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Short term effects of the REAL media e-learning media literacy substance prevention curriculum: An RCT of adolescents disseminated through a community organization



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ABSTRACT

Background: The primary aim of this study was to evaluate the short-term effects of testing an e-learning program to reduce adolescent substance use and abuse. Early initiation of substance use is linked to a variety of negative outcomes, thus effective intervention programs are needed. One approach is to use media literacy to capitalize on adolescents' immersion with media in a variety of forms. We developed, implemented, and tested an engaging substance use prevention program by collaborating with a youth-oriented community partner (4-H). **Methods:** 639 middle adolescents from nine U.S. states participated in an RCT of REAL media. Participants completed a series of online surveys and were randomized to use an online substance prevention program (REAL media) or serve as control (delayed program use). Self-report surveys were administered at three points in time. This short-term evaluation uses data from the pretest (Time 1) and short-term posttest three-month surveys, which measured demographics, self-efficacy to counterargue, and injunctive and descriptive substance use norms.

Results: Participants who completed the REAL media program reported increased self-efficacy to counterargue and decreased positive injunctive norms compared to control participants who did not complete the program. No significant differences were observed for descriptive norms.

Conclusions: We found support for the REAL media program in changing key predictors of youth substance use demonstrating (1) the efficacy of media literacy interventions targeting adolescents and (2) that e-learning substance use prevention efforts can be adapted for and implemented through community organizations.

1. Introduction

Despite fluctuations in substance use rates (Johnston et al., 2017; Substance Abuse and Mental Health Services Administration, 2014), adolescents are still at risk for early onset of substance use (Burrow-Sanchez, 2006; Johnston et al., 2017; Wong et al., 2006) as well as for the development of risk factors that predict future abuse (Graves et al., 2005; Merline et al., 2008; Timmermans et al., 2008) and attendant health and behavioral problems (American College of Cardiology, 2010). Tobacco, for example, remains the single leading preventable cause of death in the U.S. and is linked to over a dozen forms of cancer and increased risk for stroke and heart disease

(American Cancer Society, 2014; Centers for Disease Control and Prevention, 2015a). Use of e-cigarettes is most dramatically on the rise (Krishnan-Sarin et al., 2019; Vogel et al., 2018), which is disconcerting because recent research indicates they produce some of the same harmful toxins as traditional cigarettes (Goel et al., 2015) and dependence is associated with younger onset of use (Vogel et al., 2018). Marijuana use, which has held steady in recent years (Johnston et al., 2017) or increased (Keyes et al., 2019), has a number of physical and psychological short-term side effects and, long-term, is associated with changes in brain function (Ammerman et al., 2015) yet adolescents increasingly perceive marijuana as "no risk" (Sarvet et al., 2018). Alcohol use, while declining somewhat, remains at undesirable levels for

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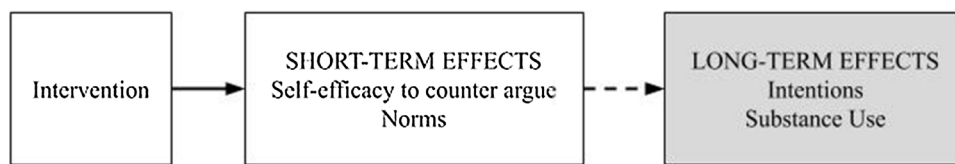


Fig. 1. Theoretical Model.

adolescents with both short- and long-term consequences for adolescents and society (Brown et al., 2000; Centers for Disease Control and Prevention, 2015b; Hingson and Kenkel, 2004; Hu et al., 2017; U.S. Department of Health and Human Services and Office of the Surgeon General, 2016; White and Swartzwelder, 2005).

These substance use/initiation problems are particularly acute during middle adolescence (ages 15–17), a developmental period often neglected by prevention research. Although risk typically emerges earlier as alcohol, tobacco, and other drug (ATOD) attitudes and norms become more positive (Pfau, 1995; Porcellato et al., 1999) and early experimentation begins (Bensley et al., 1999; Griffin et al., 2000), critical processes involved with later initiation as well as continuing and accelerating use and transition to regular use occur in early-to-middle adolescence (i.e., typically starting at age 14) (Faggiano et al., 2008; Griffin and Botvin, 2010; Onrust et al., 2016; Substance Abuse and Mental Health Services Administration, 2014). Early interventions (Waldron and Kaminer, 2004; Waldron and Turner, 2008) and media campaigns (Banerjee and Kubey, 2012; Flynn et al., 2006; Friend and Levy, 2002; Roy et al., 2007) show promise for addressing problems for younger children, but prevention curricula typically do not extend to the targeted middle adolescent age group (Spath et al., 2009; U.S. Department of Health and Human Services and Office of the Surgeon General, 2016) where it remains needed because of changes in social context, unsupervised time, and increased experimentation with substances (Burris et al., 2017; Cope et al., 2019; Rossheim et al., 2017). Targeting youth at the end of early adolescence (13–14), just before most experimentation starts, through middle adolescence (i.e., age 15–17) also holds promise to reinforce and extend the effects of earlier interventions as well as also to address dual or poly use (Merrin et al., 2018).

The changing needs during this developmental period suggest expanding prevention strategies to accommodate this period of increasing independence (Ogden and Hagen, 2018; Stockings et al., 2016). Early (age 10–14) and middle (age 15–17) adolescents live in media-filled environments due to the rapid emergence of mobile communication technologies (Chassiakos et al., 2016; Pew Research Center, 2018; Rossheim et al., 2017; Villanti et al., 2017). This exposes them to media advertising and other content including social media ATOD content (Barry et al., 2016; Jackson et al., 2018; Winpenny et al., 2013; Yang and Luo, 2017) with documented negative effects for substance use and initiation (Cabrera-Nguyen et al., 2016; Pokhrel et al., 2018; Sargent et al., 2009, 2006; Zhu, 2017). The changing media landscape suggests a media literacy approach, which differs from other prevention strategies by its focus on the development of health and media literacy along with critical thinking skills that encourage youth to consciously examine and resist pro-ATOD messages (Considine and Haley, 1992; Pinkleton et al., 2003; Tyner, 1992). Media literacy interventions discuss persuasive media strategies, analyze sample messages to help youth become more aware of the nature of media messages and teach them to critically identify message motives, tactics, and purposes (Hobbs, 1998; Kupersmidt et al., 2010; Potter and Byrne, 2009). Resulting skills empower youth through increased efficacy, making them less vulnerable to persuasive messages (Jeong et al., 2012; Scharrer, 2006).

REAL media is a media literacy substance abuse prevention curriculum that is based on a prior SAMHSA NREPP designated effective evidence-based curriculum titled *Youth Message Development* (Banerjee et al., 2015; Banerjee and Greene, 2016; Greene et al., 2017, 2016,

2015) and grounded in Theory of Active Involvement (TAI) (Greene, 2013). The theory conceptualizes media literacy as an active engagement strategy that functions by teaching media analysis and criticism followed by involving participants in the active design and production of their own prevention messages. TAI describes the progression of key constructs in decision-making that affect choices about risk decisions such as ATOD use (Banerjee and Greene, 2006; Chaturvedi, 2005), positing that effective media literacy education builds self-efficacy to counter argue through an engaging analysis of media concepts while influencing norms and expectancies. The curriculum operationalizes this by teaching youth how advertisers try to influence them, particularly in the promotion of ads targeting tobacco, alcohol, marijuana, and e-cigarette use, and guides youth in the analysis of these influence strategies. Youth are also taught about the influence of attention-grabbing production features (visuals, sounds, etc.) as well as how to recognize hidden claims (e.g., alcohol ads that imply you can only have fun if you are drinking) and develop corresponding counter-arguments (e.g., showing having fun without drinking and/or drinking not being fun). This process encourages critical thinking, the cognitive component, and then is combined with an active engagement component (i.e., developing their own anti-drug messages) to influence behavior through reinforcing or reconsidering substance use expectancies and intentions (Greene, 2013; Greene and Hecht, 2013; Lee et al., 2011). This theoretical model is presented in Fig. 1, with this paper focusing on short term effects.

REAL media also makes use of the inter-connectedness of youth by employing an online (Rogers, 2002, 1995) and interpersonal proliferation strategy (Banerjee et al., 2015; Choi et al., 2014; Kam and Lee, 2013; Shin and Hecht, 2012) that capitalizes on the ubiquitous nature of online message dissemination to spread messages to peers and family members. Youth-produced anti-substance messages are screened and posted on a social media site where an online contest is conducted, with winners chosen based on the number of visits to the message, likes, and other social media indicators. This strategy is based on prior theory (Greene, 2013; Miller-Day and Hecht, 2013; Rogers, 2002, 1995) and research (Banerjee et al., 2015; Choi et al., 2014; Kam and Lee, 2013; Shin and Hecht, 2012) showing that intervention effects can be extended to other audiences via interpersonal and social media channels. For example, in *keepin' it REAL*, a school-based substance abuse prevention curriculum, and a previous face-to-face iteration of REAL media called *Youth Message Development*, participating youth reported communicating with their peers positively about their experience (Banerjee et al., 2015; Choi et al., 2014; Kam and Lee, 2013; Shin and Hecht, 2012).

Although school-based interventions dominate the youth intervention field (Hennessy and Tanner-Smith, 2015; Ringwalt et al., 2002; Stockings et al., 2016), implementation through community-based organizations is a strategy for broadening effects in a space with intense competition for classroom time. As a result, a pilot study of the current intervention was conducted face-to-face in one state youth leadership program and showed promising results (Banerjee et al., 2015). More significant impact, however, can be achieved through large, national organizations. As a result, we partnered with 4-H in the United States to test implementation through their clubs and an e-learning format. 4-H is a non-formal educational, positive youth development program serving 7 million youth across the United States (National 4-H Council, 2018) (see 4-H.org). Utilizing a learn-by-doing approach, 4-H enables youth to develop the knowledge, attitudes, and skills they need to

become competent, caring, and contributing citizens. The potential impact of a 4-H-based intervention derives in part from the level of substance use among members, whose risk patterns mirror the general population (Lerner and Lerner, 2013), in addition to the sheer size and magnitude of the number of youth who can be reached through this dissemination vehicle.

1.1. Program development

REAL media is self-paced, e-learning substance use prevention curriculum adapted from the face-to-face *Youth Message Development* program (Greene et al., 2019, 2017) through multiple iterative stages with 4-H club members and club leaders (Ray et al., 2019). This process included focus groups to inform the e-learning adaptation, a pilot test of the resulting program, program refinements that were based on user feedback from the pilot, followed by an independent usability test with an additional group of 4-H club members and leaders demonstrating the usability and feasibility of REAL media (Ray et al., 2019). The final curriculum consists of 5 levels (lessons) and covers topics including media reach, media ethics, influence strategies, advertising claims and evidence, and production techniques. Current ads are provided as examples, including many ATOD ads, and the curriculum teaches youth to critique those ads. In addition to analysis and criticism, youth are taught to plan, produce, and disseminate their own anti-substance messages (i.e., counter-messages). The levels are designed to be engaging and interactive, using “drag and drop,” multiple choice, sliders, fill-in the blank, hover and reveal, and other involving features that require users to make decisions or participate in the program. In addition, each level has at least one “optional depth” feature, which allows participants to explore a topic in greater detail, as well as a final level “challenge” that tests knowledge of key program constructs.

The curriculum culminates in planning and developing a substance use prevention message. Level 5 guides participants through the planning process, including strategic and practical decisions about their messages. Participants produce poster or videos offline and then enter them in a social media contest designed to motivate message production and dissemination. Submitted messages were screened for content prior to uploading to a Facebook site. Participants were then encouraged to invite others to visit their message. Staff reviewed the contest page multiple times a day for content. The contest page also utilized available filtering (e.g., postings with profane words were automatically excluded). Based on the established guidelines, only one comment that critiqued a participant's grammar was removed. Three “winning” messages (with \$250, 100, and 50 prizes) per cohort were selected based on a combination of likes and comments.

The current study examines the short-term effects of the curriculum among 4-H members, testing TAI and the following hypothesis:

Hypothesis 1A&B. Youth participating in REAL media will exhibit (a) increased self-efficacy to counter argue and (b) less positive substance use norms (injunctive and descriptive) compared to control group participants.

2. Method

2.1. Participants

Participants were 639 4-H youth members across nine U.S. states (NJ, PA, OH, WV, LZ, AZ, IL, CO, WA), launched in four cohorts following the same timeline across 2018. They were between the ages of 12 and 17 years old ($M = 14.71$, $SD = 1.34$) at the time of the study pretest. The majority ($n = 420$ or 66%) were female (219 or 34% were male). Most identified as European-American or white (556 or 87%), African-American or Black (22; 3%), Asian or Pacific Islander (22; 3%), American Indian or Alaskan Native (6; 1%), or other (33; 5%); 39 participants identified as Hispanic (6%). Participants reported location

in urban areas/ large cities (39; 6%), suburban areas (147; 23%), smaller cities (67; 11%), small towns (194; 30%), rural areas (187; 29%), or not-reported (5; 1%). Most participants attended public school (452, 71%) with 57 participants (9%) in private school, 104 (16%) home-schooled, and 25 participants (4%) reported “other”.

Participants were ages 12–17 at the time of the pretest (T1), with most (67 %) between ages 13–15. Youth described their grades/marks in the current school year as mostly: As (462, 72%), Bs (144, 23%), Cs (12, 2%), with 3% “not sure” or not reported.

2.2. Procedures

Initially, state 4-H program leaders were recruited to participate in the project. States distributed project information to county leaders who distributed it to club level leaders or youth. The research team created a project website, Facebook page, and flyers, as well as made presentations in person and via telephone, video conference, and online streaming technologies at club and county-level 4-H events.

Parental consent forms were returned via email, mail, fax, text, and through the project website link directly to the research project team who addressed all questions. Parental consent forms included a contact email for all youth and/or a phone number for some youth. Participants provided assent (at each online survey) after initial parental consent. Individual survey links were sent to participating youth via email or text, and youth completed surveys individually within a three-week period.

Participants were compensated \$10 for completing each of the first three online study surveys (Time 4 surveys are long-term follow-up and not included here). T1 was the pretest, T2 occurred immediately after REAL media use for treatment participants, and T3 was the 3-month short term posttest. A university Institutional Review Board approved the study procedures. The project employed a Data Safety and Monitoring Board (DSMB) consisting of three members who reviewed procedures and monitored compliance. The consort diagram is presented in Fig. 2.

2.2.1. Condition assignment and comparability

After assent, youth were randomly assigned to treatment ($n = 349$, 55%) or delayed use control ($n = 290$, 45%) conditions. The study methodologist made efforts to balance condition assignment by participant state, sex, race, and urban/rural location. To ensure comparability between the groups, initial analyses conducted on pretest survey variables of interest, including demographic variables and outcomes variables of interests (e.g., efficacy), indicated few differences between groups at Time 1 ($p > .05$). Only one significant difference between treatment and control youth was observed, with more youth attending non-public school (e.g., private or home-schooled) in the treatment group ($n = 118$, 63%) than in the control group ($n = 68$, 37%). This variable is included in subsequent analyses.

Outcome variables of interest (e.g., efficacy) at baseline were not significantly different by cohort. In addition, the interactions between condition and cohort were not significant across the three outcome variables. Nevertheless, we control for cohort in all analyses.

2.2.2. Intervention: REAL media

On completion of the T1 survey, treatment participants received instructions for logging into the REAL media intervention. The program required youth to proceed sequentially through the 5 levels. In the fifth level, they planned their anti-substance use message, which they produced offline and submitted to the contest.

2.3. Measurement

Descriptions below include the variables measured to test the proposed hypotheses. These were measured at T1 and T3, except for demographics which was measured at T1. Because REAL media is a poly-

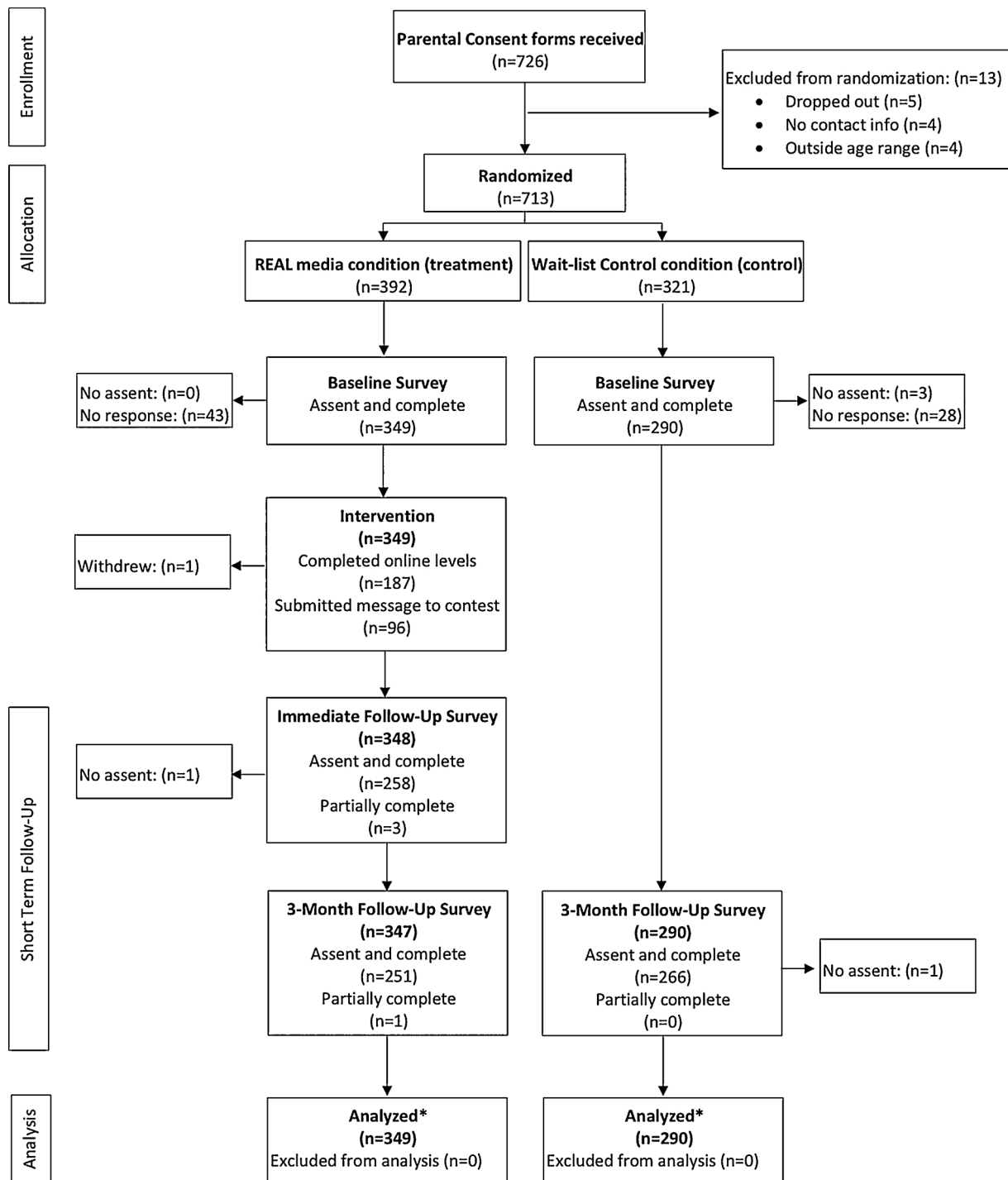


Fig. 2. Consort diagram.

substance prevention intervention (i.e., does not target any particular substance) we chose to examine overall or omnibus measures of descriptive and injunctive norms.

2.3.1. Self-efficacy to counter-argue

Self-efficacy to counter-argue was measured using three agree-disagree Likert-type items (Banerjee et al., 2015) asking respondents how confident they are that they could “come up with their own evidence or facts that argue against the claims used in the ad,” “think of at least one good argument that they can make against the claims,” and “distinguish

relevant from irrelevant claims in an ad.” Response categories range on a five-point scale from 1 (*not at all confident*) to 5 (*completely confident*). Items were averaged, with higher scores indicating higher self-efficacy or participants’ greater confidence in their abilities to counter-argue. The scale demonstrated good reliability in prior research (Banerjee et al., 2015) and in the current study (T1: $\alpha = .78$, $M = 3.60$, $SD = .86$; T3: $\alpha = .90$, $M = 3.75$, $SD = 0.78$).

2.3.2. Substance use descriptive norms

Substance use descriptive norms was measured using a continuous

measure (0–100) parallel to prior research indicating respondents' estimates of what percentage of youth their age use seven target substances (smoke cigarettes / use chewing tobacco, snuff, dip, snus, or dissolvable tobacco / use an electronic vapor product / smoke cigars, cigarillos, or little cigars / drink alcohol / use marijuana / other drug use) that were presented with a variety of informal "slang" terms as well as images. We averaged scores of these seven different substance items, with a higher score indicating higher perceived substance use prevalence (T1: $\alpha = .89$, $M = 29.85$, $SD = 18.88$; T3: $\alpha = .90$, $M = 30.36$, $SD = 18.77$).

2.3.3. Substance use injunctive norms

Substance use injunctive norms was measured based on prior research (PATH, 2018) using items assessing how acceptable the respondent perceives that people who are important to her/him find using the seven target substances (drinking alcohol / smoking cigarettes / using chewing tobacco, snuff, dip, snus, or dissolvable tobacco / using an electronic vapor product / smoking cigars, cigarillos, or little cigars / drinking alcohol / using marijuana / using other drug) "occasionally", and how acceptable they find doing so "regularly." Response categories range on a five-point scale from 1 (*very unacceptable*) to 5 (*very acceptable*). The items for each seven substances (total 14 items) were averaged with a higher score indicating youth's greater perceived substance use acceptability (T1: $\alpha = .90$, $M = 1.66$, $SD = .59$; T3: $\alpha = .91$, $M = 1.64$, $SD = 0.60$).

2.3.4. Demographic variables

Youth reported sex, age, education type (e.g. public schools, private school, home-schooling, others), race, and their lifetime individual substance use ("cigarette smoking, even one or two puffs"; "electronic vapor product use, even one or two times"; "chewing tobacco, snuff, dip, or snus use", "even one or two times; cigar, cigarillo, or little cigar use, even one or two puffs"; "drink of alcohol other than a few sips"; "tried marijuana") with yes and no responses. We created dummy-coded variables for sex (Female = 0 vs. Male = 1), education type (1 = Public school vs 0 = Other types), and race (White = 0 vs. Others = 1) and lifetime substance use across any type of individual substance (None = 0 vs. 1 = Yes).

3. Results

3.1. Analyses

We used an intent-to-treat approach ($N = 639$) to test whether there were significant differences between the two groups (control = 0 vs treatment = 1). Multiple imputation (e.g., Proc MI) was used to address missing data due to attrition and non-response of specific items and SAS PROC MIANALYZE was used to analyze the imputed data. Because youth are embedded in states, we used multilevel regression (e.g., Proc Mixed) to address intra-class correlation. Three multilevel regression models were run, one for each outcome of interest. Within each model, we controlled for sex, race, education type, age, lifetime

substance use, and cohort, as well as a baseline version of all outcomes of interest. Zero order correlations are presented in Table 1.

3.1.1. Attrition analyses

Next, we tested attrition. Participants who completed the 3-month follow-up did not differ from those who did not on baseline (T1) target variables self-efficacy ($t(635) = 1.36$, $p = .18$), descriptive norms ($t(636) = -1.18$, $p = .24$), or injunctive norms ($t(637) = 0.15$, $p = .88$). They also did not differ on race, age, cohort (compared with cohort 1) or lifetime substance use. However, females ($\chi^2(1) = 13.91$, $p < .001$) and youth in control ($\chi^2(1) = 39.31$, $p < .001$) were more likely than their counterparts to complete the 3-month follow-up, and both variables are included in the models. The retention rate from T1 to T3 was 81% (see Consort diagram).

3.2. Hypothesis testing

Tests of Hypotheses 1A-B are described below and summarized in Table 2, with Means and SD by time presented in Table 3. Participation in REAL media significantly increased self-efficacy to counter argue ($B = 0.12$, $SE = 0.06$, $t(1834.5) = 2.01$, $p = .04$) three months later. Youth who participated in the REAL media program increased scores on self-efficacy to counter-argue compared to youth in control. Thus, Hypothesis 1A was supported.

Participation in REAL media also significantly decreased positive injunctive norms ($B = -0.10$, $SE = .04$, $t(1615.4) = -2.38$, $p = .02$) three months later. Youth who participated in the REAL media program perceived key others' approval of substance use to be less favorable compared to youth in control. However, contrary to predictions, descriptive norms were not significantly different between participants in the two conditions ($B = -1.05$, $SE = 1.15$, $t(1055.6) = -0.92$, $p = .36$) at the three-month posttest. Post hoc analyses for injunctive norms for each of the 7 substances demonstrated significant effects only for vaping ($B = -.08$), although the patterns for the injunctive norms for the other substances were similar and in the same direction. Because we were not powered for individual tests, detailed findings are available by request from the lead author. Thus, Hypothesis 1B was partially supported, with effects for injunctive norms but not for descriptive norms.

Several covariates at baseline were significant in the analyses. Specifically, older youth were more likely to have greater self-efficacy to counterargue ($B = 0.06$, $SE = .02$, $t(3360.8) = 2.71$, $p = .007$). Efficacy at baseline was negatively related with positive injunctive norms ($B = -0.07$, $SE = .03$, $t(577.09) = -2.82$, $p = .005$). That is, youth with higher self-efficacy at baseline reported less acceptable substance use norms at the three-month posttest.

There were no cohort effects at baseline but two appeared in longitudinal analyses (and were controlled for). Compared with the first cohort, cohort 4 reported lower descriptive norms ($B = -4.26$, $SE = 1.45$, $t(1773.7) = -2.95$, $p = .003$). Compared with cohort 1, cohort 2 reported more negative injunctive norms ($B = -0.24$, $SE = .07$, $t(813.19) = -3.20$, $p = .001$). No other covariates were significant in these analyses.

Table 1
Zero-order correlations among variables of interest.

	T1 Efficacy to Counter -Argue	T1 Descriptive norms	T1 Injunctive norms	T3 Efficacy to Counter -Argue	T3 Descriptive norms	T3 Injunctive norms
T1 Efficacy	—					
T1 Descriptive Norms	−0.02	—				
T1 Injunctive Norms	−0.04	0.07	—			
T3 Efficacy	0.50***	−0.03	−0.04	—		
T3 Descriptive Norms	−0.05	0.72***	0.05	−0.08	—	
T3 Injunctive norms	−0.12**	0.05	0.51***	−0.08	0.04	—

*** $p < .001$; ** $p < .01$; * $p < .05$.

Table 2
Intervention effect on efficacy and norms at 3-month follow-up.

	Efficacy (T3)			Descriptive Norm (T3)			Injunctive Norms (T3)		
	b	SE	β	Est	SE	β	Est	SE	β
Intercept	1.88***	0.17		14.62***	3.70		1.16***	0.15	
Condition	0.12*	0.06	0.08	-1.05	1.15	-0.03	-0.10*	0.04	-0.09
Male	-0.03	0.06	-0.02	-1.66	1.24	-0.04	-0.07	0.05	-0.06
Other race (reference = white)	0.08	0.09	0.03	0.69	1.78	0.01	-0.09	0.07	-0.05
Public school (reference = others)	-0.01	0.07	-0.01	-0.84	1.21	-0.02	-0.06	0.05	-0.05
Age	0.06**	0.02	0.11	0.39	0.46	0.03	0.03	0.02	0.07
Lifetime substance use experience	-0.02	0.08	-0.01	0.78	1.43	0.02	0.07	0.06	0.05
Cohort_dummy1 (reference = cohort1)	0.02	0.11	0.01	0.61	1.99	0.01	-0.24**	0.07	-0.14
Cohort_dummy2	0.14	0.09	0.08	2.35	1.56	0.06	-0.03	0.07	-0.02
Cohort_dummy3	0.10	0.08	0.06	-4.26**	1.45	-0.10	-0.09	0.06	-0.07
Efficacy at baseline	0.46***	0.03	0.49	-0.88	0.69	-0.04	-0.08**	0.03	-0.11
Descriptive Norms at baseline	-0.00	0.00	-0.03	0.68***	0.03	0.69	-0.00	0.00	-0.03
Injunctive Norms at baseline	-0.04	0.06	-0.04	-0.70	1.07	-0.02	0.49***	0.04	0.49

*** $p < .001$; ** $p < .01$; * $p < .05$.

Table 3
Efficacy, Injunctive norms, and Descriptive norms Means and SD between groups by time.

	Time 1		Time 3	
	Control	Treatment	Control	Treatment
Efficacy	3.59 (0.05)	3.62 (0.05)	3.68 (0.05)	3.83 (0.05)
Descriptive norms	29.99 (1.08)	29.76 (1.04)	30.67 (1.07)	29.53 (1.12)
Injunctive norms	1.63 (0.03)	1.67 (0.03)	1.67 (0.04)	1.59 (0.04)

Note. Means and SD (in parentheses) were calculated based on imputed data to address missingness. Efficacy, descriptive and injunctive norms were not significantly different between treatment and control at Time 1.

4. Discussion

This study reports short-term effects of an RCT with 4-H participants across multiple U.S. states. REAL media participants reported increased self-efficacy to counterargue and decreased positive injunctive substance norms (but not descriptive norms). These findings are consistent with prior research (Banerjee et al., 2015; Chaturvedi, 2005) and also with the theoretical framework describing the proposed process of change. The self-efficacy to counterargue with advertisements—especially those with substance use or ATOD messages—is a key mediator of substance use predictors (Greene, 2013).

The difference in reported substance use norms effects is also consistent with theory. The decrease in injunctive substance use norms for intervention participants is expected based of the critique of multiple ATOD ads presented in the REAL media curriculum (e.g., “drinking is fun” as a claim, or “sophisticated people vape”) as well as inclusion of several anti-ATOD prevention ads presenting peer and parental norms that are both critical of use and supporting non-use. The absence of findings for descriptive substance use norms may not be surprising because none of the program content addresses that prevalence of peer use, although we expected spill-over effects from injunctive norms. Peer norms—particularly injunctive norms—are crucial intervention targets at this particular developmental age because of the increased vulnerability to social influence and peer pressure and substance use offers made by peers (Choi et al., 2017; Elek et al., 2006).

The findings of this study, along with the feasibility study described earlier, support the dissemination of REAL media, an intervention that makes innovative use of an e-learning format and social media channels, for delivery to 4-H clubs. The e-learning format allows us to maintain fidelity and implementation during widespread dissemination to many youth each year through collaboration with the 4-H clubs whose leaders, like those in other community groups, are often not well prepared to deliver prevention curricula and whose training needs are difficult to meet across a country.

This study also provides support for the underlying theory, the Theory of Active Involvement (Greene, 2013). The hypothesized short-term effects were observed for a curriculum developed based on constructs identified by the theory. TAI argues that effective media literacy strategies will develop critical thinking abilities reflected in effects on efficacy to counterargue. By presenting advertisements seeking to manipulate adolescents and others through strategies that invoke injunctive norms as well as counter-advertisements that support the norm of drug-free activities, TAI predicts effects on norms. These effects were observed only for injunctive norms indicating, perhaps, the need to add program content related to descriptive norms. Future research examining long-term effects based on current data collection will test this theory further.

The study also has some limitations. The first set of limitations are related to the sample that was primarily white and non-Hispanic 4-H club members. Because data were collected from youth in nine U.S. states, this an improvement over single-state data. However, these data do not reflect broad ethnic/racial variation. The sample included only youth affiliated with 4-H as an organization, and thus may not represent other organizations or unaligned youth. There are data, however, that despite the protective influence of 4-H their risk taking is comparable to U.S. rates (Lerner and Lerner, 2013); additionally, some youth did report substance use (past and current) in the project, despite 4-H policies prohibiting use.

The next set of critiques could be related to the procedures. First, it would be desirable to include longer delayed posttest evaluations to track effects. Additionally, there may be mediators or moderators that are unexplored or unmeasured in the project, though we tested many to rule out alternative explanations. Future research could continue to address these and other issues, including evaluations to expand on the relatively small or moderate size effects of the findings.

Moving forward, the three-month effects are encouraging for use of this flexible, brief REAL media curriculum that is easily implemented in a variety of contexts. Partnering with other youth community organizations is a promising alternative avenue to school delivery which has become overwhelmed by demands for class time. In addition to 4-H, D.A.R.E. makes a version of the curriculum, branded REAL messages, available as part of its high school curricula (D.A.R.E., 2019). The REAL media program leverages key attention to the new media development, an important consideration as we continue to address youth substance use.

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Contributors

Kathryn Greene: Co-led project and development of conceptual model, involved in all aspects and co-wrote paper.

Anne E. Ray: Contributed to project design, management, and edited paper.

Hye Jeong Choi: Contributed to project design, lead randomization and analyses.

Shannon D. Glenn: Contributed to recruitment, retention, and led participant contact.

Rachel E. Lyons: Led sample recruitment.

Michael L. Hecht: Co-led project and development of conceptual model, involved in all aspects and co-wrote paper.

Author disclosures

All authors have read and approved the final revised manuscript.

Human rights

All procedures involving human participants were in accordance with institutional review board ethical standards and with the 1964 Helsinki declaration and its later amendments, protocol approval #15-544Rc (Rutgers University). Informed consent from parents and youth assent was obtained for all participants.

Declaration of Competing Interest

Kathryn Greene and Michael Hecht disclose intellectual property interests in the REAL media curriculum; Rachel Lyons is an employee of 4-H, the target community organization.

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