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Profiles of Behavior Change Constructs for Reducing Alcohol Use in Women at Risk of an Alcohol-Exposed Pregnancy

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Abstract

Objective: Using data from Project CHOICES, a randomized controlled trial to test an intervention to prevent alcohol-exposed pregnancies, this study examined process of change profiles composed of Transtheoretical Model of Change (TTM) constructs for alcohol. The primary purpose was to identify a profile of TTM variables associated with reduced drinking.

Method: Participants (n=570) were women at risk of an alcohol-exposed pregnancy recruited from high risk settings. Profile analyses compared end-of-treatment (i.e. 3 months post-intake) TTM construct mean profiles for women who reduced drinking to below NIAAA-defined risk levels[1] (*changers*) to women who continued to drink at risk levels (*non-changers*) at the 9-month follow-up. TTM construct profiles included experiential and behavioral processes of change, pros and cons for change, confidence to reduce drinking, and temptation to drink above risk levels.

Results: Results revealed a parallelism effect or interaction ($p<.001$) in the end-oftreatment TTM construct profiles for the changers versus the non-changers at the 9-month follow-up. *Changers* reported greater pros ($p<.001$) and lower cons for change ($p=.012$), greater confidence ($p=.030$), lower temptation ($p<.001$) and greater use of the experiential ($p<.001$) and behavioral processes of change ($p<.001$). A larger percentage of the women from the CHOICES intervention were in the end-of-treatment profile of the changers (48%) compared to the control condition (39%; $p=.042$).

Conclusions: Interventions can potentially be enhanced by clinicians' understanding what successful change 'looks like' for specific clients in terms of their process use, decisional balance and self-efficacy, allowing for tailored interventions targeted to each client's specific strengths and deficits.

Keywords

Project CHOICES; transtheoretical model; processes of change; decisional balance; self-efficacy

[1]NIAAA endorsed guidelines for risk drinking at the time of the parent CHOICES study were >4 drinks per day or >7 drinks per week for women. Current NIAAA endorsed guidelines specify >3 drinks per day for women (NIH, 2005).

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The Transtheoretical Model (TTM) provides researchers and clinicians with a practical heuristic for understanding progressive movements toward intentional behavior change. The TTM takes a client-centered perspective and stems from the concept that the client "owns and manages" the change process (Connors, DiClemente, Velasquez, & Donovan, 2013). Treatment from this perspective is viewed as a catalyst or facilitator of the client's change process (Connors et al., 2013; DiClemente, 2007). Constructs of the TTM can operate as mechanisms and markers of a behavior change occurring both with and without professional treatment (Connors et al., 2013; DiClemente & Prochaska 1998; Prochaska, 2013).

The TTM, through a considerable body of research, has made a significant contribution to the study of behavior change (DiClemente, 2003; Prochaska et al., 1992). However, the model is not without controversy (Joseph, Breslin, & Skinner, 1999; Kraft, Sutton, & Reynolds, 1999; Littell & Girvin, 2002; Migneault et.al., 2005; Sutton, 2001). The primary focus of the controversy is whether the behavior change process is best represented by distinct stages or a more continuous process defined by early, more cognitive/experiential tasks and by later, more action oriented tasks. However, whether the change process is delineated by discrete stages or a continuous path, research provides considerable evidence that the TTM mechanisms and markers of change interact in consistent patterns as individuals move toward successful behavior change (DiClemente, 2003; Fava, Velicer, & Prochaska, 1995; Hall and Rossi, 2008; Heather, Hönekopp & Smailes on behalf of the UKATT Research Team, 2009; Lipschitz et al., 2015; Perz, DiClemente, & Carbonari, 1996; Prochaska, DiClemente, & Norcross, 1992; Prochaska, Velicer, Rossi, et al., 1994; Rosen, 2000), and that successful changers, with and without treatment, share common pathways to change (Sun, Prochaska, Velicer, & Laforge, 2007).

Beyond the stages of change, a major contribution of the TTM is the research on the proposed experiences and tasks that clients engage in to achieve behavior change (Connors et al., 2013; Johnson et al., 2006; Parrish, von Sternberg, Castro & Velasquez, 2016; Perz et al., 1996; Stotts, DiClemente, Carbonari, & Mullen, 1996; Sun et al., 2007). These theoretical change mechanisms are known as the experiential and behavioral processes of change, and interventions based on the TTM are designed to promote or maintain these internal and environmental processes (DiClemente, 2003; Velasquez, Crouch, Stephens, & DiClemente, 2016). In addition, the TTM incorporates other constructs that have been found to mediate treatment (self-efficacy, expressed as confidence to change and temptation to not change) or represent indicators or markers of the change process (decisional balance, expressed as the pros and cons for change) (Carbonari & DiClemente, 2000; DiClemente, 2003; DiClemente & Prochaska, 1998; Perz et al., 1996; Prochaska et al., 1992).

TTM Mechanisms and Markers of Change

The term *mechanism* refers to the process through which one variable causes or mediates change in another variable (Nock, 2007). A *marker* is an indicator of change that can describe the degree to which certain change processes have been accomplished (DiClemente, 2007). Some variables can be both a mechanism of change and a marker of change (DiClemente, 2007). In the TTM, the processes of change and self-efficacy have

been found to mediate change, so are considered mechanisms (Parrish et al., 2016; Velasquez, von Sternberg, Dodrill, Kan, & Parsons, 2005). While these constructs are both mechanisms and markers of change, depending on the application, for the purposes of the current study, along with decisional balance, the processes of change and self-efficacy serve as markers of an individual's progress in making a behavior change.

Processes of change.

Prochaska and DiClemente (1984) identified ten specific processes of change that occur over time as a person is changing a behavior. These processes have often been called the "engines" of change (DiClemente, 2003). Of the ten processes of change identified in the TTM, five, categorized as *experiential* processes, reflect internal thoughts, feelings, and perceptions about change. The other five, categorized as *behavioral* processes, focus more on actions utilized in behavior change. Table 1 provides a brief description of each of these processes of change.

In a number of clinical trials, increased use of the TTM processes of change (as measured by the subscale means of the experiential and behavioral processes of change) predicted improved outcomes: reduced heavy drinking among HIV-positive men (Velasquez, von Sternberg, Johnson et al., 2009), reduced risk drinking in women at risk for alcohol-exposed pregnancy (Floyd et al., 2007; Mullen, Velasquez, von Sternberg, Cummins, & Green, 2005), less smoking relapse in post-partum women smokers (Stotts, et al., 1996), increased exercise adoption in a worksite health promotion project (Marcus, Simkin, Rossi, & Pinto, 1996) and more percent days abstinent from cocaine in both individual and group treatment for adult cocaine abusers (Stotts, Schmitz, Rhoades, & Grabowski, 2001; Velasquez, Stotts, von Sternberg, Dodrill, & Sampson, 2009). The TTM processes of change were also found to mediate treatment for risky alcohol use and for effective contraception in women at risk of an alcohol-exposed pregnancy (Parrish et al., 2016).

Decisional balance.

Decisional Balance (Janis & Mann, 1977) describes a decisionmaking process in which individuals weigh the pros and cons of change. Research across multiple health behaviors (Hall & Rossi, 2008; Prochaska et.al., 1994) indicates that successful long-term change of adverse behaviors occurs when the pros for change outweigh the cons before the behavior change occurs. Likewise, for individuals who are attempting to adopt a healthy behavior, success is more likely as the pros for a positive change begin to outweigh the cons of change (DiClemente, 2003; Hall & Rossi, 2008; Prochaska et al., 1994; Velicer, DiClemente, Prochaska & Brandenburg, 1985). Therefore, the relative position of the pros for change in relation to the cons for change can act as a marker of progress toward successful change.

Self-efficacy.

Based on the work of Bandura (1977, 1997), self-efficacy is conceptualized in the TTM as a client's confidence and temptation regarding a specific behavior change. Confidence and temptation are represented by how confident the individual is that she/he will not perform the behavior in various real life situations and how tempted she/he would be to perform the behavior in those same situations. Self-efficacy (i.e. confidence to abstain) has been found to

mediate marijuana treatment outcomes (Litt, Kadden, & Stephens, 2005), drinking outcomes (LaChance, Ewing, Bryan, and Hutchison, 2009), and drug use outcomes (Brown, Seraganian, Tremblay, & Annis, 2002). Similar to research on decisional balance, self-efficacy evaluations also are reliable indicators or markers of movement toward behavior change. Increases in confidence and decreases in temptation have been found to predict subsequent behavior change (Connors et al., 2013; DiClemente, 2003; DiClemente, Fairhurst & Piotrowski, 1995) and abstinence self-efficacy has been found to be predictive of long-term outcomes for alcohol and drug use (Ilgen, McKellar & Tiet, 2005; Maisto, Connors, and Zywiak, 2000; Moos & Moos, 2006).

TTM profiles.

Much of the research on the TTM has examined the model's constructs in isolation as single unique predictors, mediators, or markers of change. Taken together, however, the TTM constructs (experiential and behavioral processes of change, decisional balance and self-efficacy), as markers of change, can provide a profile or "roadmap" to successful behavior change (Carbonari & DiClemente, 2000; Connors et al., 2013; DiClemente, 2003). This study offers a more complete examination of the TTM markers of change by combining each of these constructs in a single profile that could provide therapists with a picture of a client's status in the process of changing drinking behavior. If a clinician understands where a client should ideally be positioned on measures of these variables at the end-of-treatment, then he/she can strive to facilitate the client's use of the change processes that will optimize the probability of success. Thus, a therapeutic approach might be enhanced by an understanding of what successful change 'looks like' for specific clients in terms of their process use and their current position on decisional balance and self-efficacy.

In an earlier study with data from Project MATCH, a large multi-site alcohol treatment matching study, Carbonari and DiClemente (2000) compared profiles of TTM constructs (i.e. stages of change, experiential and behavioral processes of change, confidence to abstain from alcohol, and temptation to drink alcohol) at the end-of-treatment for three groups of study participants whose group membership was determined by level of past year alcohol consumption at the 15-month follow-up. The three profile groups were: 1) totally abstinent; 2) moderate drinkers (above the median percent days abstinent score for those reporting some days of drinking); and 3) heavy drinkers (reporting percent days abstinent below the median score). The TTM profile assessed at end-of-treatment for the participants who maintained abstinence at 15 months differed significantly from the profile associated with those who continued heavy drinking. The profile of the group that remained abstinent was characterized by higher action scores, lower maintenance scores[3], greater confidence to change, lower temptation to continue engaging in the problem behavior, and greater use of the behavioral processes of change compared to the profile of those who remained heavy drinkers, thus effectively identifying a "success profile."

[3]There are several items on the University of Rhode Island Change Assessment Scale for the Maintenance subscale that refer to "worry" and "struggle". For individuals with long term maintenance, these items may be endorsed less strongly. Items include: "It worries me that I might slip back on my drinking problem…", "I thought once I had resolved my drinking problem I would be free of it, but sometimes I still find myself struggling with it", and "I'm struggling to prevent myself from having a relapse….."

The current study sought to replicate the analytic technique used to create end-oftreatment profiles in Project MATCH with data from Project CHOICES, a randomized controlled trial to test the efficacy of an intervention designed to reduce risk of alcohol-exposed pregnancy in preconception women (Floyd et al., 2007; Sobell, Sobell, Johnson, et al., 2003; Velasquez et al., 2010). Unlike in Project MATCH, in which study participants had a DSM-III-R diagnosis of alcohol abuse or dependence and were considered treatment seekers, the participants in Project CHOICES were primarily non-treatment seeking women[2] who may or may not have met the criteria for alcohol abuse or dependence, but who were all drinking above risk levels.

Study Aims

The current study sought to identify profiles or patterns of constructs that are associated with positive behavior change. The specific aims of this study were:

1. To compare end-of-treatment profiles on the TTM variables for two outcome-based groups of women at the 9-month follow-up: a) women who reduced their drinking to below risk levels (*changers*), and b) women who continued to drink at risk levels (*nonchangers*), in order to identify a “success profile” similar to that found by Carbonari & DiClemente in the Project MATCH study (Carbonari & DiClemente, 2000). It is hypothesized that women who had reduced their drinking to below risk levels at 9 months (changers) would have a significantly different TTM end-of-treatment profile (i.e. characterized by greater pros and lower cons for changing alcohol use, greater confidence, lower temptation, and greater use of the experiential and behavioral processes) than the women who continued to drink at risk levels (non-changers).

2. To compare the baseline and end of treatment subscale means between the CHOICES intervention condition (Information Plus Counseling; IPC) and the control condition (Information Only; IO) for the TTM constructs, used in the profiles. The end-of-treatment profiles in Aim 1 were composed of data from the changers and the non-changers at 9 months regardless of their intervention condition. These analyses examine the relative impact of the two intervention conditions on progression toward the hypothesized profile of the changers. It was hypothesized that women in the IPC condition would have a significant increase in their pros for change, a decrease in cons for change, an increase in confidence, decrease in temptation, and an increase in the experiential and behavioral processes from baseline to end-of-treatment. It was further hypothesized that the women in the IO condition would not exhibit significant change on these TTM constructs from baseline to end-of-treatment.

[2]One of the six recruitment settings in Project CHOICES was residential substance abuse treatment. Therefore, these women would be considered treatment seeking.

Methods

Project CHOICES

Project CHOICES was a multi-site collaborative randomized controlled trial to test the efficacy of an intervention to prevent alcohol-exposed pregnancy in preconception women in large urban jails, drug and alcohol treatment centers, primary care practices, a gynecology clinic, a Medicaid Health Maintenance Organization, and media recruitment. Women were eligible for Project CHOICES (n=830) if they were of child-bearing age (18–44), fertile, sexually active with a fertile male (vaginal intercourse), drinking at risk levels (>4 drinks/day[1] or >7 drinks/week on average), and not using contraception or not using contraception effectively[4] in the prior 90 days. Women were not eligible if they were currently pregnant or planning a pregnancy in the next nine months.

CHOICES intervention.—The CHOICES experimental intervention condition, referred to as Information Plus Counseling (IPC), was manualized and delivered by trained master's level behavioral health specialists using motivational interviewing in four sessions over a 12–14 week period.

The IPC condition targeted the ten processes of change through: 1) the presentation of fact sheets and normalized feedback (e.g. consciousness raising, dramatic relief); 2) decisional balance exercises (e.g. self- and environmental-reevaluation, social liberation); 3) stating and evaluating goal change plan (e.g. social liberation, counter conditioning, stimulus control, self liberation, helping relationships, contingency management); and 4) importance, confidence and readiness rulers (e.g. self liberation, counter conditioning, stimulus control). Individual temptation and confidence graphs were presented in feedback to stimulate discussion on specific situations that could prove most problematic in making a behavior change.

In the CHOICES control condition, referred to as Information Only (IO), participants received written materials on women's health, which included information on alcohol, tobacco, diet, and exercise. In addition, women received service referral information (Floyd et al., 2007; Velasquez et al., 2010).

CHOICES Outcomes.—Just over 98% of the women in the IPC condition received at least one session and 63% received all four sessions with an average of 3.2 sessions being completed. Approximately 70% of the IPC women attended a contraception consultation visit. At the 9-month outcome, 69.1% of the CHOICES intervention women had reduced their risk of an alcohol-exposed pregnancy, 48.8% had reduced their drinking to below risk levels, and 56.3% had reduced their risk of pregnancy through consistent use of effective contraception. In this secondary analysis the outcome of interest was drinking risk status at the 9-month follow-up (the final assessment time point).

[1]NIAAA endorsed guidelines for risk drinking at the time of the parent CHOICES study were >4 drinks per day or >7 drinks per week for women. Current NIAAA endorsed guidelines specify >3 drinks per day for women (NIH, 2005).
[4]Effective contraception when used as directed in the American Congress of Obstetricians and Gynecologists published guidelines (Resources for Women and Patients, December 2015) included: diaphragm/cervical cap; intrauterine device, hormonal patch, vaginal ring, birth control pills, Depo Provera shot, sponge, Implanon, male and female condoms, and the morning after pill.

Additional study details have been published elsewhere (Floyd et al., 2007; Sobell, Sobell, Johnson, et al., 2003; Velasquez et al., 2010). IRB approval was obtained from each of the participating academic institutions (University of Texas Health Science Center at Houston, Virginia Commonwealth University, NOVA Southeastern-Florida) and the Centers for Disease Control and Prevention.

Current Study Sample

A subsample of the CHOICES participants was used for this study. Specifically, we examined all women, regardless of treatment condition, who completed the end-of-treatment assessment and had 9-month outcome data on risk drinking (n=570). The women in the current study had similar demographics to those of the full sample of CHOICES participants (n=830). The women were 30 years old on average, primarily non-Hispanic White (36%) and nonHispanic Black (49%), Nearly half of the women reported being employed (48%) while over half of the women (54%) reported household incomes of less than $20,000. The majority of the women were smokers (72%) and had a mean AUDIT score of 17.

Measures.—The measures used in this study were collected in the CHOICES Efficacy trial at intake, 3 months post-intake (i.e. end-of-treatment) and 9 months post-intake.

Timeline Followback (TLFB; Sobell & Sobell, 1992, 2000) is a calendar method for the collection of behavior data on a daily basis. The TLFB provided a continuous daily record throughout the study period that included number of standard drinks, sexual intercourse activity, use of contraception and status of the effectiveness of that use. The TLFB data were divided into 30-day segments within 90-day periods (i.e. 3, 6, and 9 months) to calculate risk drinking (drinking at risk levels at any time during a 30-day segment). Risk drinking occurring in any 30day segment in a 90-day period was categorized as risk drinking for the full 90-day period. The alcohol outcome in the current study for determining the changers and the non-changers at the 9 month follow-up was a computed binary variable from the TLFB separating women into those who were drinking below the specified risk level (no more than 4 drinks/day and no more than 7 drinks/week on average) and those who were drinking at or above the risk level in the 90 days prior to the 9 month assessment.

The Processes of Change for Alcohol (POC-A; DiClemente, Carbonari, Addy, & Velasquez, 1996; Prochaska, Velicer, DiClemente, & Fava, 1988) is a 20-item measure to assess the covert and overt activities and experiences that individuals engage in when they are changing alcohol behavior. In a confirmatory factor analysis conducted by the authors using the current data, the items on the POC-A loaded onto five latent factors that represent the experiential processes: consciousness raising, dramatic relief, environmental reevaluation, self-reevaluation, and social liberation, and the five latent factors that represent the behavioral processes: reinforcement management, counterconditioning, helping relationships, self-liberation, and stimulus control. The five experiential factors loaded onto the second-order latent factor, experiential processes. The five behavioral factors loaded onto the second-order latent factor, behavioral processes. The model had a moderate fit to the data (Chi^2 =827.47; *df*= 159; *p*<.001; CFI=.929; RMSEA=.074). Internal consistency for both the experiential (α=0.921) and the behavioral (α=0.891) processes was high in this data set.

The means of the five experiential processes items and the means of the five behavioral processes items from the end-of-treatment assessment were computed and used in the current study's construct profiles (i.e. *exp* and *beh,* respectively).

The Decisional Balance Scale for Alcohol (DBS-A; Carey, Maisto, Carey, & Purnine, 2001; King & DiClemente, 1993) is a 16-item measure to assess the pros and cons for changing alcohol use. This measure is helpful in understanding the cognitive and motivational aspects of decision making which are important indicators of movement through the stages of change (Connors, et al., 2013; Prochaska et al., 1994). When applied to risk drinking in this study, both the pros and cons scales demonstrated a high level of internal consistency (α=0.870 and α=0.899, respectively). The means of the eight pros for change items and the eight cons for change items from the end-of-treatment assessment were computed and used in the current study's construct profiles (i.e. *pros* and *cons,* respectively).

The Brief Situational Confidence Questionnaire for Alcohol (BSCQ-A; Breslin, Sobell, Sobell, & Agrawal, 2000) was adapted from the Situational Confidence Questionnaire (Annis & Davis, 1988). This 8-item measure assesses the level of confidence a woman has in her ability to abstain or drink below risk levels in various life situations: unpleasant emotions, physical discomfort, pleasant emotions, testing control over alcohol, urges and temptations, conflict with others, social pressure to drink, and pleasant times with others. The BSCQ-A was found to have good reliability in this study (α=0.868). The mean of the BSCQ-A was computed from the end-of-treatment assessment and used to represent the confidence construct in the current study's profiles (i.e. *conf).*

The Brief Situational Temptation Questionnaire for Alcohol (BSTQ-A) is a companion instrument to the BSCQ-A developed in CHOICES to assess the level of temptation that a woman experiences in each of the same life situations as the BSCQ-A. The BSTQ-A was also found to have good reliability in this study (α=0.847). The mean of the BSTQ-A was computed from the end-of-treatment assessment and used to represent the temptation construct in the current study's profiles (i.e. *temp*).

Analyses

Profile Analyses (PA; Tabachnick & Fidell, 2012) using SPSS version 23 was used to examine the end-of-treatment (i.e. 3 months post-intake) mean profiles of TTM constructs for two drinking-outcome-based groups of women. One group consisted of women who reported at the 9-month follow-up that they had consumed less than eight drinks per week on average and had no instances of drinking more than 4 drinks in one day in the previous 90 days (i.e. changers). The other group consisted of women who reported having had more than seven drinks a week on average and/or having consumed more than four drinks on any day in the previous 90 days (i.e. non-changers).

PA is a special application of multivariate analysis of variance (MANOVA) for repeated measures that can be used when several dependent variables (e.g. subscales of the TTM measures) are measured at one time. The PA test of interest was the test of parallelism, which is equivalent to the interaction effect in a standard MANOVA and assesses the patterns of the mean values of the dependent variables. Rejection of the null hypothesis of

parallelism would suggest an interaction or non-parallelism in the overall shape of the profiles (Tabachnick & Fidell, 2012). A parallelism effect in the current study would indicate differences between groups on the TTM profiles of decisional balance, self-efficacy, and processes of change constructs. An assumption of PA is that each of the dependent variables is measured on the same metric. As suggested by Tabachnick and Fiddell (2012), the profile mean scores were standardized to a distribution with a mean of 50 and a standard deviation of 10.

A PA was conducted to provide end-of-treatment profiles on the six TTM variables (i.e. pros and cons for changing drinking, confidence to drink below risk levels, temptation to drink above risk levels and the experiential and behavioral processes of change for alcohol). The endof-treatment profiles allowed us to determine if there were differences in the pattern of interaction or shape of the TTM profiles (i.e. a significant parallelism effect) immediately following the intervention for those women who were changers versus non-changers at 9 months in reducing risky drinking. As part of the PA analyses, the estimated marginal means were examined to determine if there were differences between the changers and non-changers on each of the TTM constructs in the end-of-treatment profiles.

After identification of the end-of-treatment profile for the successful changers, we addressed the second aim by performing paired sample t-tests on the TTM markers of change. We compared the baseline scale means to the end-of-treatment scale means for each of the CHOICES intervention conditions (i.e. IPC versus IO). We performed these analyses to determine if significant movement toward the successful changers end-of-treatment profile had occurred on these constructs for women within each intervention condition. In addition, we also compared the end-of-treatment TTM subscale means between intervention condition. Finally, we calculated the percent of women who were successful changers in each condition and the percent of women from each condition that made up the successful changers group.

Results

End-of-Treatment Profiles for Alcohol Risk Outcome Groups

Results of the profile analysis revealed a parallelism effect ($F(5,564)=8.86$, $p<.001$, partial $\eta^2 =.073$), suggesting differences in the end-of-treatment profiles of the women who reduced drinking to below risk levels and the women who continued to drink at risk levels at nine months (Figure 1).

In addition to the overall difference in the pattern or shape of the profiles, each of the estimated marginal means of the six variables making up the TTM profiles at the end-oftreatment assessment were significantly different for the women drinking below risk levels at nine months compared to the women with continued risk drinking. Although the effect sizes as measured by partial eta squared were small (Richardson, 2011), the women not drinking at risk levels reported greater pros ($p<.001$; partial $\eta^2 = .011$) and lower cons for change ($p=.012$; partial $\eta^2 = .026$), greater confidence ($p=.030$; partial $\eta^2 = .008$) and lower temptation ($p<.001$; partial $\eta^2 = .023$) and greater use of the experiential processes ($p<.001$; partial $\eta^2 = .033$) and behavioral processes of change ($p<.001$; partial $\eta^2 = .027$).

TTM Construct Comparisons of Baseline and End-of-Treatment Means by Condition

The profile of the successful changers was composed of 55% IPC women and 45% IO women. In addition, a larger percentage of the women from the IPC condition were changers (48%) compared to the percentage of women from the IO condition (39%; p=.042).

Changes in the six TTM variables from baseline to end-of-treatment were all significant for the IPC women and were consistent with hypothesized directions for forward movement toward change with the exception of the pros for change which decreased (Table 2). Otherwise, the cons for change decreased, confidence increased, temptation decreased, and both experiential and behavioral processes increased as predicted. In line with the profile of the changers, the pros for change remained greater than the cons for change (p=.006; Cohen's d=.196), confidence was greater than temptation (p<.001; Cohen's d=.689) and the behavioral processes of change were greater than the experiential processes (p<.001; Cohen's d=.184). The women in the IO condition also reported some significant mean changes for temptation and cons for change which both decreased. Similar to the women in the IPC, the IO women also reported a decrease in the pros for changing from baseline to end-of-treatment. There was no change in the experiential processes or behavioral processes of change for the IO women. Unlike the profile of the changers, the cons for change were greater than the pros for change (p=.030; Cohen's d=.162) and the experiential processes were greater than the behavioral processes (p<.001; Cohen's d=.167) for the IO women.

Comparisons of the end-of-treatment TTM construct means between conditions (Table 3) found greater pros for change, greater confidence, lower temptation, and greater experiential and behavioral process of change use in the IPC women over the IO women. There was no difference found between the two conditions on the cons for change at the end-of-treatment.

Discussion

This study sought to identify a profile or pattern of constructs associated with positive behavior change that could potentially inform a therapeutic approach. The CHOICES data set was ideal for the purpose of this study: 1) the intervention was based on the Transtheoretical Model and Motivational Interviewing (Velasquez et al., 2010) and therefore, the constructs of interest were assessed; and, 2) there were sufficient changers and non-changers across the two intervention conditions (44.5% of the total sample reduced drinking to below risk level at 9 months) allowing for meaningful profile comparisons.

As mentioned earlier, a critique of the TTM is that the stages are not distinct steps in the change process and that behavior change is more accurately conceptualized as a continuous process (Joseph, Breslin, & Skinner, 1999; Kraft, Sutton, & Reynolds, 1999; Littell & Girvin, 2002; Migneault et.al., 2005; Sutton, 2001). Whether distinct stages or a more continuous progression to maintained behavior change, research on the model has provided evidence that the tasks or processes of change (Parrish et al., 2016; Perz, et al., 1996) decision making considerations (Foster, Neighbors, & Pai, 2015; LaBrie, Pedersen, Earleywine, Olsen, 2006; Noar, LaForge, Maddock, & Wood, 2003, Prochaska, et al, 1994) and self-efficacy (Ilgen, McKellar & Tiet, 2005; Moos & Moos, 2006) have been found to interact in a consistent patterned manner in a process of making successful behavior change

(Carbonari & DiClemente, 2000). This study, while supporting this previous research, offers a more complete picture of the interaction of the constructs posited in the TTM and demonstrates that in changing alcohol use, a pattern or profile of TTM constructs, assessed immediately post-treatment, can provide predictive evidence of long-term changers versus non-changers. Our findings supported the hypothesis that the shape at the end-of-treatment of TTM mean construct profiles would differ for women with no risk drinking at 9-month follow-up compared to women with continued risk drinking. Specifically, in this study, women with reduced drinking outcomes reported more pros than cons for changing drinking, more confidence than temptation, and greater use of the experiential and behavioral processes at end-of-treatment than women who continued their risky drinking.

These results are consistent with those found in the Project MATCH study (Carbonari & DiClemente, 2000) that compared TTM construct profiles at end-of-treatment between groups determined by levels of abstinence and heavy alcohol use at 15 months. Both studies found the *changers* to have greater confidence, lower temptation and greater use of the behavioral processes than the *non-changers*. There are however, important distinctions that warrant mention. The participants in Project MATCH were primarily treatment seekers and they met criteria for alcohol abuse or dependence. The current study replicates the analytic technique used in Project MATCH with primarily non-treatment seeking women who did not necessarily meet criteria for abuse or dependence.

The data suggest that it is the pattern or interrelationship of the constructs in the TTM performance profile that can be especially useful in a therapeutic setting. If the pros for change for the women in the IPC condition were viewed in isolation, it may appear that the women were regressing in the change process because the pros for change actually decrease from baseline to end-of-treatment. However, when taken in the context of the profiles, we see that although both the pros and cons for change decreased, the pros for change remained greater than the cons for change. As ambivalence is resolved with greater weight given to the pros for change over the cons for change, it appears that the importance of these considerations overall decreases (Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991; Prochaska et.al., 1994). Rather than regression in the change process, it is more likely that the pros and cons for change are simply less relevant as the women have moved beyond ambivalence into taking action. Prochaska and colleagues (1994) in examining pros and cons for twelve health behaviors across stages, found that although the pros for change were always greater than the cons for change prior to action for participants who changed their behavior, for several behaviors a decrease in both the pros for change and the cons for change was associated with progression through the stages.

The CHOICES intervention was designed to prevent alcohol-exposed pregnancy. Target behaviors were risk level alcohol use and ineffective contraception. To reduce their risk of an alcohol-exposed pregnancy, women could choose to reduce their alcohol consumption to below risk levels, use effective contraception, or both. Only 67% of the women who reduced their risk of an alcohol-exposed pregnancy chose to reduce their alcohol consumption yet 48% of the CHOICES intervention women were in the end-of-treatment changers profile for alcohol.

The CHOICES intervention targets critical mechanisms and markers of change from the TTM. It includes rulers to measure the importance attributed to change by the participant, the confidence that she can make a change, and her readiness to make a change. There are decisional balance exercises designed for the woman to examine her ambivalence to change, and multiple components designed to promote use of the processes of change. The CHOICES intervention components produced significant reduction in risk behaviors but also appeared to facilitate progression toward the success profile across the six variables for the IPC women compared to the IO women. At the end-of-treatment, women in the IPC condition had pros for change that were greater than the cons for change, more confidence than temptation, and greater behavioral processes than experiential processes for changing alcohol consumption. This study suggests that interventions can be targeted to facilitate client movement to a “success profile”.

The TTM constructs used in these profiles are targeted in many interventions for substance misuse (Connors et al., 2013; Velasquez et al., 2005). In such interventions, the ability to recognize and understand the elements of a success versus a non-success profile could inform intervention development and decisions. By comparing a client’s current TTM construct profile to the ideal success profile, certain therapeutic elements could be incorporated in order to facilitate the client’s use of specific change processes that optimize the probability of the client’s success. For example, plotting the means of these TTM constructs to create a during treatment profile might indicate that the treatment focus for one client should be on ways to boost confidence by learning strategies to handle triggers (i.e., temptation, behavioral processes) while another client might benefit more from activities designed to enhance motivation and help resolve ambivalence (pros and cons, experiential processes). In addition, a client’s profile can also be utilized as a form of feedback in terms of evaluating not only their progress toward their goals, but also in suggesting strategies to include and augment over time. This type of success profile can potentially provide a “roadmap” to successful behavior change across the course of therapy by incorporating certain tasks, activities, and experiences derived from the TTM constructs.

Limitations and Future Directions

This study is only a first step in determining if such a measurement-based approach (i.e. assessing a client’s profile of TTM constructs) would provide meaningful guidance to a therapist and client. Because these findings cannot be generalized beyond the current sample of women at risk of an alcohol exposed pregnancy who participated in Project CHOICES, further studies should include replication of these profiles in additional populations and settings. Studies of the acceptability of such a tool by behavioral health specialists is also needed. Finally, there is the issue of the efficacy of interventions in which adjustments are made in the approach based on a client’s TTM construct profile. Randomized clinical trials are needed to test if targeting a therapeutic approach to client specific profiles would prove more efficacious than interventions without the benefit of the client’s profile.

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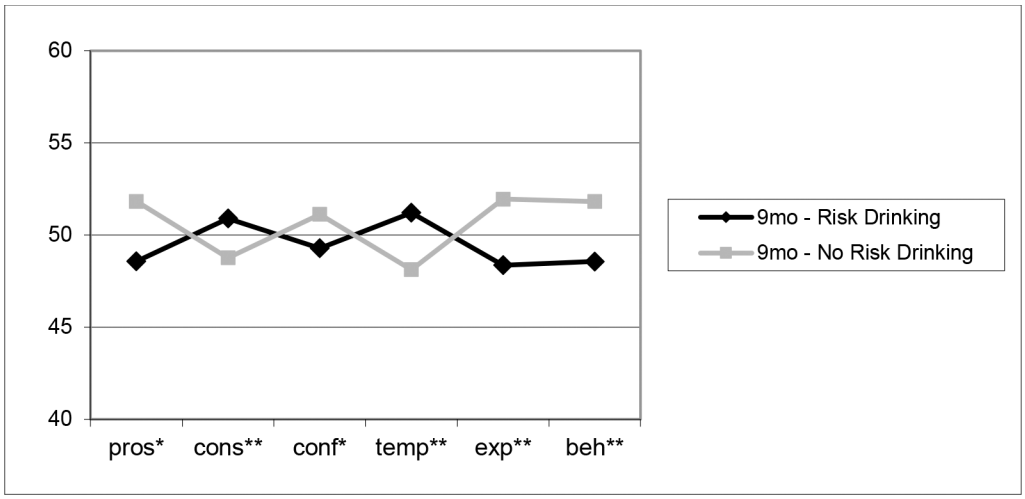

Figure 1: End-of-Treatment TTM Construct Profiles for two Groups based on Risk Level Drinking at 9 Months

p<.05; ** p<.001; The scores were standardized to a distribution with a mean of 50 and a standard deviation of 10.

pros=pros for change; cons=cons for change; conf=confidence to drink below risk levels; temp=temptation to drink at risk levels; exp=experiential processes of change; beh=behavioral processes of change

Table 1:

The TTM Processes of Change

Cognitive/Experiential	Description
Consciousness-raising	*Knowledge and awareness about the individual and his/her problem behavior is increased.*
Dramatic relief	*Emotions about the individual's problem behavior, and available treatments or solutions, are aroused.*
Self-reevaluation	Cognitions and emotions regarding the individual, especially with respect to their problem behavior, are reassessed.
Environmental reevaluation	The impact that the individual's problem behavior has on their environment is reassessed.
Social liberation	Awareness of attempts made in society to decrease the prevalence of the individual's former problem behavior.
Behavioral	
Self-liberation	Choosing a course of action to change the problem behavior, and committing to that choice.
Counter-conditioning	Positive alternative behaviors are substituted for the individual's problem behavior.
Stimulus control	Stimuli that may trigger lapse back to the problem behavior are prepared to be coped with, removed, or avoided.
Contingency management	Positive behavioral changes are rewarded.
Helping relationship	Trusting and open discussion about the problem behavior is received by a supporting individual(s).

Table 2:

Comparison of Baseline and End-of-Treatment Subscale Means for Each Condition

Profile Construct*	IPC (n=279)			IO (n=277)			Cohen's d	
	Mean (SD)		*p*	Mean (SD)		*p*	IPC	IO
	Baseline	End-of-Treatment		Baseline	End-of-Treatment			
Pros for Changing	2.51 (1.15)	2.35 (1.15)	**.013**	2.32 (1.11)	2.12 (1.06)	**<.001**	.139	.190
Cons for Changing	2.51 (0.92)	2.15 (0.89)	**<.001**	2.50 (0.95)	2.28 (0.91)	**<.001**	.400	.237
Confidence	2.99 (0.95)	3.25 (1.12)	**.002**	2.96 (0.96)	3.03 (1.05)	.338	.250	.069
Temptation	3.00 (0.93)	2.54 (0.93)	**<.001**	2.92 (0.86)	2.79 (0.94)	**.025**	.495	.144
Experiential Processes	2.49 (1.07)	2.74 (1.06)	**<.001**	2.44 (0.66)	2.47 (0.64)	.676	.235	.046
Behavioral Processes	2.61 (0.97)	2.93 (1.01)	**<.001**	2.56 (0.96)	2.61 (1.03)	.352	..323	.051

*All constructs were measured on Likert scales ranging from 1–5.

IPC – Information Plus Counseling; IO – Information Only

Table 3:

Comparison of End-of-Treatment Subscale Means by Condition

Profile Construct*	**IPC (n=279) Mean (SD)**	**IO (n=277) Mean (SD)**	***p***	**Cohen's d**
Pros for Changing	2.35 (1.15)	2.12 (1.06)	**.028**	.208
Cons for Changing	2.15 (0.89)	2.28 (0.91)	.099	.145
Confidence	3.25 (1.12)	3.03 (1.05)	**.016**	.203
Temptation	2.54 (0.93)	2.79 (0.94)	**.002**	.267
Experiential Processes	2.74 (1.06)	2.47 (0.64)	**.002**	.308
Behavioral Processes	2.93 (1.01)	2.61 (1.03)	**<.001**	.308

*All constructs were measured on Likert scales ranging from 1–5.

IPC – Information Plus Counseling; IO – Information Only