



## Changing multiple health risk behaviors in CHOICES

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### ABSTRACT

Multiple health behavior change (MHBC) intervention trials to date have only considered behaviors that were *directly* targeted. Research has yet to consider how untargeted behaviors can affect change in behaviors directly targeted by an intervention or how changes in targeted behaviors might lead to changes in other, untargeted behaviors. This study addresses these gaps with a secondary analysis of change in risk drinking (targeted behavior) and smoking (behavior that was not addressed) in the efficacy trial of CHOICES, an intervention for the prevention of alcohol-exposed pregnancies. Measures included the Timeline Followback for daily alcohol consumption and questions about smoking behavior. Participants were women of childbearing age who were at risk of alcohol-exposed pregnancy at baseline. Baseline smokers were less likely to change their drinking behavior than baseline non-smokers at nine months ( $n = 579$ ) with Odds Ratio (OR) of 0.681 (95% CI = 0.471–0.985); 41.1% of smokers vs 50.6% of non-smokers reduced drinking to below risk levels (< 5 drinks/day and < 8 drinks per week). Meanwhile, smokers who had changed their drinking behavior were more likely than smokers who had not changed their drinking behavior to have also quit smoking at nine months (OR = 2.769; 95% CI = 1.533–5.000); 19.5% vs. 8.1%, respectively. Together, these findings suggest a natural tendency towards change of multiple related behaviors and indicate that while the presence of unaddressed risk behaviors may make a targeted behavior change more difficult, change in one behavior may facilitate change in related behaviors, even when they are not addressed.

### 1. Introduction

Health-risk behaviors such as risky alcohol use and cigarette smoking are a leading cause of preventable morbidity and mortality (Asarnow et al., 2014; Eaton et al., 2012; Eaton et al., 2010). There is a tendency for health-risk behaviors to occur in combination (Evers and Quintiliani, 2013), and their clustering has been shown to have a synergistic, negative impact on health (Poortinga, 2007; Spring et al., 2012; Prochaska and Prochaska, 2011). There has been a recent shift away from studying individual behaviors as separate risk factors, towards investigation of how changes in multiple behaviors may be interrelated (Cairney et al., 2014; Johnson et al., 2014; Paiva et al., 2010; Yin et al., 2013). Multiple health behavior change (MHBC) interventions are increasingly considered an avenue to comprehensive health promotion efforts that maximize impact and cost-effectiveness (Prochaska and Prochaska, 2011; Ickovics, 2008). The purpose of this secondary data analysis is to explore MHBC of two related behaviors (risk drinking and smoking) in the efficacy trial of Project CHOICES.

Mounting evidence suggests that changes in one health behavior may bolster rather than detract from changes in another health

behavior. It has been suggested that some of the components involved in changing a behavior (e.g. motivation to change, action steps, self-efficacy) may influence a changer's choices about other similar or related behaviors (Lippke et al., 2012; Prochaska et al., 2008). A study by Johnson et al. (2014) documented a coaction effect (i.e. an effect wherein changing one treated behavior increases a person's odds of changing a second treated behavior) in clinical trials of Transtheoretical Model (TTM)-based MHBC interventions. Using data from three randomized trials of MHBC interventions for weight-related behaviors, the authors found that treatment group participants who progressed to the Action/Maintenance stage of change for one weight-related behavior were 1.4–5 times more likely to make progress on second behavior, as compared to treatment group participants who did not progress to Action/Maintenance. Coaction effects were more common among the treatment conditions of these trials, as compared to the control conditions (Johnson et al., 2014).

Yin et al. (2013) used data from five randomized trials of computer-tailored, TTM-based MHBC interventions to assess paired action across 12 behavior pairs. Paired action refers to the rate at which participants change both behaviors in a behavior pair, as opposed to just one

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behavior (Yin et al., 2013). Yin et al. (2013) found that the intervention conditions of the trials they considered consistently produced more paired action than the control conditions of the same trials. Together, findings by Johnson et al. (2014) and Yin et al. (2013) highlight the effectiveness of TTM-based MHBC interventions in sparking changes in multiple behaviors.

While many scholars have explored the benefits of targeting multiple health risk behaviors in a single intervention, there has been little attention to the impact of untargeted risk behaviors on a person's ability to change the behaviors that are targeted in a MHBC intervention. Additionally, previous studies have focused on change in multiple behaviors that were *directly* targeted in MHBC interventions (Johnson et al., 2014; Yin et al., 2013). Little is known about how change in a targeted behavior may be associated with change in related but untargeted behaviors. There is a need for research that explores how components of a facilitated change process may bring about changes in related but untargeted health behaviors. The results of such research may have implications in enhancing the efficiency of MHBC interventions.

This study used data from the efficacy trial for Project CHOICES to explore singular and paired action in risk drinking (a change that was directly targeted in the CHOICES intervention) and smoking cessation (a related but untargeted behavior change). CHOICES is a motivational interviewing and TTM-based intervention that targets change in the dual behaviors that put a woman at risk of alcohol-exposed pregnancy (AEP; i.e. risk drinking and no or ineffective use of contraception) (Floyd et al., 2007; Johnson et al., 2015; Velasquez et al., 2010). Smoking was measured at each assessment time point [baseline, three months (end of treatment), nine months] but was not targeted for change in the CHOICES intervention. Definitions of change in risk drinking and smoking are explained in the measures section of this manuscript.

The selection of risk drinking and smoking as a behavior pair is justified by the well-established association between alcohol and tobacco use (Lippke et al., 2012; Miller et al., 2007). Indeed, drinking and smoking are often embedded in a person's social life (Kelly and Barker, 2016), and it has been suggested that use of one of these substances can trigger a person to also use the other (Friend and Pagano, 2005). Like drinking, smoking is not only a leading cause of mortality and morbidity, but a behavior that is linked directly to negative birth outcomes (Sepinwall, 2002). Recent clinical trials have honed in on the need to prevent tobacco-exposed pregnancies alongside AEPs (Velasquez et al., 2017).

The current study was guided by three research questions:

- 1) *Does the presence of an additional untargeted health behavior at baseline hinder a person's ability to change a related, targeted health behavior?* We hypothesized that baseline smokers in CHOICES would be less likely than baseline non-smokers to change the targeted behavior of risk drinking at the three-month (end of treatment) and nine-month follow-ups.
- 2) *Is a person who changes a targeted behavior in a MHBC intervention more likely than a person who does not change that behavior to also change related, untargeted health behaviors?* We hypothesized that women who were baseline tobacco smokers and had reduced their drinking to below risk levels at the three- and nine-month follow ups would be more likely than their non-changing counterparts at each time point to have ceased smoking.
- 3) *Is paired action more common in the treatment condition of a MHBC intervention, as compared to the control condition, when one of the behaviors in a pair is not targeted for change?* Given the effectiveness of CHOICES in impacting the targeted behaviors of risk drinking and no or ineffective use of contraception,<sup>1</sup> the question became

whether the impact of the CHOICES intervention extended to smoking as a behavior that is related to risk drinking but was not targeted in the intervention. Given a tendency towards greater paired action in the treatment conditions of TTM-based MHBC interventions (Yin et al., 2013), we hypothesized that paired action in risk drinking and smoking cessation would be more common among women receiving the CHOICES intervention, as compared to women in the control condition.

## 2. Methods

The CHOICES efficacy trial was funded by the Centers for Disease Control and Prevention (CDC; U84 CCU614576) and involved a collaboration among the CDC, Nova Southeastern University, the University of Texas Health Science Center at Houston, and Virginia Commonwealth University (Prochaska et al., 2008). Study protocols were approved by the Institutional Review Boards at the CDC and at each participating university and are described in Floyd et al. (2007). The authors declare no conflicts of interest. The CHOICES efficacy trial is described in detail by Floyd et al. (2007). The CHOICES intervention is a four-session motivational intervention designed to reduce AEP risk and is described in detail by Velasquez et al. (2010).

### 2.1. Recruitment settings and methods

CHOICES efficacy trial participants were recruited using six settings that had been identified in the previous epidemiological study of Project CHOICES (Project CHOICES Research Group, 2002) as opportunistic settings for identifying and treating women who are at risk of AEP. These settings included jails, drug and alcohol treatment centers, suburban primary care practices, a hospital-based gynecology clinic, a Medicaid health maintenance organization, and a media-recruited sample (Floyd et al., 2007). Recruitment methods included posting and mailing out flyers and airing newspaper and radio announcements (Floyd et al., 2007). Additionally, presentations were made to groups of potential participants in the jails and treatment center settings (Floyd et al., 2007).

### 2.2. Sample

In the CHOICES efficacy trial, 830 women of childbearing age who were at risk of AEP were randomized to treatment ( $n = 416$ ) and control conditions ( $n = 414$ ). Women in the treatment condition received the CHOICES intervention. Women in the control group received information on alcohol use and women's health, along with referrals to local resources. All participants were fertile women (no tubal ligation or other cause of infertility) of childbearing age (18–44 years) who were drinking at risk levels at baseline and had been sexually active without consistent use of effective contraception during the 90 days prior to baseline (Velasquez et al., 2010). Participants had to be neither pregnant nor planning to become pregnant in the next nine months at the baseline assessment (Floyd et al., 2007; Project CHOICES Intervention Research Group, 2003).

Analyses were restricted to participants who completed a three-month or nine-month assessment ( $N = 654$ ). Attrition rates at the three- and nine-month time points were 14.7% and 11.5% respectively.

(footnote continued)

AEP at nine months, with odds ratios at each follow up time point pointing to two-folds greater likelihood of risk reduction in the intervention group as compared to the control group (Floyd et al., 2007). Among the current sample ( $N = 654$ ), women in the intervention group were more likely to change their risk drinking behavior than women in the control condition at both the three- and nine-month follow ups [44.4% of the treatment group at three months, as compared to 33.8% of the control group ( $\chi^2 = 6.652$ ,  $d.f. = 1$ ,  $p = 0.01$ ); 52.4% of the intervention group at nine months, as compared to 35.2% of the control group ( $n = 101/290$ ;  $\chi^2 = 17.511$ ,  $d.f. = 1$ ,  $p < 0.001$ )].

<sup>1</sup> In CHOICES, 69.1% of women in the treatment condition had reduced their risk of

**Table 1**  
Sample characteristic (N = 654).

Variable	Range	Mean (SD)	n (%)
Age	18 to 44	30.0 years (7.94)	
Race (n = 646)			
Latina			67 (10.2)
African American			312 (47.7)
Caucasian			232 (35.5)
Other racial or ethnic group			43 (6.6)
Marital Status (n = 653)			
Married or co-habiting			185 (28.3)
Single			333 (50.9)
Other			136 (20.8)
Annual Household Income (n = 635)			
< \$20,000			356 (54.4)
Educational Attainment (n = 652)			
Less than high school			173 (26.5)
High school graduate			248 (38.0)
More than high school			232 (35.6)
AUDIT scores (n = 653)	2 to 40	17.03 (9.51)	

Sample characteristics are summarized in Table 1. Participants had an average age of 30 years (s.d. = 7.94) and were mostly African American (47.7%) or Caucasian (35.5%). Most participants were single (50.9%) or married or co-habiting (28.3%). The majority of women were from households in which earnings in the 12 months prior to baseline assessment had been less than \$20,000 (54.4%). All participants were drinking at risk levels at baseline. Mean scores on the Alcohol Use Disorders Identification Test (AUDIT) at that time were 17.03, with a range of 2 to 40 (s.d. = 9.51).

### 2.3. Measures

The Timeline Followback (TLFB) method has been established as a valid and reliable measure of alcohol use (Sobell and Sobell, 1992) and was used in Project CHOICES to create a daily calendar of alcohol consumption that allowed for assessment of change in risk drinking status at the three- and nine-month time points. Women were considered risk drinkers at each time point if they reported any episode of risk drinking in the previous 90 days. In accordance with criteria at the time of the CHOICES trial,<sup>2</sup> risk drinking was defined as the consumption of five or more drinks on any day or 8 or more drinks in any week. Tobacco smoking was assessed with a series of three questions. The first question asked participants whether they had smoked tobacco in their lifetime, and the second asked whether they had smoked in the last six months. The final question asked those who reported smoking in the past six months whether they had smoked in the last 60 days. Smoking cessation was defined as abstinence; women were considered smokers at each time point if they reported any smoking in the 60 days prior to their assessment interview.

Covariates were measured using several measures. The Alcohol Use Disorders Identification Test (AUDIT) is a measure of problematic drinking that has been deemed valid and reliable in numerous studies, with diverse participants and in a variety of settings (Babor et al., 2001). Behavioral processes of change for alcohol were assessed using the Processes of Change Questionnaire for Alcohol (Prochaska et al., 1988). Pros for changing drinking behavior (i.e., the perceived advantages of changing) were assessed using the Decisional Balance Scale for Alcohol (Carey et al., 2001). Temptation to drink was assessed using a version of the Brief Situational Confidence Questionnaire (Breslin et al., 2000) that was modified to capture temptation rather than

<sup>2</sup> NIAAA endorsed guidelines for risk drinking at the time of the Project CHOICES trial were > 4 drinks per day or > 7 drinks per week for women (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2004). Current NIAAA endorsed guidelines specify > 3 drinks per day for women (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2016).

confidence. Finally, readiness to change was measured using a Readiness Ruler. Readiness Rulers are rulers with four visual marks that correspond to the pre-contemplation, contemplation, preparation, and action stages of change (Velasquez et al., 2005). Participants are shown the ruler and asked to select the mark that most accurately reflects their readiness to change a particular behavior (Velasquez et al., 2005).

### 2.4. Procedures

Logistic regression models were used to determine the probability of reducing drinking for baseline smokers compared to non-smokers at the three-month follow-up (i.e. end of treatment; n = 559; 403 smokers and 156 non-smokers) and at the nine-month follow-up (n = 579; 423 smokers and 156 non-smokers). Additional models examined the probability of smoking cessation for baseline smokers who had reduced drinking to below risk levels and baseline smokers who had not reduced drinking at each of the three-month and nine-month follow-ups. At three months, 161 of the 402 baseline smokers (40.0%) had changed their risk drinking behavior, and 241 (60.0%) had not changed their risk drinking behavior. At nine months, 174 of the 422 baseline smokers (41.2%) had changed their risk drinking behavior, and 248 (58.8%) had not changed their risk drinking behavior. Table 2 features a summary of rates of risk drinking at the baseline, three-month, and nine-month time points for baseline smokers versus baseline non-smokers.

Logistic regression models were also used to examine the probability of paired action. In the first set of models, the probabilities of paired action (i.e. reduction of risk drinking and cessation of smoking) versus singular action (i.e. reduction in drinking only) were examined for women who had changed their risk drinking behavior at each time point (n = 219 at three months; n = 254 at nine months). In the second set of models, the probabilities of paired action (i.e. reduction of risk drinking and cessation of smoking) versus absence of paired action (i.e. change in neither behavior or change in one behavior only) were examined for the treatment and control conditions using the full sample (N = 654).

A subsequent set of logistic regression models were run for all analyses adjusting for baseline covariates found to be related to the targeted outcomes in the original CHOICES Efficacy trial (Floyd et al., 2007) and verified for smoking in the current study. Odds ratios were adjusted for the following covariates: the AUDIT total score; experiential processes of change for alcohol; behavioral processes of change for alcohol; pros for changing alcohol; temptation to use alcohol; and readiness to change alcohol.

### 3. Results

Reduction in risk drinking did not differ significantly between baseline smokers (36.5%) and baseline non-smokers (40%) at three months. However, change of risk drinking behavior was more common at nine months among baseline non-smokers (50.6%) as compared to baseline smokers (41.1%). Baseline non-smokers had greater odds of reducing their risk drinking behavior than the odds of baseline smokers at nine months (Table 3).

A significantly higher percentage of baseline smokers who had reduced their drinking to below risk levels at nine months had also quit smoking (19.5%), as compared to baseline smokers who had not changed their risk drinking behavior (8.1%). Therefore, for baseline smokers, reducing risk drinking to below risk levels at nine months was associated with smoking cessation. There were no significant differences in smoking cessation between these smoking groups at the three-month follow-up. 14.3% of baseline smokers who had reduced their drinking to below risk levels had quit smoking at three months, as compared to 10.4% of baseline smokers who had not changed their risk drinking behavior (n = 402) (Table 3).

Among women who had changed their risk drinking behavior at three- and nine-months, there were no significant differences between

**Table 2**  
Percentage of women who drank at risk levels at 3 and 9 Months: baseline smokers versus baseline non-smokers.

Group	Three-months (n = 559)	Nine Months (n = 579)
Baseline smokers	63.5 (n = 99/156)	49.4 (n = 77/156)
Baseline non-smokers	60.0 (n = 242/403)	58.9 (n = 249/423)

**Table 3**  
Odds ratios for reducing risk drinking at nine months among baseline smokers and baseline non-smokers (N = 654).

Unadjusted Predictor	Criterion	B	S.E.	OR	95% CI	
					Lower	Upper
Smoker (n = 559)	Risk Drinking – 3 mo	0.145	0.195	1.156	0.79	1.69
Smoker (n = 579)	Risk Drinking – 9 mo	–0.384	0.188	<b>0.681*</b>	<b>0.47</b>	<b>0.99</b>
Smoker with reduced risk drinking – 3 mo (n = 402)	Smoking Cessation – 3 mo	0.365	0.309	1.440	0.79	2.64
Smoker with reduced risk drinking- 9 mo (n = 422)	Smoking Cessation – 9 mo	1.018	0.302	<b>2.769*</b>	<b>1.53</b>	<b>5.00</b>
Treatment Condition – with reduced risk drinking- 3 mo (n = 219)	Paired Action – 3 mo	–0.094	0.284	0.910	0.52	1.59
Treatment Condition – with reduced risk drinking- 9 mo (n = 254)	Paired Action – 9 mo	–0.161	0.258	0.851	0.51	1.41
Treatment Condition (N = 654)	Paired Action – 3 mo	0.247	0.245	1.281	0.79	2.07
Treatment condition (N = 654)	Paired Action – 9 mo	0.381	0.213	1.464	0.96	2.07
Adjusted**						
Smoker (n = 559)	Risk Drinking – 3 mo	–0.208	0.218	0.812	0.53	1.25
Smoker (n = 579)	Risk Drinking – 9 mo	–0.626	0.208	<b>0.535*</b>	<b>0.36</b>	<b>0.80</b>
Smoker with reduced risk drinking- 3 mo (n = 402)	Smoking Cessation – 3 mo	0.334	0.335	1.396	0.72	2.69
Smoker with reduced risk drinking- 9 mo (n = 422)	Smoking Cessation – 9 mo	1.021	0.315	<b>2.776*</b>	<b>1.50</b>	<b>5.15</b>
Treatment Condition – with reduced risk drinking- 3 mo (n = 219)	Paired Action – 3 mo	–0.069	0.298	0.933	0.52	1.67
Treatment Condition – with reduced risk drinking- 9 mo (n = 254)	Paired Action – 9 mo	–0.170	0.271	0.844	0.50	1.44
Treatment Condition (N = 654)	Paired Action – 3 mo	0.261	0.250	1.299	0.80	2.12
Treatment condition (N = 654)	Paired Action – 9 mo	0.432	0.220	1.541	1.00	2.37

\* Bolded ORs:  $p < 0.05$

\*\* Confounders adjusted for were the AUDIT Score; experiential processes of change for alcohol; behavioral processes of change for alcohol; pros for changing alcohol; temptation to use alcohol; and readiness to change alcohol.

the treatment and control groups in the likelihood of achieving paired action, as opposed to singular action in reducing risk drinking only. At three months, 34.7% of intervention group women who had reduced their drinking to below risk levels had also terminated smoking, as compared to 36.8% of women in the control group. At nine months, 42.1% of intervention group women who had changed their risk drinking had also quit smoking, as compared to 46.1% of women in the control group (n = 254). The odds of paired action among women who had changed their risk drinking at each time point did not differ between the treatment and control groups (Table 3).

Among all participants (regardless of success in changing risk drinking behavior), there were no significant differences between the treatment and control groups in the likelihood of paired action versus absence of paired action (i.e. change in neither behavior or in one behavior only). At three months, 12.5% of women in the intervention group had achieved paired change, as compared to 15.4% of women in the control group (n = 558). At nine months, 22.1% of intervention group women had achieved paired change, as compared to 16.3% of women in control group (n = 579). The odds of paired action did not differ between the treatment and control groups at either time point (Table 3).

#### 4. Discussion

Baseline smokers were less likely than baseline nonsmokers to have reduced their risk drinking to below risk levels at the nine-month follow-up. This finding suggests that the presence of multiple risk behaviors that are not targeted in a MHBC intervention may make change in a targeted behavior more difficult to achieve. However, findings at the nine-month time point also showed that baseline smokers who had successfully changed the targeted behavior of risk drinking were more likely to have also quit smoking. Thus, it appears that while having an

untargeted risk behavior may make changing a targeted behavior more difficult, the process of changing a targeted behavior may facilitate changes in related, untargeted behaviors. It is possible that motivation to change drinking behavior inadvertently bolstered motivation to quit smoking. It is also possible that the strategies participants used to monitor and change their drinking behaviors (e.g. use of experiential and behavioral processes of change) were helpful in facilitating si-

multaneous changes in smoking. Finally, it may be that the increased self-efficacy associated with change in drinking behavior boosted participants' belief in their ability to also quit smoking.

Rates of reduction in risk drinking did not differ between baseline smokers and nonsmokers at three months, and there were no significant differences at three months in rates of smoking cessation between baseline smokers who had and had not reduced their drinking to below risk levels. The delay in manifestation of group differences may reflect the longitudinal nature of behavioral change. It is possible that the changes that emerge from a MHBC intervention over the long run do not take root immediately. This possibility highlights the importance of longitudinal studies that consider follow-up data-points spanning an extended time. Such studies would yield insight into the impact of time on the changes that stem from MHBC interventions.

There were no significant differences at either time point in rates of paired action between the treatment and control groups. This was true when rates of paired action were compared against rates of singular action in risk drinking among women who had successfully changed their risk drinking behavior at each time point. This was also true when paired action in changing drinking and smoking was compared against absence of paired action among women in full sample. These findings suggest that the greater rates of paired action in targeted behaviors that have been observed in the treatment conditions of MHBC interventions (Yin et al., 2013) may not be achieved when one of the behaviors under consideration is not targeted for change. In the absence of a treatment effect, it is worth noting the tendency towards paired action in changing drinking and smoking behavior among the full Project CHOICES sample. Indeed, among the pooled intervention and control groups (n = 579), 19.2% of women had achieved paired change in risk drinking and smoking at the nine-month time point. This is a clinically significant figure that requires careful interpretation.

In a review of MHBC literature, Prochaska and Prochaska<sup>7</sup> found

that treating smoking in addition to drinking results in greater long-term sobriety from alcohol. Additionally, in the clinical trial of CHOICES Plus, an intervention that bundles smoking into the original CHOICES intervention, Velasquez et al. (2017) found that targeting risk drinking, smoking, and no or ineffective use of contraception in a single intervention was effective in reducing risk of both AEP and TEP. Against the backdrop of these studies, we caution the reader that the findings of this study should not be interpreted to mean that drinking and smoking do not require bundling. Rather, findings point to an opportunity for MHBC interventionists to tap into and maximize a tendency towards natural paired action in these behaviors.

This study contributes to the growing base of MHBC research with a fresh perspective on paired action. Findings demonstrate a link between a person's baseline health risk behavior profile and their likelihood of success in MHBC interventions. Moreover, rather than looking at paired action in a set of targeted health risk behaviors, as has been done in numerous studies, this analysis used CHOICES data to explore paired action in a behavior pair in which one behavior was not targeted for change. In so doing, this study demonstrated that paired action in drinking and smoking behavior change was fairly common in Project CHOICES despite the fact that smoking was addressed neither in the treatment condition nor the control condition of the study. As suggested above, this highlights an opportunity for MHBC interventions to harness what appears to be a natural tendency towards paired action in related health behaviors.

This study would have been enhanced by the availability of additional follow up time points. Indeed, longitudinal data that spanned a longer time would lend insight into potential explanations for the absence of significant findings at three-month time point by clarifying the long-term course of behavior changes that follow participation in a MHBC intervention. Additionally, though meaningful, the findings of this study are somewhat tempered by the fact that baseline smokers in Project CHOICES had, on average, higher AUDIT scores at baseline ( $M = 18.52$ ) than baseline non-smokers ( $M = 13.67$ ), suggesting more problematic baseline drinking among smokers in the study.

Findings can be used to inform debates in MHBC literature and open the door for future research. Indeed, when done well, the bundling of behaviors in MHBC interventions can maximize the value of interventions while minimizing cost (Ickovics, 2008). However, as increasing numbers of behaviors are bundled in MHBC interventions, concerns arise regarding a potential for diffusion of quality (Ickovics, 2008). Studies are needed to address a variety of questions. For instance, an appropriate threshold remains unknown in terms of the number of behaviors that can be bundled in an efficacious intervention. Moreover, it is unclear whether this threshold might vary depending on a tendency towards paired action among the behaviors bundled in an intervention. Future research that explores the tendency toward paired action in particular behavior pairs may impact the manner in which each respective behavior is addressed in MHBC interventions, and the amount of attention that is paid to each behavior.

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