Examining the efficacy of an mHealth media literacy education program for sexual health promotion in older adolescents attending community college

Tracy Marie Scull, PhD, **Janis Beth Kupersmidt, PhD**, **Christina Valerie Malik, PhD**, and **Elyse Mallory Keefe, MPH, MSW**

Innovation Research & Training

Abstract

Objective—To determine the feasibility of a mobile health (mHealth), media literacy education program, *Media Aware*, for improving sexual health outcomes in older adolescent community college students.

Participants—184 community college students (ages 18–19) participated in the study from April–December 2015.

Methods—Eight community college campuses were randomly assigned to either the intervention or a wait-list control group. Student participants from each campus completed web-based pretest and posttest questionnaires. Intervention group students received *Media Aware* in between questionnaires.

Results—Several intervention effects of the *Media Aware* program were significant, including reducing older adolescents' self-reported risky sexual behaviors; positively affecting knowledge, attitudes, normative beliefs, and intentions related to sexual health; and increasing media skepticism. Some gender differences in the findings were revealed.

Conclusions—The results from this study suggest that *Media Aware* is a promising means of delivering comprehensive sexual health education to older adolescents attending community college.

The sexual health of older adolescents is a major U.S. public health problem. Two-thirds of all teen pregnancies occur among 18–19 year-olds[1], while 15- to 24-year-olds account for about half of all new sexually transmitted infections.[2] These outcomes can be understood in the context of the risky sexual behaviors reported by sexually active older adolescents, including no use or inconsistent use of contraception (43%) among 18–29 year olds.[3] A study of female undergraduates demonstrated the prevalence of other risky sexual behaviors, including high levels of intoxicated sex (60.2%), sex with multiple partners (31.4%), and unprotected sex (48.9%).[4] Many older adolescents lack information related to sexual health, with just over half (56%) of 18–19 year olds reporting they have all the information they

Corresponding Author: Tracy Scull, Innovation Research & Training, 5316 Highgate Dr., Suite 121, Durham, NC 27713, 919-493-7700 (phone), 919-493-7720 (fax), tscull@irtinc.us.

need to avoid pregnancy.[3] If older adolescents have received sex education, it was likely many years in the past, as the last time they typically received information about pregnancy prevention was in middle or high school.[3] Currently, secondary school-based sexual health programming for adolescents is infrequent, inconsistent, and often incomplete. For example, only 55–60% of 15–19 year olds, reported that they received formal instruction about pregnancy prevention methods.[5] Thirty-three states and the District of Columbia mandate some form of sex education; however, only 20 states require that the content taught be medically, factually, or technically accurate.[6] Coupled with an emphasis on abstinence-based sexual education over the past decades, it is unknown to what degree older adolescents have received medically-accurate, comprehensive sex education that prepares them to effectively use and negotiate the use of contraception/protection during sexual activity.

Students who attend community college make up almost half (47%) of all US undergraduates nationally.[7] Community colleges differ from traditional 4-year institutions in several ways. They typically serve a more diverse set of students, including a large proportion of US minority undergraduates (62% of Native American, 57 % of Hispanic, and 52% of Black undergraduates) and many non-traditional students.[8] Community colleges are less likely to provide comprehensive health services or access to an on-campus student health center compared to four-year institutions.[9,10] For example, four-year institutions were found to be significantly more likely to provide condoms on campus and sexual violence prevention resources than community colleges.[11] As compared with their four-year college counterparts, sexually active community college students, 18–24 years old, are more likely to engage in risky sexual behavior, including more sexual partners; higher frequencies of sexual activity; lower rates of condom use; lower rates of HIV testing; and higher rates of relying on withdrawal and emergency contraception as birth control methods.[9] It is therefore not surprising that these community college students also have poorer sexual health outcomes, including twice the rate of unintended pregnancy and higher rates of STIs.[9] Thus, older adolescents attending community college are an underserved population with a need for increased sexual health promotion efforts.

Adolescents in the U.S. spend over 11 hours per day, on average, multitasking with media.[12] Sexual content in media is pervasive, often glamorized and objectifying, and seldom depicts the risks and responsibilities associated with sexual behavior.[13–16] These biases are problematic, considering that adolescents cite entertainment media as a *primary* source of information about sexual health and report learning ideas about how to talk with romantic partners directly from media messages.[17] In recent years, media exposure has increased for youth, and has transformed with the explosion of the internet and mobile technology.[12] One outcome of the proliferation of media exposure has been a dramatic increase in access to pornography, with 93% of males and 62% of females having seen pornography, wanted or unwanted, by the time they are 17 years old.[18] This seemingly unavoidable exposure to porn has implications for adolescent sexual health, given the unhealthy sexual scripts portrayed in mainstream pornography (e.g., male aggression toward women; lack of intimacy).[19,20]

In the absence of straightforward, medically-accurate information about sex from either parents or schools, media messages can fill in the gaps, informing attitudes and beliefs about sex and relationships. Specifically, higher sexual media exposure (SME) for adolescents is

associated with less sexually healthy attitudes, such as more favorable views about casual sex and endorsement of stricter gender role norms.[21–23] For example, associations have been found between higher exposure to sexually explicit internet media and attitudes that endorse uncommitted sexual exploration among 13–20 year olds.[23] Subsequently, the effects of SME on adolescent sexual health are well-documented, with higher levels linked to sexual behaviors.[24–29] Specifically, white preteens with the highest SME were found to be more than twice as likely to have sexual intercourse by the time they were teenagers, compared with their counterparts with the lowest SME.[24] Additionally, higher SME for adolescents predicts more permissive subjective normative beliefs (e.g., beliefs about peers' permissive attitudes toward sex) and inflated descriptive normative beliefs (e.g., the perceived frequency of peers' sexual behavior) about sexual behaviors.[25] This effect of SME on normative beliefs is important because, according to social norms theory[30], people adapt their behaviors to match their perceptions of what is common, acceptable, and desirable. Therefore, adolescents with higher SME may perceive that adolescent sexual activity and risk behaviors are more prevalent than they are in actuality, and would subsequently be more likely to mimic those perceived normative behaviors. Indeed, many adolescent sexual behaviors have been shown to be strongly associated with both injunctive and descriptive norms.[31–33] A meta-analysis of peer influence on sexual health found descriptive and injunctive norms to be more strongly associated with adolescent sexual activity than direct peer pressure.[31] Further, descriptive norms appear to become more influential with age, while the influence of peer pressure decreases with age.

In addition, the ways in which media messages are processed have been found to be important contributors to adolescent risk behavior intentions, both for substance use[34] and sexual activity.[35] The Message Interpretation Process (MIP) model[36] offers a framework for understanding how logical and emotional processing pathways contribute to whether a media message is internalized and influential in affecting decision-making. Following this model, media literacy education (MLE) programs have been developed to strengthen logical processing skills and encourage the critical evaluation of media messages with the goal of reducing the influence of unhealthy media messages related to sexual health. MLE has been shown to improve media message processing skills,[37] as well as decrease perceived norms related to other unhealthy behaviors, such as tobacco use.[38] Previous research has demonstrated the short-term effects of MLE programs on early adolescents' risk behavior intentions and antecedents.[39–41] However, to date, no sexual health programs for older adolescents have been evaluated and reported that use established media message processing theory to attenuate the potentially negative influence of media on sexual risk behaviors. Therefore, the present study seeks to address this gap to 1) determine the feasibility of delivering an mHealth sexual education program to older adolescents, and 2) examine the efficacy of an MLE approach with this population.

Media Aware (Sexual Health Program for Young Adults) is a 5-lesson, web-based, comprehensive sexual health program that uses an MLE framework and covers a wide range of sexual health topics, including pregnancy and STI prevention, dating violence, relationship health, and communication with sexual partners and medical health professionals (See Table 1 for program details). *Media Aware* is different from traditional sexual health education programming because emphasis is placed on becoming aware of a

less conscience influence on sexual behavior choices (i.e., media messages) and developing critical thinking skills in order to redress inaccurate normative beliefs about sexual health. Throughout the program, students analyze and evaluate popular media messages, and reflect on common themes about sex and relationships, including media representations of gender roles, sexual violence, consent, and sex and substance use. As part of these analyses, students learn to evaluate the accuracy and completeness of information provided in media messages by comparing the information presented in the media to medically-accurate sexual health information.

It is important that sexual health programs be respectful and inclusive of adolescents and young adults who vary in their sexual orientation and gender identity. The content in the *Media Aware* program was developed to not emphasize, normalize, or overly value any particular sex, gender, sexual orientation, or type of sexual activity. Sexual behaviors and associated risks are discussed in a medically-accurate and developmentally-appropriate manner in the program, without making assumptions about the gender or sexual orientation of the partners engaging in the activities. Health content, vocabulary (including pronouns), images, media examples, peer interviews, and scenarios were carefully selected or created with the aim being inclusive.

Media Aware is a self-paced, on-demand, multimedia, web-based program, accessible on mobile devices. The program was designed as a mobile health (mHealth) intervention to increase the accessibility to sexual health programming for community college students, a typically hard-to-reach population for health promotion interventions.[42] Mobile delivery of sexual health education can increase the consistency and accuracy of content, decrease embarrassment associated with face-to-face sexual health education, and enhance program relevance and engagement through interactive features and self-paced functionality. Furthermore, a 2012 systematic review of mHealth sexual health interventions found that many interventions targeted underserved populations and were able to improve adolescent sexual outcomes, particularly knowledge and psychosocial outcomes, indicating the potential benefit of mobile technology for the delivery of sexual health education.[43] *Media Aware* includes a variety of interactive features such as quizzes with immediate feedback, videos of peers discussing a variety of health and media topics, popular media examples (e.g., songs and song lyrics; video clips from TV and film; advertisements), and skill practice with real-time feedback (e.g., practice communicating with virtual medical professionals about sexual health using a branching scenarios activity). The interactive nature of the program also allows for program personalization (e.g., students create a personalized profile, including setting specific personal, educational, and health-related goals, which they revisit at the end of each lesson) designed to increase engagement. Development of the program included the common characteristics of programs found to be effective in changing behaviors that lead to STIs, HIV, and unintended pregnancy, as detailed in a *Tool to Assess the Characteristics of Effective Sex and STD/HIV Education Programs.*[44] The program was created through consultation with community college administrators and educators, 18–19 year old community college students, psychologists, media researchers, and sexual health experts, as well as focus group and usability testing with the target user.

This study investigates the short-term efficacy of *Media Aware* on sexual health and media-related outcomes in older adolescents attending community college. Older adolescents are more likely to be involved in romantic relationships as well as more likely to be sexually active than younger adolescents. Therefore, it was hypothesized that the older adolescents who received the *Media Aware* program would show reductions in self-reported risky sexual behaviors as well as behavioral intentions in a short-term efficacy study. MLE attempts to redress inaccurate normative beliefs about the prevalence of sexual risk behaviors that are perpetuated in media messages. The *Media Aware* program also emphasizes skills practice related to contraceptive/protection use and sexual communication. Therefore, it was hypothesized that the program will have positive effects on known risk and protective factors related to sexual risk behaviors (i.e., attitudes, efficacy, and normative beliefs). It was also hypothesized that use of the program would result in improvements in media message cognitions and analytical skills.

Methods

Participants

A cluster randomized controlled trial (RCT) design was used to evaluate the efficacy of the *Media Aware* program for older adolescents (ages 18 and 19). Eight community college campuses in a southeastern state were selected and paired based on campus demographic characteristics (i.e., age, sex, race/ethnicity, rural/urban) for stratified sampling. Within each pair, campuses were randomly assigned to either the intervention (n=4) or a wait-list control (n=4) group. Our research goal was to recruit at least 25 students from each campus to result in a final sample of 200 participants.

A convenience sample of community college students from each campus was recruited to participate (M=35 students, SD=17; range 14 to 71). Inclusion criteria required participants be age 18 or 19 at the pretest data collection and be enrolled as a community college student (as documented by a student ID or college email address) at one of the eight participating community college campuses. Exclusion criteria included not being fluent in English, and not having a smartphone or tablet, either of which were needed to access the prevention program. Participants were not required to have a data plan to participate, because the program could be accessed using public Wi-Fi.

The final sample that completed the pretest included 281 participants (118 in the control group; 163 in the intervention group); 53.33% of the sample was 18 years old (n=136) and 46.67% was 19 years old (n=119). There were 147 participants who identified as female, 109 as male, 3 as transgender, and 1 as intersex. About 77% of the sample identified as heterosexual (n=217); 12% identified as LGBTQ (n=33); 3% were unsure of their sexual orientation (n=8); and 8% declined to answer (n=23). The racial breakdown of the sample was as follows: approximately 52% White or Caucasian (n=145); 24% Black or African American (n=68); 11% Multiracial (n=32); 7% other races (i.e., Asian; American Indian or Alaska Native; Pacific Islander or Native Hawaiian; n=9); and 6% did not respond (n=17). Approximately 21% of the sample identified themselves as Hispanic, Latino, or of Spanish descent (n=54).

The final sample of students that completed both the pretest and posttest included 184 participants (88 control group; 96 intervention group). Attrition did occur in different amounts for the intervention (41%) and the control group (25%), χ^2 (2, N=281) = 7.45, p<. 01. For the intervention group, 104 students completed the program, 46 students never logged into the program and could not be reached, and 13 students completed some of the program but did not finish. Of the 104 students who completed the program, 8 did not respond to the posttest questionnaire. For the control group, 88 students completed the posttest questionnaire and 30 students did not respond to the posttest questionnaire. Chi-squared analyses were conducted to determine 1) if the participants in the intervention group who dropped out of the study were different from the participants who dropped out of the study in the control group, and 2) if the participants who were retained in the study were different from participants who dropped out of the study. These analyses revealed no significant group differences for age (18 or 19), ethnicity, SES (as measured by Pell Grant eligibility), gender, sexual orientation, relationship status, STI status, pregnancy experience, dating violence experience, sexual experience for either set of attrition analyses.

Procedure

The methods and measures, as well as other aspects of ethical research (e.g., informed consent, anonymity/confidentiality), used in this study were approved by the innovation Research & Training Institutional Review Board (IRB). Students were recruited through campus tabling and print and online advertisements directed at the participating community colleges. Students interested in participating were screened by validating their age and student status. Eligible participants were given a link to an online consent form. Consented participants were then contacted by phone and given their unique study identifiers, which were used in place of their name for the purposes of the study. Participants were then sent a link to the pretest, a web-based questionnaire, through text message or email, as preferred. After completing the pretest, participants were notified as to whether they would receive *Media Aware* before the next questionnaire (intervention group) or after the next questionnaire (wait-list control group). Participants were assigned to the intervention or control group based on their community college's group assignment. Intervention group participants received log-in information to access the program from their mobile phone and were asked to complete the program within four weeks at their own pace. Intervention and control group participants were sent the posttest questionnaire four weeks after completing the pretest. Each participant received an incentive of a $20 gift card after completing each questionnaire. Each participant in the intervention group received an additional incentive of a $50 gift card after completing the *Media Aware* program.

Measures

Demographic and background characteristics—On the pretest, participants were asked to report on several basic demographic and background characteristics including age, sex, gender, race, ethnicity, sexual orientation, sexual health experiences (e.g., relationship status, ever had sex, STI status), and lifetime numbers of sexual risk behaviors (e.g., sex with a casual partner, sex with a partner of unknown STI status, sex with someone who has had many other partners, sex with someone who was engaging in sex with others during the same period, and using alcohol or drugs before or during a hook-up or sexual encounter).

Primary behavioral outcomes—The posttest (only) included items that assessed current rates of certain self-reported risky sexual behaviors in the past month, including number of times had sex with a casual sexual partner; number of times had sex with someone with an unknown STI status; number of times had sex with someone who has had many partners; number of times used alcohol or drugs before or during a hook-up or sexual encounter; and number of times had sex with someone engaging in sex with others in the same period. These items were adapted from a larger measure of sexual risk behaviors in college students (i.e., Sexual Risk Survey[45]).

Secondary outcomes—Participants' attitudes, injunctive normative beliefs, self-efficacy, willingness, and intentions related to risky sexual activity, condom/contraception use, and sexual health communication, as well as certain media-related constructs, were assessed at pretest and posttest (see Table 2 for sources, psychometric properties, and response scale options for these measures). Separate items assessed participants' descriptive norms or perceptions of the prevalence (i.e., percentage) of peers engaging in certain sexual behaviors, including having sex, having unprotected sex at last intercourse, having sex with a casual partner or someone you just met, and having sex while high or intoxicated (adapted from the Sexual Risk Survey[45]). The Knowledge of Sexual Risk and Protection questionnaire developed for this study consisted of 23 fact-based questions about the transmission of STIs, ways to reduce the risk of STIs, and the effectiveness of contraception/protective methods. A performance-based measure of media deconstruction skills asked participants to respond to open-ended questions about an alcohol ad (adapted from a measure used in previous MLE research studies demonstrating excellent reliability and validity[37,39,46]). Participants responded to the same ad at pre and posttest. The ad contained themes related to sexuality and romantic relationships as a means of promoting alcohol use.[39] The prompts included: "Tell us about the advertisement in the space below (the more detail the better);""How are advertisers trying to get someone to buy this product?;" and "What information, if any, is missing from the media message?" The resulting qualitative responses were coded using five categories (i.e., product, target audience, graphic elements, implied messages, missing information) designed to create an aggregate score to assess overall skill in deconstructing advertisements. Coders completed training prior to coding and inter-coder reliability was established using a set of similar data from another project (kappa > .70). After reliability was established for each of the categories, coders proceeded to code the final data set with one coder coding all data and a second coder coding at least 20% of each category. Reliability was checked intermittently throughout the coding process to monitor coder drift. Discrepancies between coder responses were resolved through conversations between the coders. The six category scores were summed to create the overall media deconstruction skills composite variable, with a total potential score ranging from a low of 0 to a high of 16. The reliability for the mean composite variable was acceptable ($\kappa = .78$).

Program satisfaction (intervention group-posttest only)—Four items using a Likert response scale were used to assess the participants' satisfaction with the program on 4-point Likert scales, with higher values indicating greater satisfaction (adapted from an evaluation of web-based MLE lessons[47]).

Fidelity of implementation—Sharable Content Object Reference Model (SCORM) allowed for process data to be communicated to a Learning Management System (LMS) web-application that hosted the program. This method provided a means for tracking program dosage (i.e., time users spent in the program) and adherence (i.e., number of unique interactions users completed) received by the intervention group participants.

Results

Preliminary analyses

Descriptive statistics were conducted on the outcome variables (see Table 3 for group means and standard deviations for pretest and posttest time points). Next, chi-squared and t-test analyses examined whether the randomization of campuses to conditions produced approximately equal samples in the control and intervention groups on important demographic variables and previous sexual experiences. Control and intervention groups did not significantly differ from one another at pretest (p>.05) on any analyzed variable, namely age, gender, ethnicity, SES (measured by Pell Grant eligibility), relationship status (single/partnered), STI status, sexual orientation, sexual experience, use of contraception/protection at last intercourse, previous pregnancy, lifetime number of casual sexual partners, lifetime number of intoxicated or high sexual experiences, lifetime number of sex with a partner of unknown STI status, or experience with unwanted sexual touching. Therefore, baseline equivalence between the intervention and control groups was established.

Fidelity of implementation

Dosage—Participants spent an average time of 2 hours, 52 min ($SD = 3$ hours, 2 min) and a median time of 2 hours, 1 minute using the program. Six participants spent less than 1 hour logged into the program, with a minimum time spent of 22 min. Six participants logged more than 5 hours in the program (up to a maximum of 16 hours, 47 min). These outliers are most likely explained by users failing to log out during time spent away from the program. Females spent slightly more time ($M = 3$ hours, 14 min; $SD = 3$ hours, 20 min) than males ($M = 2$ hours, 19 min; $SD = 2$ hours, 25 min), but the difference was not significant.

Adherence—There were a total of 270 unique clickable or data entry interactions in the program. Participants completed an average number of 267.38 interactions (99.03%; $SD = 12.26$), with a minimum of 200 interactions (74.07%) to a maximum of 270 interactions (100%).

Outcome analyses

Overview—Each outcome variable was assessed using SAS PROC MIXED, with campus affiliation serving as the cluster group. Pretest scores for secondary outcome variables were collected and included as predictor variables; therefore, outcome variable means are reported as adjusted posttest mean scores. Behavioral outcomes, the primary outcome variables, were reported for the past month, and therefore, do not include pretest values as covariates in these models. Hierarchical linear model analyses were used to investigate differences in students' primary and secondary outcomes using condition (intervention/control); gender (male/female); and the gender by condition interaction as independent variables.

Primary outcomes—Three intervention effects (two interactions and one main effect) were found for the primary outcome analyses, which examined self-reported behavioral outcomes (see Table 4). At posttest, participants were asked to report the number of times certain sexual risk behaviors occurred in the past month. Compared to males in the control group, males in the intervention group reported significantly fewer instances of oral, vaginal, or anal sex with a casual partner and significantly fewer instances of using drugs or alcohol before or during a hook-up or sexual encounter. Compared to the control group, both males and females in the intervention group reported fewer instances of oral, vaginal, or anal sex with someone who has not been tested for STIs or whose STI status is unknown. No significant differences were found in the past month between the intervention and control groups for the number of times the participant reported having sex with someone who has had many partners or the number of times the participant reported having sex with someone who was engaging in sex with others during the same period of time.

Secondary outcomes—Numerous significant intervention effects were also found in the secondary outcome analyses (see Table 5). A main effect was found for sexual health knowledge. At posttest, participants in the intervention group scored significantly higher on knowledge scores compared with control group participants. No changes in attitudes as a result of the intervention were found (i.e., for risky sex, for contraception/protection use, for communication). With respect to normative beliefs, as compared with the control group, participants in the intervention group reported less acceptance of rape myths at posttest [Not-rape (NR) scale]. Significant changes were not found for the other two subscales – He didn't mean to (MT) and She asked for it (SA). Several main effects were found for the program reducing students' descriptive normative beliefs about the frequency of sex and sexual risk behaviors. As compared with the control group, participants in the intervention group reported at posttest lower estimates of the percentage of peers having sex; percentage of peers having sex with a casual partner; and percentage of peers having sex while high or intoxicated. No significant changes were found for the descriptive norms associated with unprotected sex behaviors. Finally, no significant changes were found for injunctive normative beliefs about risky sex. At posttest, intervention group participants reported significantly higher levels of efficacy for both using dental dams and communicating about sex, as compared with the control group. No significant changes were found in self-efficacy for using condoms. Regarding future behaviors, females in the intervention group at posttest reported significantly more intention to use protection (i.e., condom or dental dam) during oral sex as compared to females in the control group, and intervention group participants reported less willingness to have sex without protection than control group participants. No significant changes were found for intentions to engage in risky sexual behaviors, to use condoms, or for sexual communication. In addition, an interaction effect with gender was found for media skepticism. At posttest, males in the intervention group reported significantly higher levels of media skepticism than males in the control group; whereas, females in the intervention group did not differ from females in the control group on media skepticism. No significant effects of the program were found for general measures of perceived realism or similarity to media messages, or for media deconstruction skills.

Program satisfaction—Students in the intervention group provided feedback on *Media Aware*. Mean ratings were calculated for the following questions (rated on 4 pt. Likert scales, for example ranging from a low of 1 for not at all to a high of 4 for extremely such that higher values indicated more positive feedback): how interesting was the program (M=3.03; SD=.85); how much did you learn from this program (M=2.73; SD=.84); how glad are you that you used this program (M=3.08; SD=.82); and how likely is it that you would recommend this program to a friend (M=3.04; SD=.83). Overall, students reported having a positive experience using the program.

Comment

This is the first study, to the best of our knowledge, to demonstrate that a sexual health promotion program that uses an MLE framework can reduce adolescents' self-reported risky sexual behaviors. Previously, research has identified the promise of MLE for positively impacting adolescent sexual health outcomes through improvements in attitudes, efficacy, and even, behavioral intentions, but no studies have demonstrated the impact of MLE on self-reported sexual behaviors. Specifically, the *Media Aware* program resulted in students reporting that they engaged in fewer risky sexual behaviors in the past month, including fewer instances of sexual activity with someone who has not been tested for STIs or whose STI status is unknown, fewer instances of sexual activity with a casual partner (males only), and fewer instances of using drugs or alcohol before or during a sexual encounter (males only). These are important behavioral findings, given that older adolescents are at increased risk for the consequences of risky sexual behaviors, such as unplanned pregnancy and STIs, and because community college students engage in higher rates of sexual risk taking behavior than other individuals of the same age. Previous research exploring the impact of MLE on sexual risk behaviors has primarily focused on prevention with early and middle adolescents, who are either years from or just beginning the onset of sexual activity. This study extends previous research by examining the influence of MLE sexual health programming into older adolescence, when youth are more likely to be involved in romantic relationships and/or sexually active. In addition, this study contributes to knowledge of the sexual health of community college students as research on older adolescents and young adults has not typically focused on students attending two-year institutions of higher education.

In addition to the behavioral findings in this study, *Media Aware* resulted in a change in students' acceptance of certain beliefs about sexual health behaviors. Media messages often depict youth, particularly young adults, engaging in frequent and risky sexual behaviors without any negative consequences. One of the central components of MLE is to influence students' normative beliefs about risky behaviors by teaching them how to critically analyze media messages and question the accuracy of the information being communicated. Throughout *Media Aware,* students engaged in critical analyses of media messages and compared the information being presented in the messages (e.g., people engage in unprotected sex all the time without any negative consequences), to real-life, medically-accurate facts (e.g., engaging in unprotected sex can result in unplanned pregnancy and/or STI transmission). Importantly, *Media Aware* resulted in an increase in students' skepticism of sexually-themed media messages (for males, specifically). Specific to advertising, higher

levels of media skepticism are related to decreased susceptibility of being persuaded by the message.[48] Therefore, it is plausible that increased skepticism of sexually-themed media messages could attenuate the persuasive effects of the media on sexual behaviors. There is evidence that *Media Aware* successfully redressed inaccurate normative beliefs about how frequently peers engage in sexual activity, especially with regard to risky sexual behaviors (i.e., sex with a casual partner, sex while intoxicated), as well as lowered acceptance of rape myths regarding what constitutes sexual assault (i.e., It's not rape if….). These are important findings given the national spotlight on sexual assault, which has revealed a surprising and disappointingly high prevalence among older adolescents,[49] that is due, in part, to confusion around what constitutes consent and sexual assault. When students have a more accurate understanding of rape and consent, this increased understanding has the potential to result in fewer incidents of sexual assault and less victim blaming.

Notably, *Media Aware* armed older adolescents with medically-accurate health information that may have been missing from their previous formal sexual education experiences and that is traditionally missing from popular media, including information on how STIs are transmitted, ways to reduce the risk of STIs, and the effectiveness of contraception/ protective methods. For these students, completing this program resulted in a significant increase in sexual health knowledge, positive attitudes about contraception, and efficacy to use certain kinds of contraception and communicate about sexual health. They also reported a decreased willingness to have sex without some form of protection, an important finding given that willingness has been found to be a more predictive measure of future behavior than intentions.[50]

In summary, this study revealed that *Media Aware* positively influenced many sexual health-related outcomes, including reducing self-reported risky sexual behaviors, among community college students. While most youth will be provided with sexual health education in secondary school at least once before graduating, the content of the education they receive may be medically inaccurate, biased, and/or insufficient, demonstrating the need for effective, evidence-based, sexual health programming for older adolescents. Also, most community colleges do not require or provide formal sexual education programming for their students, even though sexual activity typically increases throughout adolescence, with the majority of teen pregnancies occurring among older adolescents.[51] Furthermore, community college students face additional barriers to accessing adequate sexual health information and medical care compared to their four-year college peers. Therefore, effective, engaging, and easy-to-implement sexual health promotion programming for older adolescents attending community college is urgently needed. This study demonstrates that *Media Aware* is an effective and engaging sexual health intervention for this population. Finally, the fact that the program can be accessed in a mobile format makes it easier for colleges to deliver to a large number of students than face-to-face instruction, which requires both faculty (e.g., a trained sexual health educator) and facilities (i.e., classroom space). In addition, the administrative capability of the software application supports administrators' ability to both monitor fidelity of implementation and course completion.

This study had several strengths. First, it used a rigorous experimental design involving stratified randomization of community college campuses to conditions based upon student

demographic characteristics. Second, the study included a diverse sample of college participants. Third, this study examined a population that is rarely the focus of research studies or health interventions, namely, community college students. This population is an underserved group of older adolescents with regards to sexual health promotion, compared to their peers attending traditional four-year institutions. Fourth, this study addressed an important barrier to health promotion access by utilizing an mHealth intervention that was accessible on demand. Finally, regarding program dosage, the web-based delivery of the program allowed for objective data collection from students and revealed that the majority of intervention participants completed close to 100% of the program interactivities.

Limitations

There were a few limitations to this study, which identify possible avenues for future research. This study was used to evaluate the short-term efficacy of *Media Aware*, with primary and secondary outcome measures assessed four weeks after participants completed the program. It would be important for future research to examine whether the impact of this program is sustained over time by conducting a longer-term follow-up study. Additionally, in this evaluation, the control group participated in a business-as-usual group (i.e., in the case of older adolescents attending community college, this means not receiving specific sex education resources). Therefore, it is not possible to determine whether *Media Aware* is a more effective intervention for sexual health promotion in older adolescents than other evidence-based sexual health programs. Future research should confirm how MLE works to reduce self-reported risky sexual behaviors using a mediator analysis, and investigate whether the mechanisms of change are different than traditional sex education programming. Another limitation is that the risky sexual behavioral outcomes were self-reported by adolescents and not observed directly. Threats to the validity of self-reported behaviors include social desirability bias and cognitive demands associated with recalling past acts. This study used online data collection with a secret ID number and included a control group, which should reduce the potential impact of social desirability. Also, the window for recalling behaviors was limited to the past month to help reduce cognitive demands of recalling sexual behaviors over an excessive time in the past. In addition, as the sample for this study included only 18- and 19-year-old students attending community college, it is not clear if these findings will generalize to other similar groups, including older adolescents attending four-year colleges, older adolescents not involved in higher education settings, or young adults 20 years old and above, without future study. This study used a convenience sample of community college students, which may also limit the generalizability of the results. Finally, there is a possibility of selection bias in this study. For example, more motivated or sexually active youth may have been more interested in participating in the study than youth who do not believe sexual health is important or relevant to them.

Conclusions

Media Aware positively impacted a number of older adolescents' self-reported sexual risk behaviors and important secondary outcomes related to media influence and sexual health. Taken together, the findings from this research study suggest that MLE is a promising means of delivering comprehensive sexual health education to older adolescents attending community college. It contributes to and builds upon previous MLE research by providing

evidence of the effectiveness of MLE programming to impact the antecedents of and self-reported sexual risk taking adolescent behavior. Students who used *Media Aware* reported high levels of satisfaction with the program. MLE programs can capitalize on older adolescents' heavy media engagement to promote healthier sexual attitudes, normative beliefs, and behaviors. Furthermore, a web-based, mobile format for MLE programming is an important strategy to provide sexual education to larger numbers of youth, who are traditionally hard-to-reach. The findings from this study have important implications for adolescent sexual health promotion among community college students, the use of mHealth technology to disseminate evidence-based programming, and research on media influence and media literacy education.

Acknowledgments

Abbreviations

MIP Model Message Interpretation Process Model

MLE media literacy education

SME sexual media exposure

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Table 1

Topics included in the *Media Aware* program

	Lesson Focus
Lesson 1	• Introduction to the program (e.g., create a personal program profile; select personal, educational, and health-related goals) • Reflect on personal media use and explore the ways that media and media messages influence sexual decision-making and sexual health
Lesson 2	• Identify gender stereotypes and unrealistic sexual expectations perpetuated and normalized in media messages, and counter those messages with factual information about gender and sexual behaviors. • Explore media representations of romantic relationships, and counter portrayals of unhealthy and abusive relationship behaviors with evidence-based information about the realities of unhealthy and abusive romantic relationships.
Lesson 3	• Reflect on the normativity of risky sexual behaviors, including sex and substance use, and the lack of consequences often associated with these behaviors depicted in media messages, and counter this information with medically-accurate sexual health information about risky sexual behaviors and their consequences. • Identify the ways in which media messages normalize and glamorize sexual violence, and counter those messages with accurate information about consent and sexual assault.
Lesson 4	• Discover that media messages often leave out information about contraception and STI protection, giving the perception that unprotected sex is normative and free of consequences, and counter these messages with medically-accurate information about unplanned pregnancy, STIs, and contraception/STI protection. • Compare information provided in media messages about the effectiveness of contraception, which often underrepresents the effectiveness of condoms and other forms of birth control, with medically-accurate information about these methods.
Lesson 5	• Explore that ways in which media messages frequently leave out conversations between partners and with medical professionals about contraception/STI protection, and counter those messages with facts about the importance of effective communication related to sexual health. • Learn a variety of strategies for effectively communicating with romantic partners about sexual health topics, and practice communicating with a virtual medical professional about sexual health using a branching scenarios activity. • Program summary (e.g., revisit personal goals to expand on how they will be accomplished).

Table 2

Scale information and psychometrics for secondary outcome variables.

Outcomes	#	Sample Item	α
Intentions			
for risky sexual activity	11	In the next 6 months, how likely is it that you will use alcohol or drugs before or during sex?	0.93
to use condoms during sexual intercourse	1	If you were to decide to have sex in the next 6 months, how likely would you be to use a condom?	--
to use protection during oral sex	1	If you were to decide to have oral sex in the next 6 months, how likely would you be to use a condom or dental dam?	--
for sexual health communication	6	If you were to decide to engage in sexual activity, how likely would you be to talk with your partner about condoms/contraception?	0.89
Willingness to engage in unprotected sex[a]	1	Suppose your boy/girlfriend wanted to have sex, but neither of you have protection. How willing would you be to have sex anyway?	--
Attitudes			
About risky sexual activity[b]	10	It is okay to use alcohol or drugs before or during a sexual encounter.	0.90
about contraception/protection use[c]	9	Condoms should always be used if a person has casual sex.	0.72
about sexual health communication[d]	4	Before deciding to have sex, people should talk with their partner about HIV/AIDS and other STIs.	0.89
Rape myth acceptance[e]			
He didn't mean to (MT)	4	Rape happens when a guy's sex drive goes out of control.	0.78
She asked for it (SA)	4	When girls go to parties wearing slutty clothes, they are asking for trouble.	0.83
It wasn't really rape (NR)	5	If a girl doesn't say 'no' she can't claim rape.	0.84
Self-efficacy[d]			
for condom use	1	I can use a condom correctly or explain to my partner how to use a condom correctly.	--
for dental dam use	1	I can use a dental dam correctly or explain to my partner how to use a dental dam correctly.	--
about sexual health communication	4	I can talk to any potential partner to make him/her understand why we should use condoms or other contraception.	0.86
Injunctive norms about risky sexual activity[b]	10	People my age believe it is okay to use alcohol or drugs before or during a sexual encounter.	0.91
Skepticism of sexually-themed media messages[f]	3	The media are dishonest about what might happen if people have sex.	0.86
Perceived realism[g]	2	People my age in the media act like average people my age.	0.77
Perceived similarity[g]	7	I am like the people in the media.	0.78

Note: 4pt. Likert scale (e.g., 1 = Strongly Disagree to 4 = Strongly Agree).

[a] adapted from Gibbons, Gerrard, Blanton, & Russell (2014)

[b] adapted from Turchik & Garske (2007)

[c] adapted from Basen-Engquist et al., (1999)

[d] adapted from Soet, Dudley, and DiIorio (1999) self-efficacy scale

[e] adapted from Illinois Rape Myth Acceptance-Short Form (IRMA-SF; 7 pt. scale); Payne et al., (1999); McMahon & Farmer (2011)

[f] adapted from Scull, Malik, & Kupersmidt (2014)

[g] adapted from Austin & Johnson (1997)

Table 3

Descriptive statistics for outcome variables between intervention and control groups (means and standard deviations) among 18–19 year old community college students.

Outcome	Pretest				Posttest			
	Control		Intervention		Control		Intervention	
	M	SD	M	SD	M	SD	M	SD
Intentions								
for risky sexual activity	1.66	0.66	1.63	0.61	1.61	0.70	1.49	0.54
to use condoms during intercourse	2.28	1.08	2.20	1.08	2.38	1.13	2.37	1.11
to use condom/dam during oral sex	3.21	0.89	3.14	0.94	3.07	1.02	3.29	0.85
For sexual health communication	3.09	0.70	3.09	0.66	3.04	0.81	3.18	0.57
Willingness to have sex without protection	2.19	1.01	2.24	0.96	2.25	0.96	2.00	0.90
Attitudes								
about risky sexual activity	1.89	0.60	2.02	0.61	1.90	0.71	1.90	0.57
about contraception/protection use	3.22	0.42	3.30	0.39	3.19	0.48	3.39	0.47
about sexual health communication	3.37	0.65	3.43	0.59	3.42	0.74	3.55	0.52
Rape myth acceptance								
He didn't mean to (MT)	2.31	0.80	2.22	0.75	2.09	0.86	2.14	0.78
She asked for it (SA)	2.07	0.76	2.07	0.76	1.95	0.77	1.91	0.73
It wasn't really rape (NR)	1.56	0.56	1.62	0.56	1.60	0.63	1.53	0.57
Efficacy								
for condom use	3.43	0.74	3.38	0.77	3.44	0.79	3.51	0.63
for dental dam use	2.08	1.00	2.10	1.03	2.23	1.08	2.72	0.95
about sexual health communication	3.35	0.57	3.33	0.57	3.29	0.72	3.44	0.50
Injunctive norms								
About risky sexual activity	2.95	0.53	2.91	0.51	2.80	0.68	2.81	0.60
Descriptive norms								
Sexual activity	76.08	17.23	75.63	16.05	74.14	18.56	63.05	22.09
Unprotected sex at last intercourse	52.29	24.79	49.87	24.15	52.23	22.94	45.18	23.14
Sex with casual partners	52.05	26.93	47.09	25.38	48.98	26.58	37.54	24.20
Sex while high or intoxicated	50.21	34.59	47.36	26.20	46.33	24.73	37.13	26.94

Outcome	Pretest				Posttest			
	Control		Intervention		Control		Intervention	
	M	SD	M	SD	M	SD	M	SD
Skepticism (sexually-themed media messages)	3.19	0.51	3.08	0.59	3.03	0.67	3.25	0.62
Perceived realism	2.43	0.69	2.51	0.77	2.48	0.74	2.30	0.75
Perceived similarity	2.07	0.49	2.04	0.55	1.99	0.57	1.96	0.56
Media deconstruction skills	4.61	1.69	4.50	2.00	4.08	1.71	4.55	1.90
Sexual health knowledge	16.73	2.67	16.83	2.45	16.27	2.86	17.64	2.67
Behaviors (past 30 days)								
Had sex with a casual partner					1.74	3.03	0.36	0.84
Had sex with someone of unknown STI status					1.62	2.99	0.40	1.45
Had sex with someone who has had many partners					0.67	1.62	0.31	0.90
Used drugs/alcohol before or during a hook-up or sexual encounter					1.04	5.26	0.51	1.87
Had sex with someone engaging in sex with others in same period					0.25	0.81	0.02	0.15

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Table 4

Primary behavioral outcomes between intervention and control groups (number of times in the past month) (least square means) among 18–19 year old community college students.

Primary Outcome	Condition						
	Control		Intervention				
	M	SE	M	SE	df	F	d
Had sex with a casual partner							
Male	2.05	0.40	0.36	0.43	75	4.05*	.58
Had sex with someone of unknown STI status	1.84	0.33	0.25	0.36	78	10.47**	.70
Had sex with someone who has had many partners	0.76	0.24	0.31	0.27	78	1.52	
Used drugs/alcohol before or during a hook-up or sexual encounter							
Male	2.73	0.82	0.22	0.84	147	5.48*	.46
Had sex with someone engaging in sex with others in same period	0.33	0.12	0.02	0.13	76	3.27	

Note:

*
p<.05;

**
p<.01.

Table 5

Results from analyses of secondary outcomes between intervention and control groups (adjusted posttest least square mean scores) among 18–19 year old community college students.

Secondary Outcome	Condition				df	F	d
	Control		Intervention				
	M	SE	M	SE			
Intentions							
for risky sexual activity	1.56	0.04	1.55	0.04	168	0.05	
to use condoms during intercourse	3.28	0.10	3.46	0.10	167	1.19	
to use protection during oral sex							
Female	3.06	0.10	3.42	0.09	165	2.60 *	.52
for sexual health communication	3.03	0.07	3.18	0.07	168	2.35	
Willingness to have sex without protection	2.22	0.08	2.01	0.08	168	4.00 *	.28
Attitudes							
about risky sexual activity	1.95	0.05	1.85	0.05	171	1.93	
about contraception/protection use	3.20	0.04	3.34	0.04	170	5.11 *	.36
about sexual health communication	3.41	0.07	3.50	0.07	170	0.99	
Rape myth acceptance							
He didn't mean to (MT)	2.08	0.07	2.21	0.07	171	1.59	
She asked for it (SA)	1.94	0.09	1.90	0.09	171	0.13	
It wasn't really rape (NR)	1.65	0.05	1.50	0.05	171	4.33 *	.31
Efficacy							
for condom use	3.44	0.11	3.58	0.11	166	0.91	
for dental dam use	2.24	0.14	2.71	0.14	163	5.89 *	.36
about sexual health communication	3.27	0.06	3.46	0.06	167	4.84 *	.34
Injunctive norms about risky sexual activity	2.82	0.08	2.85	0.08	169	0.04	
Descriptive norms							
Sexual activity	73.45	1.85	63.41	1.87	164	14.50 ***	.58
Unprotected sex at last intercourse	49.90	2.18	45.80	2.21	164	1.73	
Sex with casual partners	46.23	2.47	38.91	2.53	163	4.15 *	.31

Secondary Outcome	Condition							
	Control		Intervention					
	M	SE	M	SE	df	F	d	
Sex while high or intoxicated	45.63	2.50	37.45	2.55	162	5.22*	.35	
Skepticism (sexually-themed media messages)								
Male	2.88	0.10	3.44	0.10	170	3.94***	.74	
Perceived realism	2.50	0.12	2.21	0.12	170	1.74		
Perceived similarity	2.00	0.06	2.09	0.06	171	0.13		
Media deconstruction skills	4.09	0.26	4.42	0.26	161	0.82		
Sexual health knowledge	16.34	0.29	17.53	0.28	161	8.77**	.44	

Note:

*
p<.05;

**
p<.01;

***
p<.001.