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Long-term Outcomes of the ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) Program for Female High School Athletes

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Abstract

Adolescence and emerging adulthood are critical windows for establishing life-long behaviors. We assessed long-term outcomes of a prospective randomized harm reduction/health promotion program for female high school athletes. The intervention's immediate beneficial effects on diet pill use and unhealthy eating behaviors have been reported; however, tobacco, alcohol and marijuana use were not immediately altered (Elliot et al, 2004). One to three years following graduation, positive benefits in those domains became evident, and intervention students reported significantly less lifetime use of cigarettes, marijuana, and alcohol. Sport teams may be effective vehicles for gender-specific interventions to promote competency skills and deter harmful actions, and those benefits may manifest when acquired abilities are applied in new environments following high school graduation.

Keywords

adolescents; emerging adults; team-centered; school-based; harm reduction; alcohol; tobacco; marijuana; disordered eating

INTRODUCTION

High school is a critical window for drug prevention. During late adolescence, substance use approximately doubles, and unhealthy behaviors established as teenagers can have lifetime adverse consequences (Johnston, O'Malley, Bachman, & Schulenberg, 2004; National Center on Addiction and Substance Abuse, 1997). Although evidence-based prevention curricula are available for middle school students (Robertson, David, & Rao, 2003; U.S. Department of Health and Human Services, 2001), in high school classroom-based activities appear less effective, perhaps because gender-specific issues and peer-group influences become more prominent (Botvin, & Griffin, 2003; Faggiano et al., 2005; Rohrbach & Milam, 2003). Few

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ATHENA is a program on the Substance Abuse and Mental Health Services Administration's National Registry of Evidence-based Programs and Practices (http://www.nrepp.samhsa.gov/programfulldetails.asp?PROGRAM_ID=111), and it is distributed through the Center for Health Promotion Research at Oregon Health & Science University (OHSU). OHSU and Drs. Elliot and Goldberg have a significant financial interest from the commercial sale of technologies used in this research. This potential conflict of interest has been reviewed and managed by the OHSU Conflict of Interest in Research Committee.

school-based programs with documented efficacy are available for older adolescents (SAMHSA, 2008).

School sport teams are natural formats for bonded student-athletes to meet for gender-specific health promotion. The ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) program is a sport team-based harm reduction and health promotion program. Its development and positive immediate outcomes have been reported (Elliot et al., 2004; Elliot et al., 2006). The program achieved significant short-term reductions in new and ongoing diet pill use and appropriate changes in targeted risk and protective factors. However, alcohol, tobacco, and marijuana use also were addressed in the curriculum, and when assessed immediately following the program, intervention participants did not alter their self-reported use of those substances.

High school graduation and the transition to college or full-time employment are a period of increased vulnerability to substance abuse (Johnston et al., 2005; Mohler-Kuo, Lee, & Wechsler, 2003; O'Malley & Johnston, 2002). Because the ATHENA program emphasized decreasing risk factors for health compromising actions and augmenting life competency skills, we hypothesized that additional positive outcomes may become evident over time. To identify longer-term effects, we reassessed control and intervention ATHENA study participants one to three years following high school graduation.

METHODS

Details of ATHENA's development and its immediate outcomes have been reported (Elliot et al., 2004; Elliot et al., 2006). Eighteen public high schools from northwest Oregon and southwest Washington participated in a prospective randomized trial of the ATHENA intervention. Schools had a spectrum of locales to reduce potential cross-contamination. They were matched in dyads based on size and student demographics. An individual unfamiliar with participating schools used a program for generating random numbers to assign one member of paired schools to the intervention or control group, with the other school going to the alternative condition. After randomization, we met with intervention schools' athletic directors and coaches and offered participation to all women's sports, dance and cheerleading teams. For intervention teams electing to participate, we successfully recruited the similar team from its matching control school. Study enrollment was offered to all student-athletes from involved teams.

Immediate outcomes were assessed with confidential pre and post-sport season questionnaires, and students and their parents or guardians provided written informed consent. Because the mailed survey was not included in our original study consent, students could not be tracked with confidential surveys following high school graduation and anonymous instruments were used. For the follow-up data reported here, we mailed surveys to graduates who were older than 18 years of age at the time assessed, and passive consent was used for the graduates' mailed anonymous follow-up questionnaires. The Institutional Review Board of Oregon Health & Science University approved all procedures.

Intervention

The ATHENA curriculum was delivered during eight 45-minute team meetings, scheduled at the coach's discretion and integrated into a team's usual practice activities. The curriculum's development and scope have been described (Elliot et al., 2004; Elliot et al., 2006). It addressed depression prevention, self-esteem, healthy norms and societal pressures to be thin. Media influences were countered by directing student athletes to discuss, deconstruct, and remake magazine advertisements for cigarettes, alcohol, and nutritional supplements. Participants established shared healthy behavioral expectations, practiced refusal skills, and created and

presented to teammates public service campaigns to discourage drug use and disordered eating practices. The curriculum provided information about strength training and sports nutrition, including adequate carbohydrates, sufficient protein and appropriate calcium intakes.

During the season, team members met as a single group, partitioned into coach assigned six member squads, each with a coach assigned student leader. The coach and squad leaders used manuals with scripted lessons, and others had matching workbooks. The female-only, peer-led format may have further increased participants' self-esteem, assertiveness, and social skills (American Association of University Women Education Foundation, 1995; Sadker & Sadker, 1994). All team members received pocket-sized sport nutrition and training guides, which contained reference information and worksheets used with curriculum activities. Between ATHENA sessions, manuals and workbooks were stored in a team box in the equipment room or coach's office. Control teams were offered preprinted pamphlets concerning disordered eating, drug use and sports nutrition information.

Assessment

Intervention and control participants completed confidential questionnaires prior to and immediately following the sport season. We assessed knowledge, influences on drug use and disordered eating, and participant characteristics using items from our earlier research (Goldberg et al., 2000) and surveys concerning disordered eating (Neumark-Sztainer, Wall, Story, & Perry, 2003; Rosen, & Silberg, 1988), depression (Radloff, 1977), self-image (Offer & Howard, 1972) and self-esteem (Rosenberg, 1965). Substance abuse questions used a format similar to the Youth Risk Behavior Survey (Eaton et al., 2006).

In the summer of 2004, one year after the intervention's last year, we sent a one page anonymous survey and a self-addressed, stamped envelope to all intervention and control participants who had completed high school and were 18 years of age and older, using their original addresses. After approximately two weeks, non-respondents received a second mailing. Because response rate may vary inversely with survey length (Jepson, Asch, Hershey, & Ubel, 2005), the mailed questionnaire was brief and limited to demographics, drug use and eating behaviors, and selected attitudes. We indexed alcohol, tobacco and illicit drug use and disordered eating behaviors using our original standardized format. For less frequent behaviors (smoking and marijuana use), we compared last year and lifetime use, and for the more prevalent alcohol use, we indexed past three month and last year use. We also presented a spectrum of female physiques (Stunkard, Sorensen, & Schulsinger, 1983) and asked respondents to identify the most healthy and most attractive representation. The final mailed instrument could be completed in less than 10 minutes.

Data Analyses

Baseline equivalence and shorter-term intervention effects were examined using an analysis of covariance-based approach within the generalized estimating equations random effects model framework (Hardin & Hilbe, 2003). For the follow-up survey, subjects were no longer clustered on teams and in schools. Drug use measures were recoded into dichotomous responses, as is typical of many long-term outcome studies (Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995; Skara & Sussman, 2003). We examined the association between participants' study condition and their long-term drug and alcohol use with logistic regression, using years since graduation as a covariate in the analyses, and since we hypothesized specific *a priori* directional findings, inferences were based on one-tailed significance tests (Hardin & Hilbe, 2003; Winer, 1971). Odds ratios less than 1 indicate success of the ATHENA program on reducing drug use among graduates. Body image responses were assessed with t-tests.

RESULTS

Baseline Participant Characteristics, Attrition and Program Fidelity

At initial enrollment intervention and control participants had similar demographic parameters, baseline drug use and disordered eating indices and pre to post-season attrition (Table 1). All intervention coaches implemented ATHENA, and all intervention and control teams were retained in the study. Fidelity to the ATHENA curriculum was high, and intervention teams were observed to implement $80.8 \pm 0.2\%$ (mean \pm SD) of content items.

Immediate Effects

The findings of the initial pre to post-sport season findings have been reported (Elliot et al., 2004; Elliot et al., 2006). Following ATHENA participation, intervention student-athletes reported significantly less ongoing and new use of diet pills and less new use of athletic enhancing substances (amphetamines, anabolic steroids and sport supplements) ($p < 0.05$ for each). The program's curriculum components were altered appropriately (better able to control mood [$p < 0.005$], less belief in the media [$p < 0.001$], greater strength training self-efficacy [$p < 0.005$] and healthier eating behaviors [$p < 0.001$]). During the initial ATHENA study, the pre to post-sport season use of tobacco, alcohol and marijuana were unchanged and did not differ between conditions.

Graduates' Findings

All eligible participants (graduates older than 18 years of age) were included in the follow-up mailing. A total of 757 young women were sent surveys (368 intervention, 389 control). After an initial and second mailing, response rates for the two conditions were similar, and intervention and control respondents did not differ in years since graduation, their current situation and whether they continued to participate in sports, cheerleading and dance (Table 2).

Self-reported drug use at the time of the follow-up survey is shown in Table 3. One to three years following high school graduation, ATHENA intervention participants had significantly less regular marijuana use ($p < 0.01$ for both last year and lifetime use) and reduced alcohol use indexed as three-month ($p < 0.01$) and last year use ($p < 0.05$). Although the prevalence of cigarette use was low overall, it was significantly less for ATHENA intervention graduates when assessing those with regular ongoing use (defined as ≥ 40 times lifetime use) ($p < 0.05$). Self-reported use of other substances (e.g., club drugs, ecstasy, GHB, 'roofies,' LSD) was low (less than five percent of all respondents reported any use in the last year), and that prevalence did not differ between groups. Overall use of diet pills, diuretics, laxatives and self-induced vomiting also became less prevalent over time, with less than ten percent of all subjects indicating those activities in the last three months; no difference was observed between conditions in that outcome.

More ATHENA program participants knew their daily calcium requirement (66.3% intervention versus 40.0% control, $p < 0.0001$), and that knowledge difference was reflected in intervention graduates being more likely to indicate adequate calcium intake (odds ratio 2.15 [1.44–3.21], $p < 0.0001$). Interestingly, when asked to select the most healthy and most attractive female physiques, for both situations, the ATHENA intervention graduates indicated a significantly heavier body image than control participants ($p < 0.05$ and $p < 0.01$, respectively) (Figure 1).

DISCUSSION

In short-term study, the ATHENA program succeeded in its curriculum objectives and achieved a decrement in disordered eating practices and body-shaping drug use (Elliot et al., 2004; Elliot et al., 2006). However, when habits were assessed immediately after the program, participation did not appear to alter use of alcohol, marijuana, or tobacco. Although middle school drug prevention programs can impact immediate substance use, that short-term efficacy may be attenuated as students mature (Ellickson, Bell, & McGuigan, 1993; Skara & Sussman, 2003). In contrast to the decrement in favorable effects over time observed among middle school students, the ATHENA program's beneficial behavioral outcomes seemed to increase over time and were evident following high school graduation.

Two types of influences may have accounted for the observed long-term reductions in substance use. First, as with most other effective drug prevention programs (Botvin, 2000; Brook, Brook, Richter, & Whiteman, 2003; Goldberg et al., 2000), the ATHENA curriculum advances drug resistance abilities, along with general social, communication, and decision-making skills. However, unlike middle school programs, where students usually are reassigned to new classes each year, ATHENA is delivered to a sport team, and even after the season, ongoing teammate contact may provide a mechanism to continue practicing and reinforcing those positive life competency skills.

Evidence for that mechanism comes from findings with the ATLAS (Athletes Training & Learning to Avoid Steroids) program, which is a parallel sport team-based drug use prevention and health promotion program for adolescent male athletes. ATLAS was assessed prospectively among football teams from 16 control and 15 intervention high schools pre-season, post-season and one year later (Goldberg et al., 1996; Goldberg et al., 2000). Immediate significant positive effects included reduced use of anabolic steroids and an index of illicit drug and alcohol use ($p < 0.04$ and $p < 0.01$, respectively), along with appropriately altered mediators of those outcomes (MacKinnon et al., 2001). Observing changes pre to post-season and one year later, some immediate benefits appeared attenuated at one-year, such as healthy eating habits. However, other actions showed greater longer-term effects. For example, cumulative new occurrences of driving under the influence were not different between groups immediately after ATLAS, while at one year, they were significantly less among intervention participants ($p < 0.005$) (Goldberg et al., 2000), suggesting healthy norms and decision-making may have been endorsed and practiced among team members following football season.

A second factor relates to a change in students' environment. High school-based programs are embedded in a developmental and social context that may constrain behavior change and limit initial drug use efficacy (Lilja, Wilhelmsen, Larsson, & Hamilton, 2003; Zigler, Taussig, & Black, 1992). In the short term, the harmful actions favorably impacted by the ATHENA program were diet pill use and disordered eating behaviors, which often are solitary or secretive activities among young women. The existing high school norms for alcohol and other drug use may have limited the program's impact on those substances' use. However, the ATHENA intervention reduced risk factors and enhanced protective factors. Similar to its male counterpart ATLAS and other effective prevention programs (Botvin, 2000; Brook, Brook, Richter, & Whiteman, 2003; Goldberg et al., 2000), it was designed to target psychological well being and social competence. Beneficial drug use effects only may have become evident when ATHENA graduates faced new challenges and choices and could apply those abilities in different settings following high school.

In addition to harm reduction, the ATHENA intervention appeared to have sustained positive effects on dietary behavior. The differences in calcium knowledge and reported intake are striking and may relate to the information's relevance when presented to young women athletes

(Ireland & Ott, 2004). The finding especially may be important because of the recognized relationship between adolescents' adequate calcium intake and bone health later in life (Greer & Krebs, 2006).

Although the relative differences in the figure representations are small, they were significant and are of magnitudes found when examining differences between sexes or across generations (Fallon & Rozin, 1985; Rozin & Fallon, 1988). In other settings, body satisfaction was a predictor of healthier behaviors (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006). The interplay of body image, media representations, psychological states and dietary habits are complex (Borzekowski & Bayer, 2005; Stice, 2002). However, reductions in young women's normative discontent towards their physiques also may be a durable positive programmatic outcome.

We recognize that our findings have limitations. Assessment following high school graduation was not included in the original study consent, and accordingly, we were limited to anonymous follow-up and could not link subjects' short-term outcomes with their mailed survey results. Although mailed questionnaires have limitations, the percent returned surveys and participant characteristics were similar for intervention and control respondents. Conclusions from mailed surveys achieving comparable response rates generally are valid (Brogger, Bakke, Eide, & Gulsvik, 2003; Gilbert, Longmate, & Branch, 1992). Ethnic minorities were underrepresented among our study subjects, reflecting both local demographics and the relatively lower participation of female minority students in school sports (Lopiano, 2003), and our findings may not be applicable to those groups.

Because our findings are based on self-report, they can be biased by situational and cognitive factors (Brener, Billy, & Grady, 2003). Never-the-less, when assured of confidentiality or anonymity, survey findings are considered valid, and biochemical measures usually confirm self-reports (Harrison & Hughes, 1997). In addition, the lack of efficacy reported for most school-based smoking prevention interventions suggest that program participation alone does not bias outcomes (Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005). Finally, when specifically studied, young women's response to a prevention intervention did not appear to be biased by social desirability, and self-report was a valid indicator of program effects (Tilgner, Wertheim, & Paxton, 2004).

Although conventional wisdom may associate athletics with character building and healthy habits, support for those is mixed, at best. Male and female high school sport participants are not uniformly protected from harmful behaviors, including alcohol and other drug use (Fisher, Juszczak, & Friedman, 1996; French, Story, Downes, Resnick, & Blum, 1995; Naylor, Gardner, & Zaichkowsky, 2001). In fact, the jock mentality, for males and females, may be associated with greater health risks (Miller, Melnick, Barnes, Sabo, & Farrell, 2007). Young male athletes have more binge drinking (Miller, Melnick, Farrell, Sabo, & Barnes, 2006), and young women may be more predisposed to disordered eating habits (Ireland & Ott, 2004), which may predict greater risk for later alcohol abuse (Franko, Dorer, Keel, Jackson, Manzo & Herzog, 2005). Combining the lack of documented benefits from athletics with an over emphasis on winning at all costs have caused some to question the wisdom of school sports in general (Miracle & Rees, 1994).

However, athletics are growing in popularity; currently half of female and male adolescents participate in school-sponsored sports (U.S. Department of Health & Human Services, 1996). Coaches' incorporating health enhancement programs, such as ATHENA and ATLAS, into existing team activities has several unique advantages beyond a natural non-stigmatizing gender-specific setting. First, programs can be introduced without adding time to existing class hours. Second, athlete led training activities are common on sport teams, and program

facilitation by teammates may add to efficacy. Meta-analysis of drug-prevention programs concluded that peer-led interventions can be superior to teacher-directed programs (Black, Tobler, & Sciacca, 1998). Finally, coaches, due to their many student contact hours and influential positions, have been termed ‘missing links’ in adolescent health promotion (Brown & Butterfield, 1992). Their familiarity with playbooks and limited prep time may have augmented coaches’ adherence to scripted lesson plans and avoided the reinvention and reduced efficacy of drug-use programs that has been observed among classroom teachers (Silvia & Thorne, 1997).

High school sport team-based programs are an effective new paradigm to promote healthy lifestyles and deter harmful behaviors. Beneficial effects may accrue further following the sport season and become even more apparent following graduation, when these emerging adults establish relationships with new peer groups and apply those abilities. The findings support augmenting sports’ health-enhancing mission by incorporating effective harm reduction and health promotion curriculum into those settings.

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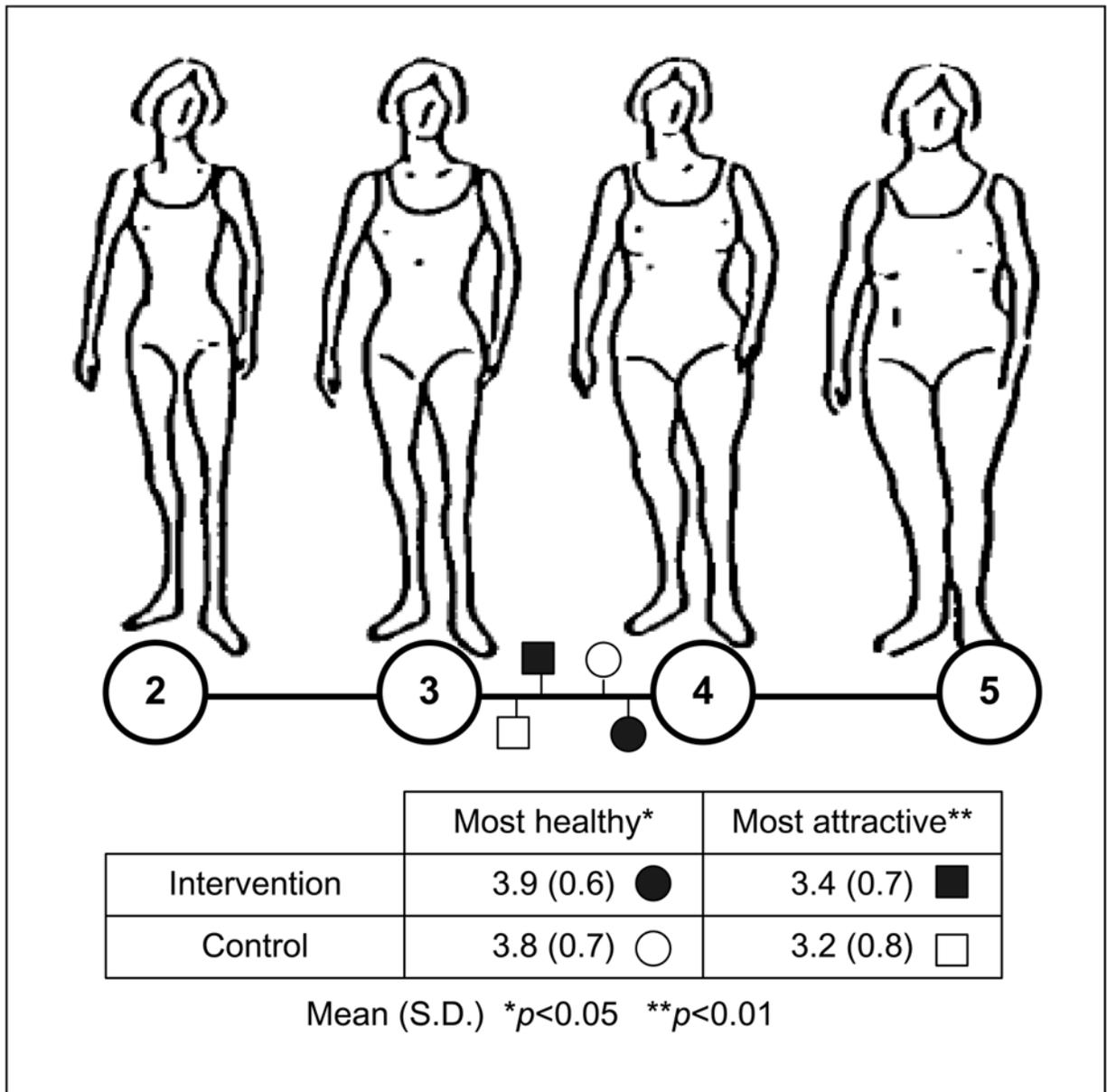


Figure 1.
Most Healthy and Most Attractive Physiques

Table 1

Initial Study Baseline Characteristics

| | Intervention | Control |
|--|---------------------|----------------|
| Number of schools | 9 | 9 |
| Total participating teams | 20 | 20 |
| Students preseason | 457 | 471 |
| Students postseason (% retained) | 337 (74%) | 331 (70%) |
| Mean age in years (SD) | 15.4 (1.2) | 15.3 (1.2) |
| Percent Caucasian | 93.6% | 91.4% |
| Self-reported prior alcohol use | 52% | 47% |
| Self-reported prior tobacco use | 27% | 33% |
| Self-reported prior marijuana use | 19% | 19% |
| Self-reported prior diet pill use | 14% | 11% |
| Self-reported prior fasting to lose weight | 28% | 26% |

Table 2

Follow-up Survey Participant Characteristics

| | Intervention | Control |
|--|---------------------|----------------|
| Surveys mailed | 368 | 389 |
| Total responses | 203 (55%) | 197 (51%) |
| Current situation | | |
| College or trade school | 188 (90%) | 184 (90%) |
| Working | 16 (8%) | 17 (8%) |
| Other | 6 (3%) | 3 (1%) |
| Years since graduation | | |
| One | 104 (50%) | 95 (47%) |
| Two | 67 (32%) | 72 (35%) |
| Three | 39 (19%) | 37 (18%) |
| Continued participation in sports, cheerleading or dance | 132 (63%) | 122 (60%) |

Table 3
Findings One to Three Years Following High School Graduation

| Variable | Intervention (prevalence [%]) | Control (prevalence [%]) | Odds Ratio (95% confidence Interval) [†] |
|-------------------------------|-------------------------------|--------------------------|---|
| Marijuana Use | | | |
| Used ≥40 times in last year | 2% | 7% | 0.26 ^{**} (0.09–0.82) |
| Used ≥40 times in lifetime | 5% | 13% | 0.38 ^{**} (0.18–0.79) ^{**} |
| Alcohol Use | | | |
| Use ≥6 times in last 3 months | 27% | 41% | 0.55 ^{**} (0.36–0.84) |
| Use ≥20 times in last year | 25% | 35% | 0.61 [*] (0.39–0.95) |
| Cigarette Use | | | |
| Used ≥20 times in last year | 8% | 12% | 0.63 (0.33–1.22) |
| Used ≥40 times in lifetime | 9% | 16% | 0.52 [*] (0.28–0.94) |

[†] Control participants were used as the reference group in calculating the odds ratio, and calculations were controlled for graduation year. An odds ratio < 1 indicates ATHENA intervention participants were less likely to engage in the behavior.

* $p < 0.05$,

** $p < 0.01$