

Spillover Effects in a Combined Exercise and Alcohol Education Intervention

Risky drinking behaviors (e.g., binge drinking, excessive drinking) among college students represent an important individual and public health concern. Although considerable effort has been devoted to alcohol-related education and intervention campaigns, and evidence suggests that such interventions can be effective (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronic, 2007), the overall level of problematic drinking behavior reported by college students remains high. According to the Substance Abuse and Mental Health Services Administration (Center for Behavioral Health Statistics and Quality, 2016), 27.8% of persons between the ages of 18-20 and 45.7% of persons between the ages of 21-25 reported binge drinking (5 drinks or more, for males, and 4 drinks or more, for females, on one occasion) at least once within the past month. Thus, improving the reach and effectiveness of alcohol-related interventions remains a high priority for researchers, health care providers, university administrators, and other concerned stakeholders.

In addition to alcohol-related interventions, college students are increasingly the focus of a wide variety of other healthy-lifestyle interventions, such as those that focus on exercise (e.g., Mailey et al., 2010) or nutrition (e.g., Poddar, Hosig, Anderson, Nickols-Richardson, & Duncan, 2010). This raises an important question: is it beneficial or harmful to integrate multiple aspects of healthy behavior into one intervention? Is an intervention that incorporates both exercise and responsible alcohol consumption more effective than an alcohol-related intervention alone, or do the two foci of the intervention compete for participants' time and attention, rendering it less effective overall?

Theories of *spillover* suggest that either of these alternatives could be plausible. *Positive* spillover occurs when an intervention increases not only the specific behavior it is intended to

increase, but also other related behaviors (e.g., Truelove, Carrico, Weber, Raimi, & Vandenberg, 2014). For example, some studies suggest that those who recycle are more likely to adopt other pro-environmental behaviors later, such as purchasing organic food (Thøgersen & Ölander, 2003). Other studies suggest that when one member of a married couple makes a positive health behavior change, the other member of the couple also experiences positive health changes (Falba & Sindelar, 2008). In both cases, the efforts of individuals to make lifestyle changes extend beyond the specific behavior they originally targeted.

Truelove and colleagues (2014) suggest that there are two reasons why we might expect to see positive spillover: *consistency* and *identity*. Longstanding psychological theory suggests that people are motivated to behave in consistent ways, particularly when they are likely to be observed by others (e.g., Festinger, 1957). Thus, if an intervention targeting both exercise and alcohol consumption is framed as an overall health intervention, participants who seek to improve in one domain may be more motivated to improve in both. If both exercise and responsible alcohol consumption are healthy behaviors, then a person who engages in one and not the other may appear inconsistent. Motivation to behave consistently is often linked to theories of identity, in that people often develop perceptions of their identities based on their past behaviors (Bem, 1967). Thus, a person who engages in one healthy behavior change may come to incorporate “healthy” into their view of their own identity, increasing the likelihood that they will engage in other behaviors they perceive as “healthy” in the future. These arguments suggest that a health intervention focused on one domain (alcohol consumption) would show enhanced effectiveness when integrated with a second, related domain (exercise) due to positive spillover.

However, other research suggests that spillover effects may just as easily be *negative* – that is, making a change to engage in one behavior may make other related behaviors *less* likely.

For example, Tiefenbeck, Staake, Roth, and Sachs (2013) tracked the effects of a water consumption intervention in a large apartment complex. The intervention was successful; the residents who experienced the intervention reduced their water use, but those same residents also increased their energy consumption (compared to a control group) over the same period of time. In another context, participants who believed they were taking a dietary supplement (a healthy behavior) exercised less than participants who took the same pill but were aware that it was a placebo (Chiou, Yang, & Wan, 2011).

This pattern of results is often explained by the theory of *moral licensing*, in which engaging in a positive action, or even reflecting on past or hypothetical positive actions, can increase the likelihood that a person will engage in a negative action (Merritt, Effron, & Monin, 2010). Merritt and colleagues propose that when people can justify viewing themselves as generally moral individuals, their self-views are less threatened by instances of less moral behavior, and so they are not motivated to resolve the discrepancy between their self-views and their actions. If this theory applies to the context of health behavior generally, it would suggest that combining healthy lifestyle interventions – or even exposing the same individuals to multiple interventions – is likely to be counterproductive, as those who make positive changes in one domain may feel licensed to continue negative behavior in another domain.

To test these competing theoretical explanations, we designed a study in which we integrated an exercise intervention with an intervention promoting responsible alcohol consumption. We recruited college student volunteers for the study and randomly assigned them to an aerobic exercise program, a weight-training exercise program, or a condition in which they followed their usual exercise habits over a period of six weeks. In addition to the exercise program, half of the participants in each condition also participated in an alcohol-related

intervention that was effective in previous research (Neighbors, Larimer, & Lewis, 2004). We compared the self-reported alcohol consumption of all groups of participants at the end of the study. As extraversion is an established predictor of alcohol consumption (Cook, Young, Taylor, & Bedford, 1998), we also measured extraversion.

Method

Participants

We posted flyers across the campus of a large Midwestern university inviting students who were interested in making healthy lifestyle changes to participate in a research study. Participants were eligible if they were enrolled at the university (so that they would have access to the university fitness center), reported exercising no more than once per week at the start of the study, and reported that they drank alcohol at least occasionally. Participants were compensated \$10 for each week that they completed all study activities (participating in exercise sessions, if applicable, and completing food, exercise, and alcohol logs), with a \$20 bonus for completing all six weeks of the study (thus, the maximum compensation was \$80).

Materials

Exercise program. We adapted the exercise intervention from a combination of previous studies: a circuit weight-training program used by Williams and Cash (2001) and an existing aerobic exercise program used by the university's fitness center. We randomly assigned participants to either the weight-training program, the aerobic program, or a control condition in which we asked them to record their exercise for six weeks but to refrain from making any changes to their exercise habits in that time. Participants in the weight-training and aerobic conditions each attended three 30-minute sessions per week for the six weeks of the study, in facilities provided by the university fitness center. All sessions were led by trained fitness

instructors, certified by the fitness center. We trained all of the fitness instructors to follow consistent procedures for the study, though we did not inform them of the study hypotheses.

Alcohol consumption intervention. We used a personalized normative feedback intervention developed by Neighbors and colleagues (2004). We randomly assigned half the participants in each exercise condition to the alcohol consumption intervention and half to the control condition. Participants assigned to the alcohol consumption intervention completed an online assessment that asked about not only their drinking behavior, but also their perceptions of drinking norms, their motives for drinking, and their expectations about the social consequences (positive and negative) of drinking alcohol. As soon as they completed the assessment, they received an electronic report comparing their responses with actual norms for their campus (based on a study conducted two years previously with a representative sample of over 1000 students at the university). Considerable previous research supports the idea that students tend to perceive others as drinking more heavily and finding drinking more socially acceptable than is in fact the case; as a result, providing feedback about actual drinking norms tends to encourage students to reduce their drinking behavior (Larimer & Cronce, 2007).

Measures

To measure alcohol consumption, we used the Alcohol Consumption Index (ACI), originally developed by Knee and Neighbors (2002). The ACI contains 8 items, each of which is scored on a scale from 0 to 6, so possible scores range from a minimum of 0 to a maximum of 48. In the intervention study by Neighbors and colleagues (2004), this measure was sensitive enough to show differences across a three-month interval, so we anticipated that it would be sufficiently sensitive to show change in the current study.

To measure extraversion, we used a measure from the International Personality Item Pool (Goldberg, 1999) based on Goldberg's (1992) personality markers. This scale consists of 10 items in statement format, all beginning with "I...", to which the participant responds by indicating how true they believe the item is of them on a scale from 1 = "not true of me at all" to 7 = "very true of me." For example, one item is "I... am the life of the party." This scale has previously demonstrated good convergent validity with other scales and acceptable levels of internal consistency ($\alpha = .86$).

We tracked participants' attendance at scheduled workout sessions directly, so participants did not need to self-report their exercise behavior. To avoid demand characteristics that might occur if participants were aware that alcohol consumption was the main outcome of interest, we also asked participants to keep a food diary; once per day, they were asked to log into the study's website and list everything they had eaten or drunk in the previous 24 hours. Although this method is relatively simple, prior research suggests that it correlates quite well with more sophisticated measures (Bingham, et al., 1994). Although the alcohol consumption reported in the food diaries was, on average, slightly greater than the alcohol consumption reported by the ACI, the two measures correlated above .90.

Procedure

The recruitment flyers mentioned above directed participants to the study website. Prospective participants who accessed the website first completed three screening questions: their enrollment status at the university and their current levels of exercise frequency and alcohol consumption. Those who met the eligibility criteria listed earlier then viewed an informed consent statement, approved by the university's Institutional Review Board, that outlined the activities involved in the study, the possible risks, and the requirements to obtain compensation.

Participants who consented to participate in the study indicated their consent electronically and then provided us with their contact information.

A graduate research assistant scheduled all participants for an individual orientation. Before each orientation session, the research assistant rolled a die to determine which study condition the participant would be assigned to. During the orientation, the research assistant reviewed the major procedures and requirements of the study and gave the participant a chance to ask questions before confirming their informed consent. All participants then completed the extraversion measure, and received instructions in how to record their weekly exercise and food diary. Participants assigned to the alcohol intervention completed the online baseline assessment and received their personalized normative feedback, printed for their future reference.

Participants who were assigned to the control conditions for the exercise intervention were asked to schedule a follow-up appointment in six weeks and dismissed. Participants assigned to the aerobic or weight-training exercise conditions were given a choice of several exercise time slots. Over the six weeks of the study, there were three scheduled workouts per week for each participant. We tracked attendance at these sessions; participants who missed more than three workouts across the six weeks were dropped from the study. However, 83% of the initial participants completed at least 15 of the 18 possible workouts.

At the end of the six-week period, all participants returned for a follow-up visit. All completed the ACI at this appointment. A member of the research team explained the purpose of the study, thanked participants, paid them the compensation they had earned and offered them an opportunity to request the results of the research.

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