its impact on youth. Contemp Drug Probl 37, 57-89.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., Schulenberg, J.E., 2012. Monitoring the Future national results on adolescent drug use: Overview of key findings, 2011 Institute for Social Research, The University of Michigan, Ann Arbor.

Karriker-Jaffe, K.J., 2011. Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. Drug Alcohol Rev 30, 84-95.

Karriker-Jaffe, K.J., 2013. Neighborhood socioeconomic status and substance use by US adults. Drug Alcohol Depend.

Kelly-Weeder, S., Phillips, K., Rounseville, S., 2011. Effectiveness of public health programs for decreasing alcohol consumption. Patient Intell 2011, 29-38.

Kling, J.R., Liebman, J.B., Katz, L.F., 2007. Experimental analysis of neighborhood effects. Econometrica 75, 83-119.

Komro, K.A., Maldonado-Molina, M.M., Tobler, A.L., Bonds, J.R., Muller, K.E., 2007. Effects of home access and availability of alcohol on young adolescents' alcohol use. Addiction 102, 1597-1608.

Kuntsche, E., Kuendig, H., Gmel, G., 2008. Alcohol outlet density, perceived availability and adolescent alcohol use: A multilevel structural equation model. J Epidemiol Community Health 62, 811-816.

Kuntsche, E.N., Kuendig, H., 2005. Do school surroundings matter? Alcohol outlet density, perception of adolescent drinking in public, and adolescent alcohol use. Addict Behav 30, 151-158.

Lambert, S.F., Brown, T.L., Phillips, C.M., Ialongo, N.S., 2004. The relationship between perceptions of neighborhood characteristics and substance use among urban African American adolescents. Am J Community Psychol 34, 205-218.

Leventhal, T., Brooks-Gunn, J., 2000. The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. Psychol Bull 126, 309.

Livingston, M., Chikritzhs, T., Room, R., 2007. Changing the density of alcohol outlets to reduce alcohol-related problems. Drug Alcohol Rev 26, 557-566.

Livingston, M., Laslett, A.-M., Dietze, P., 2008. Individual and community correlates of young people's high-risk drinking in Victoria, Australia. Drug Alcohol Depend 98, 241-248.

Luthar, S.S., Becker, B.E., 2002. Privileged but pressured? A study of affluent youth. Child Dev 73, 1593-1610.

McClure, A.C., Dal Cin, S., Gibson, J., Sargent, J.D., 2006. Ownership of alcohol-branded merchandise and initiation of teen drinking. American journal of preventive medicine 30, 277-283.

Meier, P.S., 2011. Alcohol marketing research: the need for a new agenda. Addiction 106, 466-471.

Morgenstern, M., Isensee, B., Sargent, J.D., Hanewinkel, R., 2011. Attitudes as mediators of the longitudinal association between alcohol advertising and youth drinking. Arch Pediatr Adolesc Med 165, 610-616.

Mrug, S., Windle, M., 2009. Initiation of alcohol use in early adolescence: Links with exposure to community violence across time. Addictive Behaviors 34, 779-781.

National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2004. The Scope of the Problem. Alcohol Res Health 28, 111-120.

Nelson, J.P., 2011. Alcohol marketing, adolescent drinking and publication bias In longitudinal studies: A critical durvey using meta-analysis. Journal of Economic Surveys 25, 191-232.

O'Hara, R.E., Gibbons, F.X., Li, Z., Gerrard, M., Sargent, J.D., 2013. Specificity of early movie effects on adolescent sexual behavior and alcohol use. Soc Sci Med 96, 200-207.

Office of the Surgeon General, 2007. The surgeon general's call to action to prevent and reduce underage drinking US Department of Health and Human Services, Washington, DC.

Pasch, K.E., Komro, K.A., Perry, C.L., Hearst, M.O., Farbakhsh, K., 2009. Does outdoor alcohol advertising around elementary schools vary by the ethnicity of students in the school? Ethnicity & health 14, 225-236.

Paschall, M.J., Grube, J.W., Thomas, S., Cannon, C., Treffers, R., 2012. Relationships between local enforcement, alcohol availability, drinking norms, and adolescent alcohol use in 50 california cities. J Stud Alcohol Drugs 73, 657.

Paschall, M.J., Lipperman-Kreda, S., Grube, J.W., 2014. Effects of the local alcohol environment on adolescents' drinking behaviors and beliefs. Addiction 109, 407-416.

Petraitis, J., Flay, B.R., Miller, T.Q., 1995. Reviewing theories of adolescent substance use: Organizing pieces in the puzzle. Psychol Bull 117, 67-86.

Pinchevsky, G.M., Wright, E.M., Fagan, A.A., 2013. Gender differences in the effects of exposure to violence on adolescent substance use. Violence Vict 28, 122-144.

Popova, S., Giesbrecht, N., Bekmuradov, D., Patra, J., 2009. Hours and days of sale and density of alcohol outlets: impacts on alcohol consumption and damage: a systematic review. Alcohol Alcohol 44, 500-516.

Read, B.L., 2012. Roots of the state: Neighborhood organization and social network in Beijing and Taipei. Standford University Press, Standford, California.

Reboussin, B.A., Preisser, J.S., Song, E.-Y., Wolfson, M., 2010. Geographic clustering of underage drinking and the influence of community characteristics. Drug Alcohol Depend 106, 38-47.

Rehm, J., Taylor, B., Room, R., 2006. Global burden of disease from alcohol, illicit drugs and tobacco. Drug Alcohol Rev 25, 503-513.

Saffer, H., Dave, D., 2006. Alcohol advertising and alcohol consumption by adolescents. Health Econ 15, 617-637.

Sargent, J.D., Wills, T.A., Stoolmiller, M., Gibson, J., Gibbons, F.X., 2006. Alcohol use in motion pictures and its relation with early-onset teen drinking. J Stud Alcohol Drugs 67, 54.

Scheier, L.M., Botvin, G.J., Miller, N.L., 1999. Life events, neighborhood stress, psychosocial functioning, and alcohol use among urban minority youth. Journal of Child & Adolescent Substance Abuse 9, 19-50.

Scull, T.M., Kupersmidt, J.B., Parker, A.E., Elmore, K.C., Benson, J.W., 2010. Adolescents' media-related cognitions and substance use in the context of parental and peer influences. J Youth Adolesc 39, 981-998.

Shaw, C., McKay, H., 1942. Juvenile Delinquency and Urban Areas. University of Chicago Press, Chicago.

Smith, L.A., Foxcroft, D.R., 2009. The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: Systematic review of prospective cohort studies. BMC Public Health 9, 51-62.

Snedker, K.A., Herting, J.R., Walton, E., 2009. Contextual effects and adolescent substance use: Exploring the role of neighborhoods. Soc Sci Q 90, 1272-1297.

Song, E.Y., Reboussin, B.A., Foley, K.L., Kaltenbach, L.A., Wagoner, K.G., Wolfson, M., 2009. Selected community characteristics and underage drinking. Substance Use & Misuse 44, 179-194.

Stacy, A.W., Zogg, J.B., Unger, J.B., Dent, C.W., 2004. Exposure to televised alcohol ads and subsequent adolescent alcohol use. Am J Health Behav 28, 498-509.

Stimpson, J.P., Ju, H., Raji, M.A., Eschbach, K., 2007. Neighborhood deprivation and health risk behaviors in NHANES III. Am J Health Behav 31, 215-222.

Stockwell, T., 2004. Controls on the physical availability of alcohol. In: Heather, N., Stockwell, T. (Eds.), The essential handbook of treatment and prevention of alcohol problems. Wiley and Sons, Chichester. pp. 213-233.

Stokols, D., 1996. Translating social ecological theory into guidelines for community health promotion. American journal of health promotion 10, 282-298.

Taiwan Ministry of Finance, 2014. The Tobacco and Alcohol Administration Act.

Taiwan National Communications Commission, 2003. Satellite Broadcasting Act.

Taiwan National Communications Commission, 2011. Radio and Television Act.

Taylor, C.R., Raymond, M.A., 2000. An analysis of product category restrictions in advertising in four major East Asian markets. International Marketing Review 17, 287-304.

Tobler, A.L., Komro, K.A., Maldonado-Molina, M.M., 2009. Relationship between neighborhood context, family management practices and alcohol use among urban, multi-ethnic, young adolescents. Prev Sci 10, 313-324.

Tobler, A.L., Livingston, M.D., Komro, K.A., 2011. Racial/ethnic differences in the etiology of alcohol use among urban adolescents. J Stud Alcohol Drugs 72, 799.

Toomey, T.L., Komro, K.A., Oakes, J.M., Lenk, K.M., 2008. Propensity for illegal alcohol sales to underage youth in Chicago. J Community Health 33, 134-138.

Treno, A.J., Grube, J.W., Martin, S.E., 2003. Alcohol availability as a predictor of youth drinking and driving: a hierarchical analysis of survey and archival data. Alcoholism: Clinical and Experimental Research 27, 835-840.

Trim, R.S., Chassin, L., 2008. Neighborhood socioeconomic status effects on adolescent alcohol outcomes using growth models: Exploring the role of parental alcoholism. J Stud Alcohol Drugs 69, 639-648.

Truong, K.D., Sturm, R., 2009. Alcohol environments and disparities in exposure associated with adolescent drinking in California. American Journal of Public Health 99, 264.

Tucker, J.S., Pollard, M.S., De La Haye, K., Kennedy, D.P., Green Jr, H.D., 2013. Neighborhood characteristics and the initiation of marijuana use and binge drinking. Drug Alcohol Depend 128, 83-89.

Unger, J.B., Schuster, D., Zogg, J., Dent, C.W., Stacy, A.W., 2003. Alcohol advertising exposure and adolescent alcohol use: A comparison of exposure measures. Addict Res Theory 11, 177-193.

van Praag, L., Bracke, P., Christiaens, W., Levecque, K., Pattyn, E., 2009. Mental health in a gendered context: Gendered community effect on depression and problem drinking. Health Place 15, 990-998.

Vinther-Larsen, M., Huckle, T., You, R., Casswell, S., 2013. Area level deprivation and drinking patterns among adolescents. Health Place 19, 53-86.

Wang, S.H., Lin, I., Chen, C.Y., Chen, D.R., Chan, T.C., Chen, W.J., 2013. Availability of convenience stores and adolescent alcohol use in Taiwan: A multilevel analysis of national surveys. Addiction 108, 2081-2088.

Wills, T.A., Sargent, J.D., Gibbons, F.X., Gerrard, M., Stoolmiller, M., 2009. Movie exposure to alcohol cues and adolescent alcohol problems: a longitudinal analysis in a national sample. Psychology of addictive behaviors 23, 23.

Windle, M., Windle, R., 2005. Alcohol consumption and its consequences among adolescents and young adults. In: Galanter, M. (Ed.), Recent advances in alcoholism research: Alcohol problems in adolescents and young adults. Kluwer Academic/Plenum. pp. 67-83.

Winstanley, E.L., Steinwachs, D.M., Ensminger, M.E., Latkin, C.A., Stitzer, M.L., Olsen, Y., 2008. The association of self-reported neighborhood disorganization and social capital with adolescent alcohol and drug use, dependence, and access to treatment. Drug Alcohol Depend 92, 173-182.

Witt, E.D., 2010. Research on alcohol and adolescent brain development: Opportunities and future directions. Alcohol 44, 119-124.

World Health Organization, 2014. Global status report on alcohol and health. World Health Organization, Geneva.

Yeh, C.-Y., Ho, L.-M., Lee, J.-M., Hwang, J.-Y., 2013. The possible impact of an alcohol welfare surcharge on consumption of alcoholic beverages in Taiwan. BMC Public Health 13, 810.

Young, R., Macdonald, L., Ellaway, A., 2013. Associations between proximity and density of local alcohol outlets and alcohol use among Scottish adolescents. Health Place 19, 124-130.

Chapter 2:

Residential environments, alcohol advertising, and initiation and persistence of alcohol consumption among adolescents in urban Taiwan:

A prospective multilevel study

Abstract

Background: Research indicates that place characteristics and the media environment are important contextual determinants of underage drinking behaviors in Western countries, but it is unknown whether these exposures influence adolescent alcohol consumption outside Western contexts, including in Asia's emerging global alcohol markets. Guided by the social ecological framework, we prospectively investigated the influences of place characteristics and alcohol advertising on initiation and continuation of alcohol consumption among adolescents in Taipei, Taiwan.

Methods: Data on individual-level characteristics, including alcohol use behaviors and perceived exposure to alcohol advertising, were obtained from two waves of a longitudinal school-based study through a stratified probability sampling method in 2010 (Grade 7/Grade 8, aged 13-14 years old) and 2011-2012 (Grade 9, aged 15 years old) from 1,795 adolescents residing in 22 of 41 districts in Taipei. Data on district-level characteristics were drawn from administrative sources and Google Street View virtual audit to describe districts where adolescents lived at baseline. Hierarchical generalized linear models tested hypotheses about the associations of place characteristics and perceived alcohol advertising with underage drinking, with stratification by baseline lifetime alcohol consumption.

Results: Among alcohol-naïve adolescents, lower district-level economic disadvantage, a higher proportion of betel nut kiosks (a relatively unregulated alcohol source) compared to off-premises alcohol outlets, and exposure to television-based alcohol advertising predicted increased likelihood of alcohol initiation at one-year follow-up. Among alcohol-experienced adolescents, greater spatial access to off-premises alcohol outlets, and lower access to metro rapid transportation (MRT) and to temples were found to predict a subsequent increased likelihood of continued alcohol use. Parental drinking moderated the relationship between district-level violent crime and initiation of alcohol consumption.

Conclusions: These findings suggest that local social economic status, alcohol access, and institutional resource and individual media exposure affect underage drinking behaviors in Taiwan. We discuss potential public health implications for place-based interventions. Future research on place, media, and adolescent alcohol consumption in Asian contexts is warranted.

Introduction

Alcohol industry has been expanding into emerging markets in Asia, Africa, and Latin America, and recent research suggests that this expansion has had alarming effects on youth (Jernigan and Rushman, 2014; World Health Organization Regional Office for the Western Pacific, 2015). For example, Taiwan opened its alcohol market to international alcohol industries in 1987. Since then, new alcoholic products have been introduced to the Taiwanese market and alcohol industries have launched various marketing approaches to reach younger population (Euromonitor International, 2014). Recent national surveys in Taiwan indicated the percentage of lifetime alcohol consumption among middle school students increased ten percentage points in just 4 years, from 55% in 2006 to 65% in 2010 (Health Promotion Administration, 2006, 2010). The incidence rate of alcohol consumption among middle school students also increased from 14% in 2004 to 18% in 2005 (Chen et al., 2009). The combination of rapidly expanding global alcohol marketing combined with the increasing prevalence of underage alcohol use underscores the urgent need to investigate multilevel contexts to underage drinking in emerging alcohol markets (World Health Organization Regional Office for the Western Pacific, 2015).

According to the World Health Organization (WHO), alcohol use is the greatest contributor to disability and mortality among individuals aged 10-24 years globally (Gore et al., 2011; Rehm et al., 2006). Early initiation of alcohol use increases the risks of a variety of problematic behaviors, both in the short- (e.g., school dropout, delinquent behaviors) and long-term (e.g., subsequent problem drinking, other substance use) (Windle et al., 2009; Zucker et al., 2009). Adolescence, the period when alcohol initiation

escalates, is a transitional developmental stage characterized by changes in, and increased exposure to, social contexts outside the home (Cook et al., 2002). According to the social ecological framework of human development (Bronfenbrenner, 1979), adolescent behaviors, including alcohol consumption, are greatly affected by influences operating at multiple layers of the social context, including place-based social and built environments and the media environment (Anderson et al., 2009; Bryden et al., 2012; Bryden et al., 2013; Jackson et al., 2014).

Prior research investigating the effects of multiple layers of context on underage drinking has primarily been conducted in the West (Bryden et al., 2012; Bryden et al., 2013). Because of the rapid expansion of global alcohol marketing in Asia, Taiwanese society has experienced large increases in alcohol availability and alcohol marketing (Euromonitor International, 2014; World Health Organization Regional Office for the Western Pacific, 2015). For example, the price of alcoholic beverages has decreased and global alcohol companies (e.g., Heineken, SABMiller) have gradually gained a greater share of the domestic market (Euromonitor International, 2014). Guided by the social ecological framework, this study investigates whether place-based environments and media environments affect adolescent alcohol initiation and continuation in Taipei, Taiwan. We focus on three types of place-based environments that are important to underage drinking behaviors: social, alcohol access, and institutional resource environments.

Place-based social environments

Social Disorganization Theory posits that place-based social disadvantage (e.g., economic disadvantage, violent crime) is associated with diminished social integration resulting in increased problem behaviors (Shaw and McKay, 1942). Recent systematic reviews revealed that findings about associations between place-based economic disadvantage and underage drinking are mixed (Bryden et al., 2012; Jackson et al., 2014; Karriker-Jaffe, 2011). Some cross-sectional studies found that economic disadvantage was associated with higher levels of underage drinking (Bernburg et al., 2009; De Haan et al., 2010; Huckle et al., 2008), while others indicated that local affluence was positively associated with this outcome (Lo et al., 2006; Reboussin et al., 2010; Snedker et al., 2009). Still other studies have found no association between economic disadvantage and underage drinking (Brenner et al., 2011; Fagan et al., 2013; Kulis et al., 2007). The mixed findings may arise from using different measures of place-based economic disadvantage; the lack of longitudinal studies may also prevent place-based research from providing consistent and rigorous evidence. As to the connection between place-based violent crime and underage drinking, the results are more consistent than that of economic disadvantage. Studies have generally found a positive association between place-based violent crime and underage drinking (Lambert et al., 2004; Yabiku et al., 2007). However, studies of relationships between these place-based environments and underage drinking have rarely been conducted in emerging alcohol market in Asia, where social relationships, resident composition, and collective interaction are profoundly different from those of Western contexts. For example, in Taipei, the mixed land use of commercial and residential zones, efficient public transportation, relatively short distance between activity locations, and the strong social value of collective power often

encourage social interaction and local bonds for residents. It is unknown whether these place-based social environments affect underage drinking in Asian countries.

Place-based alcohol access environments

Research on the alcohol access environment, however, has been unequivocal: recent systematic reviews have suggested that the alcohol access environment is a powerful place-based risk factor for drinking behaviors, especially for adolescents (Bryden et al., 2012; Popova et al., 2009). A positive association between alcohol outlet density and underage drinking has been found in both cross-sectional and longitudinal studies in several Western societies, including in the United States (Chen et al., 2010; Paschall et al., 2014), Australia (Livingston et al., 2008), New Zealand (Huckle et al., 2008), and Switzerland (Kuntsche et al., 2008). According to Availability Theory, increased proximity to alcohol outlets creates an "alcogenic" environment that not only increases alcohol access but also establishes pro-alcohol norms, both of which in turn increase the risk of underage drinking (Livingston et al., 2007). To date, only few studies have examined the impact of alcohol outlets on underage drinking in Taiwan (Chen et al., 2011b; Wang et al., 2013), and none has adopted a longitudinal design to examine this relationship.

Betel nut kiosks, the local unregulated off-premises alcohol outlets in Taiwan, are one of major commercial alcohol sources; they are pervasive on thoroughfares in urban Taiwanese areas. Owners of betel nut kiosks often hire "betel nut beauties", young women who dress in "provocative" clothing to sell betel nuts, soft drinks, and beer. Local news has reported that these unregulated alcohol outlets are one of the easiest commercial

sources of alcohol access for adolescents, and the number of betel nut kiosks can exceed that of ordinary off-premises alcohol outlets (e.g., convenience stores). Betel nut kiosks are a unique feature of Taiwanese culture, and it is unknown whether spatial access to betel nut kiosks can influence underage drinking. While the impact of the ordinary off-premises alcohol outlets (e.g., convenience stores) has been studied (Chen et al., 2011b; Wang et al., 2013), little attention has been paid to this unique type of off-premises alcohol outlet, perhaps because of the lack of available data on betel nut kiosks.

Place-based institutional resource environments

Prosocial institutional resources (e.g., recreational open spaces, schools, and religious resources) influence adolescent development and can shape adolescent behaviors (Leventhal and Brooks-Gunn, 2000). To date, however, studies examining the effects of *protective* environmental features for adolescent alcohol consumption are limited. One recent cross-sectional study conducted in rural and small towns in the United States found that spatial access to youth-serving organizations was inversely associated with adolescent lifetime alcohol use (Chilenski, 2011). Similarly, a cross-sectional study conducted in Taiwan found that greater spatial access to colleges in neighborhood was associated with lower likelihood of purchasing alcohol among children (Chen et al., 2011b). Evidence on prospective effects of prosocial institutional resources on underage drinking is generally lacking.

Interactions between place-based environments and individual-level risk factors

Recent studies of underage drinking not only investigate the independent effects of place-based environments, but also explore whether the relationships of place-based environments to underage drinking behaviors differ by individual characteristics (Mrug et al., 2010; Snedker et al., 2009; Trim and Chassin, 2008). Some individual characteristics such as poor parenting practices and *lower* individual economic strain may amplify the adverse effects of specific place-based environments (De Haan et al., 2010; Mrug et al., 2010), while other individual characteristics such as religious attendance and family support may have buffering effects (Lo et al., 2006; Snedker and Herting, 2008). For example, Trim and Chassin (2008) found that the prospective effect of economic disadvantage operated differently across subgroups: higher place-based economic disadvantage increased the rate of alcohol use among adolescents whose parents were alcoholics, while *lower* economic disadvantage increased the rate of alcohol use among adolescents whose parents were *not* alcoholics.

Media environment of alcohol advertising

Media is an influential environment through which adolescents form attitudes and expectations about alcohol and its effects (Zucker et al., 2009).Two recent reviews indicate that alcohol advertising contributed to alcohol initiation and higher levels of use among those with prior use (Anderson et al., 2009; Smith and Foxcroft, 2009). Social Cognitive Theory suggests that human behaviors can be affected by environmental influences through observational learning and social reinforcement (Bandura, 2004). Using both perceived (e.g., self-reported) and objective (e.g., auditor-observed) measures, previous studies have assessed the impacts of alcohol advertising through several media

channels such as televisions, movies, magazines, and websites (Pasch et al., 2007; Unger et al., 2003). Among these media channels, television is a particularly influential media channel through which adolescents obtain information about alcoholic beverages, and perceived exposure to television commercials increases the risks of subsequent alcohol use (Fisher et al., 2007; Stacy et al., 2004). In Taiwan, adolescents reported spending 15.4 hours per week watching television (Wu, 2009). Although alcohol advertising on television is banned during children's viewing time from 6:00 am to 9:00 pm, only 27.5% of parents limit their children's television watching time (Wu, 2009). Public health research on media environments and alcohol use has failed to keep up with the rapid expansion of global alcohol marketing into emerging markets outside of Western countries (Casswell, 2012; Jernigan, 2010). To date, research that examines the impact of alcohol advertising on underage drinking in emerging alcohol markets has been limited (Chang et al., 2014).

Hypotheses

Based on the existing evidence and theories, we hypothesized that greater exposure to place-based economic disadvantage and violent crime, and greater alcohol access at baseline, would be prospectively associated with an increased likelihood of alcohol initiation and continuation among Taiwanese adolescents, while greater exposure to place-based institutional resources would prospectively reduce these outcomes. Furthermore, greater exposure to alcohol advertising at baseline would be associated with subsequent increased likelihood of adolescent alcohol initiation and continuation.

We tested several cross-level interactions. We hypothesized that individual-level family drinking behaviors (i.e., parental drinking and parental approval to drink) and peer drinking behaviors would exacerbate negative effects of place-based economic disadvantage and violent crime on alcohol use among adolescents.

Materials and methods

Study sample

The data for the present study were from two waves of the Alcohol-Related Experiences among Children (AREC) II study, a longitudinal school-based study designed to investigate determinants of alcohol-related experiences from early adolescence to young adulthood in Taipei, Taiwan. AREC II methods have been described in detail elsewhere (Lee et al., 2015). In brief, a stratified probability sampling was used to select 16 public middle schools in Taipei based on school characteristics (e.g., student-teacher ratio) and the physical environment surrounding the schools (e.g., public transportation density) to obtain representative sample of middle school students in Taipei. It should be noted that the sample does not represent students living in the total Taipei Metropolitan Area due to this school-based sampling scheme (i.e., the stratification was based on schools instead of districts). With active parent and student consent, baseline data were collected from 1,926 adolescents in 2010 (students were in Grade 7 in spring semester and Grade 8 during the fall semester, aged 13-14 years old); 1,893 of these adolescents participated in the Grade 9 (aged 15 years old) follow up survey. The mean interval between the two assessment waves was 13 months. The

overall participation rate at baseline was 55% and the follow-up rate was 98%. A total of 1,870 respondents completed both waves of the surveys.

Study procedures were approved by the National Health Research Institutes in Taiwan and Emory University's Institutional Review Board.

Measures

We used a repeated measurement study design for the current study. All predictors (i.e., district-level characteristics and the perceived exposure to alcohol advertising) and individual covariates were measured at baseline; the outcome measured alcohol use behavior change between baseline and follow-up.

Outcomes

Initiation of alcohol use was assessed by examining responses to two items: "Not including a sip of alcohol and alcoholic beverages added in meals, have you ever drunk alcohol in your life?" [Responses: *no*=0 and *yes*=1], and a wave II item querying alcohol consumption in the past 12 months. Those who transitioned from "never used" to "used" alcohol across two waves were labeled initiators.

Continuation of alcohol use was defined as alcohol use both at baseline and at Wave II (yes) versus use only at baseline.

District-level predictors

Geographical area

The geographical unit of analysis in the current study is the district (*chu*). These administrative districts are created based on natural boundaries and economic

development. The median district population was 208,430 and the median square kilometers was 21.8 (8.4 square miles).

At the baseline, AREC II asked what district respondents lived in, covering a total of 29 districts of Taipei metropolitan area.

Social environments

Economic disadvantage

Economic disadvantage was measured using four indicators in 2010: (1) the percentages of residents aged 25-44 without a high school diploma; (2) the annual median household income; (3) the percentages of vacant homes built before 2006; and (4) the percentages of residents who were ethnic minorities. These economic indicators were obtained from several administrative sources, including the Taiwan Census, Ministry of Interior, and Ministry of Finance. Due to the high degree of correlation among these four indicators, we constructed the district economic disadvantage index using principal component analysis (PCA). Cronbach's alpha for the economic disadvantage index was 0.86, and the index accounted for 70.7% of the variation from the PCA. A higher value of the index denotes greater district-level economic disadvantages.

Violent crime rate

The violent crime rate was defined as the density of violent crime incidents reported per 100,000 residents in 2010. Violent crime includes murder, kidnapping, robbery, aggravated assault, forcible rape, and serious extortion threat. Annual data on

the number of violent crime reported were obtained from the Taipei City Police Department and the New Taipei City Police Department.

Alcohol access environments

Three types of alcohol outlets were assessed: on-premises consumption outlets (i.e., all-you-can-eat barbeque restaurants and karaokes), off-premises consumption outlets (i.e., convenience stores, grocery stories, and warehouse clubs), and betel nut kiosks.

Alcohol access was measured as the number of alcohol outlets per square kilometers within each district. Annual data on the numbers of on- and off-premises consumption outlets in 2010 were obtained from UrMap, an online map with geocoding data that can be used for navigation in Taiwan and has been demonstrated as a high quality data system providing location-based services for several types of Points-Of-Interests (POIs) (Chang and Tsou, 2008; OleMap Inc. et al., 2010).

Google Street View virtual audit

Given the lack of administrative data on the locations of betel nut kiosks, we created this measure by conducting a virtual audit of Google Street View data. The audit was conducted by two trained auditors using historical Google Street View images from 2009 (about one year before the baseline). The two auditors conducted virtual audits along both sides of each thoroughfare in the studied districts using standardized procedures. Districts with less than 5 participants lived in were excluded from the virtual audits because of the time constrain (n=7). Information on the geo-coordinates, names, addresses, operation status, images, and month and year of the images of the observed

betel nut kiosks was recorded. Random subsets of the thoroughfares were double coded with 91% observed agreement. Spatial access to betel nut kiosks was measured as the ratio of the number of betel nut kiosks to the number of off-premises alcohol outlets. Based on Diez-Roux and Mair' recommendation for measuring relevant spatial contexts (Diez Roux and Mair, 2010), we used a ratio measure for kiosks (instead of a density measure) because focus group data indicated that adolescents consider the *relative proximity* of betel nut kiosks to off-premises alcohol outlets as an important factor [Chen *et al.* unpublished data].

Institutional resource environments

We measured the number of each of three types of institutional resources per square kilometers for each district: (1) Taipei Metro Rapid Transit (MRT) exits; (2) recreational resources (i.e., parks and physical activity centers); and (3) temples (i.e., Taiwanese Folk religious, Buddhism, and Taoism temples). The inclusion of these institutional resources was based on previous studies (Chen et al., 2011b; Chilenski, 2011; Leventhal and Brooks-Gunn, 2000; Moore et al., 2008). We select MRT exits rather than MRT stations because one MRT station can have several exits to the ground floor and can better reflect the concept of access to public transportation. Annual data of the number of each type of resource in 2010 were acquired from UrMap.

Perceived exposure to alcohol advertising

Six commercial channels of alcohol advertising were assessed at baseline, including televisions, movies, websites, billboards, magazines, and convenience stores. For each of

the commercial channels, perceived exposure to alcohol advertising was assessed by a question, “During the past month, have you been exposed to alcohol advertising or alcohol promotion messages from (the commercial channel)” Responses were coded as no (0) and yes (1). Because TV-based exposures were much more frequent than any other, we categorized these alcohol advertising channels into television and non-television channels. *Perceived exposure to alcohol advertising on other channels* at baseline was measured by summing the response from all other five commercial channels. Scores ranged from 0 to 5.

Individual covariates

Several individual covariates that have been previously identified as important predictors of adolescent alcohol use were assessed at baseline (Windle et al., 2009; Zucker et al., 2008), including gender (boys/girls), monthly allowance (≥$NTD500/<$NTD500) (Chen et al., 2011b), living with a parent (one or none vs. both) and parental educational attainment (neither graduated college vs. either or both is a college graduate), parental approval to drink (any approval vs none), and parental/sibling/peer drinking status (any vs. none).

Analyses

Adolescents were excluded from the analyses if they were missing data on: (1) home district or (2) lifetime drinking experience at baseline. Seven districts were excluded due to the lack of betel nut kiosk data. This resulted in a final analytic sample of

1795 participants from 22 districts. The number of students in each district ranged from 7 to 398.

Descriptive statistics were used to examine the distribution of individual and district-level characteristics. To test our hypotheses, two-level hierarchical generalized linear models (HGLMs) were used to model individuals nested in districts and to estimate bivariate and multivariable associations of perceived exposure to alcohol advertising (level 1) and district-level characteristics (level 2) to adolescent drinking behaviors for the binary outcomes of alcohol initiation and continuation in separate equations (Raudenbush and Bryk, 2002).

The analytic models were built in five stages. **Stage 1**: intraclass correlation coefficients (ICCs) were computed from the unconditional model (Model 0). This unconditional model describes the degree to which outcomes were clustered within districts. **Stage 2**: bivariate associations were evaluated. As Diez Roux suggested, the effects of place-based characteristics may be artificially small because many models inadvertently control for individual-level risk factors that lie in the causal pathway (Diez Roux, 2004). To address this challenge, we used a sequential modeling strategy to examine the district-level effects in multivariable HGLM in Stage 3 and 4. **Stage 3**: the multivariable associations for perceived exposure to alcohol advertising and district-level characteristics of the intercept were estimated (Model 1), controlling for gender. This allowed us to examine the associations of district-level characteristics and perceived exposure to alcohol advertising with the outcomes *without* controlling for any individual-level risk factors that might plausibly lie in the causal pathway. **Stage 4**: the multivariable model was expanded (Model 2) with possible individual-level risk factors that might

possibly lie in the causal pathway (i.e., living with parents, parental education, monthly allowance, parental/sibling/peer drinking, and parental approval to drink). We calculated the percent difference for each focal exposure between model 1 and model 2. Differences ≥20% were classified as "substantial change". **Stage 5**: cross-level interactions between district-level characteristics (i.e., economic disadvantage and violent crime) and individual characteristics related to parenting and peer deviancy (i.e., parental drinking, peer drinking, and parental approve to drink) were included in the multivariable model (Model 3) to examine whether these individual characteristics moderated the relationships. All analyses were conducted using SAS 9.4 and HLM7.0 statistical packages.

Results

Individual- and district-level characteristics

At the individual-level, overall 12.40% reported living with one or no parents, 53.04% had a monthly allowance more than $NTD500 (~=$USD16, approximately equal to 6-7 meals), and 72.13% had ever observed their parents drinking (Table 1). At the district-level, the mean violent crime rate was 22.33 (SD=8.27) incidents per 100,000 residents. On average there were 9.67 (SD=6.51) off-premises alcohol outlets and 1.17 (SD=1.53) on-premises alcohol outlets per square kilometers within districts. The number of off-premises alcohol outlets (0.45-19.18) had a higher variation than that of on-premises alcohol outlets (0.00-5.81) per square kilometers. Among 1016 alcohol-naïve adolescents at baseline, 179 (17.6%) initiated alcohol use by wave 2. Among 779

alcohol-experienced adolescents at baseline, 362 (46.5%) had used alcohol continually by wave 2.

Alcohol initiation

Table 2 shows the results of bivariate and multivariable multilevel models for alcohol use initiation. The bivariate model and models 1-3 suggested that adolescents were more than twice as likely to initiate alcohol use if they reported recently seeing alcohol advertising on television. After adjusting for gender, model 1 suggested that adolescents in districts with a higher violent crime rate (aOR=1.05; CI: 1.00, 1.11) and higher proportion of betel nut kiosks compared to off-premises alcohol outlets (aOR=1.54; CI: 1.03, 2.29) were more likely to initiate alcohol use, while those who lived in more economically disadvantaged districts were less likely to initiate alcohol use (aOR=0.38; CI: 0.16, 0.89).

After including possible individual-level mediators in the multivariable model (Model 2), the effects of perceived alcohol advertisements, economic disadvantage, and higher proportion of betel nut kiosks compared to off-premises outlets did not change substantially. District-level violent crime, however, became non-significant, suggesting that these individual characteristics partly mediated the effects of district-level violent crime.

The cross-level interaction model (Model 3) suggested that a higher district-level violent crime rate was positively associated with alcohol use initiation only when adolescents had observed parental drinking (aOR=1.05; CI: 1.00, 1.11).

Alcohol continuation

Table 3 presents the results of bivariate and multivariable multilevel models for continued alcohol use. The multivariable model indicated that perceived exposure to alcohol advertising was not associated with alcohol use continuation. Model 1 indicated that adolescents living in districts with greater spatial access to off-premises alcohol outlets (aOR=1.12; CI: 1.03, 1.22) were more likely to use alcohol continually, while those living in districts with better spatial access to MRT exits were less likely (aOR=0.46; CI: 0.21, 0.99). The magnitude of these two relationships did not change substantially in Model 2, which included possible individual-level mediators (i.e., living with parents, parental education, monthly allowance, parental/sibling/peer drinking, and parental approval to drink). This suggested that these individual-level characteristics did not mediate the effects of district-level spatial access to off-premises alcohol outlets and to MRT exits. While the relationship between spatial access to temples and continuation was not statistically significant in Model 1, it became significantly associated with continued alcohol use in Model 2 (aOR=0.26; CI: 0.24, 0.92), suggesting that individual characteristics partly suppressed the effect of spatial access to temple. None of the cross-level interactions were significant (Model 3).

Discussion

This study is one of the first multilevel studies to examine the prospective relationships linking place-based environments and media environments with adolescent drinking behaviors in an emerging alcohol market. Consistent with our hypotheses, our analyses indicate that district-level exposures and perceived exposure to alcohol

advertising predicted alcohol consumption, even after controlling for individual, family, and peer attributes. Specifically, adolescents were more likely to initiate drinking if they lived in a district with less economic disadvantage and higher proportion of betel nut kiosks compared to off-premises outlets, or if they reported seeing more alcohol advertisements on television. In addition, our data suggest that relationship between district-level violent crime and alcohol initiation was more salient among students who had observed parental drinking. As to continued alcohol use, having better spatial access to off-premises alcohol outlets or lower spatial access to temples and to MRT exits appeared to be strong predictors.

Although the association between district-level economic affluence and initiation was contrary to our hypothesis, it has prior support in the literature (Lo et al., 2006; Snedker et al., 2009). Possibly, more economically advantaged districts may create norms supporting frequent alcohol use (Karriker-Jaffe, 2011). Another interpretation of the observed relationship is that adolescents living in more affluent districts may have more access to alcohol because their parents monitor them less (Reboussin et al., 2010). Dual career upper middle-class parents often have less time to monitor children after school and may be less engaged in children's after-school activities, especially in Taiwan, where the dual career family rate is high (Lu et al., 2008; Trim and Chassin, 2008).

Our results demonstrate that the adverse effect of district-level violent crime on alcohol initiation is only observed among adolescents who had seen their parent drink. Areas with higher levels of violent crime tend to have lower levels of social control and higher rates of youth delinquency (Ingoldsby and Shaw, 2002; Lambert et al., 2004). For example, previous research has shown that living in a violent area is associated with

subsequent alcohol initiation because of the affiliations with deviant peer groups (Lambert et al., 2004; Mrug and Windle, 2009). Also, adolescents who have observed their parent's drinking may have greater alcohol access in their home and a higher endorsement of positive alcohol expectancies, such as the expectation that alcohol enhances social behaviors (Chen et al., 2011a; Zucker et al., 2009). Both of these socialization factors may encourage adolescents to mimic parental drinking to foster positive social interaction with peers and amplify the adverse effects of violent crime on alcohol initiation. The significant moderating effect of parental drinking on district-level violent crime highlights the important interactive effect of family-level and place-based environments on adolescent alcohol initiation.

Spatial access to off-premises alcohol outlets around homes predicted continued alcohol use (Chen et al., 2010; Huckle et al., 2008; Livingston et al., 2008; Tobler et al., 2009; Wang et al., 2013), and higher proportion of betel nut kiosks compared to off-premises alcohol outlets was associated with alcohol initiation. Consistent with Availability Theory and prior research, our findings indicate that living in an alcogenic environment has a prospective impact on underage drinking, but the impact varies by their prior drinking experience. Betel nut kiosks are an easy venue to obtain alcohol without photo identification, and spatial access to such a low-threshold venue appears to facilitate alcohol initiation. In contrast, off-premises alcohol outlets are influential for adolescents who used alcohol continually. Alcohol-experienced adolescents may also be more skillful in successfully obtaining alcohol from these off-premises alcohol outlets (e.g., dressing older than their actual ages, shoulder tapping, or choosing cashiers with more than one person in line) (Forster et al., 1995).

Our findings are among the first to prospectively examine the benefits of place-based institutional resources on underage drinking in Asian countries. Consistent with our hypothesis, the proximity to MRT was associated with lower risks of continued alcohol use. Greater accessibility to MRT exits may make it easier for adolescents to reach local recreational facilities and public resources that are conducive to adolescent well-being; engagement with these resources in turn might prevent adolescent from continued alcohol consumption. Chen and colleagues also found that higher access to MRT in Taipei was associated with lower rates of alcohol purchasing among youth (Chen et al., 2011b). Because of patterns of land use and development in Taipei, districts with higher access to MRT are usually commercial regions that have a higher level of social control. Perhaps residents and businesses in these districts have higher collective efficacy (e.g., better compliance with minimum age-of-sale enforcement) that discourages underage drinking (Maimon and Browning, 2012).

The observed protective effect of spatial access to temples on adolescent continued alcohol use could be explained by the collective process of religion. Traditional temples are usually located in historical urban areas and reflect the retention of a territorial sense of place and local identity in Taipei's ever-changing urban landscape. In these areas, social cohesion may be particularly high (Dell'Orto, 2002). Local residents may play guardianship roles in these historical areas, and this may deter adolescent alcohol use continuation.

We found that television-based alcohol advertisements were the most dominant form of alcohol advertising for all adolescents. However, as reported previously, this form of alcohol advertising only had a significant long-term influence on alcohol use

initiation among alcohol naïve adolescents (Ellickson et al., 2005; Stacy et al., 2004). Among adolescents who had already initiated drinking, future continued drinking was not significantly influenced by any form of alcohol advertising. These results align with a developmental model of alcohol use. Zucker and colleagues have found that, among alcohol-naïve adolescents, observational learning about alcohol through the media (e.g., seeing popular actors enjoy beer on television) is one of the major influences that determine their attitudes toward drinking and alcohol use initiation (Zucker et al., 2009). However, advertising may not be influential for adolescents who initiated drinking during childhood (before age 13) because they generally model alcohol use through their parents or close family members (Zucker et al., 2009).

Our findings should be interpreted in light of several limitations. First, the AREC participants only lived in 54% of Taipei districts and the AREC participant response rate at baseline was low (55%). These limitations restrict our ability to generalize the findings to all adolescents in the Taipei metropolitan area. Furthermore, the results cannot be generalized to those school drop outs. Second, due to the lack of publicly available data on place-based alcohol advertising measures (e.g., exterior advertising) and the limited resolution of Google Street View imageries of exterior advertising, we were unable to assess the influence of alcohol advertising in districts (e.g., billboards). Future research may use global positioning system (GPS) techniques to conduct in-person neighborhood audits to measure the influence of place-based alcohol advertising. Third, since on-premises consumption outlets in Taiwan are not required to have a license, we were unable to obtain a complete inventory of on-premises consumption outlets. This may have limited our understanding of the influence of these outlets on adolescent alcohol

consumption. Fourth, 12.9% of the thoroughfares in the studied districts were excluded from Google Street View audit because of the incomplete coverage. Google Street View tends to be more comprehensive in more densely populated areas. As a result, we might have underestimated the number of betel nut kiosks in less densely populated districts and underestimate the impacts of betel nut kiosks on underage drinking. Fifth, there may be a bias for the retrospective self-reporting of alcohol advertising exposure.

Conclusions

This study opens the door for future place-based research on underage drinking in Asian contexts. Our findings have three important implications for future research and public health practice. First, despite the rapidly growing place-based research on underage drinking, few studies have explored whether and how youth-specific environments (e.g., institutional resources) and local alcohol access environments (e.g., betel nut kiosks) influence adolescent drinking patterns in Asia. Future research that clarifies which types of youth-specific and local alcohol access environments are meaningful to adolescents and that disentangles the possible mechanisms through which youth-specific and local alcohol access environments lead to underage drinking is warranted. Second, our findings suggest a greater need to implement a multifaceted alcohol use intervention that addresses both district-level and family-level risk factors. Third, in a context in which global alcohol marketing is expanding and alcohol advertising penetration continues, policy interventions should be considered and increased efforts to implement a more comprehensive regulations on alcohol advertising is urged, especially for televised alcohol-related marketing and promotion.

Table 2.1. Distribution of individual- and district-level characteristics at baseline among adolescents from the AREC II study in Taipei, Taiwan in 2010

Variables	Total (n=1795)	Alcohol-naïve (n=1016)	Alcohol-experienced (n=779)
	N ($\%_{wt}$) [d]	N ($\%_{wt}$) [d]	N ($\%_{wt}$) [d]
Individual-level characteristics			
Gender (boys)	852 (47.31)	476 (46.27)	376 (48.67)
Living with parents (one or none)	222 (12.40)	98 (9.53)	124 (16.26)
Parental education (both under college)	571 (30.82)	313 (29.57)	258 (32.45)
Monthly allowance (≧500 NTD) [a]	931 (53.04)	465 (46.83)	466 (61.06)
Parental drinking (one or both)	1257 (72.13)	636 (64.48)	621 (82.10)
Elder sibling drinking (any) [b]	215 (12.55)	62 (6.31)	153 (20.54)
Peer drinking (any)	327 (18.05)	89 (8.72)	238 (30.26)
Parental drinking approval (one or both)	309 (17.62)	60 (5.97)	249 (32.85)
Exposure to alcohol advertising			
Televisions (yes)	1603 (89.39)	900 (88.62)	703 (90.38)
Other channels, Mean (SD) (range: 0-5)	2.96 (0.02)	2.80 (0.03)	3.17 (0.07)
Drinking in the past 12 months (wave II)	541 (29.69)	179 (17.30)	362 (45.83)
District-level characteristics (n=22) [c]	Mean (SD)		
Social environment			
Economic disadvantage (range: -1-1)	0.00 (1.00)		
Violent crime rate	22.33 (8.27)		
Alcohol access environment			
On-premises alcohol outlets density	1.17 (1.53)		
Off-premises alcohol outlets density	9.67 (6.51)		
Betel nut kiosks to off-premises alcohol outlets ratio	1.08 (1.02)		
Institutional resource environment			
MRT density	1.18 (1.60)		
Recreational resource density	1.89 (1.63)		
Temple density	0.40 (0.32)		

[a] NTD: New Taiwan Dollar (1 USD is approximately equal to 30 NTD)
[b] 856 (50.28%) participants did not have an older sibling and were regarded as not applicable.
[c] Adolescents with different alcohol consumption status all lived in the same set of the 22 districts. Therefore, the district-level characteristics were not stratified by alcohol consumption status.
[d] $\%_{wt}$: weighted percentage

Table 2.2. Hierarchical generalized linear models predicting **initiation of alcohol use** at wave 2 among the alcohol naïve adolescents at baseline in Taipei, Taiwan between 2010 and 2012

	Bivariate		Model 0	Model 1		Model 2		Model 3 [a]	
Variables	OR (95% CI)	P-value	aOR (95% CI)	aOR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value
Fixed effects									
Level-1 (individual) variables									
Gender (boys)	0.96 (0.70, 1.33)	0.810		1.02 (0.73, 1.42)	0.923	0.98 (0.68, 1.42)	0.928	0.98 (0.67, 1.43)	0.912
Living with parents (one or none)	1.57 (0.96, 2.57)	0.074				1.35 (0.77, 2.37)	0.295	1.44 (0.82, 2.55)	0.209
Parental education (both under college)	1.33 (0.94, 1.90)	0.107				1.32 (0.88, 1.97)	0.177	1.38 (0.91, 2.08)	0.129
Monthly allowance (≥ $NTD 500)	1.55 (1.12, 2.15)	**0.008**				1.69 (1.18, 2.44)	**0.004**	1.74 (1.20, 2.51)	**0.003**
Parental drinking (one or both)	1.05 (0.75, 1.48)	0.760				0.89 (0.61, 1.32)	0.570	0.96 (0.62, 1.48)	0.840
Elder sibling drinking (any)	1.53 (0.82, 2.85)	0.180				1.49 (0.72, 3.11)	0.284	1.44 (0.67, 3.09)	0.355
Peer drinking (any)	1.62 (0.97, 2.70)	0.065				1.77 (0.99, 3.17)	0.054	1.78 (0.96, 3.30)	0.067
Parental approval to drink (one or both)	1.19 (0.62, 2.30)	0.600				1.26 (0.59, 2.66)	0.552	1.17 (0.43, 3.20)	0.752
Exposure to alcohol advertising									
Televisions (yes)	2.81 (1.41, 5.62)	**0.003**		2.71 (1.29, 5.71)	**0.009**	2.35 (1.05, 5.25)	**0.038**	2.39 (1.06, 5.38)	**0.036**
Other channels	1.11 (1.00, 1.23)	0.060		1.05 (0.93, 1.17)	0.439	1.08 (0.95, 1.23)	0.242	1.08 (0.95, 1.23)	0.240
Level-2 (district) variables									
Social environment									
Economic disadvantage	0.87 (0.67, 1.14)	0.296		0.38 (0.16, 0.89)	**0.029**	0.38 (0.15, 0.98)	**0.046**	0.37 (0.14, 0.97)	**0.044**
Violent crime rate	1.00 (0.98, 1.03)	0.921		1.05 (1.00, 1.11)	**0.043**	1.05 (0.99, 1.11)	0.086	1.05 (0.99, 1.11)	0.095
Alcohol access environment									
On-premises alcohol outlets	1.04 (0.88, 1.22)	0.660		0.90 (0.57, 1.40)	0.602	0.89 (0.55, 1.45)	0.626	0.88 (0.53, 1.46)	0.594
Off-premises alcohol outlets	1.01 (0.97, 1.05)	0.658		1.02 (0.94, 1.10)	0.612	1.04 (0.95, 1.14)	0.357	1.05 (0.95, 1.15)	0.312
Betel nut kiosks	1.05 (0.82, 1.35)	0.689		1.54 (1.03, 2.29)	**0.036**	1.62 (1.04, 2.52)	**0.036**	1.68 (1.05, 2.67)	**0.033**
Institutional resource environment									
MRT	1.30 (1.00, 1.70)	0.052		0.92 (0.50, 1.69)	0.759	0.81 (0.41, 1.62)	0.526	0.78 (0.39, 1.57)	0.452
Recreational resources	1.01 (0.88, 1.16)	0.850		0.76 (0.51, 1.11)	0.139	0.74 (0.48, 1.13)	0.151	0.75 (0.48, 1.16)	0.171
Temples	0.40 (0.17, 0.95)	0.038		0.34 (0.11, 1.02)	0.054	0.30 (0.09, 1.02)	0.052	0.31 (0.09, 1.08)	0.063
Cross-level interactions									
Parental drinking × economic disadvantage								0.96 (0.56, 1.63)	0.869
Parental drinking × violent crime								1.05 (1.00, 1.11)	**0.037**
Peer drinking × economic disadvantage								1.40 (0.63, 3.10)	0.410

Peer drinking × violent crime				0.95 (0.87, 1.03)	0.185
Approval to drink × economic disadvantage				0.79 (0.23, 2.67)	0.698
Approval to drink × violent crime				1.02 (0.93, 1.12)	0.648
Random effects					
Intercept (u_{0j})	0.05505	0.00006	0.00012	0.00011	
Deviance (-2LL)	2861.84	2907.40	2460.02	2486.26	
Number of parameters	2	13	23	33	

Statistically significant effects are printed in **boldface** ($p < 0.05$); [a] The grand-mean centering was performed for both individual-level and district-level variables to adjust for multicollinearity; [b] Sample size: individual-level: 1016; district-level: 22; [c] ICC for level-2 variance component=0.02

Table 2.3. Hierarchical generalized linear models predicting **continuation of alcohol use** at wave 2 among the alcohol experienced adolescents at baseline in Taipei, Taiwan between 2010 and 2012

	Bivariate		Model 0	Model 1		Model 2		Model 3 [a]	
Variables	OR (95% CI)	P-value	aOR (95% CI)	aOR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value
Fixed effects									
Level-1 (individual) variables									
Gender (boys)	0.71 (0.53, 0.94)	**0.018**		0.69 (0.52, 0.93)	**0.014**	0.66 (0.47, 0.92)	**0.016**	0.64 (0.45, 0.90)	**0.011**
Living with parents (one or none)	1.05 (0.71, 1.56)	0.806				1.02 (0.63, 1.64)	0.948	0.99 (0.61, 1.60)	0.956
Parental education (both under college)	1.05 (0.76, 1.46)	0.761				1.01 (0.69, 1.47)	0.972	1.02 (0.70, 1.50)	0.906
Monthly allowance (≥ $NTD 500)	1.41 (1.04, 1.91)	**0.026**				1.24 (0.88, 1.75)	0.217	1.24 (0.88, 1.76)	0.226
Parental drinking (one or both)	1.66 (1.13, 2.43)	**0.009**				1.30 (0.82, 2.06)	0.261	1.68 (0.96, 2.97)	0.081
Elder sibling drinking (any)	1.84 (1.21, 2.79)	**0.004**				1.50 (0.92, 2.45)	0.104	1.55 (0.94, 2.56)	0.083
Peer drinking (any)	1.61 (1.16, 2.24)	**0.005**				1.43 (0.96, 2.12)	0.079	1.30 (0.85, 2.00)	0.543
Parental approval to drink (one or both)	1.89 (1.34, 2.67)	**<0.001**				1.60 (1.07, 2.40)	**0.022**	1.58 (1.02, 2.45)	0.486
Exposure to alcohol advertising									
Televisions (yes)	1.28 (0.79, 2.08)	0.310		1.27 (0.73, 2.21)	0.393	1.28 (0.67, 2.44)	0.452	1.30 (0.68, 2.50)	0.432
Other channels	1.05 (0.96, 1.16)	0.307		1.02 (0.91, 1.13)	0.747	0.99 (0.88, 1.12)	0.895	0.98 (0.87, 1.11)	0.763
Level-2 (district) variables									
Social environment									
Economic disadvantage	0.93 (0.68, 1.28)	0.640		0.65 (0.28, 1.53)	0.294	0.58 (0.28, 1.23)	0.141	0.57 (0.27, 1.21)	0.070
Violent crime rate	1.01 (0.98, 1.04)	0.556		1.03 (0.97, 1.09)	0.275	1.04 (0.99, 1.09)	0.095	1.04 (0.99, 1.09)	0.124
Alcohol access environment									
On-premises alcohol outlets	1.09 (0.88, 1.35)	0.432		0.74 (0.45, 1.19)	0.194	0.66 (0.41, 1.04)	0.070	0.63 (0.40, 1.02)	0.058
Off-premises alcohol outlets	1.04 (0.99, 1.08)	0.114		1.12 (1.03, 1.22)	**0.016**	1.14 (1.05, 1.24)	**0.004**	1.14 (1.05, 1.24)	**0.004**
Betel nut kiosks	0.95 (0.70, 1.29)	0.715		1.08 (0.71, 1.66)	0.694	1.03 (0.70, 1.52)	0.866	1.08 (0.72, 1.64)	0.683
Institutional resource environment									
MRT	1.06 (0.77, 1.47)	0.692		0.46 (0.21, 0.99)	**0.047**	0.47 (0.24, 0.92)	**0.030**	0.48 (0.24, 0.94)	**0.034**
Recreational resources	1.08 (0.91, 1.29)	0.365		0.90 (0.59, 1.38)	0.611	0.85 (0.57, 1.28)	0.410	0.87 (0.58, 1.32)	0.487
Temples	0.46 (0.17, 1.26)	0.124		0.33 (0.10, 1.07)	0.062	0.26 (0.24, 0.92)	**0.016**	0.24 (0.08, 0.69)	**0.012**
Cross-level interactions									
Parental drinking × economic disadvantage								2.13 (1.00, 4.55)	0.052
Parental drinking × violent								0.96 (0.90, 1.02)	0.175

crime					
Peer drinking × economic disadvantage				0.81 (0.48, 1.38)	0.411
Peer drinking × violent crime				1.00 (0.95, 1.05)	0.848
Approval to drink × economic disadvantage				0.77 (0.45, 1.33)	0.355
Approval to drink × violent crime				1.04 (0.99, 1.10)	0.140
Random effects					
Intercept (u_{0j})	**0.22308**	**0.10280**	0.00046	0.00036	
Deviance (-2LL)	2190.41	2229.62	1871.33	1902.54	
Number of parameters	2	13	23	33	

Statistically significant effects are printed in **boldface** ($p < 0.05$); [a] The grand-mean centering was performed for both individual-level and district-level variables to adjust for multicollinearity; [b] Sample size: individual-level: 779; district-level: 22; [c] ICC for level-2 variance component=0.06

Reference

Anderson, P., de Bruijn, A., Angus, K., Gordon, R., Hastings, G., 2009. Impact of alcohol advertising and media exposure on adolescent alcohol use: A systematic review of longitudinal studies. Alcohol Alcohol 44, 229-243.

Bandura, A., 2004. Health promotion by social cognitive means. Health Educ Behav 31, 143-164.

Bernburg, J.G., Thorlindsson, T., Sigfusdottir, I.D., 2009. The neighborhood effects of disrupted family processes on adolescent substance use. Soc Sci Med 69, 129-137.

Brenner, A.B., Bauermeister, J.A., Zimmerman, M.A., 2011. Neighborhood variation in adolescent alcohol use: Examination of socioecological and social disorganization theories. J Stud Alcohol Drugs 72, 651-659.

Bronfenbrenner, U., 1979. The ecology of human development. Harvard University Press, Cambridge, MA.

Bryden, A., Roberts, B., McKee, M., Petticrew, M., 2012. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. Health Place 18, 349-357.

Bryden, A., Roberts, B., Petticrew, M., McKee, M., 2013. A systematic review of the influence of community level social factors on alcohol use. Health Place 21, 70-85.

Casswell, S., 2012. Current status of alcohol marketing policy—an urgent challenge for global governance. Addiction 107, 478-485.

Chang, F.-C., Lee, C.-M., Chen, P.-H., Chiu, C.-H., Miao, N.-F., Pan, Y.-C., Huang, T.-F., Lee, S.-C., 2014. Using media exposure to predict the initiation and persistence of youth alcohol use in Taiwan. Int J Drug Policy.

Chang, H.K.-C., Tsou, M.-H., 2008. New Approaches for Integrating GIS layers and Remote Sensing Imagery for Online Mapping Services. In: Peterson, M.P. (Ed.), International Perspectives on Maps and the Internet. Springer. pp. 91-102.

Chen, C.Y., Storr, C.L., Liu, C.Y., Chen, K.H., Chen, W.J., Lin, K.M., 2011a. Differential relationships of family drinking with alcohol expectancy among urban school children. BMC Public Health 11, 87-95.

Chen, K.H., Chen, C.Y., Liu, C.Y., Lin, Y.C., Chen, W.J., Lin, K.M., 2011b. Multilevel influences of school and family on alcohol-purchasing behaviors in school-aged children. Drug Alcohol Depend 114, 127-133.

Chen, M.J., Grube, J.W., Gruenewald, P.J., 2010. Community alcohol outlet density and underage drinking. Addiction 105, 270-278.

Chen, W.J., Fu, T.-C., Ting, T.-T., Huang, W.-L., Tang, G.-M., Hsiao, C.K., Chen, C.-Y., 2009. Use of ecstasy and other psychoactive substances among school-attending adolescents in Taiwan: National surveys 2004–2006. BMC Public Health 9, 27.

Chilenski, S.M., 2011. From the macro to the micro: A geographic examination of the community context and early adolescent problem behaviors. Am J Community Psychol 48, 352-364.

Cook, T.D., Herman, M.R., Phillips, M., Settersten Jr, R.A., 2002. Some ways in which neighborhoods, nuclear families, friendship groups, and schools jointly affect changes in early adolescent development. Child Dev 73, 1283-1309.

De Haan, L., Boljevac, T., Schaefer, K., 2010. Rural community characteristics, economic hardship, and peer and parental influences in early adolescent alcohol use. J Early Adolesc 30, 629-650.

Dell'Orto, A., 2002. Places and spirit in Taiwan: Todi Gond in the stories, strategies and memories of everyday life. RoutledgeCurzon, New York, NY.

Diez Roux, A.V., 2004. The study of group-level factors in epidemiology: rethinking variables, study designs, and analytical approaches. Epidemiol Rev 26, 104-111.

Diez Roux, A.V., Mair, C., 2010. Neighborhoods and health. Annals of the New York Academy of Sciences 1186, 125-145.

Ellickson, P.L., Collins, R.L., Hambarsoomians, K., McCaffrey, D.F., 2005. Does alcohol advertising promote adolescent drinking? Results from a longitudinal assessment. Addiction 100, 235-246.

Euromonitor International, 2014. Alcoholic drinks in Taiwan.

Fagan, A.A., Wright, E.M., Pinchevsky, G.M., 2013. Racial/ethnic differences in the relationship between neighborhood disadvantage and adolescent substance use. J Drug Issues 43, 69-84.

Fisher, L.B., Miles, I.W., Austin, S.B., Camargo Jr, C.A., Colditz, G.A., 2007. Predictors of initiation of alcohol use among US adolescents: findings from a prospective cohort study. Arch Pediatr Adolesc Med 161, 959.

Forster, J.L., Murray, D.M., Wolfson, M., Wagenaar, A.C., 1995. Commercial availability of alcohol to young people: results of alcohol purchase attempts. Prev Med 24, 342-347.

Gore, F.M., Bloem, P.J., Patton, G.C., Ferguson, J., Joseph, V., Coffey, C., Sawyer, S.M., Mathers, C.D., 2011. Global burden of disease in young people aged 10-24 years: A systematic analysis. Lancet 377, 2093-2102.

Health Promotion Administration, 2006, 2010. Taiwan Youth Health Behavior Survey report. Taiwan Ministry of Health and Welfare, Taipei.

Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., Casswell, S., 2008. Density of alcohol outlets and teenage drinking: Living in an alcogenic environment is associated with higher consumption in a metropolitan setting. Addiction 103, 1614-1621.

Ingoldsby, E.M., Shaw, D.S., 2002. Neighborhood contextual factors and early-starting antisocial pathways. Clinical Child and Family Psychology Review 5, 21-55.

Jackson, N., Denny, S., Ameratunga, S., 2014. Social and socio-demographic neighborhood effects on adolescent alcohol use: A systematic review of multi-level studies. Soc Sci Med 115, 10-20.

Jernigan, D.H., 2010. The extent of global alcohol marketing and its impact on youth. Contemp Drug Probl 37, 57-89.

Jernigan, D.H., Rushman, A.E., 2014. Measuring youth exposure to alcohol marketing on social networking sites: Challenges and prospects. J Public Health Policy 35, 91-104.

Karriker-Jaffe, K.J., 2011. Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. Drug Alcohol Rev 30, 84-95.

Kulis, S., Marsiglia, F.F., Sicotte, D., Nieri, T., 2007. Neighborhood effects on youth substance use in a southwestern city. Sociol Perspect 50, 273-301.

Kuntsche, E., Kuendig, H., Gmel, G., 2008. Alcohol outlet density, perceived availability and adolescent alcohol use: A multilevel structural equation model. J Epidemiol Community Health 62, 811-816.

Lambert, S.F., Brown, T.L., Phillips, C.M., Ialongo, N.S., 2004. The relationship between perceptions of neighborhood characteristics and substance use among urban African American adolescents. Am J Community Psychol 34, 205-218.

Lee, I.C., Ting, T.T., Chen, D.R., Tseng, F.Y., Chen, W.J., Chen, C.Y., 2015. Peers and social network on alcohol drinking through early adolescence in Taiwan. Drug Alcohol Depend 153, 50-58.

Leventhal, T., Brooks-Gunn, J., 2000. The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. Psychol Bull 126, 309.

Livingston, M., Chikritzhs, T., Room, R., 2007. Changing the density of alcohol outlets to reduce alcohol-related problems. Drug Alcohol Rev 26, 557-566.

Livingston, M., Laslett, A.-M., Dietze, P., 2008. Individual and community correlates of young people's high-risk drinking in Victoria, Australia. Drug Alcohol Depend 98, 241-248.

Lo, C.C., Anderson, A.S., Minugh, P.A., Lomuto, N., 2006. Protecting Alabama students from alcohol and drugs: A multi-level modeling approach. J Drug Issues 36, 687-718.

Lu, L., Kao, S.-F., Chang, T.-T., Wu, H.-P., Cooper, C.L., 2008. Work/family demands, work flexibility, work/family conflict, and their consequences at work: A national probability sample in Taiwan. Int J Stress Manag 15, 1-21.

Maimon, D., Browning, C.R., 2012. Underage drinking, alcohol sales and collective efficacy: Informal control and opportunity in the study of alcohol use. Soc Sci Res 41, 977-990.

Moore, L.V., Diez Roux, A.V., Evenson, K.R., McGinn, A.P., Brines, S.J., 2008. Availability of recreational resources in minority and low socioeconomic status areas. Am J Prev Med 34, 16-22.

Mrug, S., Gaines, J., Su, W., Windle, M., 2010. School-level substance use: Effects on early adolescents' alcohol, tobacco, and marijuana use. J Stud Alcohol Drugs 71, 488-495.

Mrug, S., Windle, M., 2009. Initiation of alcohol use in early adolescence: Links with exposure to community violence across time. Addictive Behaviors 34, 779-781.

OleMap Inc., FORMOSAT-2 Image Application Distribution Center at National Taiwan Normal University, National Space Organization in Taiwan, 2010.

Pasch, K.E., Komro, K.A., Perry, C.L., Hearst, M.O., Farbakhsh, K., 2007. Outdoor alcohol advertising near schools: what does it advertise and how is it related to intentions and use of alcohol among young adolescents? J Stud Alcohol Drugs 68, 587-596.

Paschall, M.J., Lipperman-Kreda, S., Grube, J.W., 2014. Effects of the local alcohol environment on adolescents' drinking behaviors and beliefs. Addiction 109, 407-416.

Popova, S., Giesbrecht, N., Bekmuradov, D., Patra, J., 2009. Hours and days of sale and density of alcohol outlets: impacts on alcohol consumption and damage: a systematic review. Alcohol Alcohol 44, 500-516.

Raudenbush, S.W., Bryk, A.S., 2002. Hierarchical linear models: Applications and data analysis methods. Sage Publications, Thousand Oaks, CA.

Reboussin, B.A., Preisser, J.S., Song, E.-Y., Wolfson, M., 2010. Geographic clustering of underage drinking and the influence of community characteristics. Drug Alcohol Depend 106, 38-47.

Rehm, J., Taylor, B., Room, R., 2006. Global burden of disease from alcohol, illicit drugs and tobacco. Drug Alcohol Rev 25, 503-513.

Shaw, C., McKay, H., 1942. Juvenile Delinquency and Urban Areas. University of Chicago Press, Chicago.

Smith, L.A., Foxcroft, D.R., 2009. The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: Systematic review of prospective cohort studies. BMC Public Health 9, 51-62.

Snedker, K.A., Herting, J.R., 2008. The spatial context of adolescent alcohol use. In: Thomas, Y., Richardson, F.D., Cheung, I. (Eds.), Geography and Drug Addiction. Springer. pp. 43-63.

Snedker, K.A., Herting, J.R., Walton, E., 2009. Contextual effects and adolescent substance use: Exploring the role of neighborhoods. Soc Sci Q 90, 1272-1297.

Stacy, A.W., Zogg, J.B., Unger, J.B., Dent, C.W., 2004. Exposure to televised alcohol ads and subsequent adolescent alcohol use. Am J Health Behav 28, 498-509.

Tobler, A.L., Komro, K.A., Maldonado-Molina, M.M., 2009. Relationship between neighborhood context, family management practices and alcohol use among urban, multi-ethnic, young adolescents. Prev Sci 10, 313-324.

Trim, R.S., Chassin, L., 2008. Neighborhood socioeconomic status effects on adolescent alcohol outcomes using growth models: Exploring the role of parental alcoholism. J Stud Alcohol Drugs 69, 639-648.

Unger, J.B., Schuster, D., Zogg, J., Dent, C.W., Stacy, A.W., 2003. Alcohol advertising exposure and adolescent alcohol use: A comparison of exposure measures. Addict Res Theory 11, 177-193.

Wang, S.H., Lin, I., Chen, C.Y., Chen, D.R., Chan, T.C., Chen, W.J., 2013. Availability of convenience stores and adolescent alcohol use in Taiwan: A multilevel analysis of national surveys. Addiction 108, 2081-2088.

Windle, M., Spear, L.P., Fuligni, A.J., Angold, A., Brown, J.D., Pine, D., Smith, G.T., Giedd, J., Dahl, R.E., 2009. Transitions into underage and problem drinking: Summary of developmental processes and mechanisms: ages 10-15. Alcohol Res Health 32, 30-40.

World Health Organization Regional Office for the Western Pacific, 2015. Young people and alcohol: A resource book. WHO Press, Geneva, Switzerland.

Wu, T.J., 2009. National youth media use survey. Center for Medical Literacy in Taiwan, National Chengcgi University, Taipei.

Yabiku, S.T., Dixon Rayle, A., Okamoto, S.K., Marsiglia, F.F., Kulis, S., 2007. The effect of neighborhood context on the drug use of American Indian youth of the Southwest. J Ethn Subst Abuse 6, 181-204.

Zucker, R.A., Donovan, J.E., Masten, A.S., Mattson, M.E., Moss, H.B., 2008. Early developmental processes and the continuity of risk for underage drinking and problem drinking. Pediatrics 121, S252-S272.

Zucker, R.A., Donovan, J.E., Masten, A.S., Mattson, M.E., Moss, H.B., 2009. Developmental processes and mechanisms: Ages 0-10. Alcohol Res Health 32, 16-29.

Chapter 3:

The social ecology of intention to drink among urban Taiwanese adolescents: A multilevel examination of place and alcohol advertising effects

Abstract

Objective: This study examined associations of district-level social characteristics, alcohol access, and institutional resources and media environments to subsequent drinking intentions among adolescents in Taipei, Taiwan. We also investigated whether gender moderated relationships of alcohol access and alcohol advertising to drinking intentions.

Method: Individual-level data were obtained from a two-wave longitudinal study of 1,795 seventh and eighth grade students in 22 districts in Taipei in 2010 at baseline. District-level data for participants' residence were obtained from administrative sources and Google Street View virtual audits. Logistic multilevel analyses were used to analyze the associations of district-level characteristics and alcohol advertising to drinking intentions at one-year follow-up, with stratification by baseline past-year alcohol use.

Results: Greater spatial access to *on*-premises alcohol outlets more strongly predicted drinking intentions for boys than girls, while greater spatial access to *off*-premises alcohol outlets strongly predicted drinking intentions for girls than boys. Greater exposure to television-based alcohol advertising was more strongly associated with drinking intentions for girls than boys who had not drunk in the past year at baseline. Greater exposure to *non*-television-based alcohol advertising was more strongly associated with drinking intentions for boys than girls who had drunk in the past year at baseline. Social and institutional resource environments were unrelated to drinking intentions.

Conclusions: Gender differences exist in the relationships of spatial access to alcohol outlets and drinking intentions. Alcohol advertising also has gender-specific effects, and may depend on previous alcohol consumption. These findings suggest gender-tailored interventions restricting alcohol access and exposure to alcohol advertising may be warranted.

Introduction

Drinking intentions are important cognitive predictors of early alcohol initiation, and of alcohol abuse and dependence in young adulthood (Andrews et al., 2008; Guo et al., 2001). Researchers have paid substantial attention to risk factors associated with drinking intentions and to the development of prevention programs designed to change youths' drinking intentions and willingness (Ennett et al., 2013; Gerrard et al., 2006; Olds et al., 2005; Tildesley and Andrews, 2008; Young et al., 2013). Most of these studies were conducted using individual-level frameworks (e.g., theory of planned behavior, stage theory). Public health researchers have, however, called for research investigating *multilevel* influences on adolescent alcohol use (Ennett et al., 2008; Gruenewald, 2008; Windle, 2010).

Social Cognitive Theory suggests that behaviors are the product of dynamic interactions among personal, behavioral, and environmental influences (Bandura, 1986). Recent research has suggested that place-based exposures, such as features of the social environment, alcohol access, and institutional resources influence underage drinking (Bryden et al., 2012; Bryden et al., 2013; Jackson et al., 2014; Karriker-Jaffe, 2011). For example, the alcohol access environment has been found to be a powerful place-level characteristic that facilitates underage drinking by increasing proximity to alcohol and contributing to establishment of an "alcogenic" environment (Chen et al., 2010; Huckle et al., 2008; Livingston et al., 2008; Murphy et al., 2014; Wang et al., 2013). Research on the relations between neighborhood economic disadvantage and adolescent alcohol use reached mixed conclusions, with some findings suggesting that adolescents living in more economic disadvantaged areas have lower rates of alcohol use (Reboussin et al.,

2010; Snedker et al., 2009), while others studies suggest that neighborhood disadvantage (e.g., social and economic deprivation, disrupted family process) is associated with *higher* rates of adolescent alcohol use (Bernburg et al., 2009; De Haan et al., 2010; Huckle et al., 2008; Snedker et al., 2009). Furthermore, environmental factors such as prosocial institutional resources (e.g., educational institutes, youth service centers) may be beneficial to adolescents and delay or prevent drinking (Chen et al., 2011; Chilenski et al., 2010). Drinking intentions are the proximal antecedents of actual drinking behaviors, especially for those who have not yet tried alcohol (Andrews et al., 2003; Fleming et al., 2004; Guo et al., 2001; Ho et al., 2014; Kuntsche et al., 2007; McMillan and Conner, 2003). Understanding place-based exposures that predict drinking intentions moves research up the "causal chain" to understand possible mechanisms through which these place-based exposures influence drinking behaviors. However, no research to date has examined such effects on drinking intentions.

Alcohol advertising is another environmental factor that shapes adolescent drinking intentions (Collins et al., 2007; Fleming et al., 2004; Grube and Wallack, 1994; Jones et al., 2009; Pasch et al., 2007; Scull et al., 2010). Alcohol advertising can affect drinking intentions by increasing the perceived social benefit of alcohol consumption and positive alcohol expectancies (Fleming et al., 2004; Grube and Wallack, 1994). Among a variety of media, television remains the primary source of exposure to alcohol advertising for adolescents in the US (Center on Alcohol Marketing and Youth, 2007; Grube and Waiters, 2005) and is the most frequently used medium among Taiwanese adolescents (Wu, 2009). Despite alcohol industry claims that it targets adults of legal drinking age, a recent study found that exposure to television-based alcohol advertising for underage

viewers continued to increase, especially for spirits and beer (Chung et al., 2010). With globalization of the alcohol industry, alcohol advertising in other media (e.g., internet, movies, and sponsorship) are increasing in emerging markets (Jernigan, 2009, 2010). However, little is known about the impact of alcohol advertising on adolescent drinking behaviors and intentions outside of Western countries (Chang et al., 2014; Ho et al., 2014).

The rapid global expansion of the alcohol industry into emerging markets is a new challenge for public health. In Taiwan, where the legal drinking age is 18, the past decade has seen a substantial increase in alcohol use among adolescents. The incidence rate of alcohol use among Taiwanese middle school students (aged 13-15 years) increased 28% in one year, from 14% in 2004 to 18% in 2005 (Chen et al., 2009) and the lifetime prevalence increased 18% in four years, from 55% in 2006 to 65% in 2010 (Health Promotion Administration, 2006, 2010). Strikingly, the lifetime prevalence of alcohol use among girls (56.4% in 2006 and 62.1% in 2008) is even higher than that among boys (53.6% in 2006 and 58.9% in 2008) (Health Promotion Administration, 2006,2008). Global alcohol companies (e.g., Heineken, Anheuser-Busch) have expanded their domestic market share in Taiwan and the retail price of alcoholic beverages has decreased gradually since 2008 (Euromonitor International, 2014). With growth in exposure to global alcohol marketing and its penetration into adolescents' daily lives, research on the determinants of alcohol-related behaviors among adolescents, including determinants operating at multiple levels, is urgently needed to inform interventions in emerging alcohol markets.

The increasing prevalence of alcohol use among Taiwanese girls is alarming. It has been suggested that boys generally have a higher degree of response to alcohol advertising than girls because of the strong portrayals of masculine characteristics (Chen, 2013; Pinkleton et al., 2008). This pattern may, however, be changing with the recent gender-based global alcohol marketing strategies (Metzner and Kraus, 2008; Mosher and Johnsson, 2005). For example, previous research has shown that the incidence of alcohol advertising on television during underage viewing time has increased and advertising of spirit and alcopops were more likely to appear in time slots with more female underage viewership than that with male underage viewership (Chung et al., 2010). It is unknown whether this recent gender-based alcohol advertising has differential effects on underage drinking behaviors by gender. In addition, recent studies have shown gender differences in the effect of alcohol access environments (Halonen et al., 2013; Mäkelä et al., 2012). To illustrate, a decrease in distance to off-premises alcohol outlets is associated with increased risks of heavy alcohol use in women, but not in men (Halonen et al., 2013). It is unknown whether alcohol access environments have different impacts on underage drinking behaviors by gender. A recent review has called for more examinations on gender-specific risk factors, especially for social and environmental influences including alcohol access and media exposure, to facilitate the development of alcohol use interventions for boys and girls (Schulte et al., 2009).

The current study examined the associations of place-based characteristics and alcohol advertising with drinking intentions among adolescents in the Taipei Metropolitan Area, Taiwan. Specifically, we sought to answer three research questions: (a) whether district-level social environments, alcohol access, and institutional resources

affect subsequent adolescent drinking intentions; (b) whether the exposure to alcohol advertising is associated with subsequent drinking intentions among adolescents; and (c) whether gender moderates the relationships between district-level alcohol access and alcohol advertising with drinking intentions. We hypothesized that adolescents with more district-level alcohol access and exposure to alcohol advertising would be more likely to report intention to drink, and that greater district-level spatial access to institutional resources would be associated with reduced intentions to drink. We expected that gender would modify the impact of district-level alcohol access and alcohol advertising on drinking intentions. However, due to the lack of prior research or strong theoretical guidance, we did not specify the directions of the modifying effects.

Methods

Study description and analytic sample

To answer the study's research questions, we integrated individual-level data from the Alcohol-Related Experiences among Children (AREC) II study with data from existing administrative sources and Google Street View virtual audit on districts where participants lived.

AREC II is a longitudinal school-based study designed to assess individual and social contexts of alcohol-related experiences from early adolescence to young adulthood in Taipei, Taiwan. AREC methods have been described in detail elsewhere (Lee et al., 2015) and are briefly summarized here. A stratified probability sampling scheme was used to select 16 schools from all 73 public middle schools in Taipei in the 2009 academic year based on school characteristics (e.g., number of students, student-teacher

ratio, and school-year budget) and the physical environment surrounding the schools (e.g., number of nearby elementary and middle schools, mass transportation density). Eleven of the 16 schools accepted the invitation to participate in the study. All students in Grade 7 (spring semester) and Grade 8 (fall semester) in these eleven schools were eligible to participate in the study. The self-administered web-based questionnaire written in Chinese was used to collect data during class hour in computer classrooms in schools. The baseline sample consisted of 1,926 adolescents in Grade 7 (spring semester) and Grade 8 (fall semester) in 2010, of whome 1,870 adolescents completed the follow up survey in Grade 9. The two waves of data were at least 12 months apart, with a mean interval of 13 months between waves. The overall participation rate at wave 1 was 55% and the retention rate was 98%.

Adolescents were excluded from this analyses if they were missing data on home district (n = 53), on any district-level characteristics (n = 17), on past year drinking experience at baseline (n = 7), or on intention to drink at baseline (n = 7). 1,795 adolescents met these criteria and completed both baseline and follow-up surveys.

The level-2 unit of analysis for the current study was the residential district (*chu*). We selected the district as the unit of analysis because data were available for these geographic units and because districts are meaningful geographic units in Taipei: for example, each district office is responsible for local development, community involvement, and service delivery within districts. Participants lived in 22 districts at baseline. For each district, indicators of economic disadvantage, violent crime, institutional resources, and alcohol access were created using existing administrative data

and Google Street View virtual audit. The number of participants who lived in each district ranged from 7 to 398 (mean = 82, SD = 99).

Measures

Dependent variable. Drinking intentions were measured at baseline and follow-up. Adolescents were asked: ”For the coming 12 months, what is the likelihood for you to have a drink?” Response options included “definitely no”, “probably no”, “probably yes”, and “definitely yes”. Based on a prior study (Collins et al., 2007) and the distribution of the response, drinking intentions were coded as a binary (0 = “probably no/definitely no”, 1= “probably yes /definitely yes”).

District-level independent variables

Economic disadvantage. The measure of district-level economic disadvantage included the following four indicators: (1) percentage of people aged 25-44 without a high school diploma; (2) annual median household income; (3) percentage of vacant homes built before 2006; and (4) percentage of ethnic minority population. The data for the index were obtained from 2010 Taiwan Census, Ministry of Finance, and Ministry of Interior. The economic disadvantage measure was constructed by an index through a principal component analysis (PCA). The composite score (Cronbach’s alpha = 0.86) had a one-factor solution that explained 70.7% of the variance and ranged from -1 to 1. All district-level variables capture 2010 unless otherwise noted.

Violent crime rate. District-level violent crime rate was operationalized as the number of violent crime incidents reported per 100,000 residents. As defined by the National Police Agency of the Ministry of Interior of Taiwan Central Government, violent crime included murder, kidnapping, robbery, aggravated assault, forcible rape, and serious extortion

threat. Violent crime data were not available for districts. They were reported at the "branch" level, and then allocated to districts based on district population if two or more districts belonged to one police department branch. The annual data on violent crime were acquired from the Taipei City and New Taipei City Police Departments.

Institutional resources. District-level institutional resources were assessed using the densities of (1) Taipei Metro Rapid (MRT) exits; (2) recreational resources (i.e., parks and physical activity centers); and (3) temples. Densities were defined as the number of each type of institutional resource per square kilometer. Data on each type of institutional resource was obtained from UrMap, a commercial map with geocoded data used for navigation in Taiwan and has been demonstrated as a high quality location-based system as compared to the Google Maps (Chang and Tsou, 2008; OleMap Inc. et al., 2010).

Alcohol access. District-level alcohol outlet density was measured as the number of alcohol outlets per square kilometer. We measured three kinds of alcohol outlets: on-premises consumption outlets (i.e., all-you-can-eat barbeque restaurants and karaokes); off-premises consumption outlets (i.e., convenience stores, grocery stores, and warehouse clubs); and betel nut kiosks. Data on on- and off-premises consumption outlets were obtained from UrMap.

Betel nut kiosks are local, unregulated off-premises alcohol outlets in Taiwan. Local news sources report that betel nut kiosks are one of the easiest commercial sources of alcohol for adolescents (United Daily News, 2014, Jan 1). There are no administrative data on betel nut kiosks, and we collected data on the number of betel nut kiosks via virtual audits of Google Street View in 2009. Two trained auditors conducted virtual audits along both sides of the thoroughfares. Geo-coordinates of betel nut kiosks and the

related information (e.g., imageries, names, addresses) were collected. A random subset of the thoroughfare was double coded, finding 91% observation agreement across coders. Findings from a focus group suggest that adolescents may obtain alcohol from betel nut kiosks when there are few other off-premises outlets nearby (Chen et al., unpublished data). Therefore, the district-level measure of betel nut kiosks was operationalized as the ratio of the number of betel nut kiosks to the number of off-premises consumption outlets.

Alcohol advertising

We measured participants' perceived alcohol advertising exposure in the past month at baseline using AREC II data. Participants were asked: "During the past month, have you ever been exposed to alcohol advertising or alcohol promotion messages from _____(the marketing exposure)?" Response options were coded as no (0) and yes (1). Because exposure to television-based alcohol advertising is much more common than exposure to any other advertisements on any other marketing channel, we categorized alcohol advertising into *television* vs. *non-television* alcohol advertising. *Perceived exposure to non-television alcohol advertising* at baseline was assessed by summing the responses from all other five marketing channels (i.e., movies, websites, billboards, magazines, and convenience stores). Higher scores corresponded to a higher level of non-television alcohol advertising exposure and ranged from 0 to 5.

Individual-level covariates

Sociodemographic and individual-level covariates were assessed at baseline and included gender (boy/girl), monthly allowance (≥$NTD500/<$NTD500)(Lee et al., 2015), living with parents (one or none vs. both), parental educational attainment (neither

graduated college vs. either or both graduated college), parental approval to drink (any approval vs. none), and parental/sibling/peer drinking (any vs. none).

Data analysis

Descriptive statistics were used to explore the characteristics of the sample and the study districts. Because participants were nested in districts, we performed two-level logistic multilevel analyses using hierarchical models, with Hierarchical Linear and Nonlinear Modeling software (HLM7) (Raudenbush et al., 2011). Multilevel models were built based on theory to examine the relationships of district-level exposures at baseline to subsequent adolescent drinking intentions. Model building occurred in four stages, beginning with bivariate analyses followed by three stages of multilevel analyses with increasingly complex models. All analyses were stratified by past-year drinking experience at baseline to examine possible differential impacts on the outcome by baseline alcohol involvement.

Stage 1: A bivariate logistic multilevel model was constructed for each individual- and district-level exposure. Each model had two levels (Level 1=individual student, Level 2=district) and included a random intercept for each district-level characteristic. All district-level characteristics were carried forward into Stage 2.The effect estimates for relationships between place-based exposure and health outcomes are often artificially low because people include covariates in the models that are actually mediators (Diez Roux, 2004). To be mindful about this possibility, individual-level covariates were classified into two types: (1) possible confounders: those that could *not* possibly lie in the causal pathway (i.e., gender) and (2) possible mediators: those that may lie in the causal pathway (i.e., living with parents, parental education, monthly allowance,

parental/sibling/peer drinking, and parental approval to drink). Potential confounders were brought forward into Stage 2; potential mediators were moved forward into Stage 3.

Stage 2: To examine the relationships between all focal exposures (i.e., perceived alcohol advertising variables and district-level characteristics) and the outcome, we created a two-level random intercept model (Model 1) to determine whether these focal exposures were associated with the outcome while adjusting for gender.

Stage 3: To investigate whether individual-level covariates that traditionally have been regarded as confounders mediate the focal relationships, we added individual-level covariates that might lie in the causal pathway (i.e., living with parents, parental education, monthly allowance, parental/sibling/peer drinking, and parental approval to drink) to the multivariable model (Model 2) (Baron and Kenny, 1986). The combination of Stage 2 and Stage 3 allowed us to conduct a more conservative analysis and we did not conduct a formal test of mediation.

Stage 4: To determine whether gender moderated the focal relationships, we added cross-level interactions between gender and the district-level alcohol access variables (i.e., on- and off-premises consumption outlets, and betel nut kiosks) and between gender and the alcohol advertising variables (i.e., television-based and non-television-based alcohol advertising) to the Stage 3 multivariable model (Model 3). Given the difficulties of detecting moderating effects in non-experimental studies, we set the criteria of $p < 0.1$ to evaluate the significance level of the cross-level interactions (McClelland and Judd, 1993).

Model fit was assessed based on the deviance statistics. Because our models were nested, a chi-square difference test of deviance was performed to determine whether

models with more parameters had a significantly better fit than models with fewer parameters. R^2 was calculated as the proportion reduction in total variance (LaHuis et al., 2014). This allows us to assess the amount of variance in the outcome accounted for by the level-1 and level-2 variables.

Ethics

All procedures were approved by the National Health Research Institutes in Taiwan and Emory University's Institutional Review Board.

Results

Descriptive analysis

Of the 1795 participants, 1304 had used alcohol in the past year at baseline and 491 had not. For the full study sample, 47.31% were boys, 53.04% reported having more than $NTD500 monthly allowance (approximately equal to $USD16), 30.82% reported that neither of their parents graduated from college, and 72.13% had ever seen their parents drink (Table 1). In the 22 districts where these participants lived, on average, there were 1.17 (SD = 1.60) on-premises alcohol outlets and 9.67 (SD = 6.51) off-premises alcohol outlets per square kilometer. The average ratio of betel nut kiosks to off-premises alcohol outlets was 1.08 (SD = 1.02). Among non-alcohol users at baseline, 305 (23.28%) reported positive intentions to drink within the next 12 months. Among adolescents who had used alcohol at baseline, 316 (64.47%) reported intending to drink in the next 12 months.

Intention to drink among adolescents <u>without</u> past-year alcohol use at baseline

In the models for adolescents who had *not* used alcohol in the past year at baseline, the multivariable model (Models 3; Table 2) indicated that the interaction between gender and television-based alcohol advertising was significant (adj. OR = .22, 95% CI [.07, .69]). This interaction indicated that the effect of being exposed to television-based alcohol advertising on intention to drink was stronger for girls than boys.

The cross-level interaction between gender and on-premises alcohol outlets was also significant (adj. OR = 1.52, 95% CI [1.03, 2.24]). This interaction indicated that boys exhibited a stronger association than girls between living in districts with greater spatial access to on-premises alcohol outlets and positive intention to drink. There was also a significant cross-level interaction between gender and off-premises alcohol outlets at $p < .10$ (adj. OR = .92, 95% CI [.84, 1.01]). The interaction indicated that the effect of living in districts with greater spatial access to off-premises alcohol outlets on intention to drink was stronger for girls than boys. No other place-based characteristics were associated with the outcome among adolescents who reported no drinking in the prior year.

Intention to drink among adolescents <u>with</u> past-year alcohol use at baseline

The interaction between gender and non-television-based alcohol advertising was significant (Table 3; adj. OR = 1.53, 95% CI [1.08, 2.17]). This interaction indicated that the effect of seeing more alcohol advertising on non-television commercial channels (i.e., movies, websites, billboards, magazines, and convenience stores) on intention to drink was stronger for boys than girls.

Two cross-level interactions were significant at $p < .10$. Boys showed a stronger association than girls between living in districts with greater spatial access to on-premises alcohol outlets and positive intention to drink (adj. OR = 1.75, 95% CI [.95, 3.22]). In addition, the effect of living in districts with greater spatial access to off-premises alcohol outlets on intention to drink was stronger for girls than boys (adj. OR = .86, 95% CI [.74, 1.01]).

Discussion

To our knowledge, this study is the first to prospectively examine the impact of both place-based characteristics and media environments on drinking intentions among adolescents. Our results highlight gender differences in the relationships of the alcohol access environment to drinking intentions. Specifically, regardless of whether they had drunk alcohol in the past year at baseline, boys were more likely to report intending to drink if they lived in a district with greater spatial access to *on*-premises alcohol outlets, and girls were more likely to report these intentions if they lived in a district with greater spatial access to *off*-premises alcohol outlets. In addition, girls who had not drunk in the past year at baseline were more likely to report intending to drink if they remembered seeing more television-based alcohol advertising. Boys who *had* drunk in the past year at baseline were more likely to report intending to drink in the next 12 months if they remembered seeing more *non*-television-based alcohol advertising. We did not, however, find significant impacts of social and institutional resource environments on drinking intentions.

Our results suggest that the mechanisms linking the alcohol access environment to drinking intentions may be gender specific. The effect of living in districts with greater spatial access to *on*-premises alcohol outlets on positive drinking intentions was stronger for boys than girls. It is worth noting that the on-premises alcohol outlets in the current study were measured by all-you-can-eat barbeque restaurants and karaokes, which are two of the major on-premises alcohol outlets where Taiwanese adolescents can easily obtain alcoholic beverages. In all-you-can-eat barbeque restaurants, alcoholic beverages are often placed in public refrigerators which adolescents can easily access without photo identification. In karaokes, adolescents can order alcoholic beverages through a phone line in private karaoke rooms also without photo identification. Such outlets may increase alcohol availability for adolescent boys, which in turn may encourage drinking intentions and related behaviors (Kuntsche et al., 2008; Paschall et al., 2012).

Another explanation for the observed relationship for boys is outlined by the "amenity effect" of alcohol outlets (Livingston et al., 2007; Stockwell, 2004). In Taiwan, all-you-can-eat barbeque restaurants and karaokes are considered common recreational settings where adolescents socialize with peers and have fun. Livingston et al. (2007) have suggested that places with more on-premises alcohol outlets may be considered entertainment areas, and can attract crowds of youth with various levels of drinking problems. It is possible that living in such districts and seeing people drinking and socializing in these settings may influence adolescents' drinking intentions through normative processes (Paschall et al., 2012). The relationship between on-premises outlets and drinking intentions was weaker for girls than boys. Because of gender stereotypes, public drinking is often viewed as unfeminine and is less acceptable for girls (de Visser

and McDonnell, 2012; Rolfe et al., 2009). This gender stereotype may inhibit girls from drinking in barbeque restaurants and karaokes, where they would be in public view.

Off-premises alcohol outlets, however, were more strongly related to drinking intentions for girls than boys. The observed association between off-premises alcohol outlet and drinking intentions may be explained by the proximity effect of alcohol outlets (Huckle et al., 2008; Livingston et al., 2007). Given that age-of-sale enforcement is lax in off-premises alcohol outlets in Taiwan, greater spatial access to off-premises alcohol outlets makes alcohol more accessible to adolescents, which in turn may encourage drinking intentions. It is likely that after acquiring alcoholic beverages from off-premises alcohol outlets, youth can consume alcohol at private settings, such as friends' homes (Campbell et al., 2009). Drinking in such settings may be more appealing to girls than drinking publicly at on-premise settings because they can avoid the undesired stereotypes while also enjoying the freedom to drink (de Visser and McDonnell, 2012). We are unsure why the effect of density of off-premises alcohol outlets was weaker for boys than girls.

Also consistent with our hypotheses, the relationship of alcohol advertising to drinking intentions also differed by gender. We found that television-based alcohol advertising was more strongly associated with drinking intention for girls than boys. This finding may be explained by the recent alcohol marketing strategy in emerging alcohol markets. Television alcohol advertising has gradually shifted its target to girls, especially for advertising alcopops, a new alcoholic beverage type that girls often consume (Chung et al., 2010; Metzner and Kraus, 2008; Mosher and Johnsson, 2005). We only observed this interaction among those who had no alcohol use experience in the past year at

baseline. This is consistent with prior research that has suggested that the influence of alcohol advertising is especially influential for adolescents who have less actual drinking experience (Zucker et al., 2009).

Non-television-based alcohol advertising (e.g., magazines, internet, and movies), however, was more strongly associated with drinking intentions for boys than girls. It is possible that boys are exposed to alcohol advertisements from these non-television-based media channels because of their choice in reading and watching materials (e.g., sexually explicit materials, on-line games, sports) (Ma and Shek, 2013; Tsai and Lin, 2004). In Taiwan, alcohol advertising is only restricted on television and radio during "children viewing times". Unpublished focus group data from adolescents suggest that the non-television-based media (e.g., internet, magazines) that boys prefer contain unrestricted alcohol advertising (Chen et al., unpublished data). We only observed this interaction among those who had consumed alcohol in the past year at baseline. This result may support the notion that people who consumed more alcohol pay more attention to alcohol-related cues (Townshend and Duka, 2001).

Contrary to our hypotheses, we found no significant associations between the social environment or institutional resources with drinking intentions. The absence of these relationships may be due to the lack of subjective measures of these environments. As shown in a previous study, using administrative-based measures of environments alone is not enough to understand adolescent behaviors (Seidman et al., 1998). Instead, the combination of objective measures and subjective measures that capture both social process (e.g., social cohesion) and structures is crucial to understand how these environments influence adolescent behaviors. Further research is needed to better

understand the effects of the social environment and institutional resources on drinking intentions.

Limitations and future directions

Several limitations should be noted when interpreting the results. First, as mentioned above, our measure of on-premises alcohol outlets only included all-you-can-eat barbeque restaurants and karaokes. In Taiwan, on-premises alcohol outlets are not required to obtain licenses. Thus, we did not have a comprehensive inventory of the locations of all on-premises alcohol outlets. The associations between on-premises alcohol outlets and drinking intentions may be different if different types of on-premises alcohol outlets were included. However, our focus group data (Chen et al., unpublished data) suggest that these two types of on-premises alcohol outlets are commonly used among adolescents which may minimize the impact of this limitation. Second, alcohol advertising measures were self-reported and may have been subject to recall bias. Further, the alcohol advertising measures were restricted to past-month exposure. Because the AREC study was conducted during regular school days, it is likely that our measures of alcohol advertising in the past-month may not reflect the alcohol advertising exposure during the summer/winter breaks, which are often the peaks of the alcohol advertising based on Nielsen data. Both of these limitations may bias the inferential statistics and associated findings of the study. Third, the sampling scheme of the AREC is based on schools rather than districts. Our participants only lived in a subset of districts in Taipei (54%), and thus our findings are not representative of the complete Taipei metropolitan area. Furthermore, the parental consent rate for students' participation in the

current study was relatively low. We have no information about the differential participation based on students' sociodemographic composition. Our results may not apply to those whose parents/guardians who did not provide parental consent and to school drop-outs. Fourth, we only select thoroughfares into our Google Street View virtual audits for betel nut kiosks because it would be too labor-intensive to include all types of roads (e.g., alleys, lanes). Since betel nut kiosks also exist on other types of roads in Taiwan, it is possible that we underestimated the relationship between the spatial access to betel nut kiosks and drinking intentions.

Conclusions

To our knowledge, this is the first attempt to investigate the impact of place-based characteristics on drinking intentions in conjunction with the impact of alcohol advertising. Future research is needed to expand the current study by taking better coverage of the districts in Taipei and by refining place-based measures, especially in contexts where global alcohol marketing is expanding. In particular, research is needed to evaluate the impacts of alcohol access environments and gendered alcohol advertising on adolescent drinking intentions. Our findings may inform interventions to reduce drinking intentions among adolescents, suggesting that gender-tailored district-level and policy-level efforts are important to restrict alcohol access and exposure to global alcohol marketing to youth.

Table 3.1. Distribution of individual- and district-level characteristics at baseline for the full sample and by past year drinking status at baseline among middle school students from the Alcohol-Related Experiences among Children (AREC) II in Taipei, Taiwan in 2010

Variables	Total (n = 1795)	None-alcohol use at baseline (n = 1304)	Alcohol use at baseline (n = 491)
	N ($\%_{wt}$)	N ($\%_{wt}$)	N ($\%_{wt}$)
Individual-level characteristics			
Gender (boys)	852 (47.31)	616 (46.81)	236 (48.65)
Monthly allowance (≧500 NTD) [a]	931 (53.04)	626 (49.14)	305 (63.33)
Living with parents (one or none)	222 (12.40)	139 (10.65)	83 (17.15)
Parental education (neither graduated college)	571 (30.82)	419 (30.87)	152 (30.67)
Parental drinking (one or both)	1257 (72.13)	849 (66.96)	408 (85.86)
Elder sibling drinking (any) [b]	215 (12.55)	106 (8.52)	109 (23.04)
Peer drinking	327 (18.05)	147 (11.24)	180 (36.21)
Parental drinking approval (one or both approved)	309 (17.62)	125 (9.83)	184 (38.55)
Exposure to alcohol advertising			
Televisions (yes)	1603 (89.39)	1155 (88.71)	448 (91.18)
Non-television, Mean (SD)	2.96 (0.02)	2.85 (0.02)	3.25 (0.04)
Intention to drink (positive)	621 (34.53)	305 (23.28)	316 (64.47)
District-level characteristics (n = 22)	Mean (SD)		
Social environment			
Economic disadvantage index (range: -1-1)	0.00 (1.00)		
Violent crime rate	22.33 (8.27)		
Institutional resource environment			
MRT exit density [c]	1.18 (1.60)		
Recreational resource density	1.89 (1.63)		
Temple density	0.40 (0.32)		
Alcohol access environment			
On-premises alcohol outlets density	1.17 (1.53)		
Off-premises alcohol outlets density	9.67 (6.51)		
Betel nut kiosks to off-premises alcohol outlets ratio	1.08 (1.02)		

[a] NTD: New Taiwan Dollar (1 USD is approximately equal to 30 NTD)
[b] 856 (50.28%) participants did not have an older sibling and were regarded as not applicable.
[c] MRT: Metro Rapid Transit

Table 3.2. Two-level hierarchical generalized linear models (HGLMs) predicting **positive intention to drink** at wave 2 in a cohort of 1304 adolescents who **had <u>not</u> used alcohol in the past year at baseline** in Taipei, Taiwan between 2010 and 2012

	Bivariate		Model 1		Model 2		Model 3 [a]	
Variables	OR (95% CI)	P-value	aOR (95% CI)	P-value	a OR (95% CI)	P-value	a OR (95% CI)	P-value
Fixed effects								
Level-1 (individual) variables								
Gender (boys)	1.09(0.83, 1.42)	0.544	1.08 (0.82, 1.42)	0.597	1.25 (0.92, 1.71)	0.149	3.86 (1.38, 10.82)	**0.010**
Living with parents (one or none)	1.45 (0.97, 2.17)	0.074			1.31 (0.83, 2.09)	0.246	1.40 (0.88, 2.23)	0.160
Parental education (both under college)	1.15 (0.86, 1.55)	0.345			1.07 (0.76, 1.50)	0.705	1.06 (0.75, 1.49)	0.742
Monthly allowance (≥ $NTD 500)	1.29 (0.98, 1.70)	0.065			1.36 (1.00, 1.84)	0.051	1.32 (0.97, 1.79)	0.081
Parental drinking (one or both)	1.34 (1.00, 1.81)	0.053			1.16 (0.83, 1.64)	0.383	1.12 (0.80, 1.59)	0.506
Sibling drinking (any)	1.79 (1.11, 2.86)	0.016*			1.77 (1.03, 3.05)	0.039*	1.86 (1.08, 3.22)	0.027*
Peer drinking (any)	1.64 (1.11, 2.43)	0.014*			1.84 (1.18, 2.89)	0.007**	1.86 (1.19, 2.92)	0.007**
Parental approval to drink (one or both)	1.62 (1.05, 2.51)	0.029*			1.32 (0.78, 2.24)	0.299	1.34 (0.79, 2.29)	0.278
Exposure to alcohol advertising								
Televisions (yes)	0.84 (0.56, 1.28)	0.422	0.86 (0.54, 1.38)	0.528	0.82 (0.49, 1.40)	0.473	1.97 (0.81, 4.82)	0.136
Non-televisions (1 – 5)	0.99 (0.90, 1.08)	0.784	1.00 (0.91,1.11)	0.975	1.01 (0.91, 1.13)	0.837	1.01 (0.87, 1.18)	0.889
Gender * televisions							0.22 (0.07, 0.69)	**0.010**
Gender * non-televisions							1.01 (0.81, 1.26)	0.924
Level-2 (district) variables								
Social environment								
SES disadvantage index	1.02 (0.81, 1.29)	0.881	0.74 (0.37, 1.47)	0.357	0.82 (0.38, 1.75)	0.574	0.85 (0.40, 1.83)	0.658
Violent crime rate	1.01 (0.99, 1.03)	0.319	1.03 (0.99, 1.08)	0.148	1.02 (0.97, 1.07)	0.382	1.02 (0.97, 1.07)	0.357
Institutional resources								
MRT exits	1.18 (0.84, 1.67)	0.317	1.11 (0.62, 1.98)	0.709	1.22 (0.65, 2.32)	0.507	1.24 (0.65, 2.38)	0.481
Recreational resources	0.96 (0.85, 1.10)	0.539	0.85 (0.59, 1.23)	0.361	0.86 (0.57, 1.29)	0.429	0.89 (0.59, 1.36)	0.578
Temples	0.64 (0.28, 1.44)	0.264	0.47 (0.18, 1.26)	0.124	0.39 (0.13, 1.13)	0.077	0.39 (0.13, 1.14)	0.079[†]
Alcohol access								
On-premises alcohol outlets	0.97 (0.83, 1.14)	0.681	0.88 (0.58, 1.33)	0.514	0.86 (0.55, 1.37)	0.505	0.83 (0.52, 1.34)	0.425
Off-premises alcohol outlets	1.00 (0.97, 1.04)	0.997	1.01 (0.94, 1.08)	0.802	1.01 (0.94, 1.10)	0.714	1.01 (0.93, 1.10)	0.801
Betel nut kiosks	1.03 (0.81, 1.30)	0.809	1.08 (0.76, 1.53)	0.660	1.14 (0.77, 1.67)	0.483	1.13 (0.77, 1.67)	0.497
Cross-level interactions								
Gender × on-premises alcohol outlets							1.52 (1.03, 2.24)	0.037*
Gender × off-premises alcohol outlets							0.92 (0.84, 1.01)	0.072[†]
Gender × betel nut kiosks							0.98 (0.63, 1.53)	0.943
Random effects								

Intercept (u_{0j})	0.02995	0.03034	0.03212
Total R^2 (proportion reduction in **total** variance)	1.69%	1.68%	1.63%
Deviance (-2LL)	3738.13	3189.69	3189.97
χ^2diff. test (*df*)	71.85 (12)***	548.44 (10)***	0.28 (5)

Note: adj. OR = adjusted odds ratio; Sample size: individual-level: 1304, district-level: 22; ICC for level-2 variance component = 0.026; [a] Logistic Hierarchical Linear Model was performed with the grand-mean centering for both individual-level and district-level variables to adjust for multicollinearity; [†] p <.10; *p <.05; ** p <.01; ***p < .001

Table 3.3. Two-level hierarchical generalized linear models (HGLMs) predicting **positive intention to drink** at wave 2 in a cohort of 491 adolescents who **had used alcohol in the past year at baseline** in Taipei, Taiwan between 2010 and 2012

	Bivariate		Model 1		Model 2		Model 3 [a]	
Variables	OR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value
Fixed effects								
Level-1 (individual) variables								
Gender (boys)	0.99 (0.67, 1.48)	0.976	0.96 (0.64, 1.45)	0.855	1.05 (0.65, 1.70)	0.849	0.84 (0.15, 4.23)	0.838
Living with parents (one or none)	1.09 (0.63, 1.88)	0.750			1.13 (0.58, 2.20)	0.711	1.05 (0.54, 2.06)	0.887
Parental education (both under college)	1.37 (0.88, 2.14)	0.162			1.38 (0.80, 2.39)	0.244	1.41 (0.81, 2.45)	0.222
Monthly allowance (≥ $NTD 500)	1.15 (0.76, 1.74)	0.513			0.94 (0.58, 1.52)	0.794	0.94 (0.58, 1.53)	0.805
Parental drinking (one or both)	1.36 (0.78, 2.39)	0.281			1.22 (0.62, 2.39)	0.566	1.18 (0.60, 2.36)	0.628
Sibling drinking (any)	1.35 (0.76, 2.39)	0.301			0.99 (0.51, 1.91)	0.966	0.95 (0.49, 1.87)	0.887
Peer drinking (any)	1.51 (0.95, 2.40)	0.083			2.07 (1.16, 3.69)	0.014*	**2.11 (1.17, 3.83)**	0.014*
Parental approval to drink (one or both)	2.05 (1.24, 3.38)	0.005**			2.31 (1.32, 4.06)	0.004**	**2.43 (1.37, 4.33)**	0.002**
Exposure to alcohol advertising								
Televisions (yes)	2.36 (1.22, 4.57)	0.011*	1.83 (0.86, 3.89)	0.116	1.42 (0.58, 3.46)	0.441	2.60 (0.80, 8.51)	0.114
Non-televisions (1 – 5)	1.15 (1.01, 1.31)	0.033*	1.09 (0.94, 1.27)	0.247	1.08 (0.91, 1.28)	0.375	0.88 (0.68, 1.12)	0.289
Gender * televisions							0.21 (0.03, 1.36)	0.100
Gender * non-televisions							**1.53 (1.08, 2.17)**	0.017*
Level-2 (district) variables								
Social environment								
SES disadvantage index	1.04 (0.79, 1.37)	0.780	0.99 (0.28, 3.58)	0.993	1.25 (0.32, 4.86)	0.729	1.36 (0.31, 3.82)	0.657
Violent crime rate	1.01 (0.99, 1.04)	0.215	1.00 (0.92, 1.09)	0.955	0.98 (0.89, 1.08)	0.684	0.98 (0.89, 1.09)	0.702
Institutional resources								
MRT exits	1.08 (0.70, 1.67)	0.704	0.71 (0.23, 2.23)	0.527	0.87 (0.24, 3.14)	0.815	0.99 (0.24, 4.07)	0.993
Recreational resources	1.05 (0.92, 1.19)	0.467	0.68 (0.38, 1.34)	0.190	0.66 (0.34, 1.27)	0.191	0.63 (0.31, 1.27)	0.179
Temples	0.58 (0.27, 1.29)	0.174	0.59 (0.11, 3.09)	0.503	0.39 (0.07, 2.27)	0.270	0.45 (0.07, 2.98)	0.379
Alcohol access								
On-premises alcohol outlets	1.12 (0.95, 1.32)	0.157	1.54 (0.80, 2.98)	0.175	1.58 (0.76, 3.30)	0.200	1.74 (0.80, 3.82)	0.147
Off-premises alcohol outlets	1.03 (0.99, 1.06)	0.156	1.04 (0.92, 1.18)	0.502	1.06 (0.93, 1.22)	0.360	1.06 (0.91, 1.22)	0.438
Betel nut kiosks	1.07 (0.80, 1.43)	0.624	1.05 (0.57, 1.93)	0.867	0.91 (0.47, 1.74)	0.748	0.89 (0.44, 1.82)	0.741
Cross-level interactions								
Gender × on-premises alcohol outlets							1.75 (0.95, 3.22)	0.073[†]
Gender × off-premises alcohol outlets							0.86 (0.74, 1.01)	0.060[†]
Gender × betel nut kiosks							1.04 (0.52, 2.06)	0.919
Random effects								
Intercept (u_{0j})			**0.25484**		**0.26304**		**0.35727**	
Total R^2 (proportion reduction in			-7.70%		-7.95%		-10.81%	

total variance)			
Deviance (-2LL)	1410.82	1173.37	1176.78
χ^2 diff. test (*df*)	14.62 (12)	237.45 (10)***	3.41 (5)

Note: aOR = adjusted odds ratio; Sample size: individual-level: 491, district-level: 22; ICC for level-2 variance component = 0.001; [a] Logistic Hierarchical Linear Model was performed with the grand-mean centering for both individual-level and district-level variables to adjust for multicollinearity; *p <.05; ** p <.01; ***p < .001

Reference

Andrews, J.A., Hampson, S.E., Barckley, M., Gerrard, M., Gibbons, F.X., 2008. The effect of early cognitions on cigarette and alcohol use during adolescence. Psychology of addictive behaviors 22, 96.

Andrews, J.A., Tildesley, E., Hops, H., Duncan, S.C., Severson, H.H., 2003. Elementary school age children's future intentions and use of substances. Journal of Clinical Child and Adolescent Psychology 32, 556-567.

Bandura, A., 1986. Social foundations of thought and action: A social cognitive theory. Prentice-Hall, Englewood Cliffs, New Jersey.

Baron, R.M., Kenny, D.A., 1986. The moderator mediator variable distinction in social psychological-research - conceptual, strategic, and statistical considerations. J Pers Soc Psychol 51, 1173-1182.

Bernburg, J.G., Thorlindsson, T., Sigfusdottir, I.D., 2009. The neighborhood effects of disrupted family processes on adolescent substance use. Soc Sci Med 69, 129-137.

Bryden, A., Roberts, B., McKee, M., Petticrew, M., 2012. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. Health Place 18, 349-357.

Bryden, A., Roberts, B., Petticrew, M., McKee, M., 2013. A systematic review of the influence of community level social factors on alcohol use. Health Place 21, 70-85.

Campbell, C.A., Hahn, R.A., Elder, R., Brewer, R., Chattopadhyay, S., Fielding, J., Naimi, T.S., Toomey, T., Lawrence, B., Middleton, J.C., 2009. The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol

consumption and alcohol-related harms. American journal of preventive medicine 37, 556-569.

Center on Alcohol Marketing and Youth, 2007. Youth exposure to alcohol advertising on television and in national magazines, 2001 to 2006. Washington, DC.

Chang, F.-C., Lee, C.-M., Chen, P.-H., Chiu, C.-H., Miao, N.-F., Pan, Y.-C., Huang, T.-F., Lee, S.-C., 2014. Using media exposure to predict the initiation and persistence of youth alcohol use in Taiwan. Int J Drug Policy.

Chang, H.K.-C., Tsou, M.-H., 2008. New Approaches for Integrating GIS layers and Remote Sensing Imagery for Online Mapping Services. In: Peterson, M.P. (Ed.), International Perspectives on Maps and the Internet. Springer. pp. 91-102.

Chen, K.H., Chen, C.Y., Liu, C.Y., Lin, Y.C., Chen, W.J., Lin, K.M., 2011. Multilevel influences of school and family on alcohol-purchasing behaviors in school-aged children. Drug Alcohol Depend 114, 127-133.

Chen, M.J., Grube, J.W., Gruenewald, P.J., 2010. Community alcohol outlet density and underage drinking. Addiction 105, 270-278.

Chen, W.J., Fu, T.-C., Ting, T.-T., Huang, W.-L., Tang, G.-M., Hsiao, C.K., Chen, C.-Y., 2009. Use of ecstasy and other psychoactive substances among school-attending adolescents in Taiwan: National surveys 2004–2006. BMC Public Health 9, 27.

Chen, Y.-C., 2013. The effectiveness of different approaches to media literacy in modifying adolescents' responses to alcohol. J Health Commun 18, 723-739.

Chilenski, S.M., Greenberg, M.T., Feinberg, M.E., 2010. The community substance use environment: The development and predictive ability of a multi-method and

multiple-reporter measure. Journal of Community & Applied Social Psychology 20, 57-71.

Chung, P.J., Garfield, C.F., Elliott, M.N., Ostroff, J., Ross, C., Jernigan, D.H., Vestal, K.D., Schuster, M.A., 2010. Association between adolescent viewership and alcohol advertising on cable television. American Journal of Public Health 100, 555-562.

Collins, R.L., Ellickson, P.L., McCaffrey, D., Hambarsoomians, K., 2007. Early adolescent exposure to alcohol advertising and its relationship to underage drinking. J Adolesc Health 40, 527-534.

De Haan, L., Boljevac, T., Schaefer, K., 2010. Rural community characteristics, economic hardship, and peer and parental influences in early adolescent alcohol use. J Early Adolesc 30, 629-650.

de Visser, R.O., McDonnell, E.J., 2012. 'That's OK. He's a guy': A mixed-methods study of gender double-standards for alcohol use. Psychology & Health 27, 618-639.

Diez Roux, A.V., 2004. The study of group-level factors in epidemiology: rethinking variables, study designs, and analytical approaches. Epidemiol Rev 26, 104-111.

Ennett, S.T., Foshee, V.A., Bauman, K.E., Hussong, A., Cai, L., Reyes, H.L.M., Faris, R., Hipp, J., DuRant, R., 2008. The social ecology of adolescent alcohol misuse. Child Dev 79, 1777-1791.

Ennett, S.T., Jackson, C., Bowling, J.M., Dickinson, D.M., 2013. Parental socialization and children's susceptibility to alcohol use initiation. J Stud Alcohol Drugs 74, 694-702.

Euromonitor International, 2014. Alcoholic drinks sources 2014: Taiwan.

Fleming, K., Thorson, E., Atkin, C.K., 2004. Alcohol advertising exposure and perceptions: links with alcohol expectancies and intentions to drink or drinking in underaged youth and young adults. Journal of Health Communication: Internaltional Perspectives 9, 3-29.

Gerrard, M., Gibbons, F.X., Brody, G.H., Murry, V.M., Cleveland, M.J., Wills, T.A., 2006. A theory-based dual-focus alcohol intervention for preadolescents: The Strong African american Families program. Psychology of Addictive Behaviors 20, 185-195.

Grube, J.W., Waiters, E., 2005. Alcohol in the media: Content and effects on drinking beliefs and behaviors among youth. Adolesc Med Clin 16, 327-343, viii.

Grube, J.W., Wallack, L., 1994. Television beer advertising and drinking knowledge, beliefs, and intentions among schoolchildren. American Journal of Public Health 84, 254-259.

Gruenewald, P., 2008. Why do alcohol outlets matter anyway? A look into the future. Addiction 103, 1585-1587.

Guo, J., Hawkins, J.D., Hill, K.G., Abbott, R.D., 2001. Childhood and adolescent predictors of alcohol abuse and dependence in young adulthood. Journal of Studies on Alcohol 62, 754-762.

Halonen, J.I., Kivimäki, M., Virtanen, M., Pentti, J., Subramanian, S., Kawachi, I., Vahtera, J., 2013. Proximity of off-premise alcohol outlets and heavy alcohol consumption: A cohort study. Drug Alcohol Depend.

Health Promotion Administration, 2006,2008. Taiwan Youth Health Survey report. https://olap.hpa.gov.tw/.accessed on.

Health Promotion Administration, 2006, 2010. Taiwan Youth Health Behavior Survey report. Taiwan Ministry of Health and Welfare, Taipei.

Ho, S.S., Poorisat, T., Neo, R.L., Detenber, B.H., 2014. Examining how presumed media influence affects social norms and adolescents' attitudes and drinking behavior intentions in rural Thailand. J Health Commun 19, 282-302.

Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., Casswell, S., 2008. Density of alcohol outlets and teenage drinking: Living in an alcogenic environment is associated with higher consumption in a metropolitan setting. Addiction 103, 1614-1621.

Jackson, N., Denny, S., Ameratunga, S., 2014. Social and socio-demographic neighborhood effects on adolescent alcohol use: A systematic review of multi-level studies. Soc Sci Med 115, 10-20.

Jernigan, D.H., 2009. The global alcohol industry: an overview. Addiction 104, 6-12.

Jernigan, D.H., 2010. The extent of global alcohol marketing and its impact on youth. Contemp Drug Probl 37, 57-89.

Jones, S.C., Gregory, P., Munro, G., 2009. Adolescent and young adult perceptions of Australian alcohol advertisements. Journal of Substance Use 14, 335-352.

Karriker-Jaffe, K.J., 2011. Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. Drug Alcohol Rev 30, 84-95.

Kuntsche, E., Knibbe, R., Engels, R., Gmel, G., 2007. Drinking motives as mediators of the link between alcohol expectancies and alcohol use among adolescents. J Stud Alcohol Drugs 68, 76-85.

Kuntsche, E., Kuendig, H., Gmel, G., 2008. Alcohol outlet density, perceived availability and adolescent alcohol use: A multilevel structural equation model. J Epidemiol Community Health 62, 811-816.

LaHuis, D.M., Hartman, M.J., Hakoyama, S., Clark, P.C., 2014. Explained variance measures for multilevel models. Organizational Research Methods 17, 433-451.

Lee, I.C., Ting, T.T., Chen, D.R., Tseng, F.Y., Chen, W.J., Chen, C.Y., 2015. Peers and social network on alcohol drinking through early adolescence in Taiwan. Drug Alcohol Depend 153, 50-58.

Livingston, M., Chikritzhs, T., Room, R., 2007. Changing the density of alcohol outlets to reduce alcohol-related problems. Drug Alcohol Rev 26, 557-566.

Livingston, M., Laslett, A.-M., Dietze, P., 2008. Individual and community correlates of young people's high-risk drinking in Victoria, Australia. Drug Alcohol Depend 98, 241-248.

Mäkelä, P., Tigerstedt, C., Mustonen, H., 2012. The Finnish drinking culture: change and continuity in the past 40 years. Drug Alcohol Rev 31, 831-840.

Ma, C.M., Shek, D.T., 2013. Consumption of pornographic materials in early adolescents in Hong Kong. Journal of Pediatric and Adolescent Gynecology 26, S18-S25.

McClelland, G.H., Judd, C.M., 1993. Statistical difficulties of detecting interactions and moderator effects. Psychol Bull 114, 376.

McMillan, B., Conner, M., 2003. Using the theory of planned behaviour to understand alcohol and tobacco use in students. Psychology, Health & Medicine 8, 317-328.

Metzner, C., Kraus, L., 2008. The impact of alcopops on adolescent drinking: A literature review. Alcohol Alcohol 43, 230-239.

Mosher, J.F., Johnsson, D., 2005. Flavored alcoholic beverages: An international marketing campaign that targets youth. J Public Health Policy 26, 326-342.

Murphy, A., Roberts, B., Ploubidis, G.B., Stickley, A., McKee, M., 2014. Using multi-level data to estimate the effect of an 'alcogenic' environment on hazardous alcohol consumption in the former Soviet Union. Health Place 27, 205-211.

Olds, R.S., Thombs, D.L., Tomasek, J.R., 2005. Relations between normative beliefs and initiation intentions toward cigarette, alcohol and marijuana. J Adolesc Health 37, 75.

OleMap Inc., FORMOSAT-2 Image Application Distribution Center at National Taiwan Normal University, National Space Organization in Taiwan, 2010.

Pasch, K.E., Komro, K.A., Perry, C.L., Hearst, M.O., Farbakhsh, K., 2007. Outdoor alcohol advertising near schools: what does it advertise and how is it related to intentions and use of alcohol among young adolescents? J Stud Alcohol Drugs 68, 587-596.

Paschall, M.J., Grube, J.W., Thomas, S., Cannon, C., Treffers, R., 2012. Relationships between local enforcement, alcohol availability, drinking norms, and adolescent alcohol use in 50 california cities. J Stud Alcohol Drugs 73, 657.

Pinkleton, B.E., Austin, E.W., Cohen, M., Chen, Y.-C.Y., Fitzgerald, E., 2008. Effects of a peer-led media literacy curriculum on adolescents' knowledge and attitudes toward sexual behavior and media portrayals of sex. Health communication 23, 462-472.

Raudenbush, S., Bryk, A., Cheong, Y., Congdon, R., du Toit, M., 2011. HLM 7. Lincolnwood, IL: Scientific Software International Inc.

Reboussin, B.A., Preisser, J.S., Song, E.-Y., Wolfson, M., 2010. Geographic clustering of underage drinking and the influence of community characteristics. Drug Alcohol Depend 106, 38-47.

Rolfe, A., Orford, J., Dalton, S., 2009. Women, alcohol and femininity a discourse analysis of women heavy drinkers' accounts. Journal of Health Psychology 14, 326-335.

Schulte, M.T., Ramo, D., Brown, S.A., 2009. Gender differences in factors influencing alcohol use and drinking progression among adolescents. Clinical Psychology Review 29, 535-547.

Scull, T.M., Kupersmidt, J.B., Parker, A.E., Elmore, K.C., Benson, J.W., 2010. Adolescents' media-related cognitions and substance use in the context of parental and peer influences. J Youth Adolesc 39, 981-998.

Seidman, E., Yoshikawa, H., Roberts, A., CHESIR–TERAN, D., Allen, L., Friedman, J.L., Aber, J.L., 1998. Structural and experiential neighborhood contexts, developmental stage, and antisocial behavior among urban adolescents in poverty. Development and Psychopathology 10, 259-281.

Snedker, K.A., Herting, J.R., Walton, E., 2009. Contextual effects and adolescent substance use: Exploring the role of neighborhoods. Soc Sci Q 90, 1272-1297.

Stockwell, T., 2004. Controls on the physical availability of alcohol. In: Heather, N., Stockwell, T. (Eds.), The essential handbook of treatment and prevention of alcohol problems. Wiley and Sons, Chichester. pp. 213-233.

Tildesley, E.A., Andrews, J.A., 2008. The development of children's intentions to use alcohol: Direct and indirect effects of parent alcohol use and parenting behaviors.

Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors 22, 326-339.

Townshend, J., Duka, T., 2001. Attentional bias associated with alcohol cues: differences between heavy and occasional social drinkers. Psychopharmacology 157, 67-74.

Tsai, C.C., Lin, C.C., 2004. Taiwanese adolescents' perceptions and attitudes regarding the internet: exploring gender differences. Adolescence 39, 725-734.

United Daily News, 2014, Jan 1. United Daily News Group, Taipei, Taiwan.

Wang, S.H., Lin, I., Chen, C.Y., Chen, D.R., Chan, T.C., Chen, W.J., 2013. Availability of convenience stores and adolescent alcohol use in Taiwan: A multilevel analysis of national surveys. Addiction 108, 2081-2088.

Windle, M., 2010. A multilevel developmental contextual approach to substance use and addiction. Biosocieties 5, 124-136.

Wu, T.J., 2009. National youth media use survey. Center for Medical Literacy in Taiwan, National Chengcgi University, Taipei.

Young, C.M., Rodriguez, L.M., Neighbors, C., 2013. Expressive writing as a brief intervention for reducing drinking intentions. Addictive behaviors 38, 2913-2917.

Zucker, R.A., Donovan, J.E., Masten, A.S., Mattson, M.E., Moss, H.B., 2009. Developmental processes and mechanisms: Ages 0-10. Alcohol Res Health 32, 16-29.

Chapter 4:
A comparison of choices of alcopops and choices of regular beer: A focus group study among urban Taiwanese adolescents

Abstract

Aim: This study aims to explore adolescents' perspectives on and responses to alcohol marketing for alcopops and regular beer, and analyze how these marketing efforts influence adolescents' drinking experience in Taiwan.

Methods: Eight focus groups were conducted with 59 vocational high school students aged 17-18 years in Taipei, Taiwan in 2014. Thematic analyses were used to analyze transcripts and identify themes.

Findings: Packaging design and television advertising were the alcohol marketing strategies that influence adolescents' choice of alcopops vs. beer, regardless of gender. For alcopops, participants indicated that alcopop packaging designs were used as camouflage to manage the stigma of underage drinking. The youthful identity obtained from packaging and television alcohol advertising also drove adolescents to choose alcopops; the "girly" alcopop packaging design was especially attractive to girls. For regular beer, participants used beer brand imagery to associate with their social identities and reflect their desired personality and lifestyle. Participants were deeply aware of the symbolic consumption imagery portrayed in television alcohol advertising and emulated this symbolic attractiveness; the packaging of regular beer strengthened the perceived symbolic attractiveness for leading brands.

Conclusions: These results expand past research by adding detailed exploration of the interpretive processes through which alcohol marketing influence adolescents' selection of alcopops vs. regular beer in an emerging alcohol market. Given these findings, we

recommend the implementation of strategies regulating alcohol packaging design especially for alcopops. Media literacy education should also be included in alcohol interventions to better equip adolescents with skills to counter persuasive messages of alcohol marketing.

Introduction

Over the past several decades, global alcohol marketing has played an increasingly prominent role in influencing adolescent alcohol use both in Western contexts and in emerging alcohol markets (Babor, 2010; Casswell, 2012; Jernigan, 2010; Jernigan and Rushman, 2014; World Health Organization Regional Office for the Western Pacific, 2015). Recent reviews of prospective studies have suggested that alcohol marketing practices adversely affect adolescent alcohol use and problem behaviors related to alcohol use (Anderson et al., 2009; Gordon et al., 2010a; Jernigan, 2010; Koordeman et al., 2012; Smith and Foxcroft, 2009). Taiwan opened its alcohol market to international alcohol industries in 1987 (Hsu et al., 2005). Since then, new alcoholic products have been introduced on the Taiwanese alcohol market, including alcopops (Euromonitor International, 2014). Alcopops, a new type of alcoholic beverage with sweet flavors introduced in late 1990s, are reported to deliberately target youth (Jernigan and O'Hara, 2004; Metzner and Kraus, 2008; Romanus, 2000; Rossheim and Thombs, 2013). Despite the implications for underage drinking, little is known about how the development of this new alcoholic product influences adolescents, especially in emerging alcohol markets where alcohol policy environment is different from Western markets (e.g., public drinking and alcohol display are permitted) (Albers et al., 2015; Metzner and Kraus, 2008; World Health Organization Regional Office for the Western Pacific, 2015).

Recent studies have shown that alcopop consumption among adolescents is associated with risky drinking behaviors and is an emerging public health problem (Albers et al., 2015; Cleary et al., 2012; Giga et al., 2011). Characteristics of alcopops, such as sweet taste and trendy packaging, differentiate this new product from other

conventional alcoholic beverages, and are appealing to adolescents (Jones, 2011; Jones and Reis, 2011; Stevenson et al., 2007). Furthermore, a recent qualitative study indicated that adolescents drink alcopops not only because of these attractive characteristics, but also because of the perceived social benefits that they gain from getting intoxicated as a part of their leisure (e.g., alcopops can bring a more intense psychoactive effect of alcohol and enable adolescents to socialize longer) (Jones et al., 2012). It is still unclear, however, how adolescents respond to this relatively new alcoholic product and why adolescents drink it. The absence of this information is striking because of growing efforts to market alcopops to youths (Fortunato et al., 2014; Jones and Barrie, 2011; Rossheim and Thombs, 2013), and because of the risks associated with underage alcopop use (Albers et al., 2015; Cleary et al., 2012).

In recent years, there has been much concern about the processes through which alcohol marketing influences underage drinking (Austin et al., 2006; Bryden et al., 2012; Durkin, 2013; Fortunato et al., 2014; Jernigan, 2010). Although research has examined the effects of alcohol marketing on adolescent alcohol use, mechanisms underlying the association between alcohol marketing and underage drinking still need to be clarified. Existing research and theories allow us to explore plausible mechanisms linking alcohol marketing strategies to underage drinking (Aaker, 1997; Austin et al., 2006; Austin and Johnson, 1997; Belk et al., 1982; McCreanor et al., 2005). According to the Message Interpretation Process (MIP) model, positive images and the appealing features of alcoholic products portrayed by alcohol industries can increase adolescents' preference for alcohol and the positive expectancies of alcohol use through cognitive and affective decision-making process (Austin et al., 2006; Austin and Johnson, 1997; Scull et al.,

2010). The alcoholic products with branded symbols, colors, and contexts can also create branded identities that are popular for adolescents through identification and the symbolic consumption process (Jones et al., 2012; McCreanor et al., 2005). Most research investigating the interpretative process or cognitive factors of alcohol marketing has been limited to conventional alcohol products. Little is known about how adolescents interpret new marketing strategies such as the development of alcopop and why alcopop marketing works for adolescents.

The reaction to alcohol marketing may be gendered (Connolly et al., 1994; Jones and Barrie, 2011; Jones and Reis, 2011; Metzner and Kraus, 2008; O'Hara et al., 2013; Saffer and Dave, 2006). Recent studies conducted in Australia have indicated that boys and girls tend to perceive alcopop marketing differently and the alcopop industry tends to employ gender-tailored marketing strategies to promote their products (Jones and Barrie, 2011; Jones and Reis, 2011). In the past decade, the alcoholic beverage preference among adolescents has shifted dramatically from regular beer to alcopops, and this shift is particularly substantial among girls (Centers for Disease Control and Prevention, 2007; Mosher, 2012). It is important to understand how boys and girls respond to alcohol marketing differently to inform gender-tailored interventions.

To deepen our understanding of the interpretative process linking alcohol marketing and underage drinking, researchers have called for more qualitative research that is grounded in adolescents perspectives to inform interventions and policies targeting psychological, social, and cultural influences on underage drinking (Atkinson et al., 2013; Bryden et al., 2012; Durkin, 2013; Jones et al., 2012). The purpose of this qualitative study is to explore adolescents' perspectives about (1) how alcohol marketing

influences their decision to drink alcopops and (2) how alcohol marketing influences their drinking experience in Taiwan. To better understand these questions beyond a single product or a single marketing strategy, we compared adolescents' perceptions about alcopops in contrast to their perspectives about regular beer. We also explored possible gender differences in these perceptions.

Methods

Design and Sampling

Focus group data with adolescents were collected as part of the qualitative arm of the Alcohol-Related Experiences among Children (AREC) study, a longitudinal school-based study set in Taipei, Taiwan, of alcohol-related experiences from early adolescence to young adulthood. We used focus groups because they provide a supportive setting with peers in which adolescents can express their thoughts and perceptions about sensitive topics such as underage drinking (Liamputtong, 2011). Focus groups can provide richer data on attitude, experiences, and behaviors that quantitative data collection methods would not offer (Liamputtong, 2011). In addition, focus groups can offer opportunities for participants to think together or challenge each other, and this allows us to learn about norms and group behaviors (Liamputtong, 2011).

Groups were recruited by the AREC team. To leverage trust between participants and the AREC team, we included only AREC participants in focus group discussions. We limited our sample to vocational high school students because of the higher drinking prevalence in this group. The AREC team first worked closely with school principals and teachers to identify vocational high schools that were willing to participate in the focus

groups and had enough students who had participated in the AREC surveys. Then, introductory letters and both parental and student consent forms were distributed to eligible students according to Taiwanese regulations. Only students who personally consented and who provided consent from parents were recruited into focus groups. Groups were stratified by alcohol access environment around schools (high vs. low alcohol access) and gender; single-gender groups can increase comfort within groups and enhance discussions (Liamputtong, 2011). Alcohol access environment was defined based on the number of off-premises alcohol outlets (i.e., convenience stores, grocery stores, and warehouse clubs) per square kilometer (i.e., off-premises alcohol outlet density) for the districts where schools were located (high alcohol access: density higher than the third tertile [14.8 off-premises alcohol outlets/square kilometers]; low alcohol access: density lower than the first tertile [1.5 off-premises alcohol outlets/square kilometers]). A total of 8 focus groups, each with 6 to 8 students, were conducted (n= 59; 31 boys and 28 girls aged 17 to 18 years old) and took place in 4 vocational high schools.

Focus group data collection

Focus group participants enrolled and focus group discussions were conducted in a private room within schools during June and August 2014. To enhance confidentiality, teachers were asked to leave the room and the moderator introduced the general discussion rules, such as not sharing information discussed in the groups with others after the groups had ended. Focus groups covered two domains: alcohol marketing and alcohol access. The current study only analyzed data on the alcohol marketing domain. We used a semi-structured discussion guide to address adolescents' perceptions, interpretations, and

responses to alcohol marketing, and their reasons for choosing specific alcohol brands. The discussion guide evolved in response to emerging findings and addition probes were added to further explore selected emerging themes. A range of techniques was used to stimulate discussions. For example, de-identified pictures of regular beer and alcopops were shown to participants; all were available on the Taiwanese market at the time of the study. Participants were asked to identify the brands and think about where they saw them and why they could recognize them. To explore brand selection behavior, we had a voting activity in which participants were asked to vote for three brands that were popular among adolescents. They were also asked to describe the reasons adolescents selected brands, and what types of adolescents would choose each product. Focus group discussions lasted between 90 and 120 minutes; the discussions about alcohol marketing took about another 50-80 minutes. All groups were moderated by the first author in Mandarin Chinese. Each participant received $NTD200 gift card and a set of stationary for participating in the focus group discussions.

Data analysis

The focus group discussions were audiorecorded and transcribed verbatim in Mandarin Chinese; two observers recorded and took notes in a systematic way to provide accurate accounts of discussions. We used thematic analysis methods to deconstruct and capture the meaning of the data from transcripts and notes (Guest et al., 2012). The process of analysis began with several rounds of transcript reading. A codebook was developed with initial codes using inductive and deductive approaches. During the open coding process, two members of the research team (i.e., the first and the third authors) followed a rigorous coding process: (1) they applied initial codes to the first four

transcripts independently; (2) then they compared coding patterns and discussed discrepancies; (3) next, they revised the definition of the initial codes and created new codes in response to new data; and (4) finally, they reviewed each other's coded transcripts to ensure both coders applied codes based upon the agreed codebook. A single set of codes was applied to all transcripts. Codes were created in English and memos were written in Mandarin Chinese. All transcripts were double coded and saved using MAXQDA 11 software (VERBI Software, 2014). During the analysis phase, the team members sorted and grouped codes with similar formulations and meanings together; compared and debriefed memos; and created themes and conceptual models. Because the analysis found an important theme related to stigma, we used Goffman's stigma concepts to further inform this theme (Goffman, 1963).

Ethics

Protocols were approved by the National Health Institutes in Taiwan and Emory University's Institutional Review Board.

Results

To enhance confidentiality, participants were not asked about their personal alcohol use experiences or related sociodemographic characteristics and so we cannot comment on the role that personal alcohol use experience or sociodemographic characteristics may have played in their responses to the discussions. Because there were no differences across alcohol access environments in the themes discussed in the current study, we present findings from both alcohol access environments together. The thematic analysis identified two overarching themes for choosing to drink alcopops and two overarching

themes for choosing to drink regular beer. Quotes were translated into English for this manuscript.

Choosing alcopops

In this section, we present focus group responses about reasons adolescents selected alcopops. There were three overarching reasons given: managing stigma of underage drinking, representing youthful identity, and representing girly images.

Drinking alcopops to manage stigma toward underage drinking

Almost all adolescent groups selected alcopops because the camouflaged packaging design helped them manage their deviant identity of underage drinking and make it less visible. Participants knew that underage drinking was often a marker for "being bad", and therefore they were trying to "cover" or minimize the stigma of underage drinking. When asked about the reasons for choosing particular alcopop brands, many participants quickly indicated that they or their peers chose alcopops such as Ice Fire because drinking those alcopops was "not like drinking". Our participants indicated that alcopop packaging designs allowed these alcoholic beverages to "pass" as soda or juice. Virtually all groups mentioned that the package designs of alcopops, including transparent glass-ware bottles, bright soda/juice-like colors of the alcohol itself, modern 3-dimensional pictures, colored cans, and fruit pictures, made alcopops look like soda or juice (Figure 1). Such designs often enabled them to "pass" as non-drinkers because their parents and other adults believed that they were drinking non-alcoholic beverages. Many groups revealed that this kind of design made them "feel better" or "feel not weird" when they

held the alcopop cans/bottles or drank alcopops. This indicates that the alcopop packaging allowed adolescents to "cover" the stigmatized behavior (i.e., underage drinking) by presenting a non-stigmatized behavior (i.e., drinking juice or soda). In addition, some groups discussed the fact that the packaging of Japanese alcopop brands (e.g., Suntory Holoyoi) provided better camouflage than the Taiwanese alcopop brands (e.g., fruit flavored Taiwan Beer). In Taiwan, there are no open container laws and drinking in public places is permitted. Therefore, this stigma management strategy of underage alcohol use is especially important to Taiwanese adolescents because it allows them drink in public view without violating social norms. As the following quote from a focus group with girls illustrates, adolescents believed that underage drinking is not a socially acceptable behavior and they were trying to find ways to overcome this stigmatization.

"…Adults always tell us not to drink…" (Girl 2, FG 5)

"But the peach flavored one [the Suntory Holoyoi alcopop] is fine because adults would mistake it as a soft drink (laughing). My mom has been fooled many times!" (Girl 1, FG 5)

"So does my mom (laughing)!" (Girl 2, FG 5)

Discussions of managing stigma via camouflaged alcopop packaging design were similar across gender. Both boys and girls talked about the importance of packaging design as a camouflage that protected them from the stigma of underage drinking. When examining packaging for alcopops and beer, members of a focus group with boys discussed when examining packaging for beer and alcopops:

> "Apparently, this person [who drinks regular Taiwan Beer] looks bad, and the other person [who drinks Ice Fire] looks better. Although we know both drinks are bad, drinking Taiwan Beer is real drinking and the Ice Fire [alcopop] is more like a soda. I feel it's just fine to drink it [Ice Fire]. …Usually, people define students who drink as bad. So we would avoid it." (Boy 2, FG 1)

Drinking alcopops to represent youthful identity

In both girls and boys the idea emerged that drinking alcopops was a way to present a youthful identity. This youthful identity primarily came from two sources: television alcohol advertising and packaging designs. According to both girls and boys, television alcohol advertising strengthened the connection between drinking alcopops and a youthful identity. Participants indicated that the settings and activities depicted in alcopop television advertising perfectly reflected the leisure activities and the usual social hangout in their age (e.g., celebrating 18 years old birthday, enjoying pop music festivals). This kind of advertising would reinforce the belief that people their age drank alcopops.

The physical appearance of alcopops increased product appeal and created a representation of youthful identity for adolescents. Almost all members across focus groups consistently expressed a clear preference for glassware bottled alcopop products. Many participants mentioned that the glassware bottles enabled people to see the colors of alcohol inside, and this feature was regarded as "eye-catching", "pretty", and "cool". Regardless of gender, focus group participants emphasized the importance of transparent bottles and colors in increasing participants' desires to drink or even just to carry the bottles. As one female group remarked,

"It [Ice Fire] just feels cooler and more stylish." (Girl 3, FG 5)

"The colors [of the alcohol inside the bottles] are so eye-catching. This makes people only want to pick it [Ice Fire] up compared to those canned beer products."(Girl 1, FG 5)

"It's a feeling of being young!" (Girl 2, FG 5)

Our participants differentiated youthful from childish and old. They drank alcopops because they did not want to be viewed either as childish or old-fashioned. However, it should be noted that our participants had mixed feelings about being old. They selected alcopops because these products fit the youthful image of their age, but they would consume other products to show their maturity. We will discuss this in the section of reasons to select regular beer.

Drinking alcopops to represent a girly image

From the voting activity, we observed that alcopops are generally attractive among girls regardless of brands. Girls often described different kinds of alcopop packaging as "pretty" or "cute". Three out of four girl focus groups reported that alcopops were generally viewed as a "girly" product and indicated that the suggested drinkers were girls around their age, particularly for the brands with soft colored backgrounds and fruit pictures designs (e.g., Suntory Holoyoi). Additionally, girls sometimes had strong views about boys who drank alcopops: "it's gay's behavior!" or "it's disgusting!". In contrast to girls, boys only showed their preference to specific alcopop brands (e.g., Ice Fire) and did not appear to favor alcopop brands with such "girly" design (e.g., Suntory Holoyoi). Boys did not discuss negative feelings about alcopop drinking among boys.

Choosing regular beer

Drinking beer because of its symbolic attractiveness

Symbolic properties are values, identities, and status attached to particular products/brands. Across groups, participants' choices of regular beer were concentrated among a small number of leading brands (e.g., Heineken, Taiwan Beer). Participants sorted the leading regular beer brands into imported and domestic categories, and they associated specific types of personality and lifestyle with each category.

Irrespective of gender, participants in all groups expressed the view that they chose imported beers because of its symbolic attractiveness. Consuming the imported beer generated immediate tangible psychological connotations such as luxury and glamour or specific lifestyles such as celebrities or "dan shen gui zu" (young single happy care-free adults). As one female participant said, "Heineken is the drink that you would consume in luxurious upper-class parties where rich people socialize." Different from the youthful images linked to alcopops, the connotations that these imported beers created were connected to young *adult* and revealed adolescents' desires to be mature. Many groups indicated that such connotations primarily came from television alcohol advertising with humorous and novel elements and delivered with pop music and "foreign westerners". These television alcohol commercials conveyed several positive social attributes (such as upper-class lifestyles, white-collar class) and signified a social hierarchy in which imported beer drinkers were at the top. Participants indicated that consuming these imported beer products was a cue they could use to communicate with others about their

standings and memberships. As the following quote illustrates, adolescents would prefer imported beers because of the social images instead of liking the flavor:

> "Heineken's commercials have jumped out of box…you prefer to have it [Heineken in your hand] rather than to drink it. Other beer commercials all only emphasize its taste and describe drinking with friends. " (Boy 1, FG 2)
>
> "…this [type of commercial] can increase your positive impression [about Heineken] and make you feel Heineken is better. …it is more expensive and this is good. …drinking Heineken is like driving a Mercedes-Benz (laughing)!" (Boy 2, FG 2)

There were mixed responses to the choice of domestic regular beer (e.g., Taiwan Beer). Domestic beer was perceived as unstylish and perceived as a low social class product: Taiwan Beer is "just not cool enough" or is "construction workers' drink." Sometimes, participants indicated that the domestic regular beer was an "old-class" product and was regarded as middle age people's drink. Interestingly, this old-fashioned character was not always unattractive, but could be used as a symbol of being grown up. Part of this grown up symbolic attractiveness came from television alcohol advertising. One female focus group echoed one Taiwan Beer's television alcohol advertising: "we just want to know why adults would drink this. …we mimic them. …just like the slogan [of the advertising], 'it is adults' flavor!'" In addition, Taiwanese beer sometimes produced a cultural identity and therefore was considered patriotic. Domestic beer produced an "I love Taiwan" identity which contrasted with the "exotic fashion" identity generated by choosing imported beer. Based on our observations, these two symbolic identities are not mutually exclusive; both could be embraced.

Choosing regular beer because of the packaging

For leading beer brands in Taiwan (e.g., Heineken, Taiwan Beer), packaging was not as important as the symbolic identities that primarily came from television advertising. Packaging of the leading beer brands only strengthened the existing symbolic identities. As one female participant said: "…because of the packaging [of Heineken]…it's just more like foreigners [Westerners]."

For non-leading regular beer brands in Taiwan (e.g., Bush, Kirin), packaging was important to catch participants' attention and to influence their decision to choose the beer. Beer cans with simple colors and simple pictures were attractive to participants because they were regarded as "good looking" or having a "good design". In addition, these designs could sometimes make participants believe the taste was good. In general, the packaging design did not create symbolic identity linking with the beer. The exceptions were members of one focus group with girls that associated the yellow color of the packaging with sunshine and beaches and thought drinking this particular beer brand could produce a joyful and youthful feeling.

Discussion

Alcohol marketing has become a potent force that influences underage drinking both in Western contexts and emerging markets such as the Asia Pacific Region (Casswell, 2012; Center for Social and Health Outcomes Research and Evaluation, 2006; Gordon et al., 2010a; Jernigan, 2010; World Health Organization Regional Office for the Western Pacific, 2015). The present study extends the current research on alcohol

marketing and underage drinking by providing the first detailed exploration of the interpretive processes through which alcohol marketing influences Taiwanese adolescents' selection behaviors between alcopops and regular beer. We found that packaging design and television alcohol advertising were two key alcohol marketing strategies influencing adolescents' selection of alcopops and regular beer.

Our participants discussed *why* alcopop packaging design was an important factor that attracted adolescents to consume alcopops. While past research has suggested that alcopop packaging is a potent factor for underage alcopop use (Jones, 2011; Jones and Reis, 2011; Rossheim and Thombs, 2013), discussions about why the alcopop design is important to adolescents have been absent. Characteristics of alcopop packaging designs, such as colors, illustrations, and bottle design, were considered as a form of camouflage that could help alcoholic beverages pass as soft drinks. Participants highlighted the importance of using such camouflage designs to manage the tension and stigma of underage drinking and deceive their parents about their drinking in a social and cultural context in which underage drinking is unacceptable.

The analysis also revealed that alcopop packaging is gendered. Our findings echo previous research, which suggests that alcopops are popular among girls (Fortunato et al., 2014; Metzner and Kraus, 2008; Mosher and Johnsson, 2005). Our results suggests that the alcohol industry uses marketing practices that appear to target girls by creating "girly" alcopop packaging designs that can particularly attract girls to start drinking alcopops. Additionally, girls in our focus groups had a strong negative response if boys consumed alcopops with these "girly" designs.

Our analysis suggests that television alcohol advertising was an important venue through which adolescents developed symbolic meanings of alcopops and regular beer brands. Consistent with past research and the MIP model, adolescents drank alcopops and regular beer to project social identities that were depicted on television and were important to how they saw themselves and others (Austin et al., 2006; Hughes et al., 1997; Jones et al., 2012; McCreanor et al., 2005). Although recent studies indicate that adolescents have a high level of critical awareness to interpret depictions of alcohol on television and on other media channels (Atkinson et al., 2013; Gordon et al., 2010b), we observed that the selective social images of alcopops and regular beer presented on television commercials still resulted in skewed social images of alcopop and regular beer use for adolescents.

These findings must be considered in relation to study limitations. First, given the nature of qualitative methods (Maxwell, 2012) our findings may not be generalizable to the broader population of Taiwanese adolescents. The purpose of this study, however, was to explore adolescents' interpretative processes in detail, rather than to provide generalizable data. We were able to reach saturation for key themes and our findings echo previous research about the importance of packaging and television alcohol advertising in influencing underage drinking. Second, we did not ask for individual alcohol use experiences, though these experiences might have been important in shaping interests in alcopops vs. regular beer. Future studies could stratify by individual alcohol use experience to maximize variation of the data. Third, although participants were encouraged to freely express their thoughts in an open discussion, the stigma attached to underage drinking and the use of a semi-structured discussion guide with prompts

developed by the moderator may have influenced some responses (Maxwell, 2012). To address this limitation, we deliberately sampled focus groups from multi-schools to increase variability and compared the responses across schools to learn if findings were robust across these different school contexts.

This study provides new insights into how and why packaging and television alcohol advertising may affect adolescents' consumption of alcopops and regular beer in an emerging alcohol market. Our findings have three important implications for future research and public health interventions. First, despite the fact that alcohol industries claim that their marketing practices do not target youth, it is clear from our results that the alcopop industry is promoting their products by intentionally creating youth-oriented and soft drink-like alcopop packaging (Jones and Reis, 2011). Given this evidence, public health practitioners should advocate for policies to regulate alcohol packaging design, especially for alcopops. Regulations might include imposing clear labeling indicating the volume of alcohol in Chinese for both imported and domestic brands and limiting the youth-oriented illustrations (e.g., cartoon style pictures and girly designs) on alcopop cans (Wilkinson and Room, 2009). Second, alcohol interventions for adolescents could include media literacy training to better equip adolescents with skills to counter the persuasive messages of alcohol marketing. Previous research has shown that the utility and effectiveness of the media literacy training on children's decision making about alcoholic beverages (Austin and Johnson, 1997; Chen, 2013). Children receiving media literacy training have increased understanding of persuasive intent, decreased positive expectation of drinking, and decreased likelihood of choosing alcohol products (Austin and Johnson, 1997). Furthermore, health literacy training for parents about different types

of alcoholic products may be also needed, especially for imported alcoholic products with little Chinese labeling. Third, the alcohol industry has rapidly extended its marketing efforts to new media channels that are commonly used by adolescents (e.g., internet, social networking sites) (Jernigan and Rushman, 2014). To better understand how alcohol marketing tools affect underage drinking, future research could extend the current study by exploring how these new media influence adolescents' alcohol use experience.

Figure 4.1. Examples of alcopop packaging designs that enable adolescents to "pass" as non-alcoholic drinks: (a) The Ice Fire with a transparent glass-ware bottle; (b) The Suntory Holoyoi with a picture of peach and a "girly" pink background; (c) The Kirin Zero with a picture lemons and a modern 3-dimensional background; (d) Fruit flavored Taiwan Beer with a picture of grapes

Reference

Aaker, J.L., 1997. Dimensions of brand personality. J Mark Res, 347-356.

Albers, A.B., Siegel, M., Ramirez, R.L., Ross, C., DeJong, W., Jernigan, D.H., 2015. Flavored alcoholic beverage use, risky drinking behaviors, and adverse outcomes among underage drinkers: Results from the ABRAND Study. Am J Public Health 105, 810-815.

Anderson, P., de Bruijn, A., Angus, K., Gordon, R., Hastings, G., 2009. Impact of alcohol advertising and media exposure on adolescent alcohol use: A systematic review of longitudinal studies. Alcohol Alcohol 44, 229-243.

Atkinson, A.M., Bellis, M., Sumnall, H., 2013. Young peoples' perspective on the portrayal of alcohol and drinking on television: Findings of a focus group study. Addict Res Theory 21, 91-99.

Austin, E.W., Chen, M.-J., Grube, J.W., 2006. How does alcohol advertising influence underage drinking? The role of desirability, identification and skepticism. J Adolesc Health 38, 376-384.

Austin, E.W., Johnson, K.K., 1997. Effects of general and alcohol-specific media literacy training on children's decision making about alcohol. J Health Commun 2, 17-42.

Babor, T., 2010. Alcohol: No ordinary commodity: Research and public policy. Oxford University Press.

Belk, R.W., Bahn, K.D., Mayer, R.N., 1982. Developmental recognition of consumption symbolism. J Consum Res, 4-17.

Bryden, A., Roberts, B., McKee, M., Petticrew, M., 2012. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. Health Place 18, 349-357.

Casswell, S., 2012. Current status of alcohol marketing policy—an urgent challenge for global governance. Addiction 107, 478-485.

Center for Social and Health Outcomes Research and Evaluation, 2006. Alcohol marketing in the Western Pacific Region. Massey University, Auckland, New Zealand.

Centers for Disease Control and Prevention, 2007. Types of alcoholic beverages usually consumed by students in 9th-12th grades–four states. MMWR 56, 737-740.

Chen, Y.-C., 2013. The effectiveness of different approaches to media literacy in modifying adolescents' responses to alcohol. J Health Commun 18, 723-739.

Cleary, K., Levine, D.A., Hoffman, R.S., 2012. Adolescents and young adults presenting to the emergency department intoxicated from a caffeinated alcoholic beverage: A case series. Ann Emerg Med 59, 67-69.

Connolly, G.M., Casswell, S., ZHANG, J.F., Silva, P.A., 1994. Alcohol in the mass media and drinking by adolescents: A longitudinal study. Addiction 89, 1255-1263.

Durkin, K., 2013. Focusing on television: Do adolescents drink it all in? Addict Res Theory 21, 100-101.

Euromonitor International, 2014. Alcoholic drinks in Taiwan.

Fortunato, E.K., Siegel, M., Ramirez, R.L., Ross, C., DeJong, W., Albers, A.B., Jernigan, D.H., 2014. Brand-specific consumption of flavored alcoholic beverages among underage youth in the United States. Am J Drug Alcohol Abuse 40, 51-57.

Giga, N.M., Binakonsky, J., Ross, C., Siegel, M., 2011. The nature and extent of flavored alcoholic beverage consumption among underage youth: Results of a national brand-specific survey. Am J Drug Alcohol Abuse 37, 229-234.

Goffman, E., 1963. Stigma: Notes on the management of spoiled identity. Simon and Schuster, New York, NY.

Gordon, R., Hastings, G., Moodie, C., 2010a. Alcohol marketing and young people's drinking: What the evidence base suggests for policy. J Public Aff 10, 88-101.

Gordon, R., Moodie, C., Eadie, D., Hastings, G., 2010b. Critical social marketing -- The impact of alcohol marketing on youth drinking: Qualitative findings. Int J Nonprofit Volunt Sect Market 15, 265-275.

Guest, G., MacQueen, K.M., Namey, E.E., 2012. Applied thematic analysis. Sage, Thousand Oaks, California.

Hsu, C.C., Levy, D.T., Wen, C.P., Cheng, T.Y., Tsai, S.P., Chen, T., Eriksen, M.P., Shu, C.C., 2005. The effect of the market opening on trends in smoking rates in Taiwan. Health Policy 74, 69-76.

Hughes, K., MacKintosh, A.M., Hastings, G., Wheeler, C., Watson, J., Inglis, J., 1997. Young people, alcohol, and designer drinks: Quantitative and qualitative study. BMJ 314, 414-418.

Jernigan, D.H., 2010. The extent of global alcohol marketing and its impact on youth. Contemp Drug Probl 37, 57-89.

Jernigan, D.H., O'Hara, J., 2004. Alcohol advertising and promotion. In: Bonnie, R.J., O'Connell, M.E. (Eds.), Reducing underage drinking: A collective responsibility. National Academies Press, Washington, D.C. pp. 625-653.

Jernigan, D.H., Rushman, A.E., 2014. Measuring youth exposure to alcohol marketing on social networking sites: Challenges and prospects. J Public Health Policy 35, 91-104.

Jones, S.C., 2011. “You wouldn’t know it had alcohol in it until you read the can”: Adolescents and alcohol-energy drinks. Australasian Marketing J 19, 189-195.

Jones, S.C., Barrie, L., 2011. RTDs in Australia: Expensive designer drinks or cheap rocket fuel? Drug Alcohol Rev 30, 4-11.

Jones, S.C., Barrie, L., Berry, N., 2012. Why (not) alcohol energy drinks? A qualitative study with Australian university students. Drug Alcohol Rev 31, 281-287.

Jones, S.C., Reis, S., 2011. Not just the taste: Why adolescents drink alcopops. Health Educ 112, 61-74.

Koordeman, R., Anschutz, D.J., Engels, R.C., 2012. Alcohol Portrayals in Movies, Music Videos and Soap Operas and Alcohol Use of Young People: Current Status and Future Challenges. Alcohol Alcohol 47, 612-623.

Liamputtong, P., 2011. Focus group methodology: Principles and practice. SAGE, Thousand Oaks, CA.

Maxwell, J.A., 2012. Qualitative research design: An interactive approach. Sage publications.

McCreanor, T., Barnes, H.M., Gregory, M., Kaiwai, H., Borell, S., 2005. Consuming identities: Alcohol marketing and the commodification of youth experience. Addict Res Theory 13, 579-590.

Metzner, C., Kraus, L., 2008. The impact of alcopops on adolescent drinking: A literature review. Alcohol Alcohol 43, 230-239.

Mosher, J.F., 2012. Joe Camel in a bottle: Diageo, the Smirnoff brand, and the transformation of the youth alcohol market. Am J Public Health 102, 56-63.

Mosher, J.F., Johnsson, D., 2005. Flavored alcoholic beverages: An international marketing campaign that targets youth. J Public Health Policy 26, 326-342.

O'Hara, R.E., Gibbons, F.X., Li, Z., Gerrard, M., Sargent, J.D., 2013. Specificity of early movie effects on adolescent sexual behavior and alcohol use. Soc Sci Med 96, 200-207.

Romanus, G., 2000. Alcopops in Sweden--a supply side initiative. Addiction 95 Suppl 4, S609-619.

Rossheim, M.E., Thombs, D.L., 2013. Multiple fruit-flavored alcoholic drinks in a can (MFAC): an overlooked class of potentially harmful alcohol products. Am J Drug Alcohol Abuse 39, 280-283.

Saffer, H., Dave, D., 2006. Alcohol advertising and alcohol consumption by adolescents. Health Econ 15, 617-637.

Scull, T.M., Kupersmidt, J.B., Parker, A.E., Elmore, K.C., Benson, J.W., 2010. Adolescents' media-related cognitions and substance use in the context of parental and peer influences. J Youth Adolesc 39, 981-998.

Smith, L.A., Foxcroft, D.R., 2009. The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: Systematic review of prospective cohort studies. BMC Public Health 9, 51-62.

Stevenson, R.J., Copeland, J., Gates, P., 2007. The role of experience in liking "read-to-drink" alcoholic beverages. Psychol Addict Behav 21, 564-569.

VERBI Software, 2014. MAXQDA Software für qualitative Datenanalyse (Version 11). Consult. Sozialforschung GmbH, Berlin, Germany.

Wilkinson, C., Room, R., 2009. Warnings on alcohol containers and advertisements: International experience and evidence on effects. Drug Alcohol Rev 28, 426-435.

World Health Organization Regional Office for the Western Pacific, 2015. Young people and alcohol: A resource book. WHO Press, Geneva, Switzerland.

Chapter 5: Summary and Conclusions

Over the past decade, the prevalence of adolescent alcohol use in Taiwan has increased rapidly and is now a significant public health problem (Health Promotion Administration, 2006, 2010). Recent studies have suggested that, while important, individual-level risk factors alone (e.g., personality, behavioral problems) are unable to explain adolescent alcohol use behaviors and have called for research investigating the impact of *multilevel* risk factors (Bryden et al., 2012; Bryden et al., 2013; Ennett et al., 2008; Jackson et al., 2014; Karriker-Jaffe, 2011; Windle, 2010). Research examining the relationships between social contexts (e.g., place-based characteristics, alcohol advertising) and adolescent alcohol use behaviors remains a relatively new area of inquiry (Anderson et al., 2009; Bryden et al., 2012; Bryden et al., 2013; Jackson et al., 2014; Karriker-Jaffe, 2011; Smith and Foxcroft, 2009). Furthermore, most of these studies were conducted in Western countries. Little is known about whether the findings from the Western contexts can be generalized to non-Western contexts.

This dissertation used a mixed methods approach to examine whether place-based characteristics and alcohol advertising were associated with adolescent alcohol use behaviors in Taiwan; and how adolescents perceived and responded to alcohol marketing. The current research provides evidence about the associations of place-based characteristics and alcohol advertising to adolescent alcohol use behaviors over time. It also provides a deeper understanding about how global alcohol marketing influences adolescent alcohol use behaviors in emerging alcohol market. The theoretical framework guiding this dissertation was based on the Social Ecological Model (SEM) and Social

Cognitive Theory (SCT), complemented by Social Disorganization Theory, Available Theory, and Message Interpretation Process model.

The first dissertation paper (Chapter 2) used multilevel methods to examine the prospective associations of place-based characteristics and alcohol advertising with alcohol use *initiation and continuation* among Taiwanese adolescents from 2010 (aged 13-14 years old) to 2012 (aged 15 years old). The results from this paper support previous research that suggests that higher-level contextual factors influence adolescent alcohol use, even after controlling for individual, peer, and family attributes (Anderson et al., 2009; Bryden et al., 2012; Bryden et al., 2013; Jackson et al., 2014; Karriker-Jaffe, 2011; Smith and Foxcroft, 2009). For alcohol initiation, we found that adolescents were more likely to initiate drinking if they lived in a district with better spatial access to betel nut kiosks, or if they reported seeing more alcohol advertisements on television. However, contrary to our hypothesis, district-level economic disadvantage was inversely related to alcohol initiation. Our results also indicated that the relationship between district-level violent crime and alcohol initiation was stronger among students who had observed parental drinking. For alcohol continuation, we found that adolescents were more likely to continue drinking if they lived in a district with better spatial access to off-premises alcohol outlets or lower spatial access to temples and to metro rapid transportation (MRT) exits. To our knowledge, no other studies have prospectively explored whether a range of place-based characteristics and alcohol advertising were associated with adolescent alcohol initiation or continuation in Taiwan. This study presents an important first step in understanding the prospective effects of place-based characteristics and alcohol

advertising on adolescent alcohol use initiation and continuation in an emerging alcohol market.

The second dissertation paper (presented in Chapter 3) moved research up to the causal chain and used similar multilevel methods to investigate the prospective effects of place-based characteristics and alcohol advertising on adolescent *drinking intentions*, and whether gender moderated the relationships between place-based alcohol access and alcohol advertising with drinking intentions. The findings indicated that living in a district with greater spatial access to *on*-premises alcohol outlets had a stronger effect on positive drinking intentions among boys than girls, and living in a district with greater spatial access to *off*-premises alcohol outlets had a stronger effect on positive drinking intentions among girls than boys. We also found that television-based alcohol advertising was associated with positive drinking intentions among girls who had not consumed in the past year at baseline. *Non*-television-based alcohol advertising was related to positive drinking intentions among boys who *had* consumed in the past year at baseline. Contrary to our expectations, we did not find significant impacts of social environments or institutional resource environments on drinking intentions. To our knowledge, this study is the first to prospectively examine the impacts of both place-based characteristics and media environments on drinking intentions among adolescents both in Western and non-Western contexts.

The last dissertation paper (Chapter 4) deepened our understanding on Taiwanese adolescents' perspectives and responses to alcohol marketing for alcopops and regular beer via a qualitative inquiry. We found that packaging design and television alcohol advertising were key alcohol marketing strategies influencing adolescents' selection of

alcopops and regular beer. Our findings support previous work that has suggested the importance of alcopop packaging design in influencing alcopop consumption (Jones, 2011; Jones and Reis, 2011; Rossheim and Thombs, 2013). The results also support past research that has found that television alcohol advertising plays an important role in shaping symbolic meanings of alcohol use (Austin et al., 2006; Hughes et al., 1997; Jones et al., 2012; McCreanor et al., 2005). The present research extends current research on alcohol marketing and underage drinking by providing the first detailed exploration of the interpretive processes through which alcohol marketing influences adolescents' selection of alcopops and regular beer among adolescents in a non-Western context.

Taken together, the findings from this dissertation highlight the associations of place-based characteristics and alcohol advertising to adolescent alcohol use behaviors in a non-Western context. Our findings regarding the prospective relationships of place-based characteristics and alcohol advertising to adolescent alcohol use behaviors (Chapters 2 and 3) support previous research on multilevel influences and adolescent alcohol use in Taiwan (Chang et al., 2014; Chen et al., 2011; Wang et al., 2013). This research extends the previous studies conducted in Taiwan by including a broad range of place-based characteristics (e.g., economic disadvantage, betel nut kiosks, on-premises alcohol outlets) and by using a prospective design. The results from the qualitative phase (Chapter 4) of the dissertation informed how we constructed meaningful place-based measures and alcohol advertising measures in this dissertation's quantitative analyses; the qualitative results also helped us to interpret quantitative findings (Chapters 2 and 3).

The qualitative phase of the dissertation was particular useful to help us develop measures for place-based characteristics and alcohol advertising in the quantitative

analyses. Participants from our qualitative study described different types of alcohol access environments that are meaningful to adolescents and how and when adolescents approach to each type of alcohol outlets. For example, the focus group data indicated that the *relative proximity* of betel nut kiosks to off-premises alcohol outlets is an important factor influencing adolescents' access to betel nut kiosks. Therefore, in the quantitative papers (Chapters 2 and 3), we constructed the measure for betel nut kiosks using the ratio of the number of betel nut kiosks to the number of off-premises alcohol outlets instead of using the density of betel nut kiosks per square kilometer. Based on the focus group data, we have learned that there are a few types of on-premises alcohol outlets that are particularly important to Taiwanese adolescents (i.e., all-you-can-eat barbeque restaurants and karaokes). Therefore, in the quantitative analyses, we constructed the measure for on-premises alcohol outlets based on the focus group data so the on-premises alcohol outlet measure can reflect the most frequently visited on-premises alcohol outlets for Taiwanese adolescents. Furthermore, it emerged in our focus groups that television is the most important media channel through which adolescents are exposed to alcohol advertising. This led us distinguish between television-based advertising and *non*-television-based alcohol advertising.

The qualitative results also helped us to understand our quantitative findings about the significant impact of television-based alcohol advertising on alcohol initiation (Chapter 2) and on drinking intentions among girls who had not drunk in the past year at baseline (Chapter 3). These results can be explained by the Social Cognitive Theory, which posits that environmental factors such as alcohol advertising can facilitate behaviors by observational learning (Bandura, 2004; Zucker et al., 2009). Furthermore,

our qualitative results may add a deeper understanding beyond this explanation. Participants in focus groups discussed how they consume alcohol to define their social identities and personalities (Chapter 4). Adolescents described the attractiveness of the social identities depicted on television alcohol advertisements and how these social identities were important to adolescents their age. Television alcohol advertising provides a channel through which adolescents can learn about how specific alcoholic beverage can help them gain preferred social identities and symbolic values.

We found that the contextual determinants of drinking initiation and continuation were different from the contextual determinants of drinking intentions. Our findings suggested that several place-based characteristics, including economic disadvantage, alcohol access environments, and institutional resource environments, were associated with drinking initiation and continuation. In contrast, only place-based alcohol access environments were associated with drinking intentions. It echoed with previous research that alcohol access environments is the powerful factor that influencing underage drinking behaviors. Place-based characteristics such as the social environments and institutional resource environments can often serve as facilitators or inhibitors of alcohol use through access and modeling (Bryden et al., 2012; Bryden et al., 2013). However, were not sure why the social environments and institutional resource environments were not influential to drinking intentions among Taiwanese adolescents. More research is needed to understand the relationships of social environments and institutional resource environments to drinking intentions.

Evaluation of the dissertation research

This dissertation research should be understood in the context of several limitations. First, the sampling scheme of the AREC is based on schools rather than residential districts. Therefore, the sample does not represent all middle school students *living* in the Taipei Metropolitan Area, which includes Taipei City and New Taipei City. The AREC participants only lived in 54% of Taipei Metropolitan Area districts and the AREC participant response rate at baseline was low (55%). Therefore, the sample was not representative of the entire Taipei Metropolitan Area. This limitation restricts our ability to generalize the findings to all adolescents in the Taipei Metropolitan Area. Second, the quantitative papers used perceived measure for alcohol advertising to understand the effect of media environments because of the lack of publicly available data on place-based alcohol advertising measures (e.g., exterior advertising), and we were therefore unable to explore how place-based alcohol advertising measures influence study outcomes, we were also unable to conduct a Google virtual audit of exterior alcohol advertising because of the limited resolution of Google Street View images. However, in the qualitative phase of the dissertation (Chapter 4), participants rarely discussed the exposure to exterior alcohol advertising. This may indicate that exterior alcohol advertising is not a common source of alcohol advertising for adolescents and may minimize the impact of this limitation. Third, participant data in the quantitative phase of the dissertation research were self-reported. However, the reliability and validity of self-reported substance use using similar survey methods have been shown to be high (Wang et al., 2005). Fourth, in the qualitative phase of the dissertation, we did not ask about individual alcohol use experiences, though these experiences might have been important in shaping interests in alcohol advertising or in influencing alcohol access experience

(Townshend and Duka, 2001; Zucker et al., 2009). Thus, we were unable to assess the differences in the response to alcohol advertising by participants' alcohol use experience in the qualitative paper.

This dissertation has a number of strengths. First, the prospective design of the quantitative phase of the dissertation strengthened our understanding of the causal associations of interest. It allowed us to learn about whether place-based characteristics and alcohol advertising influence changes in adolescent alcohol use behaviors over time. To our knowledge, this is the first study that has used a prospective design to understand these associations outside of Western contexts. Second, this dissertation research has incorporated the historical Google Street View Audit through Google Maps, a novel technique to measure the built environment such as locations of betel nut kiosks, which has not been done before. Third, we were able to sample focus group participants from multiple schools to increase participants' variability and compared responses across schools. It is the first study that has used qualitative methods to explore how non-Western adolescents perceive and respond to global alcohol marketing. Fourth, the dissertation used both quantitative and qualitative methods to examine the associations of place-based characteristics and alcohol advertising with adolescent alcohol use behaviors. We utilized a convergent parallel mixed methods design in which the quantitative and the qualitative data are designed to create a more thorough understanding of the topic at the same time (Creswell and Plano Clark, 2007).

Implications for Research and Practice

This research presented here represents a selection of the findings from the quantitative and qualitative data that were collected. More data were generated from this study than we are able to present here. At least two additional papers will be generated using the data that were collected for the dissertation research.

1. Taiwanese Adolescents' Perspectives of Alcohol Availability. Commercial alcohol availability is an important factor associated with underage drinking (Bryden et al., 2012; Gruenewald, 2008). Several studies have suggested that alcohol access at community-level is a potent factor that influences adolescent alcohol use both in Western contexts and in emerging alcohol markets (Chen et al., 2010; Huckle et al., 2008; Kuntsche et al., 2008; Livingston et al., 2008; Murphy et al., 2014; Paschall et al., 2012; Thaikla et al., 2015; Tobler et al., 2009; Truong and Sturm, 2009; Wang et al., 2013). Reducing adolescents' access to alcohol from commercial sources is one of the important interventions reducing adolescent alcohol use by increasing the "full cost" (e.g., convenience costs plus real costs) of alcohol to adolescents (Babor, 2010; Gruenewald, 2011). Recent quantitative studies and reviews have shown that factors such as density of alcohol outlets, alcohol compliance checks, and hours and days of sale can affect adolescents' alcohol access through commercial sources (Campbell et al., 2009; Chen et al., 2009; Erickson et al., 2013; Paschall et al., 2012; Popova et al., 2009). However, little is known about where and how adolescent obtain alcohol. We identified only three qualitative studies exploring adolescents' detailed alcohol access behaviors through commercial sources and all of these studies were conducted in Western contexts (Friese et al., 2013; Jennings et al., 2011;

Wagenaar et al., 1993). These studies suggested that adolescents have detailed knowledge about how to steal from commercial outlets and other ways to circumvent the enforcement policies. Future studies providing in-depth information about how adolescents access alcohol and the related contexts within which alcohol is obtained are needed, especially in non-Western contexts where enforcement policies, compliance checks, and adolescent routine activities are fundamentally different from Western contexts. Although we were unable to explore this topic in this dissertation, future analyses of the qualitative data will focus on exploring and describing detailed information on how Taiwanese adolescents access alcohol through commercial sources and related venues.

2. Methodologies of Google Street View Virtual Audit. In the papers presented in Chapters 2 and 3, we examined whether spatial access to betel nut kiosks influences adolescent alcohol use by conducting a Google Street View virtual audit. Google Street View, a 3-dimensional, interactive geographic program that allows for aerial, satellite and street view assessment of neighborhood image and is a potential tool to characterize the built environments. Recently, researchers have begun to use Google Street View as a tool to audit streetscape in local environments and Google Street View has been demonstrated to be a reliable and cost-effective virtual audit instrument to observe and characterize neighborhoods (Clarke et al., 2010; Lefer et al., 2008; Odgers et al., 2012; Rundle et al., 2011; Taylor et al., 2011). Previous studies conducted in the U.S. showed that Google Street View could provide reliable measurement for recreational facilities (e.g., parks, playgrounds, sports fields), the local food environment (e.g., convenience

stores, supermarkets/grocery stores, liquor stores), general land use (e.g., high-rise housing, commercial/industrial units, parking lots), pedestrian safety, motorized traffic and parking, and infrastructure for active travel (Clarke et al., 2010; Rundle et al., 2011). Similar results that support the use of Google Street View for measuring both negative and positive features of local environments have been shown in the U.K. (Odgers et al., 2012), New Zealand (Badland et al., 2010), and Australia (Taylor et al., 2011). The use of Google Street View to audit local environments is still in an early stage. In April 2014, Google Maps released the historical Street View function and provided it to public at no cost. This tool allows researchers to create their own maps, document imageries, and simplify mapping process. However, the utility of the tool to audit the built environments has not been demonstrated and evaluated. Although we were not able to present the methodologies of using this tool here, future analyses of dissertation data will demonstrate the application of Google Street View to conduct a virtual audit of the alcohol access environment in a non-Western context.

This dissertation research provides important information regarding associations of place-based characteristics and alcohol advertising to adolescent alcohol use in Taiwan and provides detailed information on interpretative process through which alcohol marketing influences Taiwanese adolescents' drinking experiences. The results from the quantitative papers (Chapters 2 and 3) suggest that place-based characteristics were associated with adolescent alcohol use, even controlling for individual, family, and peer attributes. Because the AREC study sampled students from schools rather than residential districts, we were only able to assess the place-based effects in 54% of the districts in the

Taipei Metropolitan Area. The districts in the Taipei Metropolitan Area excluded from the current study were all in the New Taipei City and are generally have a higher-level of economic disadvantage than districts in the study area of the this dissertation research. The sociodemographic attributes and alcohol use behaviors of adolescents in these excluded districts were also unknown. We are unsure whether the observed associations between the place-based characteristics and adolescent alcohol use would generalize to these other districts. Future research using a place-based sampling scheme (e.g., sample adolescents from residential districts) is needed to examine whether the place-based characteristics are associated with the study outcomes in these other areas. Further, because of the convenient public transportation system in the Taipei Metropolitan Area, adolescents can easily move across different districts in terms of their daily life activities. Future research using "egocentric buffers" or activity-based "spatial polygamy" to define places that might be meaningful to adolescents is also needed to explore the study associations in Taipei (Duncan et al., 2014).

Alcohol package design and television alcohol advertising emerged from the qualitative data (Chapter 4) as important factors influencing adolescent alcohol use behaviors in Taiwan. Consistent with the Message Interpretation Model (MIP), our participants described the emotional and cognitive strategies they used to respond to alcohol marketing. Few studies have applied the MIP model to understand the interpretative process of the link between alcohol marketing and adolescent alcohol use and all of the previous work has focused solely on the effect of television alcohol advertising, and has been done in the West (Austin et al., 2006; Scull et al., 2010). To better understand how package design and television alcohol advertising influence

adolescent alcohol use behaviors in Taiwan, future research should apply the MIP model and add measures to understand the interpretative process that links alcohol marketing to adolescent alcohol use.

The results of this dissertation can help guide the development of interventions and public health practices aimed at reducing adolescent alcohol use. First, the findings from this dissertation indicate that alcohol advertising is a potent factor in shaping and facilitating adolescent alcohol use experience in Taiwan. Particularly, findings from the qualitative phase of the study describe how alcohol marketing influences adolescents' choices of alcohol products. Policies and programs aimed at reducing exposure to alcohol advertising among adolescents should consider the role of packaging design and television alcohol advertising. For example, regulations should be implemented to limit youth-oriented illustrations on alcohol packaging and media literacy training should be included in prevention programs to help adolescents and parents counter the persuasive messages of alcohol marketing. Second, the quantitative phase of this dissertation research highlights the negative consequences that district-level spatial access to alcohol outlets has on adolescent alcohol use. Spatial access to different types of alcohol outlets has effects on different alcohol use behaviors and these associations varied by gender. Efforts should be taken to improve the enforcement of alcohol compliance checks; restrict hours and days of sale and in-store alcohol display; and implement gender-tailored interventions to reduce alcohol access. These changes could have important effects on restricting physical access to alcohol through alcohol outlets for adolescents. Third, the findings from Chapter 2 indicate that a multifaceted alcohol use intervention that addresses both district-level and family-level risk factors in Taipei is needed.

Programs should identify high-risk districts and high-risk families where adolescent alcohol use interventions may be most needed.

Conclusion

This dissertation research contributes to scientific understanding of the associations of place-based characteristics and alcohol advertising to adolescent alcohol use in an emerging alcohol market. In addition, findings described the interpretative process linking alcohol marketing and adolescent alcohol use among Taiwanese adolescents. The current dissertation study fills critical gap in the literature on place-based research in non-Western contexts and identifies future areas of research to advance understanding of the complex associations of place-based characteristics and alcohol advertising to adolescent alcohol use behaviors.

Reference

Anderson, P., de Bruijn, A., Angus, K., Gordon, R., Hastings, G., 2009. Impact of alcohol advertising and media exposure on adolescent alcohol use: A systematic review of longitudinal studies. Alcohol Alcohol 44, 229-243.

Austin, E.W., Chen, M.-J., Grube, J.W., 2006. How does alcohol advertising influence underage drinking? The role of desirability, identification and skepticism. J Adolesc Health 38, 376-384.

Babor, T., 2010. Alcohol: No ordinary commodity: Research and public policy. Oxford University Press.

Badland, H.M., Opit, S., Witten, K., Kearns, R.A., Mavoa, S., 2010. Can virtual streetscape audits reliably replace physical streetscape audits? J Urban Health 87, 1007-1016.

Bandura, A., 2004. Health promotion by social cognitive means. Health Educ Behav 31, 143-164.

Bryden, A., Roberts, B., McKee, M., Petticrew, M., 2012. A systematic review of the influence on alcohol use of community level availability and marketing of alcohol. Health Place 18, 349-357.

Bryden, A., Roberts, B., Petticrew, M., McKee, M., 2013. A systematic review of the influence of community level social factors on alcohol use. Health Place 21, 70-85.

Campbell, C.A., Hahn, R.A., Elder, R., Brewer, R., Chattopadhyay, S., Fielding, J., Naimi, T.S., Toomey, T., Lawrence, B., Middleton, J.C., 2009. The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol

consumption and alcohol-related harms. American journal of preventive medicine 37, 556-569.

Chang, F.-C., Lee, C.-M., Chen, P.-H., Chiu, C.-H., Miao, N.-F., Pan, Y.-C., Huang, T.-F., Lee, S.-C., 2014. Using media exposure to predict the initiation and persistence of youth alcohol use in Taiwan. Int J Drug Policy.

Chen, K.H., Chen, C.Y., Liu, C.Y., Lin, Y.C., Chen, W.J., Lin, K.M., 2011. Multilevel influences of school and family on alcohol-purchasing behaviors in school-aged children. Drug Alcohol Depend 114, 127-133.

Chen, M.J., Grube, J.W., Gruenewald, P.J., 2010. Community alcohol outlet density and underage drinking. Addiction 105, 270-278.

Chen, M.J., Gruenewald, P.J., Remer, L.G., 2009. Does alcohol outlet density affect youth access to alcohol? J Adolesc Health 44, 582-589.

Clarke, P., Ailshire, J., Melendez, R., Bader, M., Morenoff, J., 2010. Using Google Earth to conduct a neighborhood audit: reliability of a virtual audit instrument. Health Place 16, 1224-1229.

Creswell, J.W., Plano Clark, V.L., 2007. Designing and conducting mixed methods research. SAGE, Thousand Oaks, CA.

Duncan, D.T., Kawachi, I., Subramanian, S., Aldstadt, J., Melly, S.J., Williams, D.R., 2014. Examination of how neighborhood definition influences measurements of youths' access to tobacco retailers: a methodological note on spatial misclassification. American Journal of Epidemiology 179, 373-381.

Ennett, S.T., Foshee, V.A., Bauman, K.E., Hussong, A., Cai, L., Reyes, H.L.M., Faris, R., Hipp, J., DuRant, R., 2008. The social ecology of adolescent alcohol misuse. Child Dev 79, 1777-1791.

Erickson, D.J., Smolenski, D.J., Toomey, T.L., Carlin, B.P., Wagenaar, A.C., 2013. Do alcohol compliance checks decrease underage sales at neighboring establishments? J Stud Alcohol Drugs 74, 852-858.

Friese, B., Grube, J.W., Moore, R.S., 2013. Youth acquisition of alcohol and drinking contexts: an in-depth look. Journal of drug education 43, 385-403.

Gruenewald, P., 2008. Why do alcohol outlets matter anyway? A look into the future. Addiction 103, 1585-1587.

Gruenewald, P.J., 2011. Regulating availability: how access to alcohol affects drinking and problems in youth and adults. Alcohol Research and Health 34, 248.

Health Promotion Administration, 2006, 2010. Taiwan Youth Health Behavior Survey report. Taiwan Ministry of Health and Welfare, Taipei.

Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., Casswell, S., 2008. Density of alcohol outlets and teenage drinking: Living in an alcogenic environment is associated with higher consumption in a metropolitan setting. Addiction 103, 1614-1621.

Hughes, K., MacKintosh, A.M., Hastings, G., Wheeler, C., Watson, J., Inglis, J., 1997. Young people, alcohol, and designer drinks: Quantitative and qualitative study. BMJ 314, 414-418.

Jackson, N., Denny, S., Ameratunga, S., 2014. Social and socio-demographic neighborhood effects on adolescent alcohol use: A systematic review of multi-level studies. Soc Sci Med 115, 10-20.

Jennings, V.K., Friese, B., Moore, R.S., Grube, J.W., 2011. Doubly illegal: Qualitative accounts of underage alcohol access through theft. Californian journal of health promotion 9, 1.

Jones, S.C., 2011. “You wouldn’t know it had alcohol in it until you read the can”: Adolescents and alcohol-energy drinks. Australasian Marketing J 19, 189-195.

Jones, S.C., Barrie, L., Berry, N., 2012. Why (not) alcohol energy drinks? A qualitative study with Australian university students. Drug Alcohol Rev 31, 281-287.

Jones, S.C., Reis, S., 2011. Not just the taste: Why adolescents drink alcopops. Health Educ 112, 61-74.

Karriker-Jaffe, K.J., 2011. Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. Drug Alcohol Rev 30, 84-95.

Kuntsche, E., Kuendig, H., Gmel, G., 2008. Alcohol outlet density, perceived availability and adolescent alcohol use: A multilevel structural equation model. J Epidemiol Community Health 62, 811-816.

Lefer, T.B., Anderson, M.R., Fornari, A., Lambert, A., Fletcher, J., Baquero, M., 2008. Using Google Earth as an innovative tool for community mapping. Public Health Reports 123, 474.

Livingston, M., Laslett, A.-M., Dietze, P., 2008. Individual and community correlates of young people's high-risk drinking in Victoria, Australia. Drug Alcohol Depend 98, 241-248.

Maxwell, J.A., 2012. Qualitative research design: An interactive approach. Sage publications.

McCreanor, T., Barnes, H.M., Gregory, M., Kaiwai, H., Borell, S., 2005. Consuming identities: Alcohol marketing and the commodification of youth experience. Addict Res Theory 13, 579-590.

Murphy, A., Roberts, B., Ploubidis, G.B., Stickley, A., McKee, M., 2014. Using multi-level data to estimate the effect of an 'alcogenic' environment on hazardous alcohol consumption in the former Soviet Union. Health Place 27, 205-211.

Odgers, C.L., Caspi, A., Bates, C.J., Sampson, R.J., Moffitt, T.E., 2012. Systematic social observation of children's neighborhoods using Google Street View: a reliable and cost-effective method. Journal of Child Psychology and Psychiatry 53, 1009-1017.

Paschall, M.J., Grube, J.W., Thomas, S., Cannon, C., Treffers, R., 2012. Relationships between local enforcement, alcohol availability, drinking norms, and adolescent alcohol use in 50 california cities. J Stud Alcohol Drugs 73, 657.

Popova, S., Giesbrecht, N., Bekmuradov, D., Patra, J., 2009. Hours and days of sale and density of alcohol outlets: impacts on alcohol consumption and damage: a systematic review. Alcohol Alcohol 44, 500-516.

Rossheim, M.E., Thombs, D.L., 2013. Multiple fruit-flavored alcoholic drinks in a can (MFAC): an overlooked class of potentially harmful alcohol products. Am J Drug Alcohol Abuse 39, 280-283.

Rundle, A.G., Bader, M.D., Richards, C.A., Neckerman, K.M., Teitler, J.O., 2011. Using Google Street View to audit neighborhood environments. American journal of preventive medicine 40, 94-100.

Scull, T.M., Kupersmidt, J.B., Parker, A.E., Elmore, K.C., Benson, J.W., 2010. Adolescents' media-related cognitions and substance use in the context of parental and peer influences. J Youth Adolesc 39, 981-998.

Smith, L.A., Foxcroft, D.R., 2009. The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: Systematic review of prospective cohort studies. BMC Public Health 9, 51-62.

Taylor, B.T., Fernando, P., Bauman, A.E., Williamson, A., Craig, J.C., Redman, S., 2011. Measuring the quality of public open space using Google Earth. American journal of preventive medicine 40, 105-112.

Thaikla, K., Jiraporncharoen, W., Semmahasak, S., Likhitsathian, S., Angkurawaranon, C., 2015. Recent trends in alcohol outlet density, distances from educational institutions and sales campaigns in Chiang Mai Municipality (metropolitan), Thailand: Should we be worried for our youths? Alcohol Alcohol.

Tobler, A.L., Komro, K.A., Maldonado-Molina, M.M., 2009. Relationship between neighborhood context, family management practices and alcohol use among urban, multi-ethnic, young adolescents. Prev Sci 10, 313-324.

Townshend, J., Duka, T., 2001. Attentional bias associated with alcohol cues: differences between heavy and occasional social drinkers. Psychopharmacology 157, 67-74.

Truong, K.D., Sturm, R., 2009. Alcohol environments and disparities in exposure associated with adolescent drinking in California. American Journal of Public Health 99, 264.

Wagenaar, A.C., Finnegan, J.R., Wolfson, M., Anstine, P.S., Williams, C.L., Perry, C.L., 1993. Where and how adolescents obtain alcoholic beverages. Public Health Reports 108, 459.

Wang, S.H., Lin, I., Chen, C.Y., Chen, D.R., Chan, T.C., Chen, W.J., 2013. Availability of convenience stores and adolescent alcohol use in Taiwan: A multilevel analysis of national surveys. Addiction 108, 2081-2088.

Wang, Y.-C., Lee, C.-M., Lew-Ting, C.-Y., Hsiao, C.K., Chen, D.-R., Chen, W.J., 2005. Survey of substance use among high school students in Taipei: web-based questionnaire versus paper-and-pencil questionnaire. J Adolesc Health 37, 289-295.

Windle, M., 2010. A multilevel developmental contextual approach to substance use and addiction. Biosocieties 5, 124-136.

Zucker, R.A., Donovan, J.E., Masten, A.S., Mattson, M.E., Moss, H.B., 2009. Developmental processes and mechanisms: Ages 0-10. Alcohol Res Health 32, 16-29.