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Authors

Yonek, Juliet C
Meacham, Meredith C
Shumway, Martha
et al.

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Smoking reduction is associated with lower alcohol consumption and depressive symptoms among young adults over one year

Juliet C. Yonek[a,b,*], **Meredith C. Meacham**[a], **Martha Shumway**[a,b], **Marina Tolou-Shams**[a,b], **Derek D. Satre**[a,c]

[a]Department of Psychiatry and Behavioral Sciences, Weill Institute for Neurosciences, University of California at San Francisco, 401 Parnassus Ave, San Francisco, CA 94143, USA

[b]Zuckerberg San Francisco General Hospital and Trauma Center, 1001 Potrero Avenue, San Francisco, CA 94110, USA

[c]Division of Research, Kaiser Permanente Northern California Region, 2000 Broadway, Oakland, CA 94612, USA

Abstract

Background: This secondary analysis examined whether smoking reduction among young adults participating in a Facebook-based smoking cessation intervention study was associated with corresponding reductions in alcohol consumption and depressive symptoms.

Methods: Participants were young adults who smoked and engaged in heavy episodic drinking (HED). Alcohol consumption (AUDIT-C, days of HED), depressive symptoms (PHQ-2), and past-month cigarettes per day (CPD) were self-reported at baseline and 12 months (N = 150). Linear regression estimated the relationship between the mean change in CPD and mean changes in alcohol consumption and depressive symptoms.

Results: CPD, alcohol consumption, and depressive symptoms decreased significantly between baseline and 12 months. The adjusted mean reduction in CPD was significantly associated with mean reductions in AUDIT-C (Beta [β] = 0.09, 95 % confidence interval [CI] = 0.04–0.14), days of HED (β = 0.17, 95 % CI = 0.04–0.29) and PHQ-2 (β = 0.05, 95 % CI = 0.01–0.08). Smoking abstinence (n = 48) was associated with a significantly larger mean reduction in AUDIT-C compared to a ≥50 % reduction (n = 45) (−2.9 vs −1.7 points, p = 0.03) or <50 % reduction in CPD (n = 57) (−2.9 vs −1.1 points, p < 0.01). The mean reduction in AUDIT-C did not differ between a ≥50 % reduction and <50 % reduction in CPD (−1.7 vs. −1.1 points, p = 0.18). Mean

*Corresponding author at: Zuckerberg San Francisco General Hospital and Trauma Center, 1001 Potrero Avenue, Building 5, 7M15, San Francisco, CA 94110, USA. juliet.yonek@ucsf.edu (J.C. Yonek).

Contributors

DDS was the principal investigator of the study. He contributed to the study rationale and critical revision of the manuscript. JCY provided the initial study rationale, conducted statistical analyses, and drafted the manuscript. MCM provide access to the dataset, assisted with data interpretation, and contributed to editing of the manuscript. MS advised on the analyses and assisted with data interpretation. MTS contributed to editing of the manuscript. All authors have approved the final manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

reductions in days of HED and the PHQ-2 did not differ according to the level of reduction in CPD.

Conclusion: Smoking reduction was associated with reductions in alcohol consumption and depressive symptoms. Reductions appeared to be greater for those who achieved abstinence compared to a reduction in smoking.

Keywords

Smoking reduction; Alcohol; Binge drinking; Depression; Young adult

1. Introduction

Tobacco and alcohol are often used simultaneously by young adults, and smoking is prevalent among those who engage in heavy episodic drinking (HED) (i.e., 5+ drinks for men and 4+ drinks for women) (Wechsler et al., 1995). In 2017, 58.4 % of 18–25 year-olds from the United States (U.S.) who reported past-month HED also smoked (SAMHSA, 2017). Concurrent HED and smoking reduces the likelihood of a quit attempt (Weinberger et al., 2013) and achieving abstinence (Cook et al., 2012). Heavy drinking smokers are also less likely to succeed at reducing alcohol use (Fucito et al., 2012). Smoking and alcohol co-use intensifies craving for both substances (Piasecki et al., 2011; Roche et al., 2016), which share neurobiological substrates (Hendrickson et al., 2013). Co-occurrence might also be explained by the Theory of Triadic Influence (TTI) (Flay et al., 2009) and the Transtheoretical Model (Prochaska and Di Clemente, 1983). TTI posits that alcohol and nicotine use co-occur due to shared consequences, e.g., emotion regulation (Lippke et al., 2012). Under the Transtheoretical Model, changes in one risk behavior may influence motivation to change other behaviors (Ramo et al., 2019b).

These theories suggest that integrating alcohol content within smoking cessation programs may help reduce drinking. In one study, participants who received integrated treatment were more likely to achieve smoking abstinence and reduce HED episodes relative to standard treatment (Ames et al., 2014). Although smoking abstinence is difficult for heavy drinkers (Kahler et al., 2010), reducing smoking quantity could help reduce alcohol consumption.

Smoking and depression are also highly interrelated among young adults (Halperin et al., 2010). Depressed individuals are more likely to smoke and less likely to quit than smokers without depression (Weinberger et al., 2020). Contributing factors include lower positive and higher negative affect and perceived improvement in symptoms with smoking (Mathew et al., 2017; Twyman et al., 2014).

Smoking cessation is associated with reduction in depressive symptoms (Kahler et al., 2011; Taylor et al., 2014); however, the relationship between smoking reduction and depressive symptoms is less clear. One study found that larger reductions in smoking predicted greater reductions in depressive symptoms (Lechner et al., 2019).

This secondary analysis examined whether reduction in number of cigarettes smoked per day (CPD) over 12 months among heavy drinking young adults participating in a smoking

cessation trial was associated with reductions in alcohol consumption and depressive symptoms. In the parent study, both interventions showed significant declines in smoking, alcohol consumption, and depressive symptoms over 12 months (Meacham et al., 2021). We hypothesized that reduction in CPD would be associated with reductions in alcohol consumption and depressive symptoms. We also examined whether change in both outcomes varied according to level of reduction in CPD.

2. Methods

2.1. Data source and study sample

Data are from the Smoking Tobacco and Drinking (STAND) Study, a randomized trial addressing tobacco and alcohol consumption among young adults. Participants were recruited through Facebook and Instagram. Ads were targeted by age (18–25), location (U.S.), and language (English) (Meacham et al., 2021). Eligible participants were aged 18–25 who currently smoked 4+ days/week, and reported one+ HED occasion in the past month. Study methodology has been reported previously (Ramo et al., 2019a). Briefly, participants were assigned to private Facebook groups with daily intervention posts and weekly live counseling for 12 weeks. Intervention participants (N = 85) received content addressing tobacco and alcohol use, and control participants (N = 94) received tobacco-only content. Participants completed online assessments at baseline, 3-, 6-, and 12-months. The University of California San Francisco Institutional Review Board approved the study procedures.

2.2. Measures

2.2.1. Change in CPD—Participants reported CPD in the past 30 days. The primary independent variable was change in CPD, calculated as 12-month minus baseline CPD, with positive values indicating an increase in smoking, negative values indicating a decrease, and 0 indicating no change.

A categorical measure of change in CPD assessed differences in alcohol consumption and depressive symptoms according to the level of reduction in CPD from baseline. Categories were: abstinent (i.e., 100 % reduction); ≥50 % reduction (i.e., a reduction of 50 %–99 %); and <50 % reduction (includes participants for whom CPD did not change, decreased by <50 %, or increased from baseline). A ≥ 50 % reduction is considered clinically significant (Hughes and Carpenter, 2005; Mcrobbie et al., 2014).

2.2.2. Change in alcohol consumption—Alcohol consumption was assessed with The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) and days of HED in the prior 30 days. The AUDIT-C includes 3 questions about past-year alcohol consumption (Bush et al., 1998; Rubinsky et al., 2013): 1) ‘How often do you have a drink containing alcohol?’, 2) ‘How many drinks containing alcohol do you have on a typical day when you are drinking?’, and 3) ‘How often do you have six or more drinks on one occasion?’. Response options are scored 0–4 points, and total AUDIT-C scores range 0–12 points. Scores of ≥5 for men and ≥4 for women indicate hazardous drinking (Moehring et al., 2019).

Change in AUDIT-C was calculated as 12-month minus baseline AUDIT-C score. Possible change scores ranged from −12 to 12, with negative values reflecting decreased drinking, positive values reflecting increased drinking, and 0 reflecting stable drinking.

Participants reported past-month days of HED, defined as 4+ drinks in one occasion for women and 5+ drinks for men. Change in days of HED was calculated as 12-month minus baseline days, such that negative values indicate reduction in HED, positive values indicate increased HED, and 0 indicates no change.

2.2.3. Change in depressive symptoms—Depressive symptoms were assessed using the Patient Health Questionnaire-2 (PHQ-2), a validated 2-item screener (Kroenke et al., 2003). Total scores range from 0 to 6. A PHQ-2 score of 3 or higher indicates likely depressive disorder. Respondents were categorized as above (≥3) or below (≤2) the threshold for probable depression at baseline and 12 months.

Change in symptoms was calculated as 12-month minus baseline PHQ-2 score, such that negative values indicate reduction in symptoms, positive values indicate increased symptoms, and 0 indicates no change.

2.2.4. Demographics—Demographic characteristics included baseline age, and gender identity (male, female or transgender/non-binary), and race/ethnicity.

2.3. Statistical analyses

2.3.1. Descriptive analyses—Paired t-tests assessed relationships between baseline and 12-month values for CPD, AUDIT-C, days of HED, and PHQ-2. Bivariate analyses were conducted to identify demographic and intervention group differences in mean change in AUDIT-C, days of HED, and PHQ-2, and categorical change in CPD.

2.3.2. Regression analyses—Separate linear regression models estimated associations between change in AUDIT-C, change in HED, and change in PHQ-2 (dependent variables) as a function of change in the number of CPD (independent variable), modeled as both continuous and 3-level categorical variables. The categorical CPD measure was used to compare changes in alcohol and depressive symptoms between participants who quit smoking, reduced smoking by ≥50 %, and reduced smoking by <50 %. All models were adjusted for baseline age, gender, intervention condition, and baseline value for the corresponding dependent variable. Although there were no longitudinal differences between intervention groups on CPD, both alcohol consumption measures, and PHQ-2 (Meacham et al., 2021), intervention condition was included as a covariate to adjust for any unmeasured confounding. Analyses were conducted using SPSS Version 23.0 (Armonk, NY: IBM Corp).

3. Results

3.1. Descriptive findings

Of 179 enrolled participants, 151 (84 %) remained in the study at 12 months. Fewer males and younger participants completed the 12-month assessment. One participant was excluded due to missing baseline CPD. The final sample (N = 150) was 44.4 % female,

9.9 % transgender/non-binary, 78.8 % non-Hispanic White, and on average 22.2 years of age (standard deviation (SD) = 2.17; Table 1). Mean baseline CPD was 10.3 (SD = 7.0). Participants averaged 8.8 HED days in the past month (SD = 8.2), and 71.5 % had an AUDIT-C indicating hazardous drinking. Forty-three percent had a PHQ-2 indicating risk of major depressive disorder (3+).

At 12 months, mean CPD, AUDIT-C, HED, and PHQ-2 were significantly lower than baseline (Table 1). Thirty-two percent (n = 48/150) were abstinent, 30 % (n = 45/150) reduced CPD by ≥50 %, and 38 % (n = 57/150) reduced CPD by <50 %. There were no significant demographic or intervention differences between those who quit, reduced CPD by ≥50 %, or reduced CPD by <50 %; mean reduction in CPD, AUDIT-C, HED, and PHQ-2 also did not differ by demographic variables or intervention condition (not shown).

3.2. Regression analysis results

When modeled as a continuous measure, change in CPD was associated with changes in AUDIT-C and HED after adjusting for age, gender, intervention condition, and baseline value of either AUDIT-C or HED (AUDIT-C: Beta [β] = 0.09, 95 % confidence interval [CI] = 0.04–0.14; days of HED: β = 0.17, 95 % CI = 0.04–0.29). Intervention condition was not significantly associated with either measure of alcohol consumption. Fig. 1 shows the adjusted mean change in AUDIT-C and HED according to categorical change (reduction) in CPD from baseline. Smoking abstinence (i.e., 100 % reduction) was associated with a larger mean reduction in AUDIT-C (−2.9 points, 95 % CI=−3.5 to −2.2) as compared to ≥50 % reduction in CPD (−1.7 points, 95 % CI=−2.5 to −1.1) ($p = 0.03$) and <50 % reduction (−1.1 points, 95 % CI=−1.7 to −0.5) ($p < 0.01$). Mean reduction in AUDIT-C did not differ between ≥50 % and <50 % reduction in CPD ($p = 0.18$). The mean reduction in HED did not significantly differ according to level of CPD reduction. However, results for AUDIT-C and HED suggest a potential dose-response relationship with the magnitude of smoking reduction, in that larger reductions in CPD were associated with larger reductions in both alcohol measures.

For depressive symptoms, change in continuous CPD between baseline and 12 months was associated with change in PHQ-2 (β = 0.05, 95 % CI = 0.01–0.08). Intervention condition was not independently associated with change in PHQ-2. The mean change in PHQ-2 did not differ by level of smoking reduction (not shown).

4. Discussion

This study examined whether smoking reduction was associated with reductions in alcohol consumption and depressive symptoms. It contributes to the literature by focusing on potential benefits of reducing CPD as well as smoking abstinence for heavy drinking young adults. In contrast, the current literature mostly has focused on total abstinence from smoking among populations with heterogeneous drinking behaviors.

Between baseline and 12 months, reduction in CPD was associated with reductions in alcohol consumption. Abstinence was associated with greater reduction in alcohol use, relative to smoking reduction. This is consistent with prior research examining the

relationship between smoking abstinence and alcohol consumption (Berg et al., 2015; Hammett et al., 2019; Przulj et al., 2018). Because nicotine often increases alcohol consumption (and vice versa) (Roche et al., 2016), one might anticipate abstinence to have a larger effect on drinking than a reduction in smoking. Additionally, achieving abstinence may have been motivating for participants wanting to abstain from or reduce drinking (Lippke et al., 2012).

Smoking reduction was associated with decreased depressive symptoms. This finding addresses a concern shared by clinicians and smokers alike: reducing or quitting may negatively affect mood (Sheals et al., 2016). While mood may be negatively impacted by reduction in smoking short-term, it may improve long-term. Additionally, cutting down on CPD may reduce harms caused by smoking among depressed smokers not yet ready to quit. In contrast to a prior study (Lechner et al., 2019), reduction in PHQ-2 did not vary according to level of smoking reduction.

This study has several limitations. Results may not generalize to heavy drinking young adults who have not participated in a smoking cessation intervention. The sample was predominantly non-Hispanic White. Smoking quantity, alcohol consumption, and depressive symptoms were self-reported and thus potentially subject to recall bias. The study may not have been sufficiently powered to evaluate a dose-response association between categorical change in CPD and days of HED and depressive symptoms.

4.1. Conclusions

Few studies have examined potential benefits of smoking reduction versus abstinence with respect to hazardous drinking and depressive symptoms in young adults. Study findings suggest that reductions in smoking may reduce alcohol consumption and alleviate depression. Reducing CPD without cessation could assist harm-reduction approaches to HED. For depressed smokers, reducing smoking may result in reduced nicotine dependence and improved mood.

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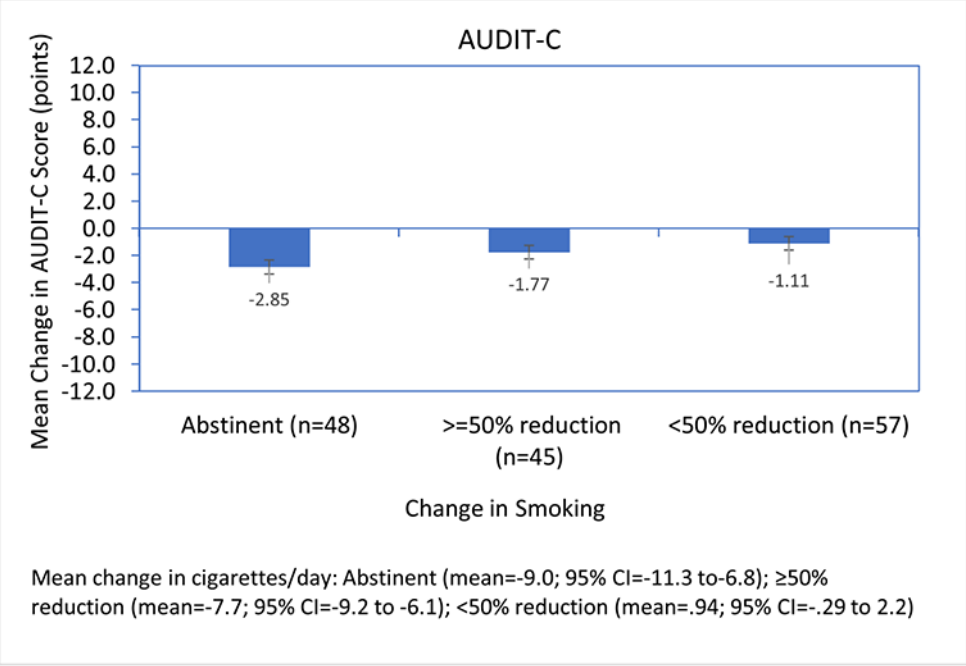

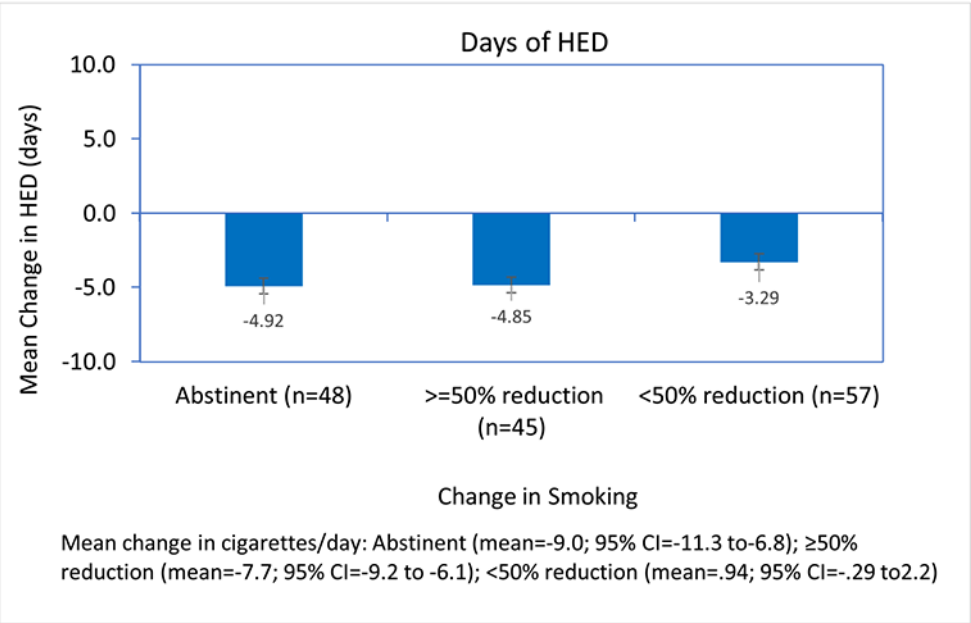

Fig. 1.

Adjusted association between the percent change in cigarettes smoked per day and change in measures of alcohol consumption between baseline and 12 months.

Table 1

Smoking, Drinking, and Depression Characteristics of Study Participants Baseline and 12 months (N = 150).

	Baseline % (n)	12 months % (n)	p-value
Cigarette Smoking			
Number of cigarettes smoked per day (CPD), Mean (SD)	10.3 (7.0)	5.4 (7.2)	<.001
Percent change in number of CPD from baseline			
<50 % reduction	–	38.0 (57)	
≥50 % Reduction (50 %–99 % reduction)	–	30.0 (45)	
Abstinent (100 % reduction)	–	32.0 (48)	
Readiness to quit smoking in the next 30 days			
No	65.6 (99)	47.3 (71)	
Yes	34.4 (52)	20.7 (31)	<.001
Have already quit	0.0 (0)	32.0 (48)	
Alcohol Consumption			
AUDIT-C, Mean (SD)	5.7 (2.7)	3.8 (2.8)	<.001
AUDIT-C categories			
Hazardous drinking (score ≥5 for males and ≥4 for females)	71.5 (108)	43.0 (65)	<.001
Days of HED past 30 days, Mean (SD)	8.8 (8.2)	4.6 (6.7)	<.001
Days of HED categories			
≤ 2 days	27.3 (41)	56.0 (84)	
3 – 14 days	47.3 (71)	34.7 (52)	.003
15 – 30 days	25.3 (38)	9.3 (14)	
Depressive Symptoms			
PHQ-2, Mean (SD)	2.9 (1.9)	2.6 (2.1)	.032
PHQ-2 categories			
≤ 2	56.7 (85)	56.0 (84)	.004
≥3	43.3 (65)	44.0 (66)	

AUDIT-C - The Alcohol Use Disorders Identification Test-Consumption. The AUDIT C asks: 1) How often do you have a drink containing alcohol? [Never (0 points), Monthly or less (1 point), Two to four times a month (2 points), Two to three times a week (3 points), Four or more times a week (4 points)]. 2) How many drinks containing alcohol do you have on a typical day when you are drinking? [1 or 2 (0 points), 3 or 4 (1 point), 5 or 6 (2 points), 7–9 (3 points), 10 or more (4 points)]. 3) How often do you have six or more drinks on one occasion? [Never (0 points), Less than monthly (1 point), Monthly (2 points), Weekly (3 points), Daily or almost daily (4 points)]. Possible AUDIT-C scores range 0–12 points.

HED - heavy episodic drinking, i.e., 4+ drinks in an occasion for women and 5+ drinks for men.

PHQ-2 - Patient Health Questionnaire-2. The PHQ-2 asks individuals how often they have been bothered by the following over the last 2 weeks: 1) Little interest or pleasure in doing things, and 2) Feeling down, depressed, or hopeless. Response options are Not at all (0 points), Several days (1 point), More than half the days (2 points), Nearly every day (3 points). Possible PHQ-2 scores range 0–6 points. A PHQ-2 score of 3 or higher indicates elevated risk of major depressive disorder.