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## An Online Drug Abuse Prevention Program for Adolescent Girls: Posttest and 1-Year Outcomes

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### Abstract

Early adolescent girls' rates of drug use have matched, and in some instances, surpassed boys' rates. Though girls and boys share risk factors for drug use, girls also have gender-specific risks. Tailored interventions to prevent girls' drug use are warranted. This study developed and tested a web-based, drug abuse prevention program for adolescent girls. The nationwide sample of 13- and 14-year-old girls ( $N = 788$ ) was recruited via Facebook ads. Enrolled girls were randomly assigned to the intervention or control condition. All girls completed pretest measures online. Following pretest, intervention girls interacted with the 9-session, gender-specific prevention program online. The program aimed to reduce girls' drug use and associated risk factors by improving their cognitive and behavioral skills around such areas as coping with stress, managing mood, maintaining a healthy body image, and refusing drug use offers. Girls in both conditions again completed measures at posttest and 1-year follow-up. At posttest, and compared to girls in the control condition, girls who received the intervention smoked fewer cigarettes and reported higher self-esteem, goal setting, media literacy, and self-efficacy. At 1-year follow-up, and compared to girls in the control condition, girls who received the intervention reported engaging in less binge drinking and cigarette smoking; girls assigned to the intervention condition also had higher alcohol, cigarette, and marijuana refusal skills, coping skills, and media literacy and lower rates of peer drug use. This study's findings support the use of tailored, online drug abuse prevention programming for early adolescent girls.

### Keywords

Female; Adolescent; Drug abuse; Prevention; Intervention; Online

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**Author Contributions** T.M.S. designed the study, wrote the protocol, oversaw study procedures described in this paper, and drafted the manuscript; S.P.S. provided guidance on study design and procedures, drafted initial sections of the manuscript, and provided final edits; J.H. conducted the study procedures outlined in the paper and assisted with the literature search, data preparation, tables, and figures; B.K. oversaw data analysis and interpretation and drafted initial sections of the manuscript; and X.L. conducted the statistical analyses. All authors contributed to and have approved the final manuscript.

#### Compliance with Ethical Standards

**Ethical Approval** All human subjects' procedures were approved by the Columbia University Morningside Campus Institutional Review Board under protocol IRB-AAAJ3409.

**Conflict of Interest** The authors declare that they have no competing interests.

**Informed Consent** Informed parental permission and youth assent were obtained for all adolescents participating in this study.

## Introduction

Gender differences in adolescent girls' drug use warrant tailored, evidence-based interventions. For more than a decade, 8<sup>th</sup> grade girls' rates of drug use have equaled or outpaced those of their male counterparts (Johnston et al. 2016a). These girls are more likely than boys to report past-month use of alcohol and cigarettes and annual use of inhalants, amphetamines, tranquilizers, and misuse of over-the-counter cold medicines (Johnston et al. 2016b). Girls' drug use increases dramatically as they transition from middle to high school (Johnston et al. 2016b). Between 8<sup>th</sup> and 12<sup>th</sup> grades, girls' rate of illicit drug increases from 15 to 37%. The number of girls reporting past-month marijuana use more than doubles from 8<sup>th</sup> to 12<sup>th</sup> grade. By 12<sup>th</sup> grade, 35% of girls report past-month alcohol use, a 250% increase from 8<sup>th</sup> grade.

The inordinate risks girls face from drug use behavior are alarming (Anker and Carroll 2011). Compared to men, women progress more rapidly from casual drug use to addiction and are more likely to relapse (NIDA 2016). Sexual risks from the compromised judgment that attend drug use weigh heavier on girls than on boys (Chung et al. 2017). That girls are using drugs at rising rates and are experiencing greater untoward consequences from their use is indisputable. To mitigate girls' drug use and risks for drug use, tailored, evidence-based interventions will ideally reach girls as they transition from middle school to the higher risk years of high school.

### Gender-Specific Interventions

Numerous gender-specific interventions appear in such fields as HIV prevention (Wechsberg et al. 2015), criminal justice (Wakai et al. 2014), and drug treatment (Chen et al. 2004). Despite the call for gender-specific drug abuse prevention programming (Kumpfer et al. 2008), few such programs exist (Elliot et al. 2008; Weiss and Nicholson 1998). Moreover, the reach and efficacy of traditional interventions delivered didactically in live-group settings are vulnerable to insufficient staff training, time limitations, budgetary issues, and space constraints. Space and staffing demands are particularly burdensome for providers who wish to deliver tailored interventions to a subgroup (e.g., programming for teen girls). With the promise of high fidelity, inexpensive distribution, and little to no staff training, online interventions hold promise to increase the reach and efficacy of gender-specific drug abuse prevention programming.

Toward advancing the science of prevention, our group has been exploring the potential of developing tailored, high-fidelity, theory-based, drug abuse prevention programs for girls. We have developed computer-based interventions that engage girls and teach them skills for preventing drug abuse. Initially, we tested a brief, three-session intervention for adolescent girls, delivered via CD-ROM (Schinke and Schwinn 2005). Subsequently, we pilot tested a 12-session, online intervention with a nationwide sample of adolescent girls that included a 6-month follow-up (Schwinn et al. 2010). The current study extends that line of research.

## Theory

For boys and girls, the chief pathway to drug use is the influence of deviant peers and social influences (Catalano et al. 2011). More than their male counterparts, however, adolescent girls' drug use is also associated with depressed and anxious moods, low self-esteem, and high levels of perceived stress (Schwinn et al. 2016). The current intervention, therefore, aims to reduce girls' risks of peer and social influences, as well as their gender-specific risks connected to mood, self-esteem, and coping with stress.

Social learning theory (Bandura 1986) guided the session content aimed at helping girls navigate the risks associated with peer and social influences to use drugs. Following social learning theory, girls' (as well as boys') risk for drug use is mitigated by enhancing their social and cognitive skills necessary to resist peer and social influences to use drugs (Scheier 2015). Accordingly, our intervention sessions included content on goal setting, self-efficacy, media literacy, peer use, and refusal skills. Because comprehensive skills training is a hallmark of effective prevention programs at the individual level (Faggiano et al. 2014), our intervention content focused on enhancing girls' social, emotional, and cognitive competencies.

A resiliency framework (Masten and Powell 2003) was used to guide intervention content aimed at addressing girls' gender-specific risk factors for drug use. Essential characteristics of resiliency include a positive self-image, and competency with communicating, coping with stress, and managing mood (Hodder et al. 2017). Therefore, our intervention sessions included content on puberty, body image, and coping to enhance girls' intrapersonal competencies around self-image, managing negative moods, and stress.

## Current Study

Against the backdrop of early adolescent girls' differential rates, consequences, and pathways to drug use, the current study examines the effects of an intervention designed expressly to reduce girls' rates of past-month use and improve their risk and protective factors associated with drug use.

Employing a nationwide sample of early adolescent girls recruited via Facebook, this article reports posttest and 1-year follow-up data on intervention effects for girls' past-month drug use, as well as risk and protective factors associated with drug use. Because the intervention content targets risk and protective factors salient for girls' drug use toward ultimately changing drug use outcomes, we hypothesize that girls who receive intervention will have lower rates of past 30-day drug use than girls who receive no intervention. We also hypothesize that girls who receive intervention will have more favorable scores on the targeted risk and protective factors for drug use (anxiety, depression, body image, coping, stress, media literacy, goal setting, self-esteem, self-efficacy, refusal skills, and peer use) than girls who receive no intervention.

## Methods

### Participants

Study participants were 788 girls from 48 states and the District of Columbia. Girls were recruited through Face-book ads. These ads appeared on the pages of users who registered as 13- and 14-year-old girls who reside in the United States. Facebook ads linked girls to our study webpage that briefly described the project. Interested girls who met the inclusion criteria—aged 13 or 14 years, United States resident, English speaker, and access to a private computer with broadband internet—were asked to provide their name, birthdate, and home mailing address. Upon receipt of this information, we mailed an enrollment packet that included: a) separate information booklets for the parents and girl, b) a parent permission form, c) a youth assent form, and d) a postage-paid, self-addressed envelope for returning the signed permission and assent forms.

Upon receipt of the returned signed forms, we mailed copies of the signed permission and assent forms to the signing parent with a letter instructing them to contact us if they had not enrolled their daughter in the study. When daughter and parent signatures displayed questionable similarities, we called the parent to verify permission. Only after these procedures were complete was a girl enrolled in the study. For details on the Facebook advertising campaign, sample recruitment, and sample characteristics, see Schwinn et al. 2017. All study procedures were approved by the Columbia University Morningside Institutional Review Board.

### Design and Procedures

After study enrollment, girls were randomly assigned to the intervention or control condition. All girls were notified by email and regular mail to complete pretest measures by logging on to the study's secure website using a unique ID number. Following pretesting, girls assigned to the intervention condition were directed to begin the intervention sessions. Upon completion of the intervention, girls were directed to complete posttest measures. Girls assigned to the control condition were asked to complete posttest measures 14 weeks after their pretest date (the time estimated for girls in the intervention condition to complete the intervention). Girls from both conditions completed 1-year follow-up measures 12 months after their posttest completion date. Girls received \$25 for pretest, \$30 for posttest, and \$35 for 1-year follow-up; each measurement occasion required approximately 15 min to complete.

### Measures

At all three measurement occasions, girls were asked to respond to items about demographic characteristics, drug use, and associated risk factors. Reliability scores for these measures come from study data. All measures were previously used with adolescents in our prior work (Schwinn et al. 2010).

### Demographics

Girls were asked to report their: age, race/ethnicity, average letter grade in school, type of school, living arrangement, and parents' highest level of education. Zip code data, obtained

at enrollment, were used to determine girls' geographic designation (urban, rural, or large town).

### **Anxious and Depressive Mood**

Scales from the Brief Symptom Inventory (Derogatis 1993) were used to assess girls' anxiety and depression. Each of the two scales included five, 5-point Likert-scaled items that asked girls to rate the extent to which they were bothered (*Not at all* = 0, *All the time* = 4) by various symptoms (e.g., lonely, tense, anxious) during the past month. The five-item scales were combined to form two indices ( $\alpha = .90$  for each).

### **Body-Image**

Items derived from the Multidimensional Body-Self Relations Questionnaire (Cash 2000) were used to assess girls' body-image. Six, 5-point Likert-scaled items asked girls to report girls' satisfaction with aspects of their physical appearance. These were combined to form an index of girls' self-evaluation of their appearance (*Very satisfied* = 1, *Very dissatisfied* = 5). ( $\alpha = .89$ ).

### **Coping Skills**

Ten, 4-point Likert-scaled items from the Brief COPE (Carver 1997) were used to assess girls' coping skills. Girls reported the frequency with which they engaged in self-distraction, active coping, destructive coping, positive reframing, and obtaining help from instrumental supports (*Never* = 0, *Very often* = 3). The 10 items were combined to form an index ( $\alpha = .74$ ).

### **Perceived Stress**

Four, 4-point Likert-scaled items adapted from the Perceived Stress Scale (Cohen et al. 1983), were used to assess girls' stress. Girls rated the degree to which their life situations were unpredictable, uncontrollable, and stressful during the past month (*Never* = 0, *All the time* = 3). The four items were combined to form an index ( $\alpha = .71$ ).

### **Media Literacy**

Eight, 4-point Likert-scaled items (Primack et al. 2006) were used to assess media literacy. Designed to measure youths' ability to critically assess advertising within mass media outlets, girls indicated their level of agreement with statements related to the use of product placement, inherent values in the messaging, and motivation of the advertiser (*Strongly agree* = 1, *Strongly disagree* = 4). The eight items were combined to form an index ( $\alpha = .77$ ).

### **Goal Setting**

This scale assessed goal-setting skills with five items (Fearnow-Kenney et al. 2002) measuring the degree to which girls set current and future goals, the extent to which they thought about how to achieve those goals, and how often they think about their goals in relation to solving problems (*Never* = 0, *All the time* = 3). The five items were combined to form an index ( $\alpha = .77$ ).

### Self-Esteem

The Rosenberg Self-Esteem Scale (Rosenberg 1989) was used to assess girls' self-esteem. Ten, 4-point Likert-scaled items combined to form a self-esteem index with lower scores indicating higher self-esteem ( $\alpha = .89$ ). For example, "*I like myself for who I am.*" (*Strongly agree* = 1, *Strongly disagree* = 4).

### Self-Efficacy

The Generalized Self-Efficacy Scale (Schwarzer and Jerusalem 1995) was used to assess girls' self-efficacy. Six, 4-point Likert-scaled items asked girls to assess their ability to take the action necessary for a successful outcome and to manage difficult life situations (*Strongly agree* = 1, *Strongly disagree* = 4). The six items were combined to form an index ( $\alpha = .85$ ).

### Refusal Skills

Girls' ability to refuse offers to use alcohol, cigarettes, and marijuana was assessed on a 5-point Likert scale (*Definitely would* = 1, *Definitely would not* = 5; Epstein et al. 1997). Girls reported the likelihood of using various strategies (e.g., "tell them not now," "change the subject," "say 'no thanks'") to refuse a drug use offer. The five items were combined to form indices for alcohol, cigarettes, and marijuana ( $\alpha = .77-.89$ ).

### Peer Drug Use

To assess peer drug use, girls were asked six items to report how many of their closest friends had used various drugs in the past month (*None* = 0, *All* = 3). Four-point Likert-scaled items were combined to form an index that had an internal consistency of  $\alpha = .87$ .

### Drug Use

Adapted from the Centers for Disease Control's (CDC) Youth Risk Behavior Survey (YRBS; CDC 2005), this scale asked girls to report how many times in the past month they used alcohol, cigarettes, marijuana, and other drugs (i.e., club drugs, cocaine, ecstasy, hallucinogens, heroin, inhalants, methamphetamines, steroids, and prescription drugs). Using a drop-down menu, girls selected a number from the available range of "*0 times*" to "*70 or more times.*" Test-retest reliability for YRBS items is 0.82 to 0.95 (CDC 2013).

### The Intervention

Immediately following completion of the online pretest, girls in the intervention condition were directed to the online program, *RealTeen*. The program was comprised of two components: the homepage and the intervention sessions. The homepage for the program was accessible at any time, included feeds from the latest entertainment sites, online polls, horoscopes, beauty tips, and a quote of the day. The nine intervention sessions focused on goal setting, decision making, puberty, body image, coping, drug knowledge, refusal skills (two sessions), and a review.

The intervention was guided by an animated narrator named Alexis. Because positive peer modeling is associated with effective intervention efforts (Salvy et al. 2012), the narrator

was portrayed as a credible, attractive, older peer. Each session was delivered sequentially as skills were intended to build off one another. Though the main topic varied, each session reinforced how to help girls make healthier decisions around drug use. Continuity was also achieved by similarly structuring each session to begin with a skills-based lesson, followed by interactive exercises to enhance skills acquisition, and ending with a review and short quiz.

To enhance skills acquisition, interactive exercises required girls to engage in hypothetical, yet realistic scenarios. For example, in a session on refusal skills, girls first learned the elements of effective communication (e.g., appropriate body language, tone, and volume). Next, for the interactive exercise, girls were presented with a scenario in which a boy is offering a marijuana joint to a girl at school. Girls in the intervention are asked to adjust the girl's voice volume, tone, and body language in various combinations. For each adjustment, the boy's response changes. Frequently, girls were also asked to generate a brief, written response to session content (i.e., a short- and long-term goal, feelings elicited from an ad for cigarettes, reframing a negative thought). Once responses were entered online, girls had the option to keep their responses private or to make them public. Private responses were stored in a girl's online journal. Public responses, posted to the social feed, were accessible to all girls in the intervention condition. For further details on intervention components, tailoring, theory, and development see, Schwinn et al. 2016.

Each session took between 15 and 20 min to complete. If a girl logged out of a session prior to completion, the session resumed where the girl left off. Subsequent sessions were available 1 week after girls completed the previous session. Research staff monitored public posts. Administrative access allowed staff to remove off-topic or inappropriate posts.

## Data Analysis

Data were cleaned and analyzed using R (R Core Team 2015). Individual cases were identified for extreme scores and unreliable patterns of reported drug use across all three measurement occasions. Thirteen cases were removed from subsequent analyses. Comparability on pretest measures was assessed with Welch's two-sample *t*-test (Welch 1947) and by examining standardized mean differences (Cohen 1988) between the treatment and control condition (*control* = 0, *treatment* = 1). Pretest comparability on demographic variables, all of which were categorical, was assessed with chi-squared tests of independence if expected counts in all cells were five or greater; otherwise, Fisher's exact test was used.

The primary outcomes of past-month drug use were collected as frequency counts. In contrast to continuous outcome data models, for which assumptions of homoscedasticity and normally distributed residuals may be tenable, count data are skewed right, heteroskedastic, and have a variance that depends on the value of the mean. Poisson regression, in which the natural log of the outcome is modeled as a linear combination of predictors, is a natural starting point for modeling count data. However, Poisson regression relies on the typically unrealistic assumption that the variance of the model is identical to its mean. When this assumption is violated, the Poisson model is said to be over-dispersed. Negative binomial regression is an extension of Poisson regression that includes an additional parameter to account for over-dispersion (Hilbe 2014).

After finding evidence of over-dispersion with Poisson models, we fit negative binomial generalized linear regression models using package MASS (Venables and Ripley 2002). In all cases, the negative binomial models provided superior fit as evaluated by likelihood ratio tests and the Bayesian information criterion (Schwarz 1978). All models controlled for pretest score for drug use, age (in years), average letter grade in school (*mostly A's* = 1 to *mostly F's* = 5), and parents' education level (*less than 2 years of college* = 0, 2 or more years of college = 1). Exponentiating the coefficient on the treatment indicator provides the incidence rate ratio (IRR), a measure of effect size. For each drug use outcome, the IRR represents the proportional change in expected drug use between the intervention and control conditions, while holding constant the other variables in the model. The reference group is the control condition (*control* = 0, *treatment* = 1). An IRR less than one indicates that the intervention is associated with decrease in the outcome. For instance, an IRR of 0.60 indicates a 40% reduction in the outcome in the treatment group relative to the control group, holding constant the other variables in the model. An IRR greater than 1 indicates that the intervention is associated with increase in the outcome. Conversely, an IRR of 1.40 would indicate a 40% increase in the outcome in the treatment group relative to the control group, holding constant the other variables in the model.

The secondary outcomes—risk and protective factors for drug use—were analyzed using ordinary least squares regression models, controlling for pretest score, age, average letter grade in school, and parents' education level.

## Results

### Demographic Data

The sample's mean age was 13.7 years ( $SD = 0.67$ ). Participants in the sample resided in 48 states (Wyoming and Alaska were not included), and were 63% White, 17% Black, 15% Latino, 4% Asian, and 16% Other. More than 80% of girls resided in urban areas, 9% in large towns, 10% in small towns/rural areas. The most recent average letter grade earned in school was 1.68 (where "*mostly A's*" = 1 and "*mostly B's*" = 2). One-half of parents had 2 or more years of college. At pretest, past-month reports of drug use were 26% for alcohol, 12% for binge drinking, 14% for cigarettes, and 14% for marijuana. Analyses of pretest data revealed that girls in the intervention and control conditions were comparable on measured demographics, risk and protective factors, and drug use (Table 1).

### Differences in Drug Use

Controlling for age, average letter grade in school, parents' education, and the pretest value of drug use, Table 2 provides the average marginal counts for past-month drug use, coefficients from negative binomial models, and the incidence rate ratio (IRR; a measure of effect size) for girls in the intervention and control conditions at posttest and 1-year follow-up. At posttest, girls assigned to the intervention smoked fewer cigarettes ( $B = -0.87$ ,  $p = .003$ ;  $IRR = 0.419$ ) compared to girls assigned to the control condition. The IRR (0.419) indicates that the expected number of cigarettes smoked in the past month by girls who received the intervention was 58% less ( $1.0 - 0.419$ ) than the expected number of cigarettes



smoked by girls in the control condition, controlling for pretest cigarette use, age, average letter grade in school, and parents' education.

At 1-year follow-up, the expected number of past-month cigarettes smoked by girls who received the intervention was 67% less than the expected number of cigarettes smoked by girls in the control condition, controlling for pretest cigarette use, age, average letter grade in school, and parents' education ( $B = -1.12$ ,  $p = .001$ ; IRR = 0.326). Relative to girls assigned to the control condition, girls assigned to the intervention also engaged in less past-month binge drinking ( $B = -0.74$ ,  $p = .006$ ; IRR = 0.477), with an expected reduction of 52% (1.0–0.477).

### Differences in Risk and Protective Factors for Drug Use

Table 3 provides marginal means and regression coefficients (adjusted for pretest values, age, average letter grade in school, and parents' education) for the risk and protective factors at posttest and 1-year follow-up. At posttest, and with 97.5% sample retention, girls assigned to the intervention had higher self-esteem ( $B = -0.11$ ,  $p = .013$ ), goal setting ( $B = 0.09$ ,  $p = .015$ ), media literacy ( $B = -0.1212$ ,  $p < .0001$ ), and self-efficacy ( $B = -0.12$ ,  $p = .002$ ) compared to girls in the control condition. At 1-year follow-up, and with 97% sample retention, girls assigned to the intervention had higher alcohol refusal skills ( $B = -0.22$ ,  $p = .001$ ), cigarette refusal skills ( $B = -0.16$ ,  $p = .008$ ), marijuana refusal skills ( $B = -0.18$ ,  $p = .013$ ), coping skills ( $B = 0.11$ ,  $p = .004$ ), and media literacy ( $B = -0.08$ ,  $p = .022$ ), and lower rates of peer drug use ( $B = -0.60$ ,  $p = .007$ ), compared to girls in the control condition.

### Process Data

The 9-session intervention program was completed by 87% of girls; 3% of girls completed zero sessions. On average, girls completed the intervention in 3.5 months. Girls typically interacted with the program during weekdays between 3:00 PM and 1:00 AM or on weekends. More than one-half (53%) of girls in the intervention condition elected to post their session responses to their private diary; 47% of girls posted their responses to the public blog. During intervention delivery, 30% of girls required additional reminders to complete the sessions; reminders were conducted via telephone, text, and paper mailings. Across the three data collection periods, 10–15% of girls in both conditions required reminders via telephone, text, and paper mailings.

### Sensitivity Analyses

We fit two additional sets of negative binomial models to probe the sensitivity of significant results to the inclusion of covariates. One set of models controlled for drug use at pretest only. The other set of models controlled for no covariates. Across all models, the same results remained significant. As a further check, we fit zero-inflated negative binomial (ZINB) models using the *pscl* package (Zeileis et al. 2008). ZINB models the probability that each case belongs to a “zero group.” Those in the zero group are assumed to always report a value of zero, whereas those not in the zero group are assumed to behave according to a negative binomial process. For instance, a number of participants may have reported zero cocaine use regardless of whether they used cocaine for fear of negative consequences. The ZINB model is used identifies such cases using the covariate information to more

accurately estimate the coefficients of the negative binomial model. ZINB models fit comparably to the negative binomial models using the BIC and likelihood ratio tests for non-nested data. There were no differences in significance between negative binomial and ZINB models.

## Discussion

Offering promise as a way to reduce drug use rates among early adolescent girls, our online intervention program decreased drug use behaviors and impacted salient risk and protective factors among a large, nationwide sample of girls. The value of these findings increases owing to the rising rates of drug use by adolescent girls (Johnston et al. 2016a), the extraordinary consequences girls face when impaired by drug use (NIDA 2016), and the near absence of drug abuse prevention programs tailored for girls (Kumpfer et al. 2008). The theory-driven intervention we tested addressed general and gender-specific risk and protective factors associated with drug use among adolescent girls (Schwinn et al. 2016). That the intervention was delivered online enhances its potential reach and lowers its implementation costs relative to traditional interventions delivered via live-group.

At posttest measurement and 1-year follow-up, girls who received the intervention had lower rates of past-month cigarette smoking relative to girls in the control condition. At 1-year follow-up, girls who received intervention also engaged in less binge drinking than their peers in the control condition. Posttest intervention effects were also seen on girls' improved self-esteem, goal setting, media literacy, and self-efficacy. At 1-year follow-up, intervention effects were seen for improved scores on alcohol, cigarette, and marijuana refusal skills, coping skills, media literacy, and peer drug use. Study findings are strengthened by low attrition, high rates of intervention completion, sample size, and longitudinal follow-up. The results also support the use of the internet to recruit and maintain a relatively large nationwide study sample, collect longitudinal data, and deliver a skills-based interactive intervention.

Though no differences in regular past-month alcohol use were detected, study data did reveal differences in binge drinking. At 1-year follow-up, girls who received the intervention had a 52% expected reduction in past-month binge drinking compared to girls in the control condition. Possibly, the prevention program left girls better equipped to moderate their drinking. Differences in binge drinking rates are notable because as girls enter early adulthood, their associated risks of excessive alcohol use include: unprotected sex, multiple sex partners, unintended pregnancies, sexually transmitted diseases, and sexual assault (Haas et al. 2016; Holway et al. 2017). The ability to minimize binge drinking, therefore, confers numerous benefits.

Notwithstanding declines in tobacco use, cigarette smoking remains the leading cause of preventable deaths in the United States, and the majority of adults who die from smoking began during adolescence (U.S. Department of Health and Human Services 2014). As such, observed intervention effects on past-month cigarette smoking are hopeful. At posttest, the expected number of cigarettes smoked in the past month by girls who received the intervention was 58% less than the number of cigarettes smoked by girls in the control

condition. At 1-year follow-up, the expected number of cigarettes smoked by girls in the intervention condition was 67% less than for girls in the control condition.

The absence of differences in marijuana use suggests that the associated risk and protective factors targeted in this intervention were less effective in reducing marijuana use risks. Support for this comes from pretest findings in which marijuana use was associated with only 5 of our 13 measured risk factors, whereas alcohol and cigarette use were associated with 11 and 12 of the risk factors, respectively (Schwinn et al. 2016).

Observed changes, at posttest and 1-year follow-up, in risk and protective factors further support the intervention's efficacy. In particular, at 1-year follow-up, girls in the intervention condition showed improved refusal skills for alcohol, cigarettes, and marijuana, as well as improved coping and media literacy skills. Perhaps most important was intervention girls' report of less drug use among their immediate peer group. Affiliation with drug using peers has long been considered highly predictive of current and future adolescent drug use (Marschall-Lévesque et al. 2014). Given the consistent association between mental health issues and drug use (Hartz et al. 2014)—including our own findings from pretest data (Schwinn et al. 2016)—the lack of differences between conditions on depressed and anxious mood was disappointing.

This study's findings must be viewed in light of their limitations. Chief among them is the generalizability of the sample. Though the sample is comparable to national data with respect to rates of past-month drug use, race, ethnicity, parents' education, geographic region, and city type (Schwinn et al. 2017), findings are limited to a convenience sample of early adolescent girls who are registered users on Facebook, who click on ads, who have access to a private computer, who reside in the U.S., and who speak English. In addition, because the likelihood of clicking on a Facebook ad may be positively associated with the amount of time spent on Facebook, the sample may disproportionately include girls who spend significant time on Facebook. Furthermore, the extent to which girls were motivated to enroll by the opportunity to earn money, complete surveys, potentially engage in material to help them avoid drug use, or some combination is unknown. Girls who did not want to avoid drugs, however, were in all likelihood disinclined to participate.

Despite these limitations, the study used a novel approach to recruit and deliver gender-specific prevention programming. All subjects were recruited via the internet, and all nine sessions of the social competence and skills building content were delivered online. The program had a positive effect on girls' cigarette use and binge drinking, as well as risk and protective factors associated with drug use. Owing to online delivery, these differences were achieved without the need for staff training or detractions from valuable classroom learning time. Furthermore, online intervention delivery maximized fidelity and afforded girls the ability to access session content according to their individual schedules, likely improving our session adherence rates.

Besides focusing in particular on drug use behavior and on risk and protective factors associated with drug use among girls, the intervention program addressed developmental influences that in part shape the choices that adolescent girls make. These influences include

the inordinate pressures exerted by peers and society (Catalano et al. 2011), as well as cognitive processes associated with age-related mood disturbances, self-esteem, body-image, and stress (Schwinn et al. 2016). To the extent that drug abuse prevention programs help girls manage their moods, alter their self-image, identify negative influences from peers and society to engage in risky behaviors, and improve their self-efficacy to communicate their intentions, these interventions may exert commensurately salubrious effects on other risks that girls face during the turbulent teen years.

## Conclusion

The intervention program tested in this study produced material changes not only in girls' drug use behavior, but also in cognitions and skills that are empirically linked to reduced drug use risks. These include higher self-esteem, positive goal setting, increased media literacy, and drug refusal self-efficacy. As expected of any successful drug abuse prevention program, the intervention positively impacted girls' drug use behavior, including their cigarette use and binge drinking. That the positive impacts of the intervention were also seen in rates of peer drug use suggests that the program had a beneficial effect on girls' friendship networks. Continued positive outcomes at 1-year follow-up serve to underscore the social-emotional learning that apparently resulted in girls' participation in the intervention. The program achieved its outcomes without the need for staff training and without distracting girls from other activities, including time in school. Our hope for this online intervention is twofold: 1) that the research extends the nascent work on developing and testing gender-specific drug abuse prevention programs, and 2) that the program will provide girls—and the adults who serve them—with access to an engaging, high-fidelity, easy to implement, gender-specific drug abuse prevention program.

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## Biographies

**Traci M. Schwinn** is a Research Scientist at Columbia School of Social Work. Her research interests include using new technologies to tailor and test interventions to prevent drug use among adolescents.

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Table 1

Sample characteristics and comparability at pretest ( $N = 788$ )

Variable	Intervention ( $n = 396$ )		Control ( $n = 392$ )		$t$ or $\chi^2$	$p$ -value
	%	$M$ (SD)	%	$M$ (SD)		
Age ( $R = 11-15$ years)		13.66 (0.67)		13.72 (0.67)	1.365	.173
Ethnic/racial group					1.722	.788
White	64%		65%			
Black	24%		25%			
Hispanic	15%		15%			
Other	18%		19%			
Average letter grade in school <sup>a</sup>		1.69 (0.82)		1.67 (0.83)	-0.423	.672
Living arrangement					4.549	.337
Mother and father	49%		47%			
Single or with a step-parent	46%		44%			
Foster parent(s), aunt and/or uncle, other	2%		3%			
Grandparent(s)	3%		6%			
Geographic area <sup>b</sup>					2.538	.281
Urban	83%		80%			
Rural	10%		10%			
Large Town	7%		10%			
Parents' highest level of education					0.032	.859
Less than 2 years of college	49%		50%			
2 or more years of college	51%		50%			
Past-month:						
Alcohol use		0.95 (4.45)		1.23 (4.86)	0.824	.410
Binge drinking		0.25 (1.23)		0.36 (1.64)	0.999	.318
Cigarette use		0.89 (5.84)		0.85 (5.55)	-0.091	.928
Marijuana use		0.88 (5.50)		0.76 (4.76)	-0.320	.749
Other drug use <sup>c</sup>		0.97 (5.19)		1.02 (4.16)	0.161	.872

Note: Past-month use of alcohol, cigarettes, marijuana, and other drugs is a count variable and ranges between 0 = 0 times and 71 = 71 or more times

<sup>a</sup>Range is 1-5, where 1 = "mostly A's", and 5 = "mostly F's"



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<sup>b</sup> According girls' zip codes and Rural-Urban Commuting Area Codes, a Census tract-based classification system

<sup>c</sup> Use of the following: club drugs, cocaine, ecstasy, hallucinogens, heroin, inhalants, methamphetamines, steroids, and/or prescription drugs

Table 2

Average marginal counts and negative binomial coefficients for past-month drug use at posttest and 1-year follow-up

Variable	Posttest		1-Year Follow-Up					
	Intervention		Control		Intervention		Control	
	M (SE)	B (SE)	M (SE)	IRR <sup>b</sup>	M (SE)	B (SE)	M (SE)	IRR <sup>b</sup>
Alcohol	0.44 (0.06)	0.49 (0.06)	-0.12 (0.17)		0.69 (0.08)	0.91 (0.10)	-0.28 (0.16)	
Binge drinking	0.12 (0.02)	0.13 (0.02)	-0.07 (0.25)		0.13 (0.03)	0.27 (0.05)	-0.74 ** (0.27)	.477
Cigarettes	0.16 (0.04)	0.49 (0.09)	-0.87 ** (0.29)	.419	0.34 (0.08)	1.05 (0.24)	-1.12 ** (0.34)	.326
Marijuana	0.39 (0.08)	0.47 (0.09)	-0.20 (0.28)		1.15 (0.24)	0.70 (0.15)	0.49 (0.30)	
Other drugs <sup>a</sup>	0.25 (0.05)	0.41 (0.07)	-0.49 (0.26)		0.24 (0.05)	0.34 (0.07)	-0.36 (0.29)	

Note: Average marginal counts of past-month drug use controlling for pretest score, age, average letter grade in school, and parents' education level at their respective means. Coefficients are adjusted for pretest score, age, average letter grade in school, and parents' education level

<sup>a</sup>Use of the following: club drugs, cocaine, ecstasy, hallucinogens, heroin, inhalants, methamphetamines, steroids, and/or prescription drugs

<sup>b</sup>IRR = Incidence rate ratio—obtained by exponentiating the coefficient—represents the proportional change in expected drug use between the intervention and control (the reference group) conditions, holding constant the other variables in the model.

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p < .01

**Table 3**  
Marginal means and coefficients for risk and protective factors at posttest and 1-year follow-up

Variable	Posttest			1-Year Follow-Up				
	Intervention		Control	Intervention		Control		
	M (SE)	B (SE)	P	M (SE)	B (SE)	P		
Anxiety	1.55 (0.05)	1.60 (0.05)	-0.06 (0.07)	.436	1.61 (0.05)	1.69 (0.05)	-0.08 (0.08)	.288
Depression	1.79 (0.05)	1.90 (0.05)	-0.10 (0.06)	.109	1.76 (0.05)	1.90 (0.05)	-0.14 (0.07)	.051
Body image	2.76 (0.03)	2.82 (0.03)	-0.06 (0.05)	.226	2.78 (0.04)	2.84 (0.04)	-0.05 (0.05)	.300
Coping	1.56 (0.02)	1.50 (0.02)	0.05 (0.03)	.111	1.62 (0.03)	1.51 (0.03)	0.11 (0.04)	.004
Stress	1.53 (0.04)	1.60 (0.04)	-0.06 (0.05)	.244	1.54 (0.04)	1.62 (0.04)	-0.08 (0.05)	.111
Media literacy	1.49 (0.02)	1.61 (0.02)	-0.12 (0.03)	.000	1.50 (0.03)	1.58 (0.03)	-0.08 (0.04)	.022
Goal setting	2.49 (0.03)	2.40 (0.03)	0.09 (0.04)	.015	2.39 (0.02)	2.37 (0.02)	0.02 (0.03)	.621
Self-esteem	2.29 (0.03)	2.40 (0.03)	-0.11 (0.05)	.013	2.28 (0.03)	2.37 (0.03)	-0.08 (0.05)	.074
Self-efficacy	2.13 (0.03)	2.25 (0.03)	-0.12 (0.04)	.002	2.15 (0.03)	2.22 (0.03)	-0.06 (0.04)	.114
Alcohol refusal	1.91 (0.04)	1.97 (0.04)	-0.05 (0.06)	.370	1.91 (0.05)	2.13 (0.05)	-0.22 (0.07)	.001
Cigarette refusal	1.80 (0.04)	1.87 (0.04)	-0.07 (0.06)	.234	1.79 (0.04)	1.95 (0.04)	-0.16 (0.06)	.008
Marijuana refusal	1.90 (0.05)	1.89 (0.05)	0.01 (0.07)	.936	1.88 (0.05)	2.06 (0.05)	-0.18 (0.07)	.013
Peer use	2.04 (0.12)	2.26 (0.12)	-0.22 (0.17)	.214	2.53 (0.16)	3.13 (0.16)	-0.60 (0.22)	.007

Note: Marginal means and coefficients controlling for pretest score, age, average letter grade in school, and parents' education level. For all variables, except coping and goal setting, lower scores are better. Treatment variable coded as 0 = control, 1 = treatment