



Published in final edited form as:

Psychol Addict Behav. 2013 September ; 27(3): 788–798. doi:10.1037/a0030925.

Two-Year Outcomes of a Randomized, Family-Based Substance Use Prevention Trial for Asian American Adolescent Girls

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Abstract

Asian Americans have been largely ignored in the prevention outcome literature. In this study, we tested a parent-child program with a sample of Asian American adolescent girls and their mothers, and evaluated the program's efficacy on decreasing girls' substance use, and modifying risk and protective factors at individual, family, and peer levels. One hundred and eight Asian American mother-daughter dyads recruited through online advertisements and from community service agencies were randomly assigned to an intervention arm ($n = 56$) or to a test-only control arm ($n = 52$). The intervention consisted of a nine-session substance abuse prevention program, delivered entirely online. Guided by family interaction theory, the prevention program aimed to strengthen the quality of girls' relationships with their mothers while increasing girls' resilience to resist substance use. Intent-to-treat analyses showed that at 2-year follow-up, intervention-arm dyads had significantly higher levels of mother-daughter closeness, mother-daughter communication, maternal monitoring, and family rules against substance use compared to the control-arm dyads. Intervention-arm girls also showed sustained improvement in self-efficacy and refusal skills, and had lower intentions to use substances in the future. Most important, intervention-arm girls reported fewer instances of alcohol and marijuana use, and prescription drug misuse relative to the control-arm girls. The study suggests that a culturally generic, family-based prevention program was efficacious in enhancing parent-child relationships, improving girls' resiliency, and preventing substance use behaviors among Asian American girls.

Keywords

Substance use prevention; Asian Americans; adolescent girls; family; web-based

Asian American adolescent girls are in critical need of effective substance use prevention programs. Contrary to conventional wisdom, substance use among Asian American adolescent girls is on the rise. Trend statistics of secondary school students have suggested that compared to girls of other ethnocultural groups, Asian American girls have the largest

increase of 30-day alcohol (from 9.5% to 28.4%), cigarette (from 7.4% to 17.1%), marijuana (from 2.4% to 9.1%), and stimulant (from 1.5% to 2.3%) use from 8th to 12th grade (Wallace et al., 2003). A longitudinal study has shown that binge drinking among Asian American adolescent girls aged 12 to 18 years doubled from 14.8% to 33.6% in less than 2 years, a rate that is as substantial as that of their male counterparts (Hahm, Lahiff, & Guterman, 2004). The prevalence of alcohol abuse among young Asian American females increased from 0.74% in 1991-1992 to 3.89% in 2001-2002, a remarkable 5-fold rise (Grant et al., 2004). These data are alarming because Asian American adolescents have been increasingly presented in substance abuse treatment (The Substance Abuse and Mental Health Data Archive, 2012). As many as 35.5% of Asian American adolescents admitted to substance abuse treatment began to use substances at age 11 or younger (Substance Abuse and Mental Health Services Administration, 2011), and among Asian American adolescents, girls had the youngest average age at admission compared to adolescents of all other ethnocultural groups (Substance Abuse and Mental Health Services Administration, 2002). Asian Americans with substance dependence appear to have greater risk for some substance-related morbidity compared to other ethnic groups (Masahiro et al., 2003; Sakai, Ho, Shore, Risk, & Price, 2005; Takao, Shimoda, Kohno, Asai, & Harda, 1998; Yokoyama & Omori, 2003) and for alcohol-related physical damage (Clarke, Ahmed, Romaniuk, Marjot, & Murray-Lyon, 1990; Stickel & Hampe, 2012; Wickramasinghe, Corridan, Izaguirre, Hasan, & Marjot, 1995). Gender-specific analyses have also shown that Asian females who use illicit drugs and who drink heavily have a greater risk for mental disorders than those do not (Cheng, Lee, & Iwamoto, 2012; Iwamoto, Liu, & McCoy, 2011). These troubling data suggest a critical need for effective prevention programming for Asian American adolescent girls in order to increase their resilience and lower risks for substance use.

In light of the epidemiological data and the need for prevention interventions, the purpose of this study is to provide 2-year outcome data on a prevention program that focused on Asian American girls. We first review risk and protective factors associated with Asian American girls' substance use behaviors and discuss the current empirical knowledge on substance use prevention programs. Then, we outline the prevention trial and provide its results.

Factors Contributing to Substance Use among Asian American Adolescent Girls

Greater attention has been paid to the etiology of substance use behaviors among Asian American adolescent girls in recent years. Factors contributing to their substance use may be broadly organized into individual, family, and peer levels. Studies examining individual-level risk factors have suggested that increased acculturation (Choi & Lahey, 2006; Unger et al., 2000), low self-esteem (Otsuki, 2003; Sasao, 1994, 1999), depressive mood (Fang, Barnes-Ceeney, & Schinke, 2011; Kim & McCarthy, 2006; Otsuki, 2003; Schepis et al., 2011), and a lack of self-efficacy and problem-solving ability (Fang et al., 2011; Sharma, 2004; Triandis, Bontempo, Villareal, Asai, & Lucca, 1988) elevate the risks of Asian American adolescent girls' substance use. Family-level factors also have a strong impact on substance use among Asian American adolescent girls (Cachelin, Weiss, & Garbanati, 2003; Espiritu, 2001; Fang & Schinke, 2011; Fuligni, Tseng, & Lam, 1999; Russell, Crockett, &

Chao, 2010; Suárez-Orozco & Qin, 2006). Specifically, poor family functioning increases Asian American girls' risk for early experimentation with cigarettes (Cachelin et al., 2003), while parental warnings (Yang & Solis, 2002), parental monitoring (Chen et al., 2002; Fang et al., 2011), parent-child communication (Fang et al., 2011; Wu, Liu, Kim, & Fan, 2011), and parent-child relationships (Fang et al., 2011; Kim, Zane, & Hong, 2002) help reduce their risk for substance use. Lastly, as with adolescents from other ethnic and racial groups, peer influence has been cited as one of the strongest influences on Asian girls' decisions to use substances (Adhikari, Chen, & Ahijevych, 2002; Iwamoto et al., 2011; Kim et al., 2002; National Asian Women's Health Organization, 2000). Despite the seemingly detrimental effect of peer influence, however, literature has suggested that family support and parent-child attachment can override peer influence and protect adolescents from substance use (Au & Donaldson, 2000; Hahm, Lahiff, & Guterman, 2003; Hishinuma et al., 2004; Kim et al., 2002), indicating that substance use among Asian American adolescent girls may be prevented by increasing parental support and strengthening parent-child relationships.

Substance Use Prevention for Asian American Adolescent Girls

The growing knowledge of risk and protective factors for Asian American adolescent girls' substance use has yet to be fully applied to develop novel and effective preventions. In spite of their unique developmental processes and programming needs, adolescent girls have been historically ignored in outcome studies targeting substance use and delinquent behaviors (Allison, 2008; Guthrie & Flinchbaugh, 2001; Kumpfer, Smith, & Summerhays, 2008). Similarly, results from meta-analyses assessing evidence-based interventions for ethnic minority youth have indicated that Asian Americans are nearly always excluded from outcome literature (Huey & Polo, 2008; Tobler et al., 2000). The lack of substance use prevention and intervention for Asian Americans is an important accessibility and equity issue given that Asian Americans have faced multiple barriers in accessing quality programs, and are underrepresented in substance use research (Fong & Tsuang, 2007; Smedley, Stith, & Nelson, 2003).

Family-Based Prevention Programs

Targeting family-level risk and resilience factors, family-based interventions are known to have a strong impact on decreasing adolescent substance use (Kumpfer, Alvarado, & Whiteside, 2003; Velleman, Templeton, & Copello, 2005). Systematic reviews have suggested that the effect sizes of family-based prevention programs are 2 to 9 times larger than adolescent-only prevention programs (Kumpfer et al., 2003) and that these programs have lasting impact (Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011). More specifically, prevention programs that change ongoing family dynamics and strengthen family capacities through improving family bonding, parent-child communication, parental involvement, parental monitoring and supervision are most effective (Kumpfer et al., 2003). Asian American populations respond favorably to topics such as wellness, health promotion, and resiliency (Bhattacharya, 2002; Kuramoto & Nakashima, 2000; Morelli, Fong, & Oliveira, 2001). As such, family-based prevention programs that focus on strength and resiliency rather than pathology and deficits may be particularly relevant to Asian Americans.

Web-based Substance Use Prevention Programs

Emerging data support the promise of web-based substance use prevention for adolescents (Di Noia, Schwinn, Dastur, & Schinke, 2003; Duncan, Duncan, Beauchamp, Wells, & Ary, 2000; Gordon, 2000; Moore, Soderquist, & Werch, 2005; Newton, Teesson, Vogl, & Andrews, 2010; Newton, Vogl, Teesson, & Andrews, 2011; Schinke & Schwinn, 2005; Schwinn, Schinke, & Di Noia, 2010; Segal, Chen, Gordon, Kacir, & Gyls, 2003; Williams et al., 2005) and their parents (Gordon, 2000; Kacir, Gordon, & Kirby, 1999; Schinke, Schwinn, & Fang, 2010; Segal et al., 2003). The Internet enables users to overcome geographical limitations, enjoy flexible access to information, and have control over navigating program materials. Participants who partake in programs online can access and navigate through topic modules at their own pace (Copeland & Martin, 2004; Patten et al., 2006). Interactively-presented content is stimulating and permits skill demonstrations, guided rehearsal, immediate individualized feedback, and tailored information and discussions, qualities that are associated with interpersonal encounters (Copeland & Martin, 2004). Participants can enjoy customized designs, animations, texts, and complex graphics. Protocol fidelity, portability, ease of use, and data storage are also advantageous characteristics of Internet technology (Meis et al., 2002). The Internet can be a very effective delivery medium for Asian American adolescents and their parents, given the high computer literacy among Asian Americans. In 2009, 80.5% families of Asian ancestry in the United States had Internet use at home (U.S. Census Bureau, 2010). Moreover, Internet-delivered interventions may be particularly suitable for Asian American adolescents and their parents who are uncomfortable with self-disclosing in group settings and with service providers (Kim et al., 2003; Yen, 1992).

The Present Study

The present study reports 2-year outcomes for a family-based, internet-delivered, substance use prevention program for early adolescent Asian American girls. The program has shown positive preliminary outcomes in reducing girls' substance use (Fang, Schinke, & Cole, 2010), but its sustained effects are unknown. The program is based on family interaction theory (Brook, Brook, Gordon, Whiteman, & Cohen, 1990), which considers the parent-child relationship as its theoretical cornerstone. Stemming from social learning theory, attachment theory, psychoanalytic theory, and the deviant behavior proneness model, family interaction theory posits that adolescent substance use depends on three domains: 1) adolescent personality (e.g., depression, low self-esteem, control of emotions); 2) familial factors, including parent-child relations (e.g., parental warmth, parent-child bonding, parent-child communication) and parental use of appropriate control behaviors (e.g., parental supervision and rule-setting); and 3) peer influence. Of these domains, the familial domain has the greatest impact on preventing adolescent substance use. Specifically, strong parent-child relationships and parental supervision can engender the positive development of adolescent personalities, reduce adolescents' affiliations with drug-using peers, and eventually insulate adolescents from using substances.

In line with family interaction theory, the tested program focused on enhancing mother-daughter attachment, improving mother-daughter communication, and increasing maternal

monitoring, while helping mothers establish appropriate family rules against substance use, promoting girls' emotional strength, self esteem, refusal skills, and self-efficacy. We hypothesized that the program would intervene on individual-, family-, and peer-level risk and protective factors for Asian American adolescent girls, and reduce their substance use behaviors.

Method

Procedure and Participants

The study protocol was approved by Columbia University Morningside Institutional Review Board and was conducted from September 2007 to May 2010. Asian American adolescent girls aged 10-14 and their mothers were recruited from 19 states in the United States via postings on social network sites and advertising through social service agencies. Over 30% of the study participants lived in the West (30.6%, $n = 33$), followed by 28.7% ($n = 31$) in the South, 26.8% ($n = 29$) in the Northeast, and 13.9% ($n = 15$) in the Midwest. We devised the recruitment method based on consultations with community agency staff members and focus groups with Asian American youth. Targeting Asian American parents and adolescent girls, the advertisements and posters directed interested participants to our recruitment website.

The recruitment website allowed prospective participants to access additional information to learn about the study, determined their eligibility, and enabled registration. To be eligible, both girls and mothers needed to commit to participation in the study and have private access to a personal computer. Interested mothers and adolescent girls were instructed to provide their contact information. Upon learning of prospective participants' interests in the study, our research assistants, both female Asian Americans, contacted both the mother and the adolescent girl to explain the consent and assent process via phone or email. Mothers and daughters who agreed to participate in the study then received the consent and assent package by mail, and were given the option to return the signed consent and assent forms by mail or fax.

Each consenting participant received a unique study identification and password and completed a baseline survey online. Upon completion of the baseline survey, each parent-child dyad was permanently assigned to one of the study groups on the basis of a blocked random number sequence, with block sizes varying randomly between 4 and 12. A research staff member who was not involved in participant enrollment and intervention assignment generated the sequence using a computer random number generator. Investigators and recruiting staff were blinded to the assignment procedure. Girls and their mothers in the intervention arm began each session by obtaining an identification code and password via email to log into the program. Intervention-arm dyads completed a nine-module session online, while control-arm dyads received no intervention. Intervention-arm participants also received one annual booster session between the two follow-up measurements. All participants were asked to complete baseline and two annual follow-up measures. To encourage timely completion of the study measurements, we provided participants in both arms with gift certificates for their preferred merchants. After finishing baseline, 1- and 2-

year follow-up measurements, girls and their mothers received gift certificates valued at \$20, \$25, and \$30, respectively.

As shown in Figure 1, of 206 mother-daughter dyads who expressed interest in the research, 98 were excluded and 108 consented and were randomized to either the intervention ($n = 56$) or control arm ($n = 52$). Out of 56 mother-daughter dyads assigned to the intervention arm, 54 (96.4%) fully attended the initial web-based program, 53 (94.6%) completed the booster session, and 50 (89.2%) completed the 2-year follow-up measure. At 2-year follow-up, the intervention arm lost a total of 6 dyads, and the control arm lost 9 dyads, resulting in an overall attrition rate of 13.9%.

Intervention

Asian American girls and their mothers in the intervention arm completed the family-based prevention program at home. The program was available in English only. Guided by family interaction theory (Brook et al., 1990) and designed explicitly for adolescent girls, the prevention program incorporated developmentally-tailored audio, animation, graphics, and activities and engaged mothers and daughters through skill demonstrations, guided rehearsal, and immediate feedback. The program had nine 35-to-45-minute interactive sessions, each including three to five interactive modules for girls and mothers to complete together. The session components and sample activities are presented in Table 1. We encouraged participants to complete one intervention session each week because limited program exposure allowed participants to apply the learned content and skills in everyday situations and receive additional feedback from their environments. On average, participants completed the initial nine-session program in 175 ($SD = 68.9$) days. One booster session reviewing initial program material and highlighting the issue on self-efficacy, problem-solving, refusal skills, parent monitoring, parent-child communication, and parent-child closeness was delivered to all intervention dyads one year after they completed the initial program.

Program fidelity was ensured through our web-based monitoring system in two ways. First, programming on the website returned participants to where they had ended the previous session. Intervention-arm participants were not allowed to log on to the next module until they completed the previous one, and they were not able to answer the web-based follow-up measures until they completed all modules and the booster session. Second, in the follow-up assessment, we asked the intervention mothers and daughters specific questions related to the intervention activity. Only data from participants who answered three out of four fidelity-check questions correctly were analyzed.

Measures

Study participants provided demographic information at baseline. Girls provided information on their age, country of birth, and family composition. Mothers reported their age, country of birth, level of education and current employment status. Girls and their mothers also completed outcome measures at baseline, 1-year, and 2-year follow-up. Table 2 presents scale descriptions, illustrative items, and Cronbach's alpha reliability statistics for all outcome measures.

Analysis

All analyses were performed using IBM SPSS Statistics version 19.0.0 (IBM SPSS, Chicago, Illinois). Outcomes were examined with general linear model repeated-measures analyses. At each measurement occasion, outcome variables comprised the within-subject factor, while study arm assignment was the between-subject factor. We employed the Mauchly's method to detect if sphericity was violated (Mauchly, 1940). When the sphericity was violated, we applied the Greenhouse-Geiser corrected epsilon value to adjust subsequent repeated-measures ANOVAs, as it is a more conservative correction compared to the Huynh-Feldt correction (Keselman, Algina, & Kowalchuk, 2001). As 15 participating dyads dropped out of the study, data were analyzed by the intent-to-treat method with the last observation carried forward using all 108 dyads, and the completer method for the 93 subjects (50 intervention and 43 control) who completed the 2-year follow-up measures.

Results

Table 3 presents the baseline characteristics for 108 Asian American mother-daughter dyads who participated in the study. Participating girls and mothers had a mean age of 13.10 ($SD = 0.96$) and 39.73 ($SD = 6.81$) respectively. Around one-fifth of the girls (19.44%) and over half of all mothers (58.33%) were born outside of the U.S. Less than 20% of girls came from a single-parent family. Most of the participating mothers had either a college education (39.81%) or a graduate degree (32.41%). No baseline differences were found in participants' demographic characteristics, in risk and protective factors, and in the substance use behaviors between intervention and control arms. All findings from the intent-to-treat and the completer groups were consistent. Because the last observation carried forward method might underestimate the effects of the intervention, we present the more conservative intent-to-treat findings in this paper.

Time by intervention interaction results (Table 4) indicated that relative to control-arm girls, intervention-arm girls reported higher levels of mother-daughter closeness [$F(2, 90) = 9.59, p < .0002$], greater mother-daughter communication [$F(2, 90) = 3.10, p = .049$], more maternal monitoring [$F(2, 90) = 4.11, p = .019$], and enhanced parental rules against substance use [$F(2, 90) = 4.75, p = .011$] at 2-year follow-up. Intervention-arm girls also reported stronger self-efficacy [$F(2, 90) = 4.32, p = .016$], greater refusal skills [$F(2, 90) = 5.41, p = .006$], and lower intention in using substances in the future [$F(2, 90) = 4.66, p = .012$]. We did not detect a significant time by intervention effect on girls' depressive mood, body esteem, and substance use normative beliefs. Notably, although the descriptive data suggested a trend that the intervention might help girls recognize that adolescent substance use was not a normative behavior, the effect was not significant ($p = .147$).

As for substance use, intervention-arm girls reported significantly fewer instances of using alcohol [$F(2, 90) = 3.38, p = .038$], marijuana [$F(2, 90) = 3.24, p = .043$], and prescription drugs for nonmedical purposes [$F(2, 90) = 3.15, p = .047$] compared to their control-arm counterparts. The intervention, however, did not exert significant effect on girls' cigarette use over time.

Discussion

The present study demonstrated the sustained efficacy of a parent-child, web-based program in lowering risk factors for Asian American adolescent girls' substance use, enhancing their individual skills and familial protective factors, and reducing their substance uptake. As hypothesized, mother-daughter dyads who received the intervention had stronger parent-child closeness and better parent-child communication at follow-up than those who did not receive the intervention. Intervention-arm mothers also exerted more parental monitoring and parental rules than the control-arm mothers. Relative to their control-arm counterparts, girls who received the program showed stronger self-efficacy in avoiding using substances in tempting situations, a greater ability to refuse offers to use substances, and a stronger commitment to not using alcohol, cigarettes and other drugs in the future. Perhaps the most encouraging results are that intervention-arm girls also reported fewer episodes of alcohol drinking, marijuana use, and prescription drug misuse 2 years after they received the program.

The program was delivered in English and its content was culturally generic. The language restriction limited the program's capacity to reach non-English-speaking Asian American families. Such a limitation directed us to focus on more acculturated, English-speaking Asian American adolescent girls, who might be at higher risk for engaging in substance use than those who were less acculturated (Choi & Lahey, 2006; Fu, Ma, Tu, Siu, & Metlay, 2003; Hofstetter et al., 2004; Lee, Sobal, & Frongillo, 2000). Moreover, although the program was not culturally specific, it was informed by family interaction theory and focused on the family unit, a salient source of resilience across all ethnic groups and particularly central in the Asian culture (Chu & Yu, 2010; Lee & Mock, 2005; Vasquez & de las Fuentes, 1999). As family bonding can render strength for Asian American adolescent girls who struggle with issues of self-esteem and conflicting expectations due to their ethnic background and gendered role expectations (Vasquez & de las Fuentes, 1999), our program provided a venue for empowering participating Asian American mothers to serve as important resources for their daughters. Through the intervention, mothers learned ways to develop clear family rules about the consequences of substance use, manage parent-child conflict, monitor their daughters' behavior and activities, and improve their daughters' self-image and self-esteem. Concurrently, girls worked with their mothers to learn skills to manage stress, solve problems, build refusal skills, and enhance self-efficacy. The program facilitated an environment where mothers and daughters could interactively practice important social and life skills protecting against substance use together, through which family support, mother-daughter closeness and mother-daughter communication were strengthened further. Delivered via the Internet, the program was also able to engage participants from different geographic areas in a relatively short time period. Overall, the study findings extend the empirical base of family interaction theory and suggest that a culturally generic program has the potential to generate meaningful public health impacts for Asian American adolescent girls.

Minimizing attrition is critical to ensure internal and external validity and maintain statistical power for outcome research. A recent systematic review of programs preventing substance use and risky sexual behaviors in young people (Jackson, Geddes, Haw, & Frank,

2012) shows that the attrition rates of these programs range from 7% (Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999) to 63% (Griffin, Botvin, & Nichols, 2006), with most studies reporting rates above 20%. Among the 12 web-based substance use prevention studies we reviewed, the attrition rate vary from as low as 4% (Schwinn et al., 2010) to as high as 46% (Williams et al., 2005). In our study, we were able to retain over 86% of study participants over a 2-year period, resulting in a relatively low attrition rate. Our ability to retain participants may be attributed to the strategies we used to retain our participants. First, both the login-required web-based program and online measurement collection were equipped with features that allowed our research staff to monitor program access and measurement completion in real time. Such features not only eased the time and effort involved in the tracking process, but also prompted our research staff to initiate participant reminders in a time sensitive manner. Second, we created a tracking database that required the consenting participants to give us their phone numbers, mailing address, names, birth dates, and phone numbers of their friends. Participants were informed that we would use the information to contact them if we had difficulty reaching them. Third, both control and intervention groups received gift certificates for completing the measurements online, with the monetary value of the incentive increased by \$5 on each measurement occasion. Fourth, we maintained ongoing contacts with study participants between follow-up periods. All participants received personalized holiday and birthday emails. In addition, we also held a “Mother-Daughter Holiday Creativity Contest” and invited all intervention-arm participants to send us a piece of creative work (e.g., essays, photos, drawings, crafts) jointly made by mothers and daughters. Lastly, although it was not a planned retention strategy, the nature of our prevention program, which focused on family engagement and facilitated parent-child relationships, might have enhanced the commitment of intervention-arm participants.

Despite promising results, our prevention program may be strengthened with culturally specific content. We did not detect a significant time by intervention effect on girls’ depressive mood, body esteem, and their cigarette use. As depression and self-esteem are important factors for Asian American adolescent cigarette use (Kim, Ziedonis, & Chen, 2008), such results warrant further examination and improvement of the program content. The literature has suggested that when working with adolescent girls from ethnic-cultural backgrounds, programs should tap their cultural assets and strengthen their knowledge, sense of belonging, and identification with their respective groups, as increased ethnic pride can offset depressive affect and enhance self-esteem (Nesdale & Mak, 2003), and thereby lessen their substance use (Guthrie & Flinchbaugh, 2001). Moreover, the intergenerational transmission of cultural values from parent to child may be important for early adolescents who are more prone to the influence of their parents as models and sources of authority (Velleman et al., 2005). Future program development should look into how to incorporate components that can enhance ethnic identification, strengthen ethnic pride, and increase intergenerational cultural interactions. Future studies may examine whether and to what extent culturally specific content further improves programming.

As with adolescents from other ethnic and racial groups, peer influence is a major risk factor for Asian American adolescent girls and perceived peer substance use norms can be seen as processes of peer influences (Pawlowicz et al., 2010). Despite an emerging trend, our intervention did not have a statistically significant impact on girls’ normative beliefs. Upon

closer examination, we feel that it might be helpful to incorporate more sophisticated norm measures that not only estimate peers' substance use, but also assess the extent to which adolescents perceive from their peers the expected rules of substance use behavior, and to what extent adolescents internalize these rules (e.g., Friedman et al., 2004; Pawlowicz et al., 2010). Such norm measures may allow us to better understand the intervention's impact on changing substance use norms.

There are additional limitations in this study. Generalizability is compromised given that the participating dyads must speak English to access the intervention. That participants needed to have a private computer at home might further limited the sample to those with a higher socioeconomic status. The small sample size not only restricted the validity and generalizability of study findings but also limited the types of analyses that could be performed. It is possible that participants in our study were highly self-motivated, so whether the intervention would benefit Asian Americans in natural settings remains unknown. As well, Asian Americans are the most culturally and economically diverse population in the United States (Fong, 2011). Our culturally generic program did not address the extreme diversity found within the Asian American population. To move beyond our study's findings, future studies can build on our work and examine larger numbers of participants with greater community heterogeneity. Such replication studies will help confirm our findings and potentially address some of the limitations before our program can be acknowledged widely with confidence (Flay et al., 2005).

The current study extends the substance use prevention outcome literature by evaluating a family-based program that was delivered over the Internet to a sample of Asian American adolescent girls. Based on a rigorous, randomized control trial methodology, the study shows encouraging results that may shed light on future practice development. Specifically, the study supports a strength-based program that underscores the importance of enhancing family resiliency and promoting adolescent girls' skills in preventing their substance use. The results indicate the potential generalizability of culturally generic programs to Asian American adolescents, while pointing to areas for future program improvement. Further controlled trials are needed to replicate our findings. Studies that test the relative efficacy between the current program and an enhanced intervention with culturally specific content will be particularly helpful and meaningful to this underserved population.

Acknowledgments

Preparation of this manuscript was supported by the National Institute on Drug Abuse (DA-17721), and Connaught Program of the University of Toronto. The authors would like to express their sincere appreciation to the anonymous reviewer for many insightful and thoughtful comments, and to Kevin Barnes-Ceeney and Reshma Dhrodia for their help in the preparation of this manuscript.

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Figure 1.
Flow of study participants

Table 1

Description of Session Components and Sample activities of the Mother-Daughter Prevention Program

Session	Component	Content
1	My mom and me	The initial session began with interactive activities that emphasized sharing, camaraderie, and trust between mothers and daughters. An illustrative module was a gift-giving exercise that underscored the importance of showing their caring for each other.
2	Conflict management	Girls and their mothers learned simple rules to prevent conflict and enhance communication. An illustrative module was a set of animated vignettes that demonstrated how raising unrelated topics and past grievances could escalate conflict.
3	Substance use opportunities	Girls and their mothers learned about risk and protective factors for girls' substance use in this session. For example, mothers and daughters were asked to pair the salient risk and protective factors in a puzzle completion.
4	Body image	Protective factors covered in this session were self-esteem in general and body esteem in particular. An illustrative module was an animation that promoted a positive body image. Girls and their mothers also learned how it was harmful and ineffective to use substances to deal with body image issues.
5	Mood management	Girls and their mothers identified negative moods and feelings and learned healthy ways to process them in this session. An illustrative module was a story-telling activity where mothers and daughters learned how to identify difficult feelings, followed by participating in activities on coping with these feelings.
6	Stress management	Girls and their mothers learned that stress from parent-child and peer relationships could inordinately affect adolescent girls. An illustrative module was a quiz of stress management techniques that girls and their mothers jointly completed. Interactively, girls and their mothers learned about and practiced techniques such as deep breathing, positive self-talk, sharing with others, humor, visualization, journal writing, and guided imagery.
7	Problem solving	Girls and their mothers learned that it was ineffective to rely on substances to deal with problems occurring in their daily life. For example, girls and their mothers were engaged through animated vignettes and interactive exercises to learn a five-step problem-solving sequence (Stop, Options, Decide, Act, and Self-praise).
8	Social influences	With assistance from their mothers, girls identified peer, family, and other social influences in their lives in this session. For example, in a module girls and their mothers were presented with vignettes that illustrated pressures from friends and boyfriends to use substances. The module then presented strategies that helped girls deliver refusal messages effectively.
9	Self-efficacy	The program showed female characters engaging in healthy and unhealthy behaviors and reaping the consequences of these behaviors. An illustrative module was a game during which girls and their mothers could only advance if they used positive reinforcement or praise. Girls also learned goal-setting skills and practiced assertiveness skills in role-play situations with their mothers.

Table 2

Descriptions of Study Outcome Measures

Outcome measures ^a	Adapted from	Items	Range ^b	Illustrative item	α^c
Mother-daughter closeness ^d	Inventory of Parent and Peer Attachment (Armsden & Greenberg, 1987)	5	1-5	My daughter always tells me about her problems and worries.	0.91
Mother-daughter communication	Family Problem Solving Communication Index (McCubbin, Thompson, & McCubbin, 1996)	5	1-5	I can discuss my beliefs with my mom without feeling restrained or embarrassed.	0.83
Maternal monitoring ^d	Parenting Practices Questionnaire (Gorman-Smith et al., 1996)	5	1-5	If my daughter is going to be late, she lets me know.	0.89
Family rules about substance use ^d	Strengthening Families Program (Spoth, Redmond, & Shin, 1998)	3	1-5	I have explained my rules about alcohol use to my child.	0.82
Depressive symptoms	Children's Depression Inventory (CDI; Kovacs, 1992)	10	0-2	I'm sad once in a while.	0.81
Body esteem	Self-Perception Profile for Adolescents (Harter, 1988)	5	1-5	I am happy with the way I look.	0.85
Self-efficacy	Self-Efficacy Scale (DiClemente, Prochaska, & Gibertini, 1985)	5	1-5	I am confident that I won't use substances when I see others use at a party.	0.89
Refusal skills	Drug Refusal Skills (Macaulay, Griffin, & Botwin, 2002)	10	1-5	If a boy you like offered you some pot and you didn't want it, how hard would it be to say no?	0.84
Peer substance use normative beliefs	Monitoring the Future national survey (Johnston, O'Malley, & Bachman, 2001)	6	0-4	How many of your friends drink alcohol at least once a week?	0.82
Substance use intention	Commitment to Not Use Drugs Scale (Hansen, 1996)	8	1-5	I plan to get drunk sometime in the next year.	0.88
30-day substance use ^e	American Drug and Alcohol Survey (ADAS; Rocky Mountain Behavioral Institute, 2003)	4	-	On how many occasions have you used prescription drugs in order to get high within the last 30 days?	-

Note.

^aUnless indicated, measures were administered to participating daughters.

^bA higher score indicates a greater propensity on each measure.

^cCronbach's alpha reliability statistics showing for the average of internal consistency correlations for items within each outcome measurement scale from baseline to 2-year follow-up.

^dMeasures were completed by mothers.

^eGirls reported the number of alcoholic drinks (i.e., beer, wine, malt liquor, wine coolers, sweet alcoholic drinks, mixed drinks, or hard liquor) they had; the number of occasions they smoked cigarettes; the number of occasions they used marijuana; and the number of occasions they took prescription drugs (e.g., Ritalin, Adderall, Vicodin, OxyContin, Xanax, Valium, Ambien, and Lunesta) just to get high in the past 30 days.

Table 3

Demographic Characteristics of Study Participants at Baseline

Demographic variable	All (<i>N</i> = 108)	Control (<i>n</i> = 52)	Intervention (<i>n</i> = 56)	<i>t</i> or χ^2	<i>p</i>
Daughter's age, <i>M</i> (<i>SD</i>)	13.10 (0.96)	13.18 (0.96)	13.03 (0.95)	<i>t</i> (106) = -.23	0.41
Mother's age, <i>M</i> (<i>SD</i>)	39.73 (6.81)	40.31 (6.75)	39.19 (6.86)	<i>t</i> (106) = -.30	0.38
Foreign born girls, % (<i>n</i>)	19.44 (21)	18.60 (8)	20.00 (13)	$\chi^2(1) = .43$	0.51
Foreign born mothers, % (<i>n</i>)	58.33 (63)	61.50 (32)	55.40 (31)	$\chi^2(1) = .42$	0.52
Single mothers, % (<i>n</i>)	16.67 (18)	17.30 (9)	16.10 (9)	$\chi^2(1) = .03$	0.86
Mother's education, % (<i>n</i>)				$\chi^2(2) = .74$	0.69
High school	27.78 (30)	30.77 (16)	25.00 (14)		
College	39.81 (43)	40.38 (21)	39.29 (22)		
Graduate school	32.41 (35)	28.85 (15)	35.71 (20)		

Table 4
Baseline and 2-year Follow-Up Outcome Data for Asian-American Mother-Daughter Dyads (N = 108)

Outcome variable	Baseline		1-year follow-up		2-year follow-up		Time by intervention interaction effect	F (2, 90)	p	η^2
	Control	Intervention	Control	Intervention	Control	Intervention				
	M (SD) (n = 52)	M (SD) (n = 56)	M (SD) (n = 50)	M (SD) (n = 54)	M (SD) (n = 43)	M (SD) (n = 50)				
Mother-daughter closeness	2.87 (1.12)	3.02 (1.04)	2.67 (1.18)	3.39 (0.89)	2.69 (1.00)	3.37 (0.75)	9.59	0.0002	0.08	
Mother-daughter communication	3.23 (2.28)	3.44 (2.10)	2.88 (1.91)	3.61 (1.98)	2.85 (2.01)	3.69 (1.99)	3.10	0.049	0.04	
Maternal monitoring	4.40 (0.87)	4.50 (0.63)	4.21 (0.94)	4.64 (0.62)	4.15 (0.98)	4.5 (0.69)	4.11	0.019	0.04	
Parental rules	1.92 (1.63)	2.01 (1.62)	1.83 (1.63)	2.58 (1.35)	1.87 (1.63)	2.65 (1.33)	4.75	0.011	0.44	
Depression	1.66 (0.62)	1.36 (0.84)	1.71 (0.75)	1.23 (0.71)	1.67 (0.65)	1.23 (0.87)	1.17	0.315	0.01	
Body esteem	3.72 (0.78)	3.90 (0.81)	3.52 (0.88)	3.98 (0.80)	3.70 (0.82)	3.92 (0.75)	2.03	0.137	0.02	
Self-efficacy	3.50 (0.80)	3.54 (0.66)	3.29 (0.83)	3.68 (0.58)	3.52 (0.78)	3.62 (0.59)	4.32	0.016	0.04	
Refusal skills	3.42 (0.78)	3.54 (0.66)	3.25 (0.91)	3.77 (0.47)	3.33 (0.86)	3.63 (0.56)	5.41	0.006	0.05	
Peer use normative beliefs	1.63 (1.15)	1.52 (1.11)	1.70 (1.29)	1.46 (1.09)	2.05 (1.63)	1.50 (1.07)	1.96	0.147	0.02	
Substance use intention	3.06 (2.81)	2.68 (2.03)	3.65 (3.13)	2.13 (2.00)	3.33 (3.12)	2.30 (1.97)	4.66	0.012	0.43	
30-day substance use										
Alcohol	0.29 (0.80)	0.04 (0.19)	0.54 (1.51)	0.04 (0.18)	0.10 (2.94)	0.05 (0.30)	3.38	0.038	0.03	
Cigarette use	0.17 (0.88)	0.07 (0.42)	0.44 (1.58)	0.02 (0.13)	1.95 (9.87)	0.02 (0.14)	1.80	0.171	0.20	
Marijuana	0.04 (0.19)	0.01 (0.12)	0.12 (0.32)	0.00 (0)	0.17 (0.38)	0.00 (0)	3.24	0.043	0.03	
Prescription drugs	0.46 (1.64)	0.64 (2.98)	1.60 (7.15)	0.07 (0.32)	3.60 (12.99)	0.00 (0)	3.15	0.047	0.03	

Note. Data representing intent-to-treat results with last observation carried forward using all 108 dyads (52 control and 56 intervention).