Combined Measures Comparing Readiness to Change and Process of Change in Opioid Users

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Abstract

Opioid overdose is growing as a leading cause of death in the United States, surpassing other unintended causes such as automobile accidents. An increase in opioid overdoses nationwide in the past decade inspired public health authorities to declare an opioid epidemic nationwide. Assessing a person’s readiness to change a substance abuse behavior has long been supported as a critical clinical intervention. The need for healthcare providers to efficiently and accurately assess treatment readiness in opioid users is examined. Literature regarding substance abuse assessments developed according to the widely accepted Transtheoretical model (TTM) is reviewed. Extant assessments of readiness to change and processes of change per the TTM are described. Rationale is provided for developing two quantitative assessments adapted from validated measures of TTM constructs: The Opioid Use Readiness for Change Questionnaire (RCQ-OP) and The Opioid Use Process of Change Questionnaire (PCQ-OP). The use of these two measures together is identified as a resource for healthcare providers seeking to identify opioid users’ readiness to change and related processes of change simultaneously. The two measures were completed by 300 adult patients of a methadone clinic in the Northeast US in treatment for opioid use disorder. Through Principal Components Analysis, the RCQ-OP scale retained 12 items that loaded on three factors and the PCQ-OP scale retained 20 items that loaded onto three factors. Correlation analysis examined whether relationships between the Stages of Change and Processes of Change, as measured in this sample, were consistent with extant TTM research conducted primarily on tobacco users. Implications and directions for future research are discussed.

Keywords: heroin, opioid, stages of change, transtheoretical model, assessment
Chapter 1

Introduction

On a national scale, authorities including the former US Surgeon General, have recently declared drug addiction as a widespread chronic illness and health crisis, and not an individualized moral failing (Firth, 2016). The United States is experiencing what Federal and local public health and medical professionals have called an opioid use epidemic, with overdose deaths at rates over four times as high as they were in 1999 (Volkow et al., 2014; Bart, 2012). Drug overdose was recently listed as the single highest “cause of injury-related death in the United States” (Hedegaard, et al., 2015, p. 1), according to data from the Center for Disease Control and Prevention (Centers for Disease Control and Prevention, 2015). Healthcare professionals treating those suffering from opioid dependence have the unique opportunity to save lives by helping opioid users seek treatment options providing safer alternatives to daily heroin use (Bart, 2012).

This manuscript details research piloting two measures of motivation designed to assist treatment providers in assessing opioid users’ motivation to change their behavior. The measures were adapted from current measures of two different constructs, that are core dimensions of The Transtheoretical Model of behavioral change (TTM), a theoretical framework of motivation with widespread use in the treatment of Tobacco Use and Alcohol Use Disorders. These two constructs are called the Stages of Change and the Processes of Change (Prochaska, Norcross & DiClemente, 2013). To date, we are not aware of any research on measuring and comparing these two core dimensions of the TTM on other drugs of abuse. A contribution of the current study is that it will begin to address this gap in the research by testing the applicability of these measures in a sample of opioid users.
There are three major goals for this research. First, the study measures will assess Readiness to Change and the Processes of Change in a sample of 300 opioid users in methadone maintenance treatment in Boston, MA. Second, the psychometric properties of both measures will be validated through Exploratory Factor Analysis (EFA). The overarching study goal is to provide a simple, reliable measurement tool to measure motivation to change among individuals in opioid treatment.

To this end, the potential implementation of the pilot measures may improve clinical care via assisting with treatment planning. According to the TTM theory, a clinician’s clinical judgment and ability to implement or plan treatment interventions would be enriched by understanding how an individual varies on their Stages and Processes of change (Prochaska & DiClemente, 1983, 2005). Accordingly, study measures may potentially provide this cross section of information to healthcare providers (i.e., on two core TTM dimensions of motivation related to behavioral change).

The Related Literature

Theoretical Framework

Transtheoretical model: overview & origins

The Transtheoretical Model of intentional behavioral change is one theory within the larger area of motivation research in psychology. The TTM covers many diverse aspects of the process of behavior change, conceptualizing health behavior change from a biopsychosocial, integrative perspective. The TTM thus considers behavioral change as a multi-faceted process influenced by several concurrent and ongoing Processes of Change, not as a process driven by a single behavioral mechanism (Prochaska, Norcross & DiClemente, 2013).
Seeking to understand what influenced long-term behavioral change, the TTM’s authors analyzed the intersections of 24 psychological theories across psychological theories (Prochaska & Velicer, 1997) resulting in identifying the ten distinct **Processes of Change** or the activities an individual utilizes to influence lasting behavioral change (Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997; Prochaska & DiClemente, 1977, 2005). These theories included Freudian psychoanalysis, Gestalt psychology, Psychodrama, Behaviorism, and Feminist theory (Prochaska & DiClemente, 2005).

Further, TTM authors contended that change occurred gradually, over time (Prochaska, Norcross & DiClemente, 2013). The TTM would therefore consider the interplay between the actions a person takes to change (the Processes of Change) while simultaneously charting a progression of change gradually across time. TTM authors labeled this temporal movement the **Stages of Change** (Prochaska & DiClemente, 2005). Together, the Processes of Change help to explain how changes occur in cognition, emotion, and behavior, while the Stages of Change explain when those changes occur. (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

When reading about the TTM, one may find references to “Readiness to Change” in the literature. To further clarify how this term relates to the theoretical framework of the TTM, it is necessary to explain how the collective concepts of the TTM (e.g. Stages of Change, Processes of change, decisional balance, and self-efficacy) relate to a larger, overarching idea of Readiness to Change. Although not a term originally used by authors of the TTM, the colloquial concept of “Readiness to Change” is often used synonymously with a person’s progression through the “Stages of Change,” broadly describing the degree of motivation a person has towards changing a target behavior (e.g. per Zimmerman et al., 2000). For a visual representation of different
components of the TTM, please also see Figure 1, which provides a graphic overlay of the TTM’s integrative conceptual components, including each dimension, self-efficacy, and decisional balance.

The TTM is in integrative theory consisting of several psychological theories which involve central change mechanisms. Many of these theories are hallmarks of psychology, such as B.F. Skinner’s theory of Operant Conditioning (1963) and Carl Rogers’ Person Centered Theory of Personality (1959). For example, Skinner argued that behavioral change occurred because organisms learned to respond to specific stimuli in various environmental contexts—such as an infant learning that praise from her mother directly follows her sitting up on her own (Skinner, 1963). Prochaska and DiClemente agreed with the validity of change mechanisms in Skinner’s theory, but synthesized key means of change within it. TTM authors thus labeled and included Stimulus Control, Counterconditioning and Contingency Management (each example of approaches that were based on the principle of Operant Conditioning) in their TTM’s Processes of Change. This approach reflected the authors’ integrated perspective of behavioral change and not a single-mechanism explanation (Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

The TTM also incorporated Carl Rogers’ Person Centered Theory of Personality (1959) into their integrative understanding of behavioral change. Rogers’ posited that “when a person's views of himself change, his behavior changes accordingly” (1959, p. 507) emphasizing a person’s introspective pursuit, as a mechanism of change. The TTM authors integrated the introspective change mechanism in their Process of Change, labeled Helping Relationships. TTM theory posits that a person demonstrating change via Helping Relationships may access a social support network to gain increased self-awareness—attending an Alcoholics Anonymous
meeting to learn about drinking behavior, for example (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005). Prochaska and DiClemente summarized the following integrated change mechanisms that explain the array of activities that people used to change: “Unconditional positive regard, authenticity, living in the here and now, confrontation of beliefs, social interest, conditioning, and contingencies are valuable rules for human functioning, but not sufficient to explain therapy change,” (2005, p. 300).

While the Processes of Change account only for one Dimension of behavioral change, a person’s progress through the Stages of Change over time comprises the other central dimension of behavior change: The Temporal Dimension (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

The TTM states that a person must do the following to progress temporally through the Stages of Change: employ self-efficacy (which includes self-efficacy to resist), engage in decisional balance and utilize the Processes of Change (Prochaska & Velicer, 1997; Prochaska, Norcross & DiClemente, 2013). The TTM framework clarifies that though these three components contribute to stage progression, the sum of their influences combined, rather than the impact of each component alone, explains what drives behavioral change (Velicer et al., 1985; Prochaska & Velicer, 1997; Guo et al., 2009). In other words, to sustain behavioral change over time, a person must employ self-efficacy, engage in decisional balance, and the activities associated with different processes of change. Each of these mechanisms influences motivation (Prochaska & Velicer, 1997).

The following example demonstrates the integrative mechanisms of change conceptualized in the TTM: To quit drinking alcohol, a person might begin to change by altering both their beliefs about drinking and behaviors related to drinking, using various Processes of
Change to do so over time. Early on, such processes may involve reading psychoeducation about alcohol use and attending Alcoholics Anonymous meetings as an active drinker, without abstaining yet. TTM theory would likely label this person temporally in the Contemplation Stage of Change, during which the pros and cons of drinking often appear equally appealing. Per the TTM, with passing time and further consideration of the pros and cons of abstinence, this person would likely progress to the Preparation Stage of Change. The TTM posits that self-efficacy (related to the ability to abstain from drinking, in this case) would help persuade the person to value the pros of abstinence over the cons, furthering TTM stage progression. (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

Self-efficacy refers to an individual’s belief in his or her capacity to influence or perform behaviors related to attainment of a goal (Bandura, 1977, 1982). In the TTM, self-efficacy is viewed as the confidence a person either has or lacks during situations specific to change. TTM authors identified self-efficacy as a key factor in determining how a person would progress through the Stages of Change via research investigating self-efficacy in cigarette smokers. This research focused on how smokers learned to attribute past quitting or abstaining behavior to a belief in their ability to continue smoking abstinence successfully. Self-efficacy theory proposes that people predict their future abilities on tasks based on prior assessments of ability on these tasks (Bandura, 1977, 1982). TTM researchers investigated whether self-efficacy influenced a cigarette smoker relapse behavior after a period of abstinence from smoking (Velicer et al., 1990).

In one study, Velicer and colleagues targeted self-efficacy as an important change mechanism related to a cigarette smoker’s perception and the smoker’s prediction of his/her chances for returning to smoking (1990). Researchers sought to evaluate two broad conceptual
models of relapse in cigarette smokers: one basing relapse behavior on global self-efficacy (or lack thereof) and one based on situation factors leading people to relapse. To test these conceptual models, researchers asked 960 adult cigarette smokers to complete questionnaires presenting different situations likely to elicit smoking behavior (e.g. stressful and social situations, etc.) and different affective states (e.g. anxiety, joy, anger, etc.) to gauge if participants might decide to relapse (smoke) in these contexts (Velicer et al., 1990).

One questionnaire asked participants how confident they felt they could resist smoking in these contexts (Confidence Inventory); the other asked how compelled they felt to smoke in these same contexts (Temptation Inventory)—each questionnaire measuring self-efficacy differently. Researchers then evaluated these different conceptual models of relapse using structural equation modeling to determine which conceptual model was an appropriate fit to the data.

For both inventories, three primary factors were identified: Positive/Social (positive affect and social situations), Negative/Affective (negative affect and social isolation) and Habit Addictive (physiological cravings to smoke); Confidence and Temptation were identified as secondary factors, respectively, with substantial primary factors loadings (.813 - .997) across both questionnaires. Items from the two questionnaires strongly loaded onto the conceptual model. Authors mention this strong loading as support that the Confidence and Temptation constructs fit their conceptual model. They conclude that this support for their conceptual model may suggest that a smoker’s self-efficacy (e.g. a smoker’s confidence to abstain from smoking versus their temptation to relapse) follows the dynamic structure of their model, which involves an interplay between affect, situational contexts and responding to physiological cravings to smoke (Velicer et al., 1990).
People use self-efficacy to help prevent relapsing during any of the Stages of Change (Prochaska and Velicer, 1997; Prochaska, Norcross & DiClemente, 2013). A person’s self-efficacy may also inspire further behavioral changes beyond preventing relapse (Velicer et al., 1990, Prochaska & Velicer, 1997). Individuals with high self-efficacy for avoiding relapse may be more inclined to enter treatment for addictions (Prochaska & Velicer, 1997).

Self-efficacy theory emphasizes that the former opioid user’s continued abstinence behavior results from the interplay between the cognition (belief in abstinence ability) and the affect the person experiences. Bandura calls this relationship “the dynamic interplay among self-referent thought, action, and affect,” emphasizing that subjective emotional experiences influence a person’s perceptions of their abilities (Bandura, 1982, p. 124). For example, an opioid user seeking behavioral change may plan (thought) to continue to abstain from opioid use after completing a successful two-week detoxification (action). This person may then perceive a sense of self-efficacy in their ability to maintain sobriety and express confidence (affect) in the ability to remain sober. Bandura’s theory states that a person’s ability to relate their thoughts to their past actions impacts how they will subjectively define their emotions and their expression of these emotions via their affect (1982). In the context of the TTM, people seeking to change behavior—relapse prevention, for example—engage in this interplay between affect, cognitions and actions (Prochaska & Velicer, 1997).

Like self-efficacy, temptation also relates the interplay of cognition and affect in self-efficacy. Temptation is a measure of how strongly a person feels compelled to engage in a specific, habitual behavior during certain situations (Velicer et al., 1990). In fact, Velicer et al. discovered three factors which they considered common classifications of the temptation to smoke. They labeled these constructs as the “Positive/Social, Negative/Affective and
Habit/Addictive” taxonomies of temptation (1990, p. 276). A person who feels an urge to smoke cigarettes in a social setting with friends is an example of “Positive/Social” temptation, per this definition, whereas a person who feels an urge to smoke to calm down nervousness would be a Negative/Affective, for example (Velicer et al., 1990). Temptation is thus understood along with self-efficacy as an underlying construct in human motivation providing a context for the development of TTM, which seeks to integrate these concepts to explain the processes responsible for behavioral change (Prochaska & Velicer, 1997; Prochaska, Norcross & DiClemente, 2013).

Another principle explaining stage progression in the TTM is decisional balance (Prochaska et al., 1994). Decisional balance considers how stress influences a person’s ability to decide—particularly when under stress, when decision-making abilities can be impaired (Janis & Mann, 1977). Janis and Mann note that during the process of decisional balance, a person may perceive both gains and losses as simultaneous consequences of deciding (1977). How a person weighs the risks and benefits (or pros and cons) tied to a decision is central to understanding decisional balance (Janis & Mann, 1977).

In a study examining decisional balance in cigarette smokers, Velicer and colleagues created and psychometrically validated a 24-item measure assessing decisional balance via examining the decision-making process in 960 smokers attempting to quit (1985). Participants were grouped according to their self-reported smoking status, according to their self-reported smoking behavior during the last six months, as well as their intentions to quit. Through principal-components analysis, researchers revealed two latent variables: the Pros of Smoking and the Cons of Smoking. Using these variables to compare groups, researchers found evidence
that groups with different smoking behaviors weighed pros and cons according to their recent smoking behavior and attitudes towards quitting (Velicer et al., 1985).

For example, TTM researchers created the Decisional Balance Scale, a 24 item self-report, 5-point Likert-type scaled questionnaire designed to measure the four central constructs of decisional balance outlined by Janis and Mann (1977): “gains or losses for self, gains or losses for significant others, self-approval or self-disapproval, and approval or disapproval of others.” (Velicer et al., 1985, p. 1281). Results of this analysis detailed significant differences in endorsement of the pros of smoking between people contemplating quitting smoking in the next six months and those who had quit smoking in the last six months or had quit over six months ago.

The participants in this study, 960 adult cigarette smokers, compared the pros and cons of smoking via using the Decisional Balance Scale. Using a Principal Components Analysis of the Decisional Balance Scale, researchers were able differentiate their sample of into five separate groups based on how they weighed the pros and cons of smoking: Precontemplators (labeled “Immotives”); Contemplators; Relapsers; Recent Quitters; and Long-Term Quitters (Velicer et al., 1985). Researchers found group differences between the five groups on both scales, citing results from significant one-way ANOVA analyzes for both the pros \(F(4, 924) = 35.90, p < .01\) and cons scales \(F(4, 924) = 24.87, p < .01\). For the pro scale, no significant differences were found between Precontemplators, Contemplators and Relapsers. However, Precontemplators, Contemplators and Relapsers all scored significantly higher on the pro scale than Recent Quitters, who themselves scored significantly higher than the Long-Term Quitters. Therefore, Recent Quitters, as well as smokers not interesting in quitting or considering quitting (e.g. Precontemplators and Contemplators) endorsed more of the positive aspects of smoking.
than Long-Term Quitters (Velicer et al., 1985). For the cons scale, no significant differences were found between Precontemplators and Long-Term Quitters, but significant differences were found between both groups and Contemplators and Relapsers, in that both Precontemplators and Long-Term Quitters endorsed lower cons of smoking scores than the other three groups. Based on this difference, it appears that people who are either not interested in quitting smoking (Precontemplators) or those who have quit and maintained abstinence (Long Term Quitters) weigh the negative aspects of smoking similarly, compared to other types of smokers (Velicer et al., 1985).

Researchers maintained that the results of these analyzes support that people able to quit and/or abstain from smoking consider the potential gains and losses of smoking differently than active smokers. Specifically, people considering quitting smoking or who have recently quit smoking more readily identified the potential gains of smoking, whereas people not interested in smoking weighed the losses of smoking similarly to former smokers with established abstinence (Janis & Mann, 1977; Velicer et al., 1985). In previous research, people often considered losses (e.g. losing the “pros” of smoking) more heavily than gains (e.g. healthy living, saving money, etc.) when making decisions (Janis and Mann 1977). This research demonstrates that cigarette smokers have engaged in decisional balance in different ways across time as they progress through the Stages of Change (Miller & Rollnick, 1991; Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

At each Stage of Change, the TTM theory postulates that the pros favoring behavior change must outweigh the cons in favor of maintaining the existing behavior (Prochaska, Norcross & DiClemente, 2013). For example, a person in the Contemplation Stage typically weighs pros and cons equally. If pros outweigh cons, the decisional balance tips towards
behavioral change. Otherwise, progression through this stage does not occur (Prochaska, Norcross & DiClemente, 2013). In summary, decisional balance in the TTM means that people constantly weigh the pros and cons of deciding to make a change at each given Stage of Change (Velicer et al., 1985).

Research has also examined a hypothesized relationship among decisional balance and temptation. Norman and colleagues (1998) conducted a longitudinal study of 2088 cigarette smokers attempting to quit smoking across two years. Researchers used cluster analysis to profile participants into Precontemplation, Contemplation and Preparation Stage of Change groups per the behavioral change patterns exhibited (smoking cessation behaviors). Participants were categorized into subgroups according to the rate at which they progressed through the TTM Stages of Change across the study data collection points at baseline, six months, one year, eighteen months and two years. Progression through the Stages of Change was measured according to two outcome variables measured at each time point: the number of cigarettes smoked per day and time elapsed until the first cigarette smoked each day (Norman et al., 1998). The subgroup labels were named stable, progressing, vacillating and regressing—each representing participants’ rate of change through the TTM Stages of Change (Norman et al., 1998).

Results revealed that participant change pattern groups were associated with self-report measures of temptation and decisional balance consistent with the TTM framework. For example, participants labeled in the Contemplation stage reported lower temptation scores, more cons than pros of changing behavior and fewer cigarettes smoked per day, compared to participants in Precontemplation (Norman et al., 1998). Similarly, participants identified in the Preparation stage listed more cons to changing behavior than pros, smoked fewer cigarettes per
day, and reported lower temptation scores, compared to participants in Contemplation (Norman et al., 1998). Though limited to cigarette-smokers only, these findings lend evidence to support the TTM concept that people must navigate temptation and the process of decisional balance as they progressively express motivation to change (e.g. the TTM Stages of Change).

In another study, Plummer and colleagues measured decisional balance (pros and cons of smoking-related beliefs), via a validated decisional balance scale (Velicer et al., 1985) and self-efficacy, using an adaptation of a psychometrically validated scale of temptation (Situational Temptation Measure; Velicer et al., 1990) to smoke for adolescents (Plummer et al., 2001). Results of one-way ANOVA analyzes revealed that decisional balance and temptation scores were both consistently associated with participants’ transitions from one TTM stage to another, across all Stages of Change. TTM stage transitions were operationally determined by participants’ responses on two questionnaires. The first measured active/inactive smoking status based on a self-report of cigarettes smoked per week; the second assessed the Stage of Change determination for the participant based on a questionnaire asking whether participants intended to quit smoking and, if so, during what time-frame (e.g. during the next 6 months or next 30 days) did they plan to quit. In the ANOVA analyzes, researchers compared T scores from the Decisional Balance Inventory with participants’ Stage of Change determination for the Precontemplation, Contemplation, Preparation, Action and Maintenance stages (Plummer et al., 2001).

Decisional balance was defined by participants’ attitudes about whether the pros of smoking outweighed the cons, as measured by scores on the “pros” and “cons” scales on an adaptation of a 12-item Decisional Balance Inventory. The adapted inventory, verified on a sample of adolescents, revised the two scales (e.g. pros and cons) created by Velicer and
colleagues (1985) by splitting the pros scale into “Social Pros” and “Coping Pros” of smoking, keeping the “Cons” scale the same (Pallonen, Velicer et al., 1998; Plummer et al., 2001 p. 557). An example of a “Social Pros” item is “kids who smoke have more friends”; an example of a “Coping Pros” item is “smoking cigarettes relieves tension” (Plummer et al., 2001 p. 557).

The temptation construct was operationally defined as the degree to which someone has the urge to smoke, as measured by the Temptation to Smoke measure for adolescents (e.g. Ding et al., 1994; Ding, Pallonen & Velicer, 1995), an adaptation for adolescents of a validated adult temptation inventory (Velicer et al., 1985; Plummer et al., 2001). Items on the Temptation to smoke measure used a five-point Likert type scale from 1 (not at all tempted) to 5 (extremely tempted) across four constructs of temptation: Negative Affect, Positive Social, Habit Strength and Weight Control. An example item for Negative Affect is “When things are not going my way and I’m frustrated”; an example item for Habit Strength is “When I realized I haven’t smoked for a while” (Plummer et al., 2001, p. 561).

Authors conducted multiple one-way ANOVA analyzes and identified significant differences across the Stages of Change and all three scales of the Decisional Balance Inventory. Specifically, significant differences across the Stages of Change and the Cons scale [$F(4,793) = 67.1, P < .001$], Social Pros scale [$F(4,793) = 5.4, P < .001$] and Coping Pros scale [$F(4,793) = 61.6, P < .001$] were identified. In summary, participants’ endorsement of both “pros” of smoking scales progressively declined between the Precontemplation and Maintenance groups, whereas participants’ endorsement of the “Cons” of smoking scale progressively increased, across the same Stages of Change (Plummer et al., 2001). Findings suggest that intention and attitude may influence motivation to change smoking behavior.
Researchers also compared standardized scores from the Temptation to Smoke measure to participants in each Stage of Change group, identifying significant differences across the Stages of Change, in a negative linear pattern, across all four of the constructs on the measure (Plummer et al., 2001). Significant differences were found between the Stages of Change and the Negative Affect \( F (4, 793) = 84.6, P < .001 \), Positive Social \( F (4, 793) = 72.5, P < .001 \), Habit Strength \( F (4, 793) = 99.3, P < .001 \) and Weight Control \( F (4, 793) = 17.9, P < .001 \) constructs. Overall, a negative linear trend between scores on the Temptation to Smoke measure and the Stages of Change was observed; for all four scales, scores were highest for participants at Precontemplation, declining progressively at each subsequent Stage of Change, with the lowest standardized scores reported at the Maintenance stage (Plummer et al., 2001). These findings support that smokers progressing through the Stages of Change may feel less temptation to smoke, as they concurrently weigh the pros and cons of decisional balance.

**Differentiating stages of change and Processes of change**

An important, seldom emphasized distinction within the TTM framework is that the Stages of Change and Processes of Change are *separate domains*. The Stages of Change comprise the Temporal Dimension of the TTM. Broadly, the Stages of Change describe what happens in each stage and define parameters for how long change takes during that stage (Prochaska & DiClemente, 2005). Prochaska and DiClemente explain that: “a Stage of Change represents both a period of time and a set of tasks needed for movement to the next stage” (Prochaska & DiClemente, 2005, p. 303). Processes of Change comprise the Independent Dimension of the TTM, variability in individual activities that occur in each Stage of Change.
(Prochaska & DiClemente, 2005). A description of each of those discrete concepts follows; please see Figure 1 for a visual depiction of the components of the TTM.

A key difference between Stages of Change and Processes of change is that The Stages of Change signify *when* people change behavior, whereas the Processes of Change describe *how* people change behavior (Norcross, Krebs, & Prochaska, 2011). This implies that people are more likely to use certain Processes of Change at specific Stages of Change, relative to others. For example, Consciousness Raising is a Process of Change in which cigarette smokers are more likely to engage during Precontemplation, compared to later stages such as Action or Maintenance (Prochaska et al., 1984; DiClemente et al., 1991). TTM theorists argue that cigarette smokers tend to use Consciousness Raising more often than at earlier Stages of Change because the activities of Consciousness Raising include learning about the specifics of the behavior pattern a person targets for change—a cigarette smoker reading smoking health literature, for example. (Prochaska & DiClemente, 1983, Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005).

A person’s engagement in a Process of Change at one point in time does not prevent further utilization of that Process of Change. For example, a cigarette smoker who uses Consciousness Raising during Precontemplation, early on in their progression through the Stages of Change, may also use Consciousness Raising during Action (DiClemente et al., 2004). This clarifies that people can theoretically use the same Processes of Change at more than one Stage of Change. For example, someone may continually use the skill of weighing the pros and cons of a decision during both Precontemplation and Action (DiClemente et al., 2004). Therefore, someone using Consciousness Raising during Precontemplation may use this Process of Change
to increase their awareness of the health risks of smoking. Later, during the Action phase, Consciousness Raising may inform the same smoker about the healthiest ways to quit smoking.

In summary, per the TTM, people can use all the Processes of Change across the Stages of Change. TTM authors encourage further research to further investigate how different populations seeking change (e.g. in lifestyle/health, drug or alcohol use, etc.) use the Processes of Change across the Stages of Change (DiClemente et al., 2004). The available empirical support for the claim that people tend to engage in specific Processes of Change at specific stages of change exists mainly in TTM research on smoking cessation (e.g. Prochaska and DiClemente, 1983).

One such study in smoking cessation research investigated how cigarette smokers use Processes of Change as they progress through the Stages of Change. Researchers used MANOVA analysis of 872 adult cigarette smokers to explain how cigarette smokers are more likely engage in certain Processes of Change at specific Stages of Change (Prochaska & DiClemente, 1983). Researchers hypothesized that participants would use the ten TTM Processes of Change differently according to the Stages of Change to which they were grouped. Participants in this study consisted of low-income adults (60% female) from Rhode Island and Texas who completed self-report indicators of smoking status. Researchers grouped participants by motivation to change in groupings which share similar time spans with the TTM Stages of Change.

Participant groups included Long-term quitters (those who had not smoked in six months or more), Recent quitters (those who quit smoking within the last six months), Contemplators (reporting currently smoking, but thinking about quitting within the next year), Immotives (reporting no intention of quitting in the next year, similar to Precontemplation), and Relapsers
(people who did not quit smoking in the past year). Every six months, over two years, participants in each group completed a validated 40-item self-report questionnaire measuring the ten TTM Processes of Change and provided oral swabs of thiocyanate (a chemical associated with smoking) as an indicator of their current smoking behavior.

Researchers conducted a MANOVA analysis in which the ten Processes of Change were independent variables and the five Stage of Change groups were the dependent variable. Authors then conducted separate ANOVA tests for each of the ten Processes of Change because they considered them relatively independent” of one another (Prochaska et al., 1983, p. 393). Findings of the MANOVA analysis were significant \[ F (1, 40) = 11.199, \ p < .001 \]; all ten ANOVA tests were also significant at the \( p < .05, \ p < .001 \) and \( p < .0001 \) levels. Researchers also ran Newman-Keuls comparisons to compare the five groups and ten Processes of Change, to find which Processes of Change were used most frequently by which Stage of Change groups (Prochaska & DiClemente, 1983).

Researchers indicated that these post-hoc comparisons demonstrate that Immotives (e.g. people in the Precontemplation stage) used 8 of 10 processes of change significantly less than subjects in any other stage. Researchers also noted that MANOVA results support participants’ emphasis of certain Processes of Change in more than one Stage of Change—Self-Reevaluation in the Contemplation and Action stages and Counterconditioning in the Action and Maintenance stages, for example (Prochaska & DiClemente, 1983).

Research has either compared both the Stages of Change and Processes of Change or focused on a single measure and construct (e.g. Prochaska, DiClemente & Fava, 1988; Rollnick et al., 1992; Heather & Hönekopp, 2008). One TTM study compared the Stages of Change and Processes of Change in 276 opioid users (Belding et al., 1995). Authors compared how
participants reported using different Processes of Change at given Stages of Change in their sample via MANOVA \([p<0.05, \text{Wilk’s Lambda (16, 773.57) = 0.76, P < 0.001}]\). Tukey comparisons indicated that participants in the Action stage scored significantly higher than those in the Precontemplation stage and the Contemplation stage, on using Behavioral Processes of change. For example, at the \(p < .05\) level, Tukey comparisons comparing Behavioral Processes of Change to Stages of Change were as follows: Precontemplation < Contemplation, Preparation, Action & Maintenance < Action & Maintenance (Belding et al., 1995, p. 51).

**Stages of change**

The six distinct TTM Stages of Change represent the continuous progression of change over time. Specifically, the TTM postulates that as a person moves through these stages, changes in their target behavior, such as quitting cigarette smoking or starting an exercise program, also occur (Prochaska and Velicer, 1997).

*Precontemplation* is the first Stage of Change. A person in Precontemplation stage has neither expressed thought nor intentions related to the behavior in potential need of change (Prochaska and Velicer, 1997 in the next six months. To substantiate this time frame, DiClemente and Prochaska refer to findings from a meta-analysis of 89 studies on smoking cessation which reported that relapse in cigarette smoking commonly occurs between three and six months (Hunt & Bespalec, 1974).

Prochaska and DiClemente also found support for this 6-month time frame in their own longitudinal study. In this study, authors grouped 540 adults attempting smoking cessation into Precontemplation, Contemplation, Preparation and Action groups based on their response to a TTM Stages of Change measure and evaluated whether participants had attempted to quit
smoking at one, six, twelve and eighteen-month time points (DiClemente & Prochaska, 1982). They found that by six months, only 3 percent of participants labeled at Precontemplation had attempted quitting, compared to 20 percent of those in Contemplation and 41 percent of those in Preparation (DiClemente & Prochaska, 1982). Based on this evidence, DiClemente and Prochaska proposed a six-month time-frame for Precontemplation (1982). Prochaska and colleagues have referenced this distinction at six months to gauge whether people were ready to change in the “near future” (Prochaska, DiClemente & Norcross, 1992, p. 1103).

Contemplation, the next Stage of Change in the TTM, marks a change in a person’s intention to modify behavior. This change is often a change in thoughts or attitudes about changing behavior, as opposed to a measurable difference in behavior itself—a cocaine user may experience ambivalence about their daily use, for example (Prochaska and Velicer, 1997, Prochaska et al., 2005). Notably, Prochaska and colleagues observe that among the cigarette-smokers they studied to determine the length of Contemplation (e.g. Prochaska & DiClemente, 1982), the time it takes for a person to progress through the Contemplation stage can vary considerably. This variance depends largely on how a person thinks about changing a behavior and defines resolution of a problem. (Prochaska, DiClemente & Norcross, 1992). It also depends on if a person committed to quitting smoking attempts to quit during this six-month period of Contemplation (DiClemente et al., 1991).

Contemplation also presents the first opportunity for a person to begin weighing considerations of change via engaging in decisional balance (e.g. per Janis & Mann, 1977; see Figure 1). TTM theory states that a person aware of the pros of behavioral change also explores the cons of change, sometimes remaining in a state of cognitive dissonance for a considerable amount of time (Prochaska, DiClemente & Norcross, 1992; Prochaska and Velicer, 1997;
Prochaska, Norcross & DiClemente, 2013). Individuals in this stage will sometimes experience *cognitive dissonance*—a psychological discomfort generated a person holding two (or more) contradictory beliefs (Festinger, 1962). Cognitive dissonance occurs because a person’s current actions contradict their goals to change a given behavior. For example, a person who smokes cigarettes currently, but desires to quit may experience cognitive dissonance due to their smoking behavior directly contradicting their quitting goal (Prochaska, DiClemente & Norcross, 1992; Prochaska and Velicer, 1997).

**Preparation**, the next stage of change in the TTM, represents the stage in which a person’s intentions to change have become immediate and more concrete, no longer delayed by cognitive dissonance or struggles with decisional balance. Specifically, a person in Preparation would typically express plans to change within the next month, such as joining a weight loss program, beginning to use a smoking cessation aid, or voluntarily admitting themselves to an inpatient detoxification center (Prochaska and Velicer, 1997; Prochaska & DiClemente, 2005).

The **Action** stage directly follows Preparation and represents the point at which behavioral change begins. The “action” is a clear, observable behavior that a person begins and repeats over the next six months. The act of making behavioral change according to a person’s states goals for change is a critical aspect of this stage of change; a simple or temporary behavior modification does not suffice, per this stage’s parameters. For example, people quitting smoking may only be considered in the Action stage if they reduce their cigarette use, for example, to five cigarettes per day down from twenty, a behavior change (reducing cigarette use) that specifically aligns with a person’s stated goals and is repeatedly done across a six-month period (Prochaska and Velicer, 1997).
The **Maintenance** stage follows the Action stage in the TTM because it represents a person’s ability to establish a long-term pattern or routine of engaging in their desired change behavior. Temporally, Maintenance starts anywhere from six months to 5 years from initiating the Action stage. It is important to clarify that during Maintenance; a person is less likely to actively use certain Processes of Change because the person’s focus has shifted from repeating a desired change behavior towards using cognitive and behavioral resources to avoid relapsing or engaging in whatever prior behavior was targeted for change (e.g. drinking alcohol). During this stage, a person may develop a means to cope with a temptation to relapse (e.g. per Velicer et al., 1990). Prochaska and Velicer pointed out that the likelihood of returning to a previous Stage of Change in cigarette smokers varied according to the Stage of Change in which a person was profiled—people in Contemplation were more likely to uphold abstinence from smoking than those in Precontemplation (1997). Norcross and colleagues clarify that relapse should be expected as people progress through the Stages of Change and work towards achieving long-term Maintenance (2011).

A final, often overlooked Stage of Change theorized to occur after Maintenance, is the **Termination** stage. This stage represents a person’s successful ability to reach self-efficacy entirely and resist temptation indefinitely. This means that no relapse should ever occur, regardless of the emotions and cognitions a person may encounter from the temptation to relapse (Velicer et al., 1990). Though no specific temporal parameter is defined for Termination, it is hypothesized to persist after Maintenance. However, this hypothesis is theoretical and not supported by longitudinal research investigating relapse rates in people in the Maintenance Stage of Change. Termination is thus considered an ideal for which people strive in their progression through the Stages of Change because the criterion established for reaching Termination (e.g.
The five stages of behavioral change: Precontemplation, Contemplation, Preparation, Action, and Maintenance, are conceptualized as having temporal phases and motivational or cognitive? I would choose one term tasks that distinguish each other, such as the expected 6-month timeframe for transitioning from Precontemplation to Contemplation or the 6-month to 5-year timeframe for the transition from Maintenance to Termination (Prochaska, DiClemente & Norcross, 1992). A person progressing through the Stages of Change must address the motivational and cognitive tasks, for the hypothesized time periods, to have progressed through stages. For example, an individual progressing from Contemplation to Preparation will often evaluate the amount of effort that will be necessary for change. This process involves decisional balance (e.g. weighing pros and cons)—a potential cognitive barrier preventing stage progression. The time frame, in this case, is the 6-month period after which the person may revert to a prior stage (Prochaska, DiClemente & Norcross, 1992; Prochaska & DiClemente, 2005).

Time frames define one parameter for the Stages of Change. These temporal parameters are not static, however, and may vary according to individuals’ motivation to change (DiClemente et al., 1991; Prochaska and Velicer, 1997). Other factors influence individual progression through stages: level of self-efficacy, resistance of temptation to relapse, and engagement in the Processes of Change. For example, a person is expected to establish a plan to quit smoking during the Preparation Stage of Change within one month of beginning this stage. However, if that person struggles with building self-efficacy (e.g. weighing the pros and cons of quitting), they may delay progression to the Action Stage of Change to two months (Prochaska,
DiClemente & Norcross, 1992; Prochaska and Velicer, 1997). This example illustrates how individual variance in other constructs influencing motivation (e.g. self-efficacy) may impact how long it takes people to progress through the Stages of Change.

**Critiques of the stages of change model**

Critics of the TTM have expressed several concerns over the time frames associated with the Stages of Change. For example, the temporal distinction of six-months for Precontemplation is largely based on research on people changing smoking behavior, thus the actual duration (six months) may not be generalizable to other substances of abuse (West, 2005). Additionally, few studies have examined the validity of the 1-month timeframe during the Preparation stage as representative of how long it takes a person to reconcile cognitive dissonance and decisional balance (e.g. DiClemente et al., 1991; Prochaska & Velicer, 1997). Additionally, evidence supporting the validity of the 6-month timeframe for the Action stage in longitudinal studies is limited to cigarette-smokers (e.g. DiClemente et al., 1991).

This variability in temporal criteria for each stage is viewed as a major limitation of its generalizability across behaviors because there is only support for the existing time frames in research on people trying to quit smoking. No other extant research supports these time frames in studies of people trying to change other behaviors related to quitting alcohol use, cocaine use or heroin use, for example. Critics of the TTM cite this lack of evidence as a reason to question how useful these time frames are when considering any populations other than cigarette smokers (West, 2005).

Moreover, critics of the TTM also cite the cross-sectional nature of most TTM measures, which capture an individual’s self-reported motivation or intention to change at a single, static
time point. Critics argue that studies which categorize a population according to TTM stages at onetime point has little value compared to longitudinal research which could test whether the same participants demonstrate behavioral change over time for a given behavior like cessation of alcohol or drug use. Cross-sectional research instead provides a snapshot in time simply comparing how different people feel about changing their behavior at that moment. TTM critics contend that longitudinal research thus provides more empirical support for the existence of a course by which people change over time (Sutton, 2001; West, 2005). Citing the lack of longitudinal support for the Stages of Change, criticism of the TTM posits that the TTM defines the Stages of Change and Processes of Change arbitrarily (e.g. Sutton, 2001; West, 2005; Guo et al., 2009).

**Nonlinear movement through the stages of change**

Another critique is that progression through the Stages of Change does not occur linearly (Prochaska, DiClemente & Norcross, 1992). For example, individuals may move from Precontemplation to Contemplation and then back again, via recycling, or returning to a previous Stage of Change. Indeed, studies show there is a high likelihood that a person will recycle through earlier stages before arriving at later stages (DiClemente & Prochaska, 1991). The concept of recycling, in this context, refers to the regressive movement to a previously achieved Stage of Change, due to repeating the behavior originally targeted for change. In the context of substance abuse recovery, recycling means returning to the given substance targeted for abstinence—smoking a cigarette when trying to quit cigarette use, for example (Prochaska & DiClemente, 2005). This non-linear movement through the Stages of Change, which includes recycling to previous stages, has been defined as a “spiral” progression (Prochaska, DiClemente
& Norcross, 1992, p. 1104). Authors of the TTM identify recycling as a potential opportunity for a psychotherapy treatment intervention in which the therapist and client can address negative feelings related to a person recycling to a previous Stage of Change (Norcross, Krebs, & Prochaska, 2011). Moreover, TTM authors identify recycling as an opportunity for a client seeking behavior change to learn insight from past behaviors which prevented change—a former smoker may learn to stop keeping cigarettes in the home, for example (Prochaska et al., 1993). This nonlinear process of behavioral change is dynamic and requires a return to previous stages several times before a desired behavioral change occurs. This dynamic movement between Stages of Change relies on a person’s use of the Processes of Change: specific activities related to behavioral change. For example; to progress from Contemplation to Preparation, an individual will often engage in introspective evaluation of assessing both their personal values and the surrounding environment—activities involved in the Processes of Change known as Self-Reevaluation and Environmental Reevaluation, respectively (Prochaska & DiClemente, 2005).

**Processes of change**

To explain the activities in which individuals engage as they progress across the Stages of Change, originators of the TTM developed ten discrete Processes of Change. These Processes of Change measure emotional, behavioral, and cognitive means of behavioral change which vary from person-to-person and represent another foundation of the TTM’s theoretical framework (Prochaska, DiClemente & Fava, 1988; Prochaska & Velicer, 1997). People use these activities to progress through the Stages of Change (Prochaska & Velicer, 1997).

The authors of the TTM categorized ten Processes of Change, each representing motivational strategies which bring about behavioral change. The TTM notes that it is possible for a person to engage in any of the ten Processes of Change across any of the Stages of Change.
According to the TTM research primarily focused on smoking cessation, during certain Stages of Change, specific Processes of Change are more likely to occur (Prochaska et al., 1992; Prochaska & Velicer, 1997). Research measuring engagement in discrete Processes of Change at given Stages of Change indicates that in cigarette smokers, people consistently employ specific Processes of Change across certain Stages of Change (e.g. Prochaska, DiClemente & Fava, 1988; DiClemente et al., 1991; Norcross et al., 2011).

An individual engages in a Process of Change which can modify their thinking or behaviors (Norcross, Krebs, & Prochaska, 2011). The TTM also states that people engage in the Processes of Change simultaneously with other key components influencing behavioral change, such as self-efficacy (e.g. Bandura, 1982) and decisional balance (Janis and Mann, 1977). In addition to using the activities specific to the Processes of Change, people also decide to change according to their belief in their ability to avoid relapse (e.g. self-efficacy) and how they weigh the pros and cons associated with behavioral change (Velicer et al., 1985; Prochaska & DiClemente, 2005). Furthermore, people struggling with temptation (a challenge to self-efficacy) may be more likely to recycle to a previous Stage of Change (Velicer et al., 1990).

Ten processes (Prochaska & DiClemente, 1983; Prochaska, Velicer, DiClemente, & Fava, 1988) have received the most empirical support to date (Norcross et al., 2011). The first five are classified as Experiential Processes and are used most often during the early stage transitions. The last five are labeled Behavioral Processes and are used most often during later stage transitions. Table 1 provides a list of the processes labeled as either Experiential or Behavioral. Each of these Processes of Change draws from integrated concepts in psychotherapy theories related to human motivation mechanisms. Examples of integrated concepts include the psychoanalytic idea that people work to reveal the unconscious during consciousness (known in
the TTM as *Consciousness Raising*) and the corrective emotional experience people undergo via during catharsis—what the TTM labels *Dramatic Relief* (Prochaska & DiClemente, 1982; Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).

Importantly, during any stage of change (i.e., Precontemplation to Termination) there can be more than one change process taking place. This means that it is always possible for people to utilize the Processes of Change, though TTM research on smoking cessation supports that people are more likely to certain Processes of Change at specific Stages of Change (e.g. Prochaska & DiClemente, 1983; Prochaska, Velicer, DiClemente, & Fava, 1988; Prochaska & Velicer, 1997; Norcross et al., 2011). It should be noted that criticism of the TTM cites empirical findings which challenge the notion that in smoking cessation, people consistently use the Processes of Change at specific Stages of Change (Guo et al., 2009). That said, individuals may tend to use the Experiential Processes of Change during the Precontemplation and Preparation Stages of Change and the Behavioral Processes of Change during the later Stages of Change—Action, Maintenance and Termination (Norcross et al., 2011).

Empirical research in studies of smoking cessation supports the theoretical separation of the Processes of Change into Experiential and Behavioral categories. For example, Prochaska and colleagues used Principal Components Analysis in a sample of 970 cigarette smokers (continuing 6 months later with confirmatory factor analysis on the same sample of smokers—770 total, after attrition) using a 40-item self-report questionnaire (1988). Researchers identified a ten-component solution, labeling each of the ten theoretical Process of Change as components: Consciousness Raising, Dramatic Relief, Self-Liberation, Environmental Reevaluation, Helping Relationships, Self-Reevaluation, Social Liberation, Stimulus Control, Counterconditioning and Reinforcement Management (Prochaska, DiClemente & Fava, 1988). In confirmatory analysis,
researchers fit a conceptual model to the data with two primary factors: Experiential and Behavioral Processes of change, each with five secondary factors, per the TTM theory. This model fit the data well (GFI .890); secondary factor loadings ranged from .557 to .802 (Prochaska, DiClemente & Fava, 1988).

Certain limitations of this study should be noted, however. Subjects’ smoking behavior was based on responses to a self-report measure of recent smoking activity, so the impact of social desirability bias should be considered in interpreting findings. The sample was limited to cigarette smokers, the age, gender and race/ethnicity of whom was not specified. Furthermore, researchers found evidence of a high correlation between the Experiential and Behavioral factors, which suggests an overlap between Behavioral and Experimental Processes of Change. Authors also noted that it is possible some subjects did not utilize any of the Processes of Change at all. This clarification recognized that people changing behavior may also engage in activities beyond those described in the Processes of Change (Prochaska, DiClemente & Fava, 1988).

*Consciousness Raising, Dramatic Relief, Self-Reevaluation, Environmental Reevaluation,* and *Social Liberation* comprise the Experiential Processes of Change because using them involved a person restructuring their experience cognitively (Prochaska, DiClemente & Fava, 1988). Moreover, Prochaska and colleagues clarify that someone may employ several or all five Experiential Processes of Change simultaneously to change a target behavior (Prochaska, DiClemente & Fava, 1988). The other five Processes of Change are behavioral in nature: *Self-Liberation, Counterconditioning, Stimulus Control, Contingency Management* and *Helping Relationships* (1988). These Processes of Change were labeled Behavioral because they are actions to change, and thus clear behaviors, whereas the Experiential Processes of Change refer to thought processes (Prochaska, DiClemente & Fava, 1988). Below, each of the ten Processes of
Change will be explained further and contextualized within the larger TTM structure. Further, for each Process of Change, we will identify the Stage(s) of Change in which cigarette smokers most often utilize that Process of Change, per the TTM literature on smoking cessation.

**Experiential processes of change**

*Consciousness Raising* is a Process of Change focused on increasing an individual’s awareness and knowledge about the desired change behavior. Consciousness Raising, which draws from the idea in psychoanalytic theory of making unconscious information conscious, is most likely to occur in smoking cessation during the Precontemplation and Contemplation Stages of Change (Prochaska, DiClemente & Fava, 1988; Norcross et al., 2011). Consciousness Raising also draws from concepts of building awareness (e.g. of how one’s actions/behaviors reflect one’s place in sociocultural systems such as a family, nation, culture, etc.) present in Feminist and Multicultural movements in Psychology (e.g. Helms & Cook, 1999; Goodman et al., 2004). Activities common in Consciousness Raising include accessing psychoeducation, using bibliotherapy and soliciting feedback from healthcare practitioners about how they engage in a behavior targeted for change (Prochaska & Velicer, 1997; see Table 1). Consciousness Raising is noteworthy for its accessibility for people in the Precontemplation stage of change because it constitutes a largely cognitive modification, which may be less challenging than actual behavioral change. TTM authors note those in Precontemplation, whose ambivalence towards thinking about change may prevent them from accessing other Processes of Change, may prefer Consciousness Raising over more behaviorally based Processes of Change which necessitate explicit changes to behavior (Prochaska & DiClemente, 2005).

*Dramatic Relief* refers to another Process of Change often used by people progressing through the Precontemplation or Contemplation Stages of Change, in smoking cessation research.
(Prochaska and Velicer, 1997; Prochaska & DiClemente, 2005, Norcross et al., 2011). This Process of Change draws from branches of psychotherapy such as Gestalt and Psychodrama which assist people with behavioral change via examining their own emotional expression. Examples of this include using in-vivo interventions such as role playing or the empty-chair technique. Dramatic Relief involves a person engaging in activities meant to connect to their affect as it relates to the behavior targeted for change. Through using introspection to gain more awareness of their affect, a person using Dramatic Relief is theorized to realize solutions (thoughts or behaviors) related to changing their target behavior. (Prochaska & DiClemente, 2005).

For example, an opioid user may use Dramatic Relief to reveal uncomfortable feelings they associate with their opioid use to take the first action they can take to reduce their use. For example, an opioid user attempting to reduce their opioid use might role play a situation in which they are offered opioids in a social setting. The opioid user could use Dramatic Relief to focus on the (potentially) negative feeling this situation presents. By recognizing this negative feeling, the opioid user could use their desire to avoid this negative emotion as motivation to avoid future social situations involving potential opioid use. The goal of this Process of Change is to stimulate emotions through experience (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005). Reflecting on life experiences such as enduring the death of a loved one due to addiction can also represent a form of Dramatic Relief because it represents another way for opioid users to use their emotions to motivate them to change. In this case that might mean becoming motivation to cease opioid use to spare an opioid users’ loved ones the grief they felt when they lost someone to opioid overdose.
**Self-Reevaluation** is a Process of Change people use to cognitively and affectively evaluate how they feel about themselves regarding a problem behavior. In smoking cessation research, people in the Contemplation and Preparation Stages of Change typically use Self-Reevaluation as to identify a contrast between a person’s current self-image and their desired change behavior. (Prochaska and Velicer, 1997; Prochaska & DiClemente, 2005). Self-Reevaluation draws from principles of self-psychology concerning identity as understood in the context of social stress (e.g. Burke, 1991). According to Burke (1991), social stress occurs when a person’s self-perception does not match a facet of their identity in social situations. For example, a person who considers themselves confident may reappraise their sense of confidence when speaking in front of a large crowd, due to experiencing performance anxiety often associated with the social context of public speaking (Burke, 1991).

In the TTM, this self-reappraisal due to social context also applies to people trying to change behavior. A person engaging in Self-Reevaluation assesses their self-image as they compare their identity in social contexts with the behavior they want to change. For instance, a person having trouble trying to achieve a healthy lifestyle may realize that their healthy peers consider their current diet as unhealthy. This realization may elicit an emotional response in the person seeking a healthier lifestyle. Per the TTM, this emotional response has the potential to inspire the person to use Self-Reevaluation as an opportunity to assess their values. This assessment or self-reappraisal may challenge the person’s “healthy” identity, prompting the person to think about how changing behavior would align with identifying as healthy (Prochaska, DiClemente & Fava, 1988; Prochaska & Velicer, 1997).

Another Process of Change utilized commonly by those moving through the Precontemplation and Contemplation Stages of Change in smoking cessation research is
**Environmental Reevaluation.** This process has a theoretical basis in Maslow’s theory of self-actualization (Maslow, 1962, Prochaska, Norcross & DiClemente, 2013). Environmental Reevaluation requires a person to examine or reflect upon how their current (unchanged) behavior influences others in their social environment, considering both affective and cognitive mechanisms of change (Prochaska & Velicer, 1997). For example, a cocaine user may engage in Environmental Reevaluation via reflecting upon how stealing money from a family member has affected their relationship with this person negatively, precipitating emotional consequences for both people. This assessment of a person’s environment also involves considering a person’s awareness of how their engagement in their problem behavior appears to others. For example, an opioid user may utilize Environmental Reevaluation to explore how using opioids may have led others to notice that person’s recent absence at work (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005).

**Social Liberation** is a Process of Change which occurs most commonly during the Contemplation and Preparation Stages of Change. It is rooted theoretically in Feminist Theory concepts concerning inciting larger societal change via taking action (e.g. Miller, 2012). This Process of Change was not mapped between two specific Stages of Change in the smoking cessation research, implying that a person could employ Social Liberation across any given Stage of Change (Prochaska & DiClemente, 1983; Prochaska, DiClemente & Norcross, 1992). A person engaging in Social Liberation may advocate for larger societal changes related to their targeted change behavior—someone trying to change heroin use behavior may advocate for the presence of more opioid treatment facilities in their community, for example (Prochaska & Velicer, 1997). Social Liberation, along with the four Processes of change, is one of the five Processes of Change Prochaska and colleagues identified as Experiential (1988).
Behavioral processes of change

Certain Processes of Change which underlie the Action and Maintenance Stages of Change have theoretical roots in Behaviorism (e.g. Skinner, 1963). Namely, three Processes of Change: Counterconditioning, Stimulus Control, and Contingency Management, all apply principles of Behaviorism within the larger TTM framework. Each process draws from the core principle of learning behavior via understanding the relationship between action and consequence, or stimulus and response. Counterconditioning focuses on replacing behaviors, Stimulus Control targets removing/replacing environmental stimuli, and Contingency Management involves using punishment and reward (Prochaska & DiClemente, 2005). these three Processes of Change, along with two others: Self-Liberation and Helpful Relationships, comprise the Behavioral Processes of Change, per the TTM (Prochaska, DiClemente & Fava, 1988).

Self-Liberation, another Process of Change, is typically utilized by people in both the Preparation and Action Stages of Change, in smoking cessation research (Prochaska & Velicer, 1997; Norcross et al., 2011). Self-Liberation is a Process of Change related to Bandura’s theory of self-efficacy, which requires a person to evaluate their own sense of autonomy, rooted in their own self-appraisal (1982). Engaging in this process, therefore, requires believing that one can influence their ability to change, despite present circumstances making change difficult. (Prochaska & DiClemente, 2005). People commonly use Self-Liberation during the Preparation stage to point out (e.g. via verbally pledging or writing it down) their commitment towards a specific, planned action related to their desired change behavior—an opioid user planning to explore medication-assisted treatment, for example (Prochaska & Velicer, 1997).
**Counterconditioning** occurs most commonly during the Action and Maintenance Stages of Change and refers to a person contrasting healthy behaviors with targeted problem behaviors—using controlled breathing to counter feelings of acute stress, for example. Counterconditioning involves learning and repeating a new behavior to replace a previous behavior—a process mirroring principles of Operant Conditioning (e.g. Skinner, 1963). A person starting to chew Nicotine gum instead of smoking cigarettes is an example of using Counterconditioning to replace a previous behavior with a healthy behavior.

**Counterconditioning** functions to build learned associations to stimuli related to alternatives to the previous behavior, typically replacing drug use behavior. Developments in the literature on the neuroscience of addiction explain the role of habitual behavior in patterns of drug use (Belin et al., 2013). Namely, the formation of habitual behavior patterns involves people associating environmental stimuli with responses to those stimuli—using drugs to relive stress instead of other coping skills, for example (Baler & Volkow, 2006). In smoking cessation research, people often utilize Counterconditioning during the Action or Maintenance Stages of Change (Prochaska & Velicer, 1997).

**Stimulus Control** occurs most commonly in cigarette smokers between the Action and Maintenance Stages of Change, also rooted in principles of Behaviorism (Prochaska & DiClemente, 1983). It is a Process of Change whereby someone removes parts of the environment associated with the targeted change behavior, replacing these stimuli with healthier alternatives. Addiction literature detailing the neurobiological components of addiction (e.g. memory in learning) supports interventions targeted at weakening the associations people make between drugs and drug-related stimuli (Baler & Volkow, 2006). Researchers explain the role of stimulus/response in learning as follows: “As the drug achieves increasing preeminence over that
of alternative reinforcers, the conditioned learning towards the drug and previously neutral stimuli associated with it (cues) strengthens” (Baler & Volkow, p. 560). Using *Stimulus Control* can promote a new behavior while simultaneously preventing relapse. A person uses stimulus control, for example, when discarding drug paraphernalia in the home and replacing it with reminders to read recovery literature from a support group (Prochaska, DiClemente & Fava, 1988; Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005).

*Contingency Management* also shares a theoretical basis in Behaviorism. In smoking cessation literature, people use *Contingency Management* in both the Action and Maintenance Stages of Change (Prochaska & DiClemente, 1983). In this Process of Change the principles of Operant Conditioning are enacted, such as reinforcement schedules, punishment and reward, to promote behavioral change (Skinner, 1963; Prochaska & Velicer, 1997). A person using *Contingency Management* may attend a support group where sober peers reward increasing sobriety time as a means of reinforcing changing a prior drug use behavior (Prochaska & Velicer, 1997).

Researchers studying the neurobiological function of executive control in addiction recognize the role of *Contingency Management* in preventing drug users from cementing patterns habitual drug-seeking behavior. Specifically, they propose that a drug user’s repeated exposure (a response) to a drug (a contingency) will, over time, shift a drug user’s behavior from being goal-directed and not involving drug use, to habitual and compulsive drug use (Belin et al., 2013). To counter this pattern, authors offer that “conditioned reinforcement” is a psychological process potentially related to impacting executive control in drug users (Belin et al., 2013, p. 569). Drug users can therefore use *Contingency Management* as a means of altering planned behavior related to drug use, to avoid relapse. An example of this would be a person using
positive reinforcement via earning praise at support groups in exchange for abstinence behavior (Prochaska & DiClemente, 2005).

A final Process of Change, occurring most commonly in smoking cessation during the Action and Maintenance Stages of Change, is called **Helping Relationships**. This Process of Change has theoretical roots in client-centered or humanistic psychotherapy (e.g. Rogers, 1959) and refers to how people access and employ social supports to promote behavioral change. A person targeting alcohol use behavior employs Helping Relationships via consulting with a support group sponsor, for example. Prochaska and DiClemente clarify that engaging in Helping Relationships could include seeking social support via attending psychotherapy as well as traditional social supports such as friends and family (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005).

**Existing TTM measures**

*The University of Rhode Island change assessment scale (URICA) measure*

It should be noted that other measures, such as the University of Rhode Island Change Assessment (URICA), and the Stages of Change and Treatment Eagerness Scales (SOCRATES), have previously been validated for use in measuring readiness to change per the TTM in various substance use populations (Norcross et al., 2011). The URICA, a 32-item scale measuring the TTM Stages of Change, was designed on a sample of 155 adults attending outpatient psychotherapy. Researchers performed a Principal Components Analysis with an orthogonal, varimax-rotated component pattern, which revealed four-factor solution accounting for 58 percent of the total variance (McConnaughy, Prochaska, & Velicer, 1983). Authors reported high factor loadings on four components representing the TTM Precontemplation, Contemplation,
Action and Maintenance Stages of Change. Cronbach’s alpha coefficients reported for the four scales ranged from .88 to .89 (McConnaughy, Prochaska, & Velicer, 1983).

A subsequent Principal Components Analysis of URICA scale was performed to reassess this scale on an alcohol treatment sample. This analysis replicated the four-factor solution produced by McConnaughy, Prochaska, & Velicer (1983). (DiClemente & Hughes, 1990). Researchers used hierarchical cluster analysis, a statistical method which involves categorizing data sets based on predetermined criteria, to address heterogeneity within a given data set (Bridges Jr., 1966). Cluster analysis differs from data reduction analyzes such as factor analysis and Principal Components Analysis (which reduce large data sets into components or factors) because it functions to categorize data into “clusters” or unique groupings based on mathematical pairings of the highest average intercorrelations within a correlation matrix. Clusters, for example, can involve further categorization of a data set which has already been reduced by factor or Principal Components Analysis (Bridges Jr., 1966).

In this study, a hierarchical cluster analysis revealed five constructs labeled “Precontemplation, Ambivalent, Participation, Uninvolved, and Contemplation” which represent further categorizations of the data set beyond the four Stages of Change subscales (DiClemente & Hughes, 1990). Researchers demonstrated the internal and construct validity of these five clusters (DiClemente & Hughes, 1990). Though reliability was not demonstrated, authors note that the URICA scale itself is an adaptation of the Stages of Change Questionnaire, which demonstrated reliability previously for the four subscales for Precontemplation, Contemplation, Action and Maintenance (McConnaughy et al., 1983). Adaptations of the URICA have been validated with polysubstance users (e.g. Abellanas & McLellan, 1993, Field et al., 2009).
The stages of change and treatment eagerness scales (SOCRATES) measure

The SOCRATES scale was developed on alcohol users (N=1265, 76% male, mean age: 38 years) as a 39-item scale measuring “motivation to change in problem drinkers” (Miller & Tonigan, 1996a, p. 81). Principal component analysis revealed a factor solution involving three constructs which authors labeled “Recognition, Ambivalence, and Taking Steps”, constructs which authors describe as “continuously distributed motivational processes that may underlie stages of change,” (Miller & Tonigan, 1996a). The scale was determined to be reliable, in terms of both test-retest reliability and internal consistency (Miller & Tonigan, 1996a). Support for the predictive and concurrent validity of the SOCRATES was later established by Mitchel and Angelone on a sample of 357 active duty military service members seeking substance abuse treatment (2006). The SOCRATES has been used in studies of smoking cessation (DiClemente et al., 1991), alcohol use (Isenhart, 1997), and polysubstance use (Henderson, Saules, & Galen, 2004).

Readiness to change questionnaire (RCQ)

The Readiness to Change Questionnaire was developed as a 12-item self-report questionnaire about motivation to change drinking behavior, by Rollnick and colleagues (1992) on a non-treatment sample of heavy alcohol consumers recruited in two general hospitals in Australia and Wales. Developers of the RCQ cited various reasons for creating a measure separate from the URICA to measure motivation to change drinking behavior. For example, they adapted item language from the URICA measure, which was previously piloted in a study allocating 224 adults in outpatient treatment to the TTM Stages of Change (i.e. DiClemente & Hughes, 1990). Furthermore, Rollnick and colleagues developed RCQ items with language
focused more on drinking behavior, whereas the URICA language described drinking “problems.” RCQ Authors acknowledge that the URICA effectively measures attitudes that people may express within or between specific Stages of Change on a continuum, which could prove clinically useful (DiClemente & Hughes, 1990; Rollnick et al., 1992) However, Rollnick and colleagues note that a cluster analysis performed on the URICA by DiClemente & Hughes produced five clusters which only loosely resemble the Stages of Change described by Prochaska and colleagues in previous research on the TTM Stages of Change with cigarette smokers (1990).

RCQ authors thus sought to develop the RCQ as a measure which would allocate respondents to the TTM Stages of Change using the respondents’ own judgments (as opposed to researcher judgments) to represent their attitudes towards change (Rollnick et al., 1992). RCQ creators argue if a simple tool such as the RCQ could allocate respondents to the Stages of Change effectively, clinicians would benefit from this insight in tailoring their interventions accordingly—for example, recommending relapse prevention for someone moving from Action to Maintenance (Heather, Rollnick, & Bell, 1993).

Researchers thus piloted the 12-item RCQ on 141 adults (93% male) identified as heavy alcohol users in two medical settings in Australia (Rollnick et al., 1992). They used Principal Components Analysis to reveal a clear factor structure differentiating the Precontemplation, Contemplation and Action Stages of Change, with significantly higher inter-correlations for scale scores on adjacent stages of change than for scores on non-adjacent stages. For example, the correlation between Precontemplation and Contemplation was -0.53, the correlation between Contemplation and Action was 0.57; the correlation between Precontemplation and Action was -0.36, however. Authors also established internal consistency (α = .73 -.85), test-re-test-reliability
(r = .78 -.86) of the 12-item RCQ measure (Rollnick et al., 1992). Authors also established the concurrent validity of the RCQ by comparing participants’ allocated Stage of Change with how participants self-identified. Participants did this by selecting a statement paired with a cartoon image to describe their drinking behavior. Results of this comparison indicated that subjects who identified the Precontemplation and Contemplation cartoons obtained a higher mean RCQ score on those respective scales, compared to the other two scales, though this finding was not true of participants identifying the cartoon for the Action Stage (Rollnick et al., 1992).

A subsequent RCQ study (N=141, 94% male), grouped participants according to low, medium or high alcohol dependence via responses to the self-report Short-form Alcohol Dependence Data Questionnaire (SADD; Raistrick, Dunbar & Davidson, 1983). Respondents were allocated to the Precontemplation, Contemplation or Preparation or Action Stages of Change per the RCQ previously developed and validated by Rollnick et al. (1992). Researchers note that a group mean comparison of participants in the Action Stage of Change to all other Stages of Change revealed statistically significant differences in mean alcohol consumption (per self-report), including reductions in alcohol consumption at both 8-week and 6-month follow-up points (Heather, Rollnick, & Bell, 1993). Further, authors cited results from a multiple regression analysis which indicate that participants’ Stage of Change significantly predicted alcohol consumption at six-month follow up, compared to baseline (β = 0.22, p < 0.05). Authors note this result supports that participants in the Action stage were more likely to reduce alcohol dependence in six months (as measured by the SADD) than those in all other Stages of Change (Heather, Rollnick, & Bell, 1993).

Another study matched 742 alcohol-dependent individuals randomized from 7 different alcohol treatment centers to the Precontemplation, Contemplation, and Action Stages of Change
as part of a pilot study to validate an updated treatment version of the RCQ (e.g. Rollnick et al., 1992) and measure related alcohol use outcomes. Authors provided evidence for the construct validity of the revised RCQ by citing the presence of significant correlations between participant Stage of Change dichotomy (Action vs. all other Stages of Change) and variables indicating alcohol use problems, including percent days abstinent (PDA) drinks per drinking day (DDD), and scores on the Negative Alcohol Expectancies Questionnaire (NAEQ: McMahon and Jones 1993). Specifically, negative correlations found between Stage of Change allocation and NAEQ score \( r = -.34, p < .01 \) at 3 month-follow-up) suggested that participants in the Action stage perceived heavy drinking more negatively than those in all other Stages of Change. Additionally, negative correlations were found between participant Stage of Change and PDA \( r = -.35, p < .01 \) at 3 month-follow-up; \( r = -.45, p < .01 \) at 12 month-follow-up); whereas positive correlations were found between Stage of Change dichotomy and DDD \( r = .29, p < .01 \) at 3 month-follow-up). Participants in the Action stage reported less frequency and intensity in drinking than those in the Preparation stage (Heather & Hönekopp 2008).

In terms of treatment outcomes at 12-month follow-up, participants ranked their treatment progress on a self-report questionnaire, which labeled possible treatment outcomes on a Likert-type scale across categories such as “Worse,” “Same,” “Somewhat Improved,” “Much Improved,” and “Abstinent.” Researchers then coded outcomes from 6 (Abstinent) to 1 (Worse) and the Stages of Change as 2 and 1 (“2” and “1” representing Action and all stages before Action, respectively). Researchers identified via correlation analysis that the relationship between outcome and TTM Stage of Change at baseline was \( r=0.107 \) (\( p=0.014 \)). The same comparison at 3-month assessment was \( r=0.279 \) (\( p< 0.001 \)) and \( r=0.403 \) (\( p< 0.001 \)) at 12-month assessment (Heather & Hönekopp 2008). Researchers also noticed that, at both three and twelve-
month follow-ups, more than 60% of participants labeled in stages before Action reported no improvement in addressing alcohol problems treatment, compared to baseline. Authors indicated that these results support the measure’s predictive validity (Heather & Hönekopp 2008). This research, which included strengths such as a large sample and longitudinal design, supports the predictive validity of the RCQ in alcohol studies. Researchers compared participants allocated to Stage of Change groups to treatment outcomes directly related to changing alcohol use behavior.

Other studies establish the construct validity of TTM Stages of Change measures by matching participants in a given Stage of Change to profiles consistent with that stage. Willoughby and Edens used cluster-analysis criteria to identify two Stage of Change-matched subgroups of veterans in residential treatment (the Precontemplation Stage and a combined Contemplation-Action stage group). They conducted a study which established further evidence for the construct validity of the URICA Stages of Change-based readiness measure (Willoughby and Edens, 1996). Researchers studied 144 adults entering residential alcohol treatment into two groups via hierarchical cluster analysis: a Precontemplation group and a Contemplation/Action group. In addition to the URICA measure, participants completed a self-report measures of mood and attitude towards drinking, the Revised Alcohol Use Inventory (AUD-R; Horn et al., 1990). Authors reported that a comparison of means from participant scores on suggested support for the construct validity of the URICA; participants in the Precontemplation group expressed less guilt and worry about drinking than did participants clustered in the Contemplation/Action group, for example. Likewise, participants in the Contemplation/Action group scored higher on a subscale of the AUD-R indicating their ability to manage their mood than did the Precontemplation group (Willoughby and Edens, 1996). Edens & Willoughby later replicated this cluster analysis with a different sample of 162 alcohol-dependent adults in residential
treatment (2000). This time their findings provided support for the predictive validity of the URICA. Authors found statistically significant differences in a two-tailed t-test \[X^2(1, N = 162) = 8.30, p = .004\] which compared participants who completed the residential treatment program in the Precontemplation group (54% completion) and Contemplation/Action group (76% completion), respectively. Those in the Contemplation/Action group completed treatment at a higher rate than those in Precontemplation (Edens & Willoughby, 2000).

In research about Tobacco Use Disorder (formerly known as nicotine dependence), the predictive validity of Stages of Change has also been demonstrated. For example, Velicer et al. conducted a secondary data analysis of five studies of smoking intervention effectiveness, using a Chi-square analysis to compare effect sizes in differences in smoking outcomes across the five studies—specifically comparing outcome differences across demographic sample characteristics and five smoking behavior variables (2007). Their analysis indicated that Stage of Change was among the strongest predictors of smoking status at both 12 and 24 months \(X^2=42.31\) and \(X^2=42.41\), respectively), across all five studies of different cigarette smoking populations (Velicer et al., 2007). The authors consider this finding robust, noting it as a replication of earlier studies of predictive validity (e.g. Spencer et al., 2002), contending that this finding demonstrates that Stages of Change are not just descriptive, but predictive of behavioral change (2007).

Other research has demonstrated associations between Stages of Change and other outcomes related to tobacco use. For instance, in a study of 127 tobacco users, those who showed progression in TTM Stages of Change over six months also demonstrated improvements to self-efficacy, an outcome related to constructs in the TTM framework (Macnee & Talsma, 1995). Another study, randomly sampled a large population of adult cigarette smokers in the northeastern US (N=4,144) and required participants to complete TTM inventories for the Stages
of Change, Processes of Change, in addition to Decisional Balance and Situational Temptation measures.

Authors used MANOVA and various ANOVA comparisons to indicate statistically significant relationships between the Precontemplation, Contemplation, and Preparation Stages of Change and Decisional Balance and Situational Temptation subscales (Fava, Velicer & Prochaska, 1995). Specifically, the authors found clear differences in smoking behavior in those areas in different Stages of Change—for example, Tukey comparisons were performed after ANOVAs between the Precontemplation (PC), Contemplation (C) and Preparation (PR) Stages of Change and all three Situational Temptation subscales: Positive/Social ($F[2,4141] = 7.13, p < .001; \text{PC} = \text{C} > \text{PR}$), Negative/Affective ($F[2,4141] = 6.83, p < .01; \text{PC} > \text{PR}$), and Habit/Addictive ($F[2,4141] = 4.68, p < .01; \text{PC} = \text{C} > \text{PR}$). Authors contend these results indicate that participants in Precontemplation and Contemplation reported more temptation to smoke than participants in the Preparation Stage (Fava, Velicer & Prochaska, 1995). These comparisons also represent the types of situations or conditions in which smokers in Precontemplation, Contemplation and Preparation would be tempted to relapse. The comparisons indicate that smokers in Preparation would be least tempted by social pressure to smoke (e.g. Positive/Social) and physiological cravings to smoke (e.g. Habit/Addictive), but most tempted by experiencing negative affect and social isolation (e.g. Negative/Affective), situationally. Moreover, the comparisons indicate that smokers in Precontemplation and Contemplation are equally likely to be tempted to relapse by physiological cravings to smoke and social pressure to smoke (Fava, Velicer & Prochaska, 1995). These differences in situational temptation help provide support for the idea that temptation to smoke decreases as someone progresses through the Stages of Change.
Researchers also found a significant group difference in an ANOVA comparison of daily cigarette use between participants in the Precontemplation, Contemplation and Preparation groups. In terms of the number of cigarettes smoked daily during the past week ($F \left[2, 4139\right] = 34.07, p < .0001$), those in Precontemplation smoked the most cigarettes, those in Contemplation smoked less, and those in Preparation smoked the least. Authors argue that the TTM Stages of Change and Processes of change act as indicators of group differences capable of providing insights into differences in attitude that distinguish different types of smokers, based on their motivations towards quitting. (Fava, Velicer & Prochaska, 1995).

Using secondary data analysis, Gökbayrak et al. compared four populations of (N=521) adult cigarette smokers using TTM-based self-help manuals to quit smoking, whose smoking behaviors and attitudes towards smoking (e.g. severity of smoking, TTM Stage of Change, situational balance and situational temptation) were assessed for every 6 months over a 30-month period (2015). Results indicated that participants who endorsed more temptation to smoke were more likely to relapse at follow-up (Gökbayrak et al., 2015). Researchers relate this finding to the framework of the TTM Stages of Change model, which posits that those in the earlier Stages of Change (e.g. pre-Action/Maintenance) tend to struggle with the temptation to relapse or repeat a targeted change behavior (Prochaska and Velicer, 1997; Prochaska, Norcross & DiClemente, 2013). Additionally, researchers found that participants who did not utilize the TTM self-help materials (e.g. the control groups across the four samples) were twice as likely to relapse at follow up (Gökbayrak et al., 2015). This finding helps support the utility of the TTM as a resource for adult smokers motivated to change behavior.

**Measuring the stages of change in different drugs of abuse**
Since the conception of the TTM theory in the 1970s, certain measures have been developed to measure the constructs of the TTM—chiefly the Stages of Change (e.g. McConnaughy, Prochaska, & Velicer, 1983; Rollnick, Heather, Gold & Hall, 1992) and the ten processes of change, as Prochaska originally measured them (1988). Measures such as the URICA and the Stages of Change and Treatment Eagerness Scales (SOCRATES) have also been developed and psychometrically validated for use in measuring the Stages of Change in substance use disorder research (McConnaughy, Prochaska, & Velicer, 1983; McConnaughy et al., 1989; Miller & Tonigan, 1996a).

The Readiness to Change Questionnaire (RCQ) is another TTM Stages of Change measure, developed by Rollnick, Heather, Gold & Hall (1992) in Alcohol Use Disorder research. Authors piloted the RCQ on a sample of 141 adults labeled as excessive drinkers (94% male); subjects were all recruited from inpatient or outpatient medical providers making referrals related to excessive alcohol use. Item selection for the RCQ initially adapted items from the URICA measure before narrowing the item pool via expert review from clinical psychologists familiar with the TTM Stages of Change. Before running any analyzes, researchers dropped items corresponding to the Maintenance Stage on their measure, due to inadequate participant endorsement of these items during item screening. The development of the RCQ scales therefore narrowed the number of Stages of Change assessed from the four TTM stages measured on the URICA (e.g. Precontemplation, Contemplation, Action and Maintenance), to three stages: Precontemplation, Contemplation or Action Stages of Change (Rollnick et al., 1992).

Researchers then performed a principal components analysis (PCA) on their 15-item questionnaire, which revealed a three-factor structure accounting for 67% of the total variance (Rollnick et al., 1992). The decision to reduce the measure to 12-items was then made because
three items had moderately high factor loadings on more than one scale. Authors indicate that Cronbach’s alpha coefficients from the exploratory PCA reliably placed alcohol users in the Precontemplation ($\alpha = .73$), Contemplation ($\alpha = .80$) and Action ($\alpha = .85$) Stages of Change. Predictive validity for the RCQ was also demonstrated via the direction of Product-moment correlation coefficients, which were higher between adjacent scales (Precontemplation and Contemplation) than between non-adjacent scales (Precontemplation and Action); correlations of $r = -0.53$ between Precontemplation and Contemplation and $r = -0.36$ between Precontemplation and Action were found accordingly (Rollnick et al., 1992).

**Measuring the processes of change in different drugs of abuse**

Compared to measures of the Stages of Change, fewer measures are available to evaluate the Processes of Change. Since Prochaska et al. developed the first Process of Change Questionnaire (PCQ) in 1988, which contained ten subscales of experiential and behavioral change in smoking behavior, a subsequent version was created and psychometrically validated by DiClemente and colleagues Hoeppner and colleagues (2006), also for cigarette-smoking behavior. Additionally, one 60-item measure for process of change was developed in a sample of people with Opioid Use Disorder (OUD) in methadone treatment (Belding et al., 1995).

With the goal of evaluating a 20-item short-form version of the original PCQ measure, Hoeppner and colleagues tested their adaptation of the PCQ on 798 ninth-graders (87% white, 48% female) identifying as smokers in Rhode Island. Authors used structural equation modeling to test the factor structure of their 20-item PCQ questionnaire, in comparison to the 40-item PCQ developed by Prochaska and colleagues (1988). Researchers indicate their model fit indices support a factor structure aligned with that of the original PCQ (RMSEA=0.08, CFI=0.92; Hoeppner et al., 2006) Additionally, authors indicated that in the model, 10 primary factors
represented each Processes of Change, along with two secondary factors which grouped the processes into Behavioral and Experiential processes of change, with the same five Processes of Change as the original PCQ, for each secondary factor. Authors reported that internal consistency via Cronbach’s alpha calculated for the Experiential and Behavioral item scales value ranged 0.60 to 0.84—values only slightly lower than those reported on the original PCQ measure (Prochaska, DiClemente & Fava, 1988; Hoeppner et al., 2006). Researchers therefore maintain that this short-form version of the PCQ demonstrated theoretical alignment with the original PCQ measure, as well as comparable internal consistency (Hoeppner et al., 2006).

Select studies have measuring the TTM Stages of Change in other substance using populations outside of tobacco users. This research includes studies comparing TTM Stages of Change profiles to behavioral change outcomes with other drugs of abuse and with retention in treatment for addiction. One such study compared 276 people in methadone maintenance treatment for opioid dependence profiled in various Stages of Change, to treatment outcomes such as treatment length of stay and opioid (medication assisted therapy)-use (Belding et al., 1995). Of note, participants in the Precontemplation stage reported ongoing opioid use and no intention to cease opioid use in the next six months. In comparison, participants in the Preparation stage reported participation in substance abuse treatment within the past six months to two years. These findings together provide limited support associating a person’s assigned Stage of Change and behaviors associated with opioid use and cessation (Belding et al., 1995).

Another study compared the Stage of Change profiles of 451 women seeking substance use treatment for Cocaine Use Disorder and Polysubstance Dependence to their reported readiness to enter treatment (Brown et al., 2000) Authors found via logistic regression analysis that participants’ classification to a TTM Stages of Change effectively predicted entrance into
drug treatment. Specifically, the analysis supported a higher likelihood for participants in the Preparation and Action Stages of Change to enter drug treatment, compared to those in the Precontemplation and Contemplation stages (Brown et al., 2000).

Outcomes: TTM stages of change in substance use disorder research

Studies on outcomes related to the TTM Stages of Change in the substance use disorder literature have often classified individuals in one Stage of Change according to a specific criterion relevant to substance use behavior. For example, a tobacco smoker may be asked if he or she is planning on quitting smoking within the next 30 days or the next six months. If the person indicates a willingness to quit within the next 30 days, that person would likely fit into the Preparation Stage of Change (Migneault, Adams, & Read, 2005). Research on the TTM typically measures self-reported readiness to change as an outcome (Prochaska & Velicer, 1997).

Outcome studies have provided evidence for the predictive validity of Stages of Change measures in individuals with alcohol use disorders. One such study suggested that the Stage of Change to which 174 men characterized as heavy drinkers (consumed over 28 standard drinks per week) were allocated predicted changes in their drinking behavior (e.g. total weekly drinks consumed, self-report assessment of drinking behavior) at eight-week and six-month follow up after they were discharged from hospitalization (Heather, Rollnick, & Bell, 1993).

Outcomes: TTM processes of change in substance use disorder research

According to the TTM framework, people change health-related behaviors—abstaining from substance use, for example—by weighing the pros and cons of decisional balance and using self-efficacy to resist the temptation to relapse. Simultaneously, people also change via engaging
in the activities of the Experiential and Behavioral Processes of Change over time, as they progress through the Stages of Change. (Prochaska, DiClemente & Fava, 1988; Norcross et al., 2011). Compared to the available literature on Tobacco Use Disorder, few extant studies demonstrate the predictive validity of the Processes of Change in the context of other substance abuse treatment. However, three studies have examined the relationship between the Processes of Change to treatment outcomes for Alcohol Use Disorder.

The first, qualitative research profiling a small sample (N=87, 33% female) of treatment-seeking adults (ages 23-65) in outpatient treatment for Alcohol Use Disorder, measured participants’ use of the Processes of Change in the context of drinking cessation after a recent relapse with alcohol use. Researchers qualitatively coded participant responses to questions from The Relapse Experience Interview (REI; Marlatt and Gordon, 1980) a structured clinical interview about alcohol cessation. They documented 312 total strategies participants described for ceasing alcohol use and categorized them into the ten TTM Processes of Change (Hodgins et al., 1997). Participants reported using Behavioral Processes of Change commonly associated with the Action Stage of change more frequently than processes associated with earlier Stages of Change. The Processes of Change commonly used by people in the action stage were Stimulus Control, Self-Liberation, Counterconditioning and using Helping Relationships (Hodgins et al., 1997).

Another study compared the involvement in 191 participants who participated in Alcoholics Anonymous (AA) to TTM Processes of Change, using involvement in Alcoholics Anonymous as an outcome for comparison (Snow, Prochaska & Rossi, 1994). Participants (98% white, 61% male; 19-75 years old) varied in terms of time abstinent (per self-report) from alcohol use, from 1 month to 27 years abstinent. Study findings supported associations between
AA involvement (e.g. meeting attendance, rating of usefulness of AA in a sobriety effort) and the use of Processes of Change. Specifically, participants attending AA were more likely to utilize Helping Relationships, Stimulus Control, Contingency Management and Consciousness Raising than participants reporting less AA involvement. These Processes of Change used by AA participants are primarily Behavioral Processes of Change used by people navigating the Action and Maintenance Stages of Change (Snow, Prochaska & Rossi, 1994).

Carbonari and DiClemente also compared adult alcohol users’ (28% female, aged 18-75 years) use of Experiential and Behavioral Processes of Change, to their drinking behavior at one year after baseline assessment. Participants were categorized into abstinent, moderate and heavy drinking groups, based on their self-reported drinks per day, over one year (2000). Their study profiled two samples of 673 outpatient and 510 aftercare patients in the Project MATCH study. Their profile analysis used a psychometrically validated, 40-item measure of the TTM Processes of Change scale which contained 4-items to measure of each of the five Experiential and five Behavioral Processes of Change (Carbonari & DiClemente, 2000). Results indicated that compared to the moderate and heavy drinkers, abstinent participants indicated less use of Experiential Processes of Change (less than the moderate and heavy drinking groups). Furthermore, abstinent drinkers indicated more use of Behavioral Processes of Change (e.g. Counterconditioning, Stimulus Control, Reinforcement Management, Self-Liberation, and Helping Relationships) at one year follow up, compared to the moderate and heavy drinking groups (Carbonari & DiClemente, 2000).

Two other studies compared Processes of Change to behavioral change outcomes for Tobacco Use and Opioid Use Disorder samples. Prochaska and colleagues demonstrated the predictive validity of using Processes of Change (Helping Relationships and Self-Reevaluation)
in tobacco users, predicting smoking behavior at six months after baseline (1985). In another study, Tejero et al. discriminated categorically between participants reporting abstinence from heroin use versus active heroin users based on their responses to items measuring the Stimulus Control and Counterconditioning Processes of Change (1997).

**Literature gap & rationale for use of combined TTM measures for opioid use**

Authors of the TTM acknowledge that people seeking to change different addictive behaviors may not progress through the TTM Stages of Change and Processes of Change in the same manner as alcohol and tobacco users (DiClemente et al., 2004). Since the bulk of TTM research primarily draws from those two populations, conclusions cannot be generalized to explain motivation in other people changing substance use behavior. In fact, DiClemente and colleagues explicitly identify that “Measures targeting specific drugs of abuse are needed to accurately reflect the stage status of individuals entering substance abuse treatment,” indicating a gap in the current literature on TTM measures of motivation to change for people seeking treatment for substance use behaviors other than those related to the use of tobacco and alcohol (2004, p. 112).

Extant measures of motivation and stages of change in literature are often quite generic, using terms that refer to substance use behavior, unauthorized drugs, alcohol and drugs, drug use, or illegal drug use (DiClemente et al., 2004). Research on the TTM in cigarette smokers maps the Processes of Change onto the Stages of Change (Prochaska & DiClemente, 1983; 2005). However, a gap in the literature exists concerning the creation or use of a measure for both TTM motivational constructs in specific substance use populations, such as cocaine users and opioid users (i.e. Prochaska & DiClemente, 1983; DiClemente et al., 2004; Migneault, Adams, & Read, 2005).
Only one study to date identifies TTM measures tailored to OUD treatment (e.g. the Processes of Change; Tejero et al., 1997). Tejero and colleagues developed the Processes of Change Inventory for Opiate Addicts (PCI-OA), demonstrating limited discriminative efficiency and reliability (1997).

Clinically, there are additional reasons to measure motivation specifically in people with OUD. People seeking treatment for OUD are likely to benefit from intervention, regardless of whether their opioid use began via nonmedical pain reliever use or via heroin use, due to the significant overlap in treatment needs and in serious health risks (e.g. death via overdose) for both populations (Muhuri et al., 2013; Compton et al., 2016). Once someone using opioids presents for treatment, assessing that person’s motivation may offer both treatment providers and those in need of treatment important assistance with selecting a course of treatment. For example, in a recent literature review examining key facets of the American opioid crisis, authors mentioned that a person’s motivation at the onset of treatment may help determine which type of medication-assisted treatment (e.g. methadone versus naltrexone) best fits the person’s needs. For example, authors indicate that naltrexone injection treatment may be beneficial for opioid users with a very high motivation to get treatment, as compared to other treatments such as methadone or buprenorphine (Kolodny et al., 2015). It is therefore important that measures of motivation in opioid users designed are available to providers, easy to administer and effective at communicating a person’s current motivation towards addressing their opioid use. The RCQ-OP and PCQ-OP are designed to be such measures.

A variety of treatments involving pharmacological intervention (e.g. methadone, buprenorphine-naloxone, and naltrexone) have long been both available and widely used to combat OUD (Veilleux et al., 2010). Providers of treatments for substance use disorders—
namely Tobacco Use Disorder and Alcohol use Disorder—have often applied TTM principles of motivation such as measuring the TTM Stages of Change with pharmacological interventions as part of a wider harm-reduction approach to treatment.

An established treatment model in with which core TTM principles align is the harm reduction model of substance abuse treatment. The harm reduction treatment philosophy shifts substance abuse treatment focus from its traditional objective of helping people achieve abstinence to a goal of reducing or minimizing the harmful costs of substance use to both the individual and to society (Marlatt, 1996; Marlatt, Larimer, & Witkiewitz, 2011). In the context of opioid treatment, needle-exchange programs and all medication-assisted opioid-replacement medications (e.g. methadone, buprenorphine) are examples of harm reduction treatments (Lua et al., 2011; Veilleux et al., 2010).

The philosophy of harm reduction treatment makes parallels several foundational principles of TTM. For example, the principles of harm reduction include acknowledging that many substance abusers do not initially wish to stop using their substance of choice; as such, harm reduction theory states that to make changes to their substance use behavior, substance users will probably need to do so incrementally, over an often-prolonged period (Tatarsky, 2003; Marlatt, Larimer, & Witkiewitz, 2011). This philosophy and the TTM Stages of Change align closely in terms of this perspective—each theory understands change as occurring over time.

In terms of planning interventions for helping people change, the TTM and harm reduction approaches also share general theoretical elements. For example, in harm reduction, treatment providers engage substance users by forming therapeutic alliances, joining them in identifying their present strengths and supporting those strengths in the service of creating change (Tatarsky, 2003). Harm reduction principles also explicitly state that providers should
prioritize “meeting the client as an individual” and “starting where the patient is” (Marlatt, Larimer, & Witkiewitz, 2011, p. 39). Each of those two stated principles aligns with the TTM Stages of Change model; the idea of identifying present strengths likewise reflects the structure of the Processes of Change. For example, consider an opioid user in Precontemplation using Environmental Reevaluation explaining to their psychotherapist that they continue to use heroin daily, despite suspecting that their recent decline in social relationships directly relates to their heroin use. From a treatment perspective, both the harm reduction model and the TTM would characterize this client’s realization as 1) evidence of where this person stands in terms of being ready/prepared to change on a time continuum (not ready/ in Precontemplation) and 2) using available strengths (introspection / Environmental Reevaluation) to communicate their current perspective (Prochaska et al., 2005; Marlatt, Larimer, & Witkiewitz, 2011).

Given the theoretical alignment of the TTM and harm reduction, it makes sense to assess TTM constructs such as the Stages of Change and Processes of Change in opioid treatment. Using TTM measures parallels the effort made in harm reduction to consider the client’s perspective and recommend treatments which are consistent with that perspective. A treatment provider already familiar with or trained in harm reduction-based intervention could thus potentially benefit from having a TTM assessment tool that measures both Processes of Change and Stages of Change. For the heroin user in the above example, a provider could review the Precontemplation/Experiential profile with the client, providing opportunities for interventions consistent with both the TTM and harm reduction, as follows:

First, the TTM profile review would present a psychoeducation opportunity on strategies/activities people often use in Precontemplation (e.g. Experiential Processes of Change). Second, the review could also validate the client’s current ability to use Environmental
Reevaluation and help meet the client where they stand, in terms of their willingness/readiness to change their heroin use. Measuring motivation to change via measuring TTM principles therefore aligns with current treatments used for a variety of populations seeking substance abuse recovery.

Though both the Stages of Change and Processes of change constructs of the TTM have been measured in extant research (e.g. Prochaska, DiClemente & Fava, 1988; Rollnick et al., 1992; Prochaska, Norcross & DiClemente, 2013), a gap in the literature remains when considering the intersection of these two constructs. Namely, research detailing how to identify in which specific Processes of Change an individual engages at a given Stage of Change has largely been limited to populations using tobacco and alcohol (Prochaska & DiClemente, 1983; Rollnick et al., 1992; Prochaska & DiClemente, 2005).

According to TTM authors, when people engage in certain Processes of Change at specific Stages of Change, these processes will be “optimally applied” or most likely to be effective for encouraging behavior change. For example, if a person in Contemplation, per the theory, is most likely to utilize Consciousness Raising, a Process of Change which can involve therapeutic interventions such as psychoeducation or bibliotherapy. If a treatment provider was aware that a client was in Contemplation and utilizing Consciousness Raising, this realization could therefore indicate that psychoeducation may be an intervention to which the client would favorably respond (Prochaska, Norcross & Krebs, 2013).

Researchers who have previously measured these TTM constructs have therefore recommended that more research investigate the cross-section between the Processes of Change and Stages of Change in other drugs of abuse, including opioids. This is recommended because relatively fewer studies of motivation per the TTM constructs have been developed with
populations other than tobacco and alcohol users. Moreover, researchers propose further research in opioid users and other substance use populations because they believe collecting this information will further increase how we understand motivation, per the TTM (Tejero et al., 1997, DiClemente et al., 2004). The current study therefore seeks to address both gaps via studying both the Stages of Change and Processes of Change on a sample of opioid users.

A thorough examination of the mechanisms or factors which contribute to motivating people to change in addiction treatment is underway, particularly in response to the opioid crisis in America (Brady, McCauley & Back, 2015; Dugosh et al. 2016). One specific aspect of this behavioral context authors for which authors warrant further study is the study of “mechanisms of action” within the interpersonal treatment process; specific mechanisms recommended for further study include “readiness” for change and “self-efficacy”—both mechanisms which are theoretical foundations of the TTM (Miller & Moyers, 2015, p. 408). Examining readiness to change as a mechanism of change in people in treatment for Opioid Use Disorder is therefore warranted.

Along with studying specific mechanisms influencing motivation, OUD researchers have also investigated whether the interpersonal qualities of psychotherapy also promote relapse prevention and similar treatment outcomes, such as abstinence from opioid use. Literature on OUD treatment indicates that psychosocial treatments, though understudied overall, may play an important role in treatment retention and relapse prevention). Research indicates that psychotherapy in conjunction with pharmacological interventions is likely to increase the overall efficacy of treatment, due to increasing the likelihood of treatment program compliance (Veilleux et al., 2010). There is an emerging interest in researching the efficacy in the “common factors” (e.g. empathy and the therapeutic relationship) in determining treatment outcome. A
recent literature review of non-specific or common factors in four decades of research addiction psychotherapy interventions. After presenting compelling support for various common factors’ influence on treatment outcomes across the addiction treatment literature, authors recommend that researchers and clinicians alike consider earnestly the behavioral context of evidenced-based psychotherapy treatments (Miller & Moyers, 2015).

**Implications of measuring the stages of change & process of change in opioid use**

According to the TTM theory, the Processes of Change are both covert and overt, meaning that a person using them may or may not be aware of whether and how they are using the Processes of Change. Identifying a person’s Process of Change, therefore, may increase a person’s awareness their own explicit and implicit activities they are using to change their behavior (Perz, DiClemente, & Carbonari, 1996; Prochaska & DiClemente, 2005; Norcross, Krebs & Prochaska, 2011). TTM research on tobacco users supports it is possible to use TTM measures (e.g. the RCQ and the PCQ) to match a smoker’s Process of Change allocation with their current Stage of Change allocation (Prochaska et al., 1988; Rollnick et al., 1992). TTM researchers who have matched participants’ Stages of Change and Processes of Change have identified which Processes of Change most people use (and therefore consider relevant) to their experience of navigating their current Stage of Change. Providing information about how a smoker’s Stage of Change and Process of Change profiles align allows smokers to compare what Processes of Change they are using to what most smokers have most often used. Reviewing this comparison, TTM theorists argue, will allow smokers to compare what Processes of Change they are using to those than the literature considers most effective at each Stage of Change. Reviewing these profiles together may also educate smokers about the activities they may use to
change of which were previously unaware (Prochaska & DiClemente, 2005; Norcross, Krebs & Prochaska, 2011).

Consider the following example: a smoker who takes the RCQ and PCQ measures at an annual physical may produce response profiles identifying him in the Contemplation Stage of Change and as primarily using the Experiential Processes of Change. The physician could provide the patient with TTM psychoeducational materials to provide details about the Contemplation stage and each of the Experiential Process of Change. Through reviewing these materials, the patient may feel empowered through the TTM’s normalization finding the pros of cons of smoking is expected when smokers are in Contemplation. Second, the smoker may confirm that they have been using activities of Consciousness Raising (e.g. reading about the risks of smoking), but may not be aware that they are using Dramatic Relief when they think about the emotional discomfort they feel when they smoke, aware of the health risks of smoking (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005; Norcross, Krebs & Prochaska, 2011).

TTM authors might describe this smoker’s review of how their TTM profiles align as an opportunity for the smoker to engage in psychoeducation about motivation and self-reflection of their efforts to quit smoking (Prochaska & Velicer, 1997; Prochaska & DiClemente, 2005; Norcross, Krebs & Prochaska, 2011). In a treatment setting, providers could use this initial set of TTM profiles as cross-sectional data representing a person’s baseline, in terms of their motivation to change. Treatment providers could use TTM measures to establish a subsequent cross-section of Stage of Change and Process of Change profiles at a later stage of treatment to compare how these two dimensions of motivation have or have not changed. It is important to reiterate the limitation that the research on matching Processes of Change and Stages of Change
is currently limited to findings in samples of tobacco users. Nonetheless, using the TTM measures as assessment and intervention tools in the treatment of other drugs of abuse (e.g. opioids) remains both clinically feasible and effective for measuring motivation.

Prochaska and colleagues point out that their research on smokers’ motivation to change suggests that smokers trying to quit tend to first use Processes of Change that are more cognitive and affective (Experiential Processes) in the Precontemplation and Contemplation Stages of Change later transitioning to using Behavioral Processes of Change during the Preparation through Termination Stages of Change (1997). This observation, they argue, should inform clinicians who assess their clients’ motivation to change via the TTM so that, for example, they do not try to apply behavioral strategies that encourage change to clients in the Precontemplation and Contemplation Stages of Change, who may see little benefit from behavioral approaches that they may not feel ready to consider/accomplish (Prochaska & Velicer, 1997).

This research reviewed so far lends empirical support for the relevance of the temporal and behavioral parameters of the Stages of Change, as well as the various behavioral strategies, or Processes of Change that people employ to influence behavioral change. Limitations of extant TTM outcome research in substance abuse point out that far more outcome studies exist for cigarette smokers than any other substance abuse population (Migneault, Adams, & Read, 2005). This specific limitation also underscores the importance of providing more empirical support for the predictive validity and construct validity of the TTM Stages of Change and Processes of Change in substance abuse populations outside of tobacco or cigarette users (Migneault, Adams, & Read, 2005).

Clinical implications of research on the TTM
The state of the opioid crisis in America underscores the urgent need for providers to collaborate and utilize all available treatment resources to address the needs of those in recovery from OUD (Rudd, 2016). The United States is currently experiencing what Federal and local public health and medical professionals have called an opioid use epidemic (Volkow et al., 2014; Bart, 2012). Overdose deaths due to all opioid use (e.g. pain medications and heroin) have increased 200% since 2000, with deaths attributed to heroin use showing a sharp increase since 2010, tripling between 2010-2013 (Rudd, 2016; Hedegaard, et al., 2015). Additionally, as of 2013, drug overdose was listed as the single highest “cause of injury-related death in the United States” (Hedegaard, et al., 2015, p. 1), Mental health professionals treating those living with opioid dependence have the unique opportunity to save lives by helping opioid users seek treatments providing safer alternatives to daily illicit opioid use (Bart, 2012).

With limited treatment resources available to opioid users operating at near capacity across the country (Jones et al., 2015), it is imperative for medical, social work and mental health professionals to remain informed about how to best assist patients in finding treatment appropriate to their needs. Therefore, effective resources must be available for healthcare providers to effectively plan treatment or provide appropriate referrals for chronic opioid users. One effort to produce these resources involves adapting brief measures designed to assist treatment providers in identifying present motivation to change in opioid users. Quickly assessing both a person’s Stage of Change and Processes of Change with straightforward measures presents a treatment provider with relevant information for treatment planning based on the level of motivation to change assessed (Prochaska & DiClemente, 2005; Prochaska, Norcross & DiClemente, 2013).
According to Prochaska and DiClemente, understanding the distinctions between the Stages of Change and Processes of Change has the potential to enhance clinical practice (2005). To increase treatment effectiveness, TTM researchers emphasize that clinicians attempt to tailor treatment strategies to the Stage of Change in which the client is identified. Specifically, clinicians would match their clinical impressions about a client’s motivation to change a target behavior with one of the TTM Stages of Change. This effort to match Stage of Change with treatment would theoretically help therapists leverage, for example, an action-oriented treatment strategy for a client identified in the Action Stage of Change (Prochaska, DiClemente & Norcross, 1992).

TTM authors lend theoretical rationale to empirical findings which support smokers’ use of certain Processes of Change at different Stages of Change (e.g. Prochaska and DiClemente, 1983). For example, Consciousness Raising is a process of change involving building awareness in which a person is more likely to engage during Precontemplation or the Contemplation stages of change, whereas Self-Reevaluation is an introspective, self-regulatory process in which a person is more likely to engage during the Preparation and Action stages (Prochaska, DiClemente & Norcross, 1992; DiClemente & Velasquez, 2002). In other words, a cigarette smoker may first use Consciousness Raising to read about the health benefits of quitting smoking during Contemplation. When this smoker progresses to Preparation, they may then use Self-Reevaluation to determine that smoking cigarettes is incompatible with identifying as a healthy person (Prochaska and DiClemente, 1983). Developers of the TTM theory maintain that treatment providers in substance use disorders may benefit from familiarizing themselves with the processes emphasized at certain stages of change in order to best align with clients engaging in actions associated with each process (Prochaska & DiClemente, 2005).
Research on the alignment of Processes of Change and Stages of Change has primarily concerned cigarette smokers. As such, TTM authors encourage further research on stage alignment in other populations desiring behavior change, such as opioid users. (Tejero et al., 1997; Prochaska & DiClemente, 2005). TTM authors suggest that psychotherapists consider the set of ten Processes of Change comprehensively because it is possible—albeit not necessarily probably—for people to engage in any Process of Change at any Stage of Change. Further, they advocate that therapists approach treatment by assuming a dynamic, integrative perspective which includes awareness of all Processes of Change (Prochaska & DiClemente, 2005).

**Integrating stages of change and processes of change in treatment**

TTM researchers cite even distributions of the Stages of Change in the general U.S. population as evidence of the need to develop treatments matched to people in all Stage of Change, not just people ready to change (Laforge et al., 1999). For example, one study surveyed people attempting to change five health behaviors (cigarette smoking, adherence to a low-fat diet, regular exercise, weight loss and stress reduction) across two samples of HMO subscribers in the United States (N=16,673) and three samples in various sectors of the workforce in Australia (N=3,378) to compare Stage of Change distributions across two different cultures. The first goal of the study was to describe TTM stage distribution within both samples. Through assessing these distributions, authors wanted to see if there was a clear pattern in how many people were assigned to each TTM stage across the five health behaviors.

Researchers found the distribution across the Stages of Change for five health behaviors (cigarette smoking, adherence to a low-fat diet, regular exercise, weight loss and stress reduction) was similar across all five samples, revealing a stable pattern of Stage of Change
distributions (Laforge et al., 1999). Though distributions of each Stage of Change varied slightly across samples and from one health behavior to the next, researchers contend that the general distribution of the Stages of Change was stable across health behaviors. Health behaviors were defined as “Using seatbelts, Avoiding Fat, Eating fiber, Losing weight, Exercising, Avoiding Sun, Using sunscreen, Reducing stress, Smoking,” and “Self-exam” (Laforge et al., 1999, p. 475). Researchers highlight this stable distribution across the five groups in their large sample as support for measuring a person’s motivation to change via self-report measures. Authors also refer to these findings as evidence supporting the need to match treatment interventions to specific Stages of Change, as per the TTM theory (Prochaska, DiClemente & Norcross, 1992; Laforge et al., 1999).

Similarly, TTM theorists recommend that clinicians identify activities complementary of Processes of Change most likely to accompany certain Stages of Change. For example, while it is theoretically possible for a person to engage in the activities indicating the ten Processes of Change when modifying behavior, TTM authors suggest that clinicians prioritize treatment specificity (Prochaska & DiClemente, 1983, 2005). Treatment specificity involves providers describing or modeling the activities defining the Processes of Change a person is currently utilizing. For example, when treating people in the Action Stage of Change quitting opioid use, a treatment provider could assist their client in identifying ways to occupy oneself other than using opioids (Counterconditioning)—specifying a Behavioral Process of Change associated with the Action Stage of Change in intervention (Prochaska & DiClemente, 1983, 2005; Prochaska & Velicer, 1997).

A study of 1466 cigarette smokers from two US states provides evidence in support of the need for treatment specificity (DiClemente et al., 1991). In this study, researchers distributed
participants across the Precontemplation (PC), Contemplation (C), and Preparation Stages (PA) of Change and compared them according to the ten Processes of Change and smoking cessation outcomes at 1-month and 6-month follow up. Authors concluded that while smokers in each group had similar smoking histories, markedly different Processes of Change were employed by smokers at different Stages of Change (DiClemente et al., 1991).

DiClemente and colleagues highlighted observed patterns in participants’ use of the Processes of Change as follows: “On the more cognitive/affective processes like Consciousness-Raising, dramatic relief, and self-reevaluation, Contemplation and Preparation subjects were more similar and differed more from Precontemplation subjects. On the more behavioral processes of Stimulus Control and Counterconditioning, Contemplation and Precontemplation subjects were more similar” (DiClemente et al., p. 299-300). Authors interpreted this observed usage of the Processes of Change as support that participants in Preparation strategized ways to change their present smoking behavior, while participants in Contemplation collected and evaluated information without changing smoking behavior. In contrast, participants in Precontemplation neither considered nor acted towards behavioral change (DiClemente et al., 1991).

DiClemente and colleagues cite these differences in what Processes of Change participants used at a different Stages of Change as indications that treatment providers could specify interventions to complement the intentions and actions already employed by people attempting to quit smoking. For example, a therapist helping someone in Contemplation to quit smoking may identify Self-Reevaluation as a Process of Change employed by their client and specify treatment by engaging the client in a comparison of the client’s current beliefs with the client’s goals for behavioral change. Proponents of treatment specificity contend that tailoring
TTM-stage-matched interventions will better retain people in treatment than offering “one-size-fits-all” interventions, thus increasing opportunity for people to change their behavior. This higher likelihood of treatment retention, authors propose a person’s TTM stage can communicate their treatment readiness to providers. Providers can then target interventions appropriate for this level of readiness or motivation to change (DiClemente et al., 1991; Prochaska & Velicer, 1997; Noar et al., 2007).

Researchers also reported significant differences in smokers among all three stage groups. Specifically, researchers compared mean differences in engagement in each Process of Change between subjects in Preparation, Contemplation and Action. Significant (p<.01) Tukey comparisons in nine out of ten self-reported Processes of Change indicated that across nine out of ten Processes of Change, subjects in Preparation were the most active, while subjects in Contemplation were less active and subjects in Precontemplation were least active (DiClemente et al., 1991). This research, therefore, supports the idea that psychotherapy treatments designed for people seeking behavioral change should consider the interaction demonstrated in this research between the Processes of Change and Stages of Change. TTM authors contend that treatment interventions tailored according to this intersection of TTM dimensions will have more success than interventions with a broader focus on strategies to quit smoking, for example (DiClemente et al., 1991, Prochaska & Velicer, 1997; Noar et al., 2007).

The TTM thus indicates that knowledge of the interaction between Stages of Change and Processes of change may add to a clinician’s clinical judgment and potentially inform pre-treatment intervention planning (Prochaska & DiClemente, 1983, 2005). Furthermore, the TTM states that a clinician’s role and therapeutic relationship with a client develops and changes over the course of psychotherapy, occurring alongside a client’s progression through the Stages of
Change and Processes of Change (Norcross, Krebs, & Prochaska, 2011). For example, a clinician trained to identify Stages of Change and Processes of Change per the TTM may target an intervention combining awareness of two of these elements—the Contemplation Stage of Change and the Consciousness raising stage, for example—to maximize potential clinical outcomes of emphasizing these theoretically matched elements. This clinician would continually monitor a client’s progression through the Stages of Change and Processes of Change throughout the course of psychotherapy, ideally matching these two TTM domains and accordingly tailoring interventions consistent with the client’s present motivation to change production of a behavior (Prochaska & DiClemente, 1983, 2005).

Recent research recommends that psychotherapists match appropriate treatment strategies to a person’s current Stage of Change and Processes of Change, once identified (Norcross, Krebs & Prochaska, 2011; Prochaska, Norcross & DiClemente, 2013). This recommendation is given based on a meta-analysis of 39 studies of the TTM, primarily in behavioral health and substance use disorder populations (e.g. Norcross, Krebs & Prochaska, 2011). This reference, and the need to address those affected by the opioid crisis in America (Rudd, 2016) underscores the need for behavioral health providers who treat opioid dependence to assess both the Stages of Change and Processes of Change for the purposes of treatment planning. Providers who gain knowledge of a person’s current Stage of Change, researchers contend, allows them to better assist the client by prescribing stage-matched interventions and anticipating when a client may be at risk for recycling via relapse, for example (Prochaska, Norcross & DiClemente, 2013).

Recently, in substance abuse literature, some researchers have advocated for including measures which go beyond measuring abstinence from the substance. New measures, researchers contend, “should be measuring a reduction in direct consequences of drug use, rather than
improvement in overall functioning” (Kiluk et al., 2019, p. 12). Researchers promote this approach to measuring outcomes in the substance abuse literature because they advocate for measuring a substance user’s functioning based on factors beyond whether they are currently abstaining from substance use (Kiluk et al., 2019). Measuring TTM constructs can assist providers in identifying Processes of Change, which indicate engagement in activities beyond abstinence alone. For example, an opioid user’s PCQ-OP score could indicate engagement in Contingency Management and Stimulus Control, suggesting that the opioid user may be using strategies to improve functioning such as adhering to methadone treatment and removing drug paraphernalia from the home (Prochaska & Velicer, 1997). This data presents a more complex view of functioning beyond measuring abstinence status alone. The next section of this manuscript focuses on the development of a measure designed for ease of use in measuring both dimensions of the TTM in an OUD population.
Chapter II

Abstract

Opioid overdose is growing as a leading cause of death in the United States, surpassing other unintended causes such as automobile accidents. An increase in opioid overdoses nationwide in the past decade inspired public health authorities to declare an opioid epidemic nationwide. Assessing a person’s readiness to change a substance abuse behavior has long been supported as a critical clinical intervention. The need for healthcare providers to efficiently and accurately assess treatment readiness in opioid users is examined. Literature regarding substance abuse assessments developed according to the widely accepted Transtheoretical Model (TTM) is reviewed. Extant assessments of readiness to change and processes of change per the TTM are described. Rationale is provided for developing two quantitative assessments adapted from validated measures of TTM constructs: The Opioid Use Readiness for Change Questionnaire (RCQ-OP) and The Opioid Use Process of Change Questionnaire (PCQ-OP). The use of these two measures together is identified as a resource for healthcare providers seeking to identify opioid users’ readiness to change and related processes of change simultaneously. The two measures were completed by 300 adult patients of a methadone clinic in the Northeast US in treatment for opioid use disorder. Through Principal Components Analysis, the RCQ-OP scale retained 12 items that loaded on three factors and the PCQ-OP scale retained 20 items that loaded onto three factors. Correlation analysis examined whether relationships between the Stages of Change and Processes of Change, as measured in this sample, were consistent with extant TTM research conducted primarily on tobacco users. Implications and directions for future research are discussed.

Keywords: heroin, opioid, stages of change, transtheoretical model, assessment
The United States is currently experiencing a national opioid epidemic (Volkow et al., 2014; Bart, 2012). Drug overdose was deemed the single highest “cause of injury-related death in the United States” (Hedegaard, et al., 2015, p. 1), according to data from the Center for Disease Control and Prevention (Centers for Disease Control and Prevention, 2015). Healthcare professionals treating those suffering from opioid dependence have the unique opportunity to save lives by helping opioid users seek treatment options providing safer alternatives to daily heroin use (Bart, 2012).

This manuscript details research piloting two measures of motivation designed to assist treatment providers in assessing opioid users’ motivation to change their behavior. The measures were adapted from current measures of two different constructs, that are core dimensions of The Transtheoretical Model of behavioral change (TTM), a theoretical framework of motivation with widespread use in the treatment of Tobacco Use and Alcohol Use Disorders (Prochaska, Norcross & DiClemente, 2013). The two measures piloted in this study assessed two separate conceptual domains of the Transtheoretical Model (TTM): Readiness to Change and Processes of Change (Prochaska & Velicer, 1997; Prochaska, Norcross & DiClemente, 2013). This chapter outlines the methods utilized in the study, including a rationale for developing the piloted measures and a description of all study measures. Data collection procedures and the study sample and are also described. The results of data collection and analysis are then detailed and discussed. This discussion includes examining limitations of this study and recommendations for future research on this topic.
Methods

Rationale for developing combined measures

Understanding whether someone struggles with substance dependence is ready to change his or her addictive behavior (Prochaska & DiClemente, 1977, 2005) assumes the ability to gauge readiness for change (Prochaska, DiClemente & Fava, 1988, Rollnick et al., 1992). Since Prochaska and DiClemente articulated the original Transtheoretical Model (TTM) of change in 1977, various measures have been developed to assess readiness to change for nicotine cessation (Bolger et al., 2010), heavy drinking (Rollnick et al., 1992; Heather & Rollnick, 1993), cocaine use (Pantalon et al., 2002), and heroin/polysubstance use (Henderson et al., 2004). These measures focus primarily on measuring how ready a respondent is to a given stage of change by mapping a respondent’s self-reported questionnaire scores to a corresponding stage (e.g. Precontemplation through Maintenance; see Prochaska & DiClemente, 1977, 2005).

Rationale for developing the opioid readiness for change questionnaire (RCQ-OP)

Early on, readiness to change was assessed by clinicians as part of a clinical interview. However, Prochaska and colleagues recognized that interview-based assessment procedures for assessing readiness to change were cumbersome (1988). Accordingly, self-report measures were developed. One of the most researched measures in the field is the Readiness to Change Questionnaire (RCQ; Rollnick et al., 1992).

The Readiness to Change Questionnaire (RCQ; Rollnick et al., 1992) measures via self-report the current TMM Stage of Change through which a respondent is progressing. It was developed to help professionals who are not substance abuse treatment specialists assess the change stage of clients who drink excessively (Rollnick et al., 1992). The RCQ items were
designed to create a dialogue between clinician and client to increase clients’ self-awareness about their motivation to change. Developers of the Readiness to Change Questionnaire favor this approach to treatment instead of providers offering clients generic skills or strategies they might not be prepared to use based on their current level of motivation to change (Rollnick et al., 1992).

In this study, we developed Opioid Use Readiness to Change Questionnaire (RCQ-OP) to assess an opioid user’s current readiness to change based on the TTM Stages of Change. Our proposed RCQ-OP measure, like recent iterations of the RCQ, assesses a person’s readiness to change between the Precontemplation, Contemplation or Action stages. The RCQ-OP was based on Heather & Hönekopp’s adaptation of the RCQ (2008).

Besides the RCQ, two other extant measures of the Stages of Change and Processes of Change also assess these TTM constructs. These measures are the University of Rhode Island Change Assessment (URICA; DiClemente & Hughes, 1990) and the Stages of Change and Treatment Eagerness Scales (SOCRATES; Miller & Tonigan, 1996a). Both measures have previously been validated for use in measuring readiness to change per the TTM in various substance use populations (Norcross et al., 2011). However, we chose to adapt the proposed RCQ-OP from the RCQ (e.g. Heather & Hönekopp, 2008) because we felt this adaptation would produce a measure which would provide an effective assessment of the TTM constructs in opioid users.

Our rationale for this adaptation considers some key differences in how the RCQ measures TTM constructs, in comparison to other measures. For example, the URICA and SOCRATES were developed to measure readiness to change in populations other than opioid users and resulted in factor solutions which differ significantly than that of the RCQ (Rollnick et al., 1992).
The SOCRATES scale (Miller & Tonigan, 1996a), which was developed on alcohol users, revealed a factor solution involving three constructs: “Recognition, Ambivalence, and Taking Steps”, constructs which authors describe as “continuously distributed motivational processes that may underlie stages of change,” (Miller & Tonigan, 1996a, p. 84). Though this scale has been adapted to measure readiness to change in opioid-using populations, exploration of this readiness to change has been limited to small samples of polysubstance users (e.g. Abellanas & McLellan, 1993) and larger polysubstance-user samples demonstrating limited predictive validity of the scale (e.g. Field et al., 2009).

**Comparing the RCQ-OP to the SOCRATES and URICA measures**

Though other widely used evidence-based measures of readiness to change are currently applied in substance abuse populations, the proposed RCQ-OP will differ from both the SOCRATES and the URICA measurements in how it will be used to quantify readiness to change. For example, the SOCRATES measure was validated on a sample of people seeking drug or alcohol treatment, categorizing them into three categories: “Ambivalence,” “Taking Steps,” and “Recognition” (Miller & Tonigan, 1996a). The URICA measure was validated on a sample of people seeking alcohol treatment. In contrast to the SOCRATES subscales, The URICA produces subscales corresponding to the Precontemplation, Contemplation, Action, and Maintenance stages of change (Field et al., 2009).

The RCQ-OP differs from both measures because it is designed to measure specifically how respondents may fit the profile of the Precontemplation, Contemplative and Action stages of change. It measures these select Stages of Change because it was adapted from the RCQ developed by Heather & Hönekopp, which omitted the Preparation and Maintenance stages due
to a previous analysis failing to distinguish these two stages psychometrically from other stages (2008). This adaptation, which has omitted these Stages of Change, represents a potential limitation of the proposed RCQ-OP’s ability to reach a wider range of opioid users (e.g. those in Maintenance). With this limitation in mind, adapting the RCQ-OP measure from a psychometrically valid version of the RCQ (e.g. Heather & Hönekopp, 2008) was prioritized in selecting a source measure.

Besides differences in measurement properties, recent studies of extant TTM scales indicate that more research is needed to examine psychometric aspects of these measures. For example, the predictive validity of TTM readiness to change measures on different substance abuse populations was reviewed by Field et al. (2009) in a validity study of the URICA measure on an outpatient sample of drug and alcohol users. Field et al. (2009) concluded that “evidence for the predictive validity of composite scores was very limited and there were no moderating or mediating effects… on treatment outcome,” (p. 115) indicating possible limitations associated with measuring and/or applying the URICA constructs to predict substance use treatment readiness. This cited limitation of the URICA raises questions as to the measure’s clinical utility, since providers may not find an instrument without predictive validity helpful in assisting them with treatment planning.

**Rationale for developing the opioid process of change questionnaire (PCQ-OP)**

The PCQ was designed to measure the ten sub-constructs hypothesized to be the TTM Processes of Change (Prochaska, DiClemente & Fava, 1988; see Appendix B2 for scoring criteria). Several subsequent versions of the PCQ have been adapted and validated for application with other substances of abuse, including alcohol use (Heather et al., 1993), cocaine
use (Martin et al., 1992), and heroin use (Tejero et al., 1997). Further adaptations of the PCQ for opioid use and adolescent tobacco use (e.g. Tejero et al., 1997; Hoeppner et al., 2006) follow the general construct design by Prochaska et al. (1988).

It is useful to compare the PCQ-OP to two extant measures commonly used in substance abuse treatment and research, the URICA and SOCRATES assessments. Considerably fewer extant Process of Change measures have been developed—particularly those adapted specifically for opioid use (Tejero et al., 1997). Since Prochaska et al. developed the first Process of Change questionnaire in 1988, which contained 10 subscales of experiential and behavioral change in smoking behavior (see Appendix B2), two subsequent versions were created by DiClemente and colleagues (1991) and Hoeppner and colleagues (2006). The PCQ-OP was adapted from the latter which was psychometrically validated on a sample of adolescent tobacco users. One limitation of this adaptation is that the PCQ-OP is intended for clinical use with a considerably different population than the sample Hoeppner and colleagues (2006) used: adults either actively using opioids or in treatment for opioids.

Previous iterations of the PCQ have rarely included opioid users in their study samples. Prior to Tejero et al. in 1997, for example only one PCQ adaptation had included opioid users in a treatment setting (Belding et al., 1995). Belding and colleagues specifically piloted a 60-item adaptation of a previous version of the Process of Change Questionnaire (e.g. Prochaska et al., 1992) on 276 adults in methadone maintenance treatment, to psychometrically validate this adapted scale (1995). Researchers also used a self-report measure (validated by DiClemente et al., 1991) to divide participants into five TTM Stages of Change based on their report of drug use and responses regarding their plans to use drugs during the next 30 days to six months (Belding et al., 1995).
Belding and colleagues used confirmatory factor analysis to identify the following four overarching constructs, each composed of select TTM Processes of Change: Reevaluation (e.g. Consciousness Raising, Self-Reevaluation, Dramatic Relief, & Environmental Reevaluation), Self-Liberation (e.g. Self-Liberation), Reinforcing Relationships (e.g. Contingency Management & Helping Relationships), and Behavioral Processes (e.g. Counterconditioning and Stimulus Control) (1995). Additionally, authors cited limited evidence for predictive validity of the adapted scale—for example, MANOVA analysis revealed that participants rated in the Precontemplation Stage of Change reported significantly longer participation in methadone treatment than participants in all other Stages of Change besides Maintenance (Belding et al., 1995). Tejero and colleagues recommended finding additional support for both the internal validity and reliability of a Process of Change measure for an Opioid Use Disorder. Authors advocated for more research testing the psychometric properties of such a measure, noting that doing so would be necessary before they could use the measure that they piloted in clinical practice (1997).

Considering that only two known studies (e.g. Belding et al. 1995; Tejero et al., 1997) have researched and developed adaptations of the PCQ for opioid use currently, the need for further investigation of the Processes of Change on an Opioid Use Disorder sample warranted further development of the PCQ-OP. This further research could, for example, address limitations of extant research designs such as relatively small sample size, heterogeneous sample and a differentiation in participant groups beyond active and non-active opioid users—groups based on the Stages of Change, for example. (e.g. Tejero et al., 1997). Testing an instrument measuring the Processes of Change on another opioid use sample would also answer whether the three-factor solution demonstrated by Tejero and colleagues (1997) in opioid users is
satisfactory, compared to the two-factor solution (e.g. one Experiential factor and one Behavioral factor) originally found in tobacco users (Prochaska, DiClemente & Fava, 1988). Such a measure could thus complement the extant research on Process of Change measures by examining how opioid users in treatment endorse Experiential and Behavioral Processes of Change.

If treatment providers used the PCQ-OP and RCQ-OP together, they could present assisting opioid users working on behavioral change with a concise profile of how they appear to be using the Processes of Change while navigating the Stages of Change. We know of no extant research aimed at providing information about these two core constructs of the TTM simultaneously, designed for clinical use. Both the PCQ-OP and RCQ-OP will require psychometric tests of reliability and validity to be widely disseminated clinically, despite its adaptation from a more recently validated version of the PCQ (i.e. from Hoeppner et al., 2006).

**Rationale for using both the RCQ-OP and the PCQ-OP in concurrence**

One of the key reasons the RCQ-OP and the PCQ-OP are intended to be used in conjunction with one another is that the questionnaires, when combined, are meant to provide a health care professional treating someone with opioid dependence a convenient, evidence-based summary of 1) how ready to change the respondent appears to be and 2) which experiential processes and behavioral processes of change, per the constructs of the TTM (Prochaska et al. 1988; DiClemente et al. 1991). Measuring readiness to change and processes of change together considers two key dimensions the of TTM theory (Prochaska & DiClemente, 1997).

The RCQ-OP and the PCQ-OP are therefore designed to be used together because they each provide individualized readiness and change process information useful in predicting treatment response. Gathering this information collectively distinguishes these measures from previously
designed scales which provide either given substance user’s current Stage of Change or Process of Change (e.g. the SOCRATES questionnaire adapted for opioid and cocaine use in Henderson et al., 2004). Further, we propose to study two measures meant to be administered together which assess two different constructs at the same time. We are not aware of any other TTM measures which have been designed for administration this way. This method of administration is intended to offer providers information about both central TTM constructs within a short time span.

Furthermore, we propose to examine the relationship between these two constructs. Tejero and colleagues, who created the Process of Change Inventory for Opiate Addicts (PCI-OA), indicate the need to examine whether an opioid user’s Process of Change directly relates a user’s Stage of Change (1997). For example, the TTM theory indicates that Consciousness Raising is a Process of Change in which people are likely to engage during Precontemplation (Prochaska & DiClemente, 1997, 2005). Researchers have yet to identify a specific Process of Change at a given Stages of Change in opioid users. The creation and psychometric valuation of the RCQ-OP and the PCQ-OP will further investigate the utility of measuring these TTM constructs simultaneously in opioid users.

Identifying these constructs together is important for several reasons. First, doing so unifies two central conceptual pillars of the TTM theory (e.g. that people characterized by certain Stages of Change will likely engage in related Processes of Change) which directly inform how a clinician tailors treatment to meet a client’s specific needs. Per the TTM framework, it is useful for clinicians to identify whether people are utilizing certain Processes of Change during related Stages of Change to leverage their ability to plan interventions specific to the client’s current readiness to change and change behaviors (Prochaska & Velicer, 1997). This rationale is founded
upon research on smoking cessation and has not yet been replicated for all other drugs of abuse. Nonetheless, TTM authors advocate that tailoring interventions based on matching Processes of Change and Stages of Change will increase treatment efficacy (Norcross et al., 2011).

TTM authors contend that treatment specificity occurs when clinicians target interventions according to their assessment of a person’s Stage of Change and Processes of Change. For example, a clinician identifying a client in the Action Stage of Change as using Counterconditioning and Stimulus Control (Behavioral Processes of Change) may prioritize using related behavioral interventions, to maximize treatment specificity (Prochaska & DiClemente, 1983, 2005).

Measures of Stages of Change and Processes of Change are also useful for producing TTM profiles for people using certain Processes of Change not typically associated with a measured Stage of Change—an opioid user in Precontemplation utilizing Helping Relationships, for example. In this example, the opioid user seeking to change their opioid use currently does not believe that the benefits of reducing opioid use outweigh the perceived shortcomings associated with doing so, such as enduring withdrawal. If this person was focusing on using Helping Relationships—including their family in their opioid cessation efforts, for example—they would be employing a Behavioral Process of Change typically associated with the Action or Maintenance Stages of Change in smoking cessation research (Prochaska & Velicer, 1997; Prochaska & DiClemente, 1983, 2005).

In such an instance, a clinician could point out the theoretical discrepancy to investigate the client’s reasoning in their responses to the two TTM measures. In the above example, the clinician might explore how much help the opioid user is leveraging from their social network, given they readily admit, as someone in Precontemplation, that their reasons for continuing
opioid use outweigh their reasons to quit (Prochaska & Velicer, 1997; Prochaska & DiClemente, 1983, 2005). This type of exchange provides the clinician with the ability to gather information from the client to further tailor treatment specificity. It also allows the clinician an opportunity to provide psychoeducation about which Processes of Change tobacco users tended to use at the given Stage of Change measured.

Healthcare providers could benefit from having the ability to assess a person’s Stage of Change and Processes of Change as dynamic descriptors of both where a person currently stands and what interventions may assist that person’s progression to the next stage of change (Norcross et al., 2011). In the context of opioid treatment, making this determination efficiently could impact an opioid user’s ability to access scarce treatment resources (e.g. MATs; Jones et al. 2015) available. A hypothetical treatment example helps support this rationale.

Consider a provider who uses TTM-based measures to assess that their client is currently in the Contemplation Stage of Change and is engaging in primarily Experiential Processes of Change. Based on this TTM profile, the client may benefit from a referral to a psychotherapy group which integrates insight-oriented approaches (e.g. client-centered and supportive psychotherapy) with more behaviorally focused interventions (e.g. contingency management). The type of targeted referral for psychosocial intervention would, in this case, align with this client’s specific TTM profile. As a person in Contemplation, they would likely be currently weighing the pros and cons of change equally; as a person currently using Experiential Processes of Change (such as Consciousness Raising and Self-Reevaluation) the client would be engaging in self-reflection and exploring new perspectives (Prochaska & Velicer, 1997).

An important limitation to measuring the Stages of Change and Processes of Change by using the RCQ-OP and PCQ-OP should be noted. The RCQ-OP measures only the
Precontemplation, Contemplation and Action Stages of Change (omitting the Preparation and Maintenance stages). The PCQ-Op measures ten Processes of Change which span all Stages of Change, per the TTM. Therefore, the ability to measure whether an opioid user’s Processes of Change specifically match a given Stage of Change is limited to the Precontemplation, Contemplation and Action stages.

Nonetheless, it should be noted that the PCQ-OP score will broadly characterize an opioid user’s responses to either fit an Experiential or Behavioral profile, in terms of the Processes of Change that person appears to be using. TTM research indicates that cigarette smokers tend to use four out of the five Behavioral Processes of Change (e.g. Contingency Management, Counterconditioning, Stimulus Control and Helping Relationships) between the Action and Maintenance Stages of Change.

Moreover, the TTM theory also indicates that cigarette smokers tend to use all five Experiential Processes of Change during the Contemplation Stage and three out of the five Experiential Processes of Change (e.g. Consciousness Raising, Dramatic Relief and Environmental Reevaluation) during the Precontemplation Stage (Prochaska & Velicer, 1997). The potential use of several Behavioral or Experiential Processes of Change at each of the Stages of Change measured by the RCQ-OP is therefore very likely and thus remains a useful means of comparing the two major theoretical components of the TTM.

**Research aims, questions and hypotheses**

The central aim of this study was to assess the psychometric properties of two newly developed measures: 1) Readiness to Change in adults who identify as having a history of opioid use, and 2) Processes of Change in adults who identify as having a history of opioid use. To test
the psychometric properties of the measures, we first examined the factor structure of both measures, to identify latent variables in the data. Then, we conducted tests of reliability to confirm the internal consistency of the RCQ-OP and PCQ-OP subscales.

**Testing the factor structure of the TTM measures**

The primary research question broadly examines the psychometric properties of both piloted measures on a new population by asking whether the factor solution for each measure will resemble the factor structures of the RCQ/PCQ source measures. Principal Components Analysis (PCA) is typically recommended in psychological research when the study’s goal is to identify latent constructs when there is no preexisting conceptual model (Fabrigar et al., 1999). Therefore, PCA is appropriate for this study, given the study’s central goal of testing the psychometric properties of two newly adapted TTM measures. The RCQ-OP and PCQ-OP have been adapted from extant TTM measures in other substance using populations (e.g. alcohol and tobacco users). Since both questionnaires measure motivation in opioid users, no extant conceptual model serves as a basis of comparison for measuring the Stages of Change and Processes of Change.

Principal Components Analysis (PCA), a widely used general linear modeling method, was proposed for use in this study for several reasons. First, PCA is preferred to Common Factor Analysis due to its utility in determining the maximum amount of variance present in each set of variables (Crocker & Algina, 2006). Further, it is assumed that the error variance will account for a relatively small portion of the total variance in both measures. In our analysis of the proposed measures, we seek to determine the maximum amount of variance present for each scale of our two proposed measures. We also assume error variance will represent a low portion of the total error variance for each measure. Therefore, principal component analysis is appropriate for this
study (Crocker & Algina, 2006). Researchers who tested the psychometric properties of the
source measures for both the RCQ-OP and PCQ-OP also utilized PCA as their initial analysis,
before running subsequent general linear modeling such as Confirmatory Factor Analysis (CFA;
i.e. Prochaska, DiClemente & Fava, 1988; Rollnick et al., 1992).

We used an orthogonal varimax rotation because it was assumed that factors in each
measure will be uncorrelated (Crocker & Algina, 2006; Fabrigar et al., 1999). Intuitively, a
relationship between factors seems plausible—that there may be a correlation between thinking
about making a change and making a change, for example. However, creators of the original
RCQ and PCQ measures both used varimax rotations in their exploratory factor analyzes, which
assumed orthogonal data and resulted in clear factor solutions for the components of both the
Stages of Change and Processes of Change (Prochaska et al., 1999; Rollnick et al., 1992).
Accordingly, we maintained that a varimax rotation would best fit the data.

Beyond mirroring internal consistency criteria from the source measures for the RCQ-OP
and PCQ-OP, an analysis of several guidelines of internal consistency in psychology research
measures cites an alpha value 0.7 as a minimum acceptable value of internal consistency
(Ponterotto & Ruckdeschel, 2007). Data was considered appropriate for Principal Components
Analysis if inter-item correlations were greater than .6; we determined that items that were
correlated less than .6 would be considered for deletion (Crocker & Algina, 2006). Component
loadings for items on each measure were generally considered acceptable if they were above .45,
a benchmark recognized in the literature (e.g. Comrey & Lee, 1992) and by Prochaska and
colleagues, who reported component loadings ranging from .34 to .72 (1988).

There were specific internal consistency criteria for each of the measures piloted in this
study. For both the RCQ-OP (12-item) and PCQ-OP (20 item) measures, internal consistency, as
measured by Cronbach’s alpha of at least 0.70, was expected for each of the subscales for items in each measure. For both the RCQ-OP and PCQ-OP, this expectation was consistent with that established for items written for tobacco users (Prochaska et al., 1988) and alcohol users (Heather & Hönekopp, 2008).

For each of the subscales for the RCQ-OP (Precontemplation, Contemplation & Action) and the PCQ-OP (Experiential and Behavioral), the minimum acceptable alpha value was established as 0.7. Items which did not meet these criteria were considered for deletion, though items slightly below this threshold (e.g. between 0.6 and 0.7 alpha levels) were considered for retention because they were potentially useful for analysis, particularly when comparing internal consistency between our pilot measures and the sources from which they were adapted. This rationale to retain items with slightly lower alpha levels (noting this decision in study limitations) is one commonly used in psychological research, including the development of scales (Ponterotto & Ruckdeschel, 2007). We expected that the alpha levels of the scales on our pilot measures would closely resemble the alpha levels reported on to their source measures, since we directly adapted our pilot scales from these sources, with minimal revisions to item language. Therefore, we expected that Cronbach’s alpha (α) values for items on each subscale of the RCQ-OP and PCQ-OP would be less than 0.7; H_A: Cronbach’s alpha (α) values for items on each subscale of the RCQ-OP and PCQ-OP would be greater than 0.7. Items with a Cronbach’s alpha value less than 0.7 would be considered for removal from each measure.

Correlations between each item, or inter-item correlations, on each of the three scales for the RCQ-OP and the two scales for the PCQ-OP, were examined prior to completing Principal Components Analysis. Data was considered appropriate for Principal Components Analysis if inter-item correlations for several items on each scale were greater than 0.6; we determined that
items that were correlated less than .6 would be considered for deletion (Crocker & Algina, 2006). Component loadings for items on each measure were generally considered acceptable if they were above .45, a benchmark recognized in the literature (e.g. Comrey & Lee, 1992) and by Prochaska and colleagues, who reported component loadings ranging from .34 to .72 (1988).

Lastly, we predicted our analysis would reveal components (latent variables) consistent with TTM theory constructs (Crocker & Algina, 2006). Specifically, we expected our PCA of our readiness to change measure (RCQ-OP) to reveal three principal components: the Precontemplation, Contemplation and Action Stages of Change. Likewise, we expected our PCA of our Processes of Change measure (PCQ-OP) to reveal two principal components: The Experiential and Behavioral Processes of Change. These predictions were based on the results of psychometric evaluation of the source measures for both the RCQ-OP and PCQ-OP measures (Prochaska, DiClemente & Fava, 1988; Rollnick et al., 1992).

Previous TTM research supported the idea that participants who endorsed using Behavioral Processes of Change would also endorse the Action Stage of Change (Prochaska, DiClemente & Fava, 1988; Rollnick et al., 1992). Based on this literature, we developed the following two hypotheses for this study: 1) that participants who endorsed the Action Stage of Change on the RCQ-OP would endorse significantly higher scores for Behavioral Processes of Change on the PCQ-OP and 2) that participants who endorsed the Precontemplation and Contemplation Stages of Change on the RCQ-OP would endorse significantly higher scores for Experiential Processes of Change on the PCQ-OP.

This study explored whether Experiential and Behavioral Processes of Change would be positively correlated with a respondent’s current Stage of Change. We hypothesized that participants in the Action stage would endorse Behavioral Processes of Change at higher rates
than participants in the Precontemplation and Contemplation Stages of Change. We also hypothesized that participants in the Precontemplation and Contemplation stages would endorse Experiential Processes of Change at higher rates than participants in the Action stage.

**Design**

**Item development**

The Opioid Use Readiness to Change Questionnaire (RCQ-OP) was adapted from the 12-item version that Heather & Hönekopp developed (2008). Adaptation largely involved replacing “drinking” with “opioid use,” adjusting the wording grammatically for this revision. This measure requires respondents to complete twelve (12) items by answering on a Likert type scale of agreement, as follows: A response of 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 = Agree, 5 = Strongly Agree. The twelve items correspond to three stages of change per the TTM model—The Precontemplation (PC) stage, the Contemplation (C) stage, and the Action (A) stage—assessing each construct with four items as follows: Items numbered 1, 3, 6, 10 assess Precontemplation, items numbered 2, 4, 7, 11 assess Contemplation, items numbered 5, 8, 9, 12 assess Action.

Scoring for the RCQ-OP is on a 5-point scale ranging from -2 to +2 as follows: -2 = Strongly Disagree, -1 = Disagree, 0 = Unsure, 2 = Agree, 5 = Strongly Agree. As such, a respondent who scores, for example 8 points for Precontemplation (by scoring two points on all items 2, 4, 7, and 11) and 6 points on Contemplation would be labeled as in the Precontemplation stage of change, according to the RCQ-OP. One scoring rule should be noted for the RCQ-OP: if scores for two stages of change are equal (e.g. a score of 6 on Precontemplation and a score of 6 on Contemplation) would be labeled as Contemplation, as
the scale farthest along the continuum of change (Precontemplation-Contemplation-Action) represents the subject’s Stage of Change Designation (see scoring rubric in Appendix A2).

The Opioid Use Process of Change Questionnaire (PCQ-OP) was adapted from the 20-item “Processes of Change Scale for Alcohol Misuse” (e.g. DiClemente et al., 1996; VonSternberg, 2005; Freyer et al. 2006). Adaptation largely involved replacing “drinking” with “opioid use,” adjusting the wording grammatically for this revision. This measure requires respondents to complete twenty (20) items by answering on a Likert type scale, measuring to what degree the respondent considers each item true “for me,” as follows: A response of 1 = Never True for Me, 2 = Seldom True for Me, 3 = Occasionally True for Me, 4 = Frequently True for Me, 5 = Always True for Me. The twenty items broadly correspond to the behavioral (10 items) and experiential (10 items) constructs per the TTM model (Prochaska et al. 1998), via specifically using two items for each construct.

Items map to specific subscales within the experiential and behavioral constructs via subscales as follows: Items 5 and 9 measure Consciousness Raising, items 3 and 12 (Dramatic relief), items 4 and 14 (Environmental Reevaluation), items 8 and 15 (Self Reevaluation), and items 7 and 20 (Social Liberation). The Behavioral construct consists of items 1 and 18 (Contingency Management), items 6 and 17 (Counter Conditioning), items 2 and 11 (Helping Relationships), items 13 and 19 (Self Liberation), and items 10 and 16 (Stimulus Control). Identifying how respondents score according to these subscales may assist the assessor in using this data to make an informed treatment decision. See Table 1 for item language and brief descriptions of each process measured on all PCQ-OP items.

Table 1.

<p>| Descriptions for items on the Opioid Use Process of Change Questionnaire (PCQ-OP) |</p>
<table>
<thead>
<tr>
<th>Scale</th>
<th>Process of Change</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH</td>
<td>Contingency</td>
<td>Using positive reinforcement to increase opioid abstinence behavior</td>
</tr>
<tr>
<td>BH</td>
<td>Management</td>
<td>Accessing social support to promote change in opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Dramatic Relief</td>
<td>Considering modification to opioid use via examining emotional expression</td>
</tr>
<tr>
<td>EX</td>
<td>Environmental</td>
<td>Examining relationship between opioid use behavior and social environment</td>
</tr>
<tr>
<td></td>
<td>Re-evaluation</td>
<td>Increasing knowledge/awareness of abstaining from opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Consciousness</td>
<td>Increasing knowledge/awareness of abstaining from opioid use behavior</td>
</tr>
<tr>
<td></td>
<td>Raising</td>
<td></td>
</tr>
<tr>
<td>BH</td>
<td>Counterconditioning</td>
<td>Associating new behavior with previous opioid use behavior antecedent</td>
</tr>
<tr>
<td>EX</td>
<td>Social Liberation</td>
<td>Considering larger societal change in modifying opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Self-Reevaluation</td>
<td>Contrasting self-image with opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Consciousness</td>
<td>Increasing knowledge/awareness of abstaining from opioid use behavior</td>
</tr>
<tr>
<td></td>
<td>Raising</td>
<td></td>
</tr>
<tr>
<td>BH</td>
<td>Stimulus Control</td>
<td>Replacing opioid use behavior with following reminders</td>
</tr>
<tr>
<td>BH</td>
<td>Helping Relationships</td>
<td>Accessing social support to promote change in opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Dramatic Relief</td>
<td>Considering modification to opioid use via examining emotional expression</td>
</tr>
<tr>
<td>BH</td>
<td>Self-Liberation</td>
<td>Using autonomy/self-efficacy to commit to opioid abstinence behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Environmental</td>
<td>Examining relationship between opioid use behavior and social environment</td>
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<tr>
<td></td>
<td>Re-evaluation</td>
<td>Contrasting self-image with opioid use behavior</td>
</tr>
<tr>
<td>EX</td>
<td>Self-Reevaluation</td>
<td></td>
</tr>
<tr>
<td>BH</td>
<td>Stimulus Control</td>
<td>Replacing opioid use behavior with avoiding former use environment</td>
</tr>
<tr>
<td>BH</td>
<td>Counterconditioning</td>
<td>Associating new behavior with previous opioid use behavior antecedent</td>
</tr>
<tr>
<td>BH</td>
<td>Contingency</td>
<td>Using positive reinforcement to increase opioid abstinence behavior</td>
</tr>
<tr>
<td>BH</td>
<td>Management</td>
<td></td>
</tr>
<tr>
<td>BH</td>
<td>Self-Liberation</td>
<td>Using autonomy and self-efficacy to commit to opioid relapse prevention</td>
</tr>
</tbody>
</table>
The scoring rubric for the PCQ-OP (see Appendix B) generally scores items as follows: To find a mean overall Process of Change score, the assessor would sum scores from all the items and divide by total number by 20. The summary score for Experiential and Behavioral subscales would quantify the opioid user’s response pattern and classify it as more Experiential, more Behavioral, or an even endorsement of each subscale (e.g. an equal score on each subscale). To calculate the mean overall Experiential Process score, the assessor would sum item scores from all Experiential subscales and divide that total by 10.

To obtain a mean Behavioral Process score, the assessor would sum item scores for all Behavioral subscales and divide that total by 10. To obtain mean scores for individual subscales, the assessor would sum item scores for each subscale and divide by 2. If a respondent’s mean Experiential Process score is Higher than their mean Behavioral Process score, this result indicates the respondent appears to be engaging primarily in Experiential Processes. If a respondent’s mean Behavioral Process score is the higher of the two scores, the respondent appears to be engaging primarily in Behavioral Processes. For more details and to view the scoring rubric, see Appendix B2).

Data collection

All data collection was done by in-person screening and surveying at a methadone treatment center in a major urban area in the Northeastern United States in which 500-800 adults receive medical and behavioral health treatment for Opioid Use Disorder per year.
Approval for data collection for this study was sanctioned by the Northeastern University Institutional Review Board (IRB #16-03-35), as well the IRB of the parent company governing the methadone treatment center.

Data collection began on 1/17/2017 and was completed on 7/18/2017; a total of 300 total participants were sampled. All study participants were remunerated for their participation with a $5 retail gift card.

**Analytic methods-procedures**

The first author reviewed all measures to confirm that all participants completed all applicable items on each study measure administered. This review ensured that there was no missing data for any participant in the study. Had missing data been present, list wise deletion would have been the preferred method of accounting for missing data in analysis, assuming the amount of missing data is small in comparison to the total (N) of the sample, per best practices guidelines (Johnson & Young, 2011).

Manual inspection of the dataset was performed between 01/05/18 and 4/30/18 to identify errors or inconsistencies in data entry. Any errors and inconsistencies found during manual data inspection were treated as omissions (missing data) and entered as “NA” into the dataset, resulting in list wise deletion in SPSS.

**Participant screening**

All study participants met certain screening criteria to participate in this study. Because all study participants were interviewed in a methadone treatment center, they were either in treatment or seeking treatment for opioid dependence at this facility. Nonetheless,
verification of their opioid treatment status was also part of the inclusion criteria questions. All participants were adults (aged 18 or older). Inclusion criteria were defined as follows: participants were eligible to complete the study assessment measures 1) if they were in substance abuse treatment currently for opioid dependence, 2) were seeking substance abuse treatment for opioid dependence or 3) had used any form of opioids during the last 30 days. “Opioid use” in this context means the use of any kind of opioids, licit or illicit, including drugs of abuse such as heroin, as well as the non-medical use of synthetic opioids (e.g. oxycodone (OxyContin®), oxycodone/acetaminophen (Percocet®), methadone, buprenorphine (Subutex®), buprenorphine/naloxone (Suboxone®), hydromorphone (Dilaudid®), morphine and fentanyl). All participants were asked a series of three possible questions to determine inclusion eligibility as part of the screening process.

The questions to assess inclusion criteria were: 1) “Are you currently in substance abuse treatment for opioid dependence? 2) “Are you seeking substance abuse treatment for opioid dependence?” and 3) “Have you used nonmedical or illicit opioids in the last 30 days?” If the participant scored as “yes” on any of the three questions they were deemed eligible to participate.

Exclusion criteria for this study involved a participant either not currently being treated for Opioid Use Disorder or not having used any opioid of any kind in the past 30 days. This was determined by participants scoring a “no” response to all three of the above screening questions. Participants were also deemed ineligible by presenting with organic impairment upon screening. Organic impairment was determined by participants scoring at least 24 points or more on a printed form of the Telephone-Mini-Mental Exam (T-MMSE; adapted from Rovner & Folstein, 1987). If organic impairment due to a score below 24 points on the
T-MMSE was determined, participants were informed they were ineligible presently, but welcome to participate in screening if interested at a future date. Two respondents were determined impaired during screening due to organic impairment, per their T-MMSE score.

**Primary measures**

All items from all screening and assessment measures were read aloud to each study participant by research staff. Participants completed question on demographics and substance use history. They also completed the Drug Use Questionnaire (DUQ) and The Drug Abuse Screening Test (DAST-10).

Demographics. The Demographics questionnaire collected demographic information from respondents about their gender, age, nationality, country of origin, race/ethnicity, highest education level attained, employment status, housing status, and individual/household annual income.

Substance use history. The Substance Use History questionnaire contained 4 items specifically tailored towards gathering more specific information about respondents’ past opioid use. Accordingly, the first three items asked respondents to respond dichotomously about whether they have ever engaged in specific opioid use behaviors, the age of their first use, and the nature of their opioid use (e.g. non-medical use of opioid medications or illicit heroin use). The final item asked whether participants were currently participating in any kind of substance abuse treatment. Participants that responded “yes” to this question then noted all treatment programs they had ever used, including treatments such as: inpatient detox, methadone maintenance treatment, Buprenorphine (e.g. Subutex®), Buprenorphine/naloxone (e.g. Suboxone®), Naltrexone (e.g. Vivitrol®), inpatient (hospital)
mental health, outpatient counseling (individual), outpatient counseling (group), 12-step groups (e.g. AA/NA) or other treatments.

DUQ. The DUQ measure is a brief, 4-item self-report questionnaire which asks respondents about recent drug use behavior (US Dept. of Health and Human Services, 2009). Each item asks respondents if they have used a given psychoactive substance during the past 90 days (e.g. “Have you used opiates (heroin, opium, morphine, etc.) in the past 90 days?”). If respondents indicate “Yes” in response to any such item, they are then asked to estimate during how many days (out of the past 90 days) did they use the substance in question (e.g. heroin, cocaine, marijuana, etc.). Substances included on the DUQ are Marijuana, Opiates, “Designer Drugs” (e.g. ecstasy, MDMA, GHB, etc.), and “Other Drugs,” which include “Stimulants, Cocaine, Bath salts or Herbal Spice, Sedatives, LSD or PCP,” and “Inhalants” (US Dept. of Health and Human Services, 2009).

DAST-10. The DAST-10 measure is also a brief, psychometrically validated 10-item self-report questionnaire used widely in substance abuse research. Items on the DAST-10 ask respondents about “possible involvement with drugs not including alcoholic beverages during the past 12 months” (Skinner, 1982). Respondents then reply dichotomously (“Yes” or “No”) to all 10 items. Items vary in terms of how they inquire about drug use during the past year. Some items elicit straightforward responses about drug use behavior (e.g. “Have you used drugs other than those required for medical reasons?”), whereas others ask about attitudes and/or feelings about recent drug use (e.g. “Do you ever feel bad or guilty about your drug use?”). Scoring the DAST-10 involves scoring all “Yes” responses 1 point and all “No” responses 0 points; scores between 0-2 points indicate a “Low” level of problems with recent drug use, scores between 3-5 points indicate a “Moderate” level of problems, scores
between 6-8 points indicate a “Substantial” level of problems, and scores between 3-5 points indicate a “Moderate” level of problems, scores between 9-10 points indicate a “Severe” level of problems (Skinner, 1982).

**Power Analysis and other assumptions**

The sample size in this study, 300 participants, was considered a good sample size for Principal Components Analysis, suggesting adequate power (Comrey & Lee, 1992). To determine the number of factors in each measure to retain in our analysis, we identified factors with Eigenvalues greater than one, using Kaiser’s methodology (e.g. Kaiser, 1960). In addition, we compared results from Cattell’s Scree Test for each measure, as a second assessment of how much of the variance in the data is accounted for by the factors identified.

Items in both measures used a continuous ordinal (non-dichotomous) scale, which meets the assumption of continuous data necessary for running a factor analysis. To test the assumption that no outliers exist in the data set, we assessed possible outliers and influential data points was using Mahalanobis distance. Several (50) data points (~17% of the sample) fell above the critical value of 45.31 established for Mahalanobis distance ($df$ =20). These cases data were not deleted from the sample, however and were thus retained in analysis. The decision to retain these outliers was based on researchers preferring to avoid potentially biasing results due to deleting these data (e.g. Liu & Zumbo, 2012).

The non-critical assumption of multivariate normality is considered met due to the central limit theorem, since this dataset is large (300 cases), despite both Shapiro-Wilk and Kolmogorov-Smirnov tests being significant for several IVs in the data set. The assumption of linear relationships between variables is met via investigating and confirming linear relationships between variables in the data set. The correlation matrix indicates that mild multicollinearity
exists, but perfect (value = 1) correlations do not exist between any variables in the data set. Therefore, assumptions for multicollinearity and singularity are met, as both singularity and extreme multicollinearity are avoided. The results of the Kaiser-Meyer-Olkin (KMO) test reveal that moderate-to-high moderate correlations exist without multicollinearity and a relationship exists between variables (assumption of Sphericity).
Results

Participants

Study participants were 300 adults who were in treatment for Opioid Use Disorder at a methadone treatment center located in a major city in the Northeast United States. Participants all met screening criteria (detailed below), which measured their current opioid use and excluded any participants presenting with potential organic cognitive impairment. The 300 participants were almost evenly distributed by gender (male 53%) with a mean age of 43.53 (SD = 11.81) years. In terms of the age of opioid use onset, the average participant reported first using opioids by age 19 (SD = 6.8). In formal education, the mean education was a high school degree (12 years). Approximately 26% of these subjects were employed full or part time. In terms of household income, the average participant reported earning between $5,001 - $10,000, annually. Please see Table 4 in the appendices for other descriptive statistics regarding study participants.

Principal Components Analysis: Opioid Use Readiness to Change Questionnaire

The 12 items of the Opioid Use Readiness to Change Questionnaire (RCQ-OP) were subjected to Principal Components Analysis using SPSS Version 25. Before performing PCA, the suitability of the data for Principal Component Analysis was assessed. Inspection of the correlation matrix revealed the presence of several coefficients above .3. The Kaiser-Meyer-Okin (KMO) value was .820, exceeding the recommended value of .6 and Bartlett’s Test of Sphericity (BTS) reached statistical significance ($p < .001$), supporting the factorability of the correlation matrix.

Principal Components Analysis was used for extracting components from the 12 items of the RCQ-OP. An orthogonal rotation (Varimax rotation in SPSS) was used. A solution
containing three components with eigenvalues exceeding one emerged, accounting for 59.40% of the total variance. The first component accounted for 32.38 percent (Eigenvalue = 3.88), the second accounted for 18.02% and the third accounted for 8.99% of the total variance. An inspection of the scree plot demonstrated a break after the third component. A three-component solution was supported additionally by the bend or “knee” in the scree plot line occurring at three on the x-axis (Figure 2).

An examination of the structure matrix reveals that four items of the proposed RCQ-OP scale loaded highly onto the first component, at loadings of .718, .761, .794 and .729, respectively. We identified this scale as Action (A). It should be noted that one item had a small loading on component two, of .338. See Table 2 for the component matrix for the RCQ-OP.

Four additional items on the proposed RCQ-OP scale demonstrated moderate-to-high loadings on component two (.706, .527, .728, and .770) which we identified as Contemplation (C). It should be noted that item had a small loading on component one, of .370. The last four items of the proposed RCQ-OP scale demonstrated moderate-to-high loadings on component number three (.710, .750, .661 and .591). It should be noted one item had a small loading on component two, of -.358. We have identified component three as Precontemplation (PC).

**Relationship between stages of change measured by the RCQ-OP**

Relationships between the TTM Stages of Change, as measured by the RCQ-OP, were compared via Pearson product-moment correlation coefficient (r) analysis. Correlation analysis results revealed significant correlations ($p < .01$) between adjacent and non-adjacent (e.g. stages next in temporal sequence) Stages of Change. For example, the correlation between
Precontemplation and Contemplation was -0.33, the correlation between Contemplation and Action was 0.18, and the correlation between Precontemplation and Action was -0.57.

**Reliability for the RCQ-OP**

Cronbach's alpha coefficient was calculated for each of the 4-item scales representing the three stages of change. The results were as follows: precontemplation = 0.69; contemplation = 0.68; action = 0.79. These values indicate that the item scores are adequate to establish a scale in each case. We expected alpha values to be greater than .70, based on comparisons to alpha coefficients from the exploratory PCA for the original RCQ measure, which were .73 for Precontemplation, .80 for Contemplation and .85 for Action (Rollnick et al., 1992). However, the mean alpha value for all three scales is 0.72, for all three RCQ-OP scales. Further, the range of alpha values for the three RCQ scales is well within the range of 0.60 to 0.84, considered acceptable for internal consistency by Hoeppner and colleagues (2006). According to these results, all three RCQ-OP scales reliably and consistently measure within the domains across each of the subscales. See Table 3 for summary statistics for the reliability of both the RCQ-OP and PCQ-OP.

**Principal components analysis: opioid use process of change questionnaire**

The 20 items of the Opioid Use Readiness to Change Questionnaire (PCQ-OP) were subjected to Principal Components Analysis using SPSS Version 25. Before performing PCA, the suitability of the data for component analysis was assessed. Inspection of the correlation matrix revealed the presence of several coefficients above .3. The Kaiser-Meyer-Oklin (KMO)
value was .859, exceeding the recommended value of .6 and Bartlett’s Test of Sphericity (BTS) reached statistical significance \((p<.001)\), supporting the factorability of the correlation matrix.

Components for the 20 items of the PCQ-OP were extracted using Principal Components Analysis and were rotated using an orthogonal rotation (Varimax rotation in SPSS). Five components with eigenvalues exceeding one emerged, accounting for 53.73\% of the total variance. The first component accounted for 27.69\% (Eigenvalue =5.54), the second component accounted for 8.09\% (Eigenvalue =1.62) and the remaining three components together accounted for 6.71\%, 6.07\% and 5.17\% of the variance, respectively. An inspection of the scree plot demonstrated a break after the third component, however, supported by the bend or “knee” in the scree plot line occurring at the third component on the x-axis (Figure 4). This analysis indicated that a three-component solution was advisable. A varimax rotation was performed on the resulting component pattern (see Figure 5). This solution accounted for 42.5\% of the total variance. This three-component solution will be described at length.

An examination of the structure matrix reveals that ten items of the proposed PCQ-OP scale loaded onto the first component, with loadings varying between poor/fair to very good (.341 - .695). This component contained all the items adapted from the original PCQ Behavioral Processes of Change subscales of Counterconditioning, Stimulus Control, and Contingency Management. Per the TTM, people who engage in these Behavioral processes are most likely to be in the Action stage (Prochaska et al., 1997; 2005). This component was therefore labeled ‘Action processes.’ It should be noted that items two items had small loadings on component two, of .316 and .390.

Five items on the proposed PCQ-OP scale demonstrated good-to-excellent loadings on component two (e.g. .590 - 735). It should be noted that one item had a small loading on
component one, of .341. This component contained all the items adapted from the original PCQ Experiential Processes of Change subscales of Dramatic Relief and Environmental Re-Evaluation, along with one item from Self-Re-Evaluation (See Table 2). These three subscales are Experiential Processes of Change, in which, according to the TTM, people are likely to engage during both the Precontemplation and Contemplation Stages of Change (Prochaska et al., 1997; 2005). This component was thus labeled ‘Precontemplation and Contemplation processes.’

Five additional items on the proposed PCQ-OP scale demonstrated poor-to-excellent loadings on component two (e.g. .385 - 795). This component contained all the items adapted from the original PCQ subscales of Social Liberation and Helping Relationships, along with one item from Consciousness Raising (See Table 2). Social Liberation and Consciousness Raising are Experiential subscales; Helping Relationships is a Behavioral subscale. Despite this key difference, in the TTM, Social Liberation and Helping Relationships refer to Processes of Change which involve people using social engagement to change their behavior. For example, in Helping Relationships, an opioid user may become more involved with family life, while reducing opioid use, whereas in Social Liberation, an opioid user in recovery may advocate for reducing stigma against opioid use (Prochaska et al., 1997; 2005). Since most of the items loading on this component were for the Social Liberation and Helping Relationships subscales, this component was labeled ‘social engagement processes.’ This label references the social engagement actions characteristic of both the Social Liberation and Helping Relationships Processes of Change, per the TTM theory (Prochaska & Velicer, 1997).

Cross-loadings were present for three items between the first two components in this solution. However, these cross-loadings ranged in value from .32 to .39. This range falls below
the criterion of .50 recommended to determine a strong cross-loading by Costello & Osborne (2005) and is therefore not grounds deleting any items.

Cross loadings were present on item 13 (Self-Liberation; Behavioral), item 14 (Environmental Re-evaluation; Experiential), and item 15 (Self-Reevaluation; Experiential). For each of these items, the component to which the item was assigned was determined by the higher component loading, between Component I and Component 2. Two out of the three items with cross-loadings measured Processes of Change which, per the TTM theory, are most likely to occur between the Contemplation and Action Stages of Change: Self-Reevaluation (Experiential) and Self-Liberation (Behavioral). As a person progresses through these Stages of Change, they tend to transition from using primarily Experiential processes to Behavioral processes (Prochaska & Velicer, 1997; Prochaska & DiClemente, 1977, 2005). The cross-loading on items 13 and 15 can therefore be attributed, in part, to where the Processes of Change measured by these items exist within the TTM framework. Self-Reevaluation (Experiential) and Self-Liberation (Behavioral) are Processes of Change considered likely during three concurrent Stages of Change. See Table 3 to compare loadings and cross-loadings on these components; see Figure 1 for a visual representation of a person’s progression through the TTM.

**Reliability for the PCQ-OP**

Reliability was estimated for the two subscales of the 20-item PCQ-OP measure, Experiential and Behavioral. For these two scales, internal consistency was again evaluated using Cronbach’s alpha. Alpha statistics for the PCQ-OP subscales for Experiential and Behavioral subscales had moderate-to-high internal consistency, with Cronbach alpha coefficients between .72 and .82. These alpha values therefore meet our expectation of being greater than .70 and
appear to reliably and consistently measure within the proposed domains across both subscales for the Processes of Change. Internal consistency (α) values for the three components revealed in the PCA for the PCQ scales (e.g. Action Processes, Precontemplation/Contemplation Processes, and Social Process) were between .60 and .83. These alpha values were in a range (e.g. 0.60 to 0.84) considered acceptable for internal consistency by previous TTM researchers (e.g. Hoeppner et al., 2006). Also reference Table 3 for summary statistics for the reliability of both the RCQ-OP and PCQ-OP.

**Relationship between TTM measures in this study**

A secondary aim of this study was to explore whether Experiential and Behavioral Processes of Change will be positively correlated with a respondent’s current Stage of Change. Two research hypotheses tested this inquiry. First, we hypothesized that participants will endorse Behavioral Processes of Change at higher rates during the Action Stage, compared to the Precontemplation and Contemplation Stages of Change. A Pearson product-moment correlation coefficient (r) analysis resulted in the presence of a moderate positive correlation ($r = .47, p < .01$) between participants endorsing Behavioral Processes of Change, on the PCQ-OP, whose scores placed them in the Action Stage, on the RCQ-OP. Further, results of this analysis also revealed no correlation between participants placed in the Contemplation Stage of Change and participants endorsing Behavioral Processes of Change ($r = -.04$). Finally, a weak negative correlation was observed between participants placed in the Precontemplation Stage of Change and participants endorsing Behavioral Processes of Change ($r = -.29, p < .01$).

Second, we hypothesized that participants will endorse Experiential Processes of Change at higher rates during both the Precontemplation and Contemplation Stages of Change, as compared to the Action stage. Correlation analysis results indicated a negative correlation, or
inverse association (e.g. higher Precontemplation score on RCQ-OP: lower Experiential score on PCQ-OP), between the Precontemplation stage and Experiential Processes of Change ($r = -.39, p < .01$). A positive correlation was observed between participants placed in the Contemplation Stage of Change and participants endorsing Experiential Processes of Change ($r = .15, p < .01$). When comparing participants placed in the Action Stage of Change and participants endorsing Experiential Processes of Change, a moderate positive correlation was reported ($r = .43, p < .01$).


**Discussion**

We hypothesized that a Principal Components Analysis of the RCQ-OP would result in a three-component solution resembling the Precontemplation, Contemplation and Action Stages of Change. Responses by 300 opioid users in a treatment setting revealed a clear component pattern and good internal consistency, for Component I (Action; 4 items), Component II (Contemplation; 4 items) and Component III (Precontemplation; 4 items), which together accounted for approximately sixty percent of the total variance in responses. This component structure for each of the three subscales was consistent with the three-component solution (e.g. Action/Contemplation/Precontemplation; 4 items per component) reported on original RCQ measure piloted by Rollnick and colleagues on heavy alcohol users, which accounted for sixty-nine percent of the total variance (1992).

The internal consistency reported for the three Stages of Change scales in the current study (e.g. \( \alpha \)) was between 0.69 and 0.79 on a sample of 300 opioid users in treatment. This range of alpha values was very similar to the range (e.g. 0.66 - 0.85) considered good internal consistency by researchers who piloted the source measure for the RCQ-OP, on a sample of 724 alcohol users in treatment (Heather & Hönekopp, 2008). Likewise, the internal consistency reported for the three Process of Change scales in the current study was between 0.60 and 0.83 This range of alpha values was very similar to the range (e.g. 0.60 - 0.84) reported by researchers who tested the source measure for the PCQ-OP, on a sample of 798 cigarette smokers (Hoeppner et al., 2006). For both measures piloted in the current study, internal consistency generally met the standards determined by the source measures from which they were adapted. This indicates that the items written for both piloted measures produce scores similar enough to reasonably assess
the general constructs they were designed to measure (e.g. an opioid user’s profile according to the Stages of Change continuum and the Process of Change).

When comparing Pearson product-moment correlations between Stages of Change, the TTM literature on both alcohol and tobacco users compared correlations between adjacent Stages of Change, or stages sequentially preceding or following one another (McConnaughy, Prochaska, & Velicer, 1983; Rollnick et al., 1992). For example, Precontemplation is the stage adjacent to Contemplation because, per the TTM, a person is expected to first move through Precontemplation, before moving to Contemplation. Likewise, Action is adjacent to Contemplation because it occurs sequentially after Contemplation, in the theory. Precontemplation and Action are an example of non-adjacent Stages of Change because they are not sequentially following or preceding one another, in the TTM (Prochaska & DiClemente, 1997).

The pattern in correlations found between stages in the present study, which measured readiness in opioid users, differed from the original RCQ, which measured readiness in heavy drinkers. In previous research on readiness to change in alcohol users, comparisons in Pearson product-moment correlation coefficients were calculated among the three scale scores for Precontemplation, Contemplation and Action, to test the prediction that correlations between adjacent stages, per the TTM (i.e. Precontemplation/Contemplation and Contemplation/Action) would be higher than the correlation between non-adjacent scales (i.e. Precontemplation/Action) (McConnaughy, Prochaska, & Velicer, 1983; Rollnick et al., 1992). These correlations between adjacent stages were interpreted as evidence of the hypothesized TTM pattern fitting their study sample (Rollnick et al., 1992). For the piloted RCQ-OP measure, the correlations between adjacent Stages of Change maintained the same direction, but were weaker in each case,
compared to the original RCQ measure. When comparing non-adjacent stages, however, the
correlation was slightly higher on the RCQ-OP than on the RCQ. Therefore, on the RCQ-OP,
on-adjacent stages were more highly correlated than were adjacent stages—a pattern opposite
of what was found with the original RCQ, with heavy drinkers. Reading very well so far -

The finding that a relatively strong negative correlation was observed between
Precontemplation and Action may suggest that in this sample of opioid users in treatment, people
who score low on the Precontemplation scale score high on the Action scale. This finding is
consistent with the hypothesis tested in previous TTM research on alcohol users, which predicted
that heavy drinkers in Precontemplation would correlate negatively with those in Action because
a decrease in Precontemplation represents an increase in readiness to change (Rollnick et al.,
1992). It therefore appears that in our sample, this negative correlation may suggest that as
opioid users’ Precontemplation scores decrease, their Action scores would increase, representing
an increase in their readiness to change. This pattern of an inverse relationship between opioid
users’ decrease in score on the Precontemplation scale (e.g. not intending to change opioid use
behavior in the next six months) and their increase in score on the Action scale (e.g.
demonstrating a consistent, repeated pattern of change in their opioid use behavior over the past
six months) was first observed in tobacco users and has been replicated across several studies of
the TTM in several populations of substance users (Prochaska and Velicer, 1997; Prochaska &
DiClemente, 2005).

Another relationship of note in the current study is the general absence of magnitude in
correlation between the Contemplation Stage and all other stages of change. This finding differs
from comparisons of PC/C/A stage comparisons in samples of tobacco and alcohol users
(Prochaska et al., 1988; Rollnick et al., 1992). For alcohol users profiled in the Contemplation
stage, correlations were observed both with the Precontemplation (-0.53) and Action (0.57) stages (Rollnick et al., 1992). Correlations were also observed with tobacco users profiled in Contemplation, with the Precontemplation (-0.45) and Action (0.38) stages (McConnaughy, Prochaska, & Velicer, 1983; Prochaska, DiClemente & Norcross, 1992). Researchers comparing Action and Contemplation profiles in tobacco users, note that those in Contemplation and those in Action may share similarities in their motivation to change, in that thinking about, or knowing how to change characterizes both groups. The key difference observed in tobacco users, compared to the present study, which did not measure any behavioral outcomes, however, was that tobacco users in Action had not just thought about or planned how to change, but they had taken the action(s) required to change (Prochaska, DiClemente & Norcross, 1992). The positive correlation reported between the Contemplation and Action stages in this study could similarly represent an overlap in motivation in opioid users profiled to each stage. Future research such as a confirmatory factor analysis on a larger sample of opioid users is recommended, to further investigate relationships between TTM stages and how the relationships between Precontemplation, Contemplation and Action compare with those observed in other samples. Additional research could also measure behavioral outcomes as a result of readiness to change among opioid users.

The RCQ-OP measure piloted in this study on opioid users resembles the component structure of the original RCQ measure (piloted on heavy alcohol users) in terms of its intended design to profile respondents into TTM Stages of Change, as a tool for brief clinical interventions (Rollnick et al., 1992; Heather et al., 2006; Heather & Hönekopp 2008). The correlations observed between the Precontemplation, Contemplation and Action profiles of opioid users in this study resemble correlations observed in samples of tobacco users and heavy
drinkers, in terms of an inverse relationship being observed between Precontemplation and Action and a relationship being observed between Contemplation and Action (McConnaughy, Prochaska, & Velicer, 1983; Prochaska, DiClemente & Norcross, 1992; Rollnick et al., 1992).

Additional analyzes should investigate the factor structure of the Stages of Change in opioid users via SEM and/or confirmatory factor analysis (CFA) approaches could further clarify the differences between stages of change. These analytic methods may be able to more clearly indicate, for example, how opioid users in Contemplation compare to those in the other stages, in terms of their readiness to change. It may also be helpful to compare opioid users in treatment versus those not in treatment, in future studies, to measure whether being in opioid treatment impacts motivation to change opioid use behavior. These findings from correlation analysis support cross-sectional differences in TTM profiles that could be further investigated in longitudinal research establishing external validity by, for example, comparing TTM readiness profiles at baseline, 3, 6, and 12-month intervals with rates of abstinence from opioid use. Future research replicating this finding in other samples of opioid users would provide support for using the RCQ-OP in opioid treatment settings, as a tool to help clinicians readily identify differences in motivation between different clients presenting for treatment.

Quickly profiling an opioid user in treatment (or seeking treatment) initiates a dialogue to increase opioid users’ self-awareness about their motivation to change their opioid use behavior. Opioid treatment providers could use data from the RCQ-OP to assist an opioid user seeking help in making an informed, collaborative treatment decision. Before the RCQ-OP measure can be used as a clinical tool, however, the Stage of Change profiles of opioid users should be examined via longitudinal research designs, as has been done with research on readiness to
change in tobacco users (Prochaska, DiClemente & Norcross, 1992) and heavy drinkers (Rollnick et al., 1992).

A secondary aim of this study was to explore whether Experiential and Behavioral Processes of Change will be positively correlated with a respondent’s current Stage of Change. First, we hypothesized that participants will be more likely to engage in Behavioral Processes of Change during the Action Stage, compared to Precontemplation and Contemplation. Correlation analysis results indicated a significant ($p < .01$) positive correlation between opioid users profiled to Behavioral Processes of Change and opioid users in Action. Further, no relationship was observed between the Precontemplation/Contemplation stages and the Behavioral Processes of Change. This study’s findings therefore provided additional support for a relationship existing between the Action stage and Behavioral Processes of Change. See Table 5 for all correlations reported.

In the present study, our PCA solution for the PCQ-OP measure resulted in three components. This solution resembled the three-component solution found by Tejero and colleagues on a sample of treatment-seeking opioid users, which labeled components not by Experiential or Behavioral processes, but rather by the Stages of Change associated with each process. The three components in that study were labeled “contemplation and preparation processes,” “processes of the final part of the action phase and maintenance,” and “processes of action” (Tejero et al., 1997). We likewise labeled the three components in our solution: Action Processes, Precontemplation/Contemplation Processes, and Social Process, based on the items corresponding to them in the rotated component matrix. Good internal consistency was observed for the three components revealed in the PCQ-OP scales.
Support for the PCA solution reported upon is limited, however, because the three-component pattern does not replicate the two-component solution consisting of Experiential and Behavioral Processes of Change originally observed (Prochaska et al., 1988). Though the reason for this discrepant finding is uncertain, it closely replicates the three-component structure previously identified in TTM research using Principal Components Analysis to evaluate a measure of the Processes of Change on a sample of opioid users (Tejero et al., 1997). Authors of this study reported a three-component solution, which similarly similar, but not precise theoretical alignment with the Experiential and Behavioral factors Prochaska and colleagues originally identified (1988). This discrepancy could potentially be a limitation, therefore, of attempting to replicate two higher-order factors (Experiential and Behavioral) which Prochaska first identified through SEM modeling, after originally identifying the ten processes of change via PCA (Prochaska et al., 1988). These two methodologies for data reduction differ considerably, which limits the generalizability of comparisons between the two. Research on the PCQ-OP, such as a Confirmatory Factor Analysis (CFA), could investigate our finding that only two, not the three-components were revealed by the PCA in the current study (e.g. Action, Precontemplation/Contemplation, and Social) in opioid users, compared to the two-components (e.g. Experiential and Behavioral) identified originally in tobacco users (Prochaska et al., 1988). A CFA analysis could add additional insight, based on observable patterns in the data, on the relationship between the Processes of Change and the items on the PCQ-OP.

Three-component solution. The first component (‘Action Processes’) most closely resembles the Behavioral Processes of Change, previously identified on a Confirmatory Factor analysis of the original PCQ measure. Prochaska and colleagues first identified the ten Processes of Change as primary factors and experiential and behavioral as secondary factors (Prochaska et
al., 1988). This component contained all the items adapted from the original PCQ Behavioral Processes of Change subscales of Counterconditioning, Stimulus Control, and Contingency Management. For example, the items “I find that keeping myself busy is a good substitute for opioid use” (Behavioral; Counterconditioning) and “I use reminders to help me not to use opioids” (Behavioral; Stimulus Control) loaded onto this component. Per the TTM, people who engage in these Behavioral processes are most likely to be in the Action stage (Prochaska et al., 1997; 2005). This component was therefore labeled ‘Action processes.’

We hypothesized that participants would endorse Experiential Processes of Change at higher rates during both the Precontemplation and Contemplation Stages of Change, compared to during the Action stage. The second component (‘Precontemplation/Contemplation Processes’) most closely resembles the Experiential Processes of Change, the second higher order factor identified on the original PCQ measure (Prochaska et al., 1988). The Experiential Processes of Change generally involve a person restructuring their experience cognitively (Prochaska, DiClemente & Fava, 1988). This component contained all the items adapted from the original PCQ Experiential Processes of Change subscales of Dramatic Relief and Environmental Re-Evaluation, along with one item from Self-Re-Evaluation (See Table 2). For example, the items “I stop to think about how my opioid use is hurting people around me” (Experiential; Environmental Re-Evaluation) and “Stories about opioids and their effects upset me” (Experiential; Dramatic Relief) loaded onto this component. According to the TTM, tobacco users are likely to engage the Experiential Processes of Change during both the Precontemplation and Contemplation Stages of Change (Prochaska et al., 1997; 2005). This second component was thus labeled ‘Precontemplation and Contemplation processes.’
A negative correlation was reported between Precontemplation and Experiential processes and a positive correlation was reported between Action and Experiential processes. These correlations in our sample of opioid users provide evidence to potentially support a relationship existing between the Action stage and opioid users’ engagement in Experiential Processes of Change. The TTM literature on the integration of Processes of Change and Stages of change in both tobacco users in people working towards weight loss, people emphasized Experiential Processes of Change during Precontemplation and Contemplation and Behavioral Processes of Change during Action and Maintenance (Prochaska, DiClemente & Norcross, 1992). The correlation we reported between the Action stage and Experiential processes is suggestive of a relationship between the two variables; it is not indicative of opioid users’ engagement or emphasis of Experiential Processes during Action. Nonetheless, the positive relationship between the two variables is still somewhat unexpected, compared to the TTM literature on other populations (e.g. tobacco users and people attempting to lose weight).

Another description of the interplay between the Stages of Change and the Processes of Change in the TTM literature may help support the relationship we observed between Action and Experiential processes, however. The TTM literature states that a person’s engagement in a Process of Change at one point in time does not prevent further utilization of that Process of Change. For example, a cigarette smoker who uses Consciousness Raising (Experiential) during Precontemplation may also use Consciousness Raising during Action (DiClemente et al., 2004). This clarifies that people can theoretically use the same Processes of Change at more than one Stage of Change. To compare whether opioid users emphasized specific Experiential processes during the Action stage, we would have needed to use a longitudinal design comparing separate groups profiled by Stage of Change (e.g. per DiClemente et al., 1991, Norcross, Prochaska, &
DiClemente, 1991; Prochaska & DiClemente, 1983,1984). The correlation observed between Action and Experiential processes in our sample of opioid users nevertheless provides justification to further explore the observation that people can use the same Process of Change across several Stages of Change (DiClemente et al., 2004).

We hypothesized that participants would endorse Experiential Processes of Change at higher rates during both the Precontemplation and Contemplation Stages of Change, compared to during the Action stage. We therefore expected to observe positive correlations between opioid users in the Precontemplation and Contemplation stages and opioid users profiled to Experiential processes. Correlation analysis partially supported this hypothesis: a significant ($p < .01$) positive correlation was observed between Contemplation and Experiential processes. However, we also reported a negative correlation between Precontemplation and Experiential processes and a positive correlation between Action and Experiential processes.

In our sample of opioid users, the inverse relationship reported between Precontemplation and Experiential processes diverges from the research on tobacco users which suggests that tobacco users are likely to emphasize Experiential Processes (e.g. Consciousness Raising) during Precontemplation (Prochaska, DiClemente & Norcross, 1992). Our data does not support a relationship between Precontemplation and Experiential processes, but also does not provide evidence that opioid users emphasize Experiential processes during Precontemplation. Whereas TTM research on tobacco users often targeted samples of smokers interested in quitting or engaging in self-help smoking cessation strategies (e.g. Prochaska, DiClemente & Norcross 1992), our sample of opioid users were in methadone maintenance treatment for opioid use disorder. Our study was therefore similar to other studies in the limited literature on TTM variables in opioid users, which also used treatment samples (e.g. Tejero et al., 1997). Future
research involving treatment and non-treatment samples of opioid users grouped by TTM variables (Stages of Change or Processes of Change, for example) would be needed to substantiate whether sample characteristics potentially influence the data. However, contingency management remains one of the most frequently used psychosocial interventions for treating Opioid Use Disorder (Dugosh et al., 2016). Our entire sample was in methadone maintenance treatment, an intervention which pairs methadone dosing with contingency management strategies for achieving and maintaining a stable methadone dose. For example, methadone treatment often rewards dosing consistently from the onset of treatment, while limiting or reducing illicit opioid use—a contingency management strategy (Dugosh et al., 2016). It may therefore be reasonable to consider whether the setting in which we sampled our study population potentially influenced opioid users’ willingness to emphasize Experiential processes during the Precontemplation stage.

Evidence of such engagement in Experiential Processes of Change during Precontemplation could be supported by a comparison between outcome data (e.g. completion of an OUD psychoeducation web course—a Consciousness Raising activity) and opioid users profiled in Precontemplation (versus other Stages of Change). Tejero and colleagues used MANOVA analysis to compare mean Process of Change scores for each process in both abstinent and non-abstinent heroin users in their sample. Their analysis revealed only significant comparisons ($p < 0.001$) in Counterconditioning and Stimulus Control (both Behavioral processes) between those using heroin and those abstinent, in their sample (Tejero et al., 1997). They did not report any significant mean differences between any other Processes of Change and abstinent/non-abstinent heroin use status (Tejero et al., 1997). This comparison revealed no evidence of a relationship between heroin use (or abstinence) and any of the Experiential
Processes of Change. To support the idea that opioid users emphasize Experiential processes during Precontemplation empirically, we would need to find significant group comparisons between those in Precontemplation and outcome variables related to the activities associated with Experiential Processes of Change. Providing these comparisons would also support the external validity of the PCQ-OP measure.

The third component (‘Social Processes’) includes items from both the Experiential and Behavioral Processes of Change. Items which measured Helping Relationships items (Behavioral), and two Social Liberation items (Experiential) both loaded onto this component. Per the TTM theory, this component represents both the Behavioral and Experiential Processes of Change in which tobacco users were likely to engage during the Contemplation stage through the Action stage, in the literature (e.g. Prochaska, DiClemente & Norcross, 1992). Per the TTM literature, two Stages of Change which are both related to social engagement and commonly accessed by tobacco users during Contemplation through Action are Helping Relationships and Social Liberation. (Prochaska, DiClemente & Norcross, 1992, Prochaska et al., 1997; DiClemente et al., 2004). Helping Relationships and Social Liberation represent the Processes of Change to which the items on this scale loaded. The items “I have someone whom I can count on to help me when I’m having problems with my opioid use” (Behavioral; Helping Relationships) and “I see advertisements on television about how society is trying to help people who use opioids” (Experiential; Social Liberation) loaded onto this component.

Experiential processes were negatively correlated with Precontemplation (-0.39) and positively correlated with Contemplation (0.15) and Action (0.43). These results in our sample of opioid users diverge from the TTM findings for tobacco users, whom researchers who report relationships between users engaging in Experiential processes and the Precontemplation and
Contemplation stages (Prochaska & DiClemente, 1983). Prior TTM research also reported a similar relationship between Experiential processes and the Precontemplation and Contemplation stages in people trying to lose weight (Prochaska, DiClemente & Norcross, 1992). The key difference in observed relationships between the three Stages of Change and Experiential processes in our sample of opioid users is that the strongest correlation reported with Experiential processes was with the Action stage. Our correlational analysis supports that opioid users in the Action stage may therefore be simultaneously engaging in Experiential and Behavioral Processes of Change, which TTM authors reported as a possibility in tobacco users (DiClemente et al., 2004). Further comparisons of the Stages of Change and Processes of change with SEM analysis, samples of abstinent vs. non-abstinent opioid users, and longitudinal study designs could help explain how opioid users engage in the Processes of Change as they progress through the Stages of Change.

A body of literature promotes the integration of the Stages of Change and Processes of Change in clinical interventions (Prochaska, DiClemente & Norcross, 1992; Prochaska & DiClemente, 1997; Prochaska et al., 2008). This study tested the component structure and internal consistency of two self-report measures of TTM constructs in opioid users piloted for potential future clinical use. Adequate internal consistency was demonstrated for both pilot measures. However, only the component pattern of one measure, the RCQ-OP, reflected that of its source measure (e.g. Heather & Hönекopp, 2008). The component pattern for the PCQ-OP measure did not closely compare to its source measure (e.g. Prochaska et al., 1988). Moreover, additional psychometric properties, such as construct and content validity, should also be established before the RCQ-OP and PCQ-OP could have potential clinical utility for providers.
treat Opioid Use Disorder. A number of limitations to this current study should be noted to
direct future research on this topic.

First, although Principal Components Analysis in this study resulted in component
solutions corresponding to TTM constructs for both measures examined, it is recommended that
future studies replicate these component patterns via structural equation modeling analysis (e.g.
confirmatory factor analysis). Confirmatory factor analysis has been utilized to further refine
scales in other extant TTM research on measures quantifying the Stages of Change and the
Processes of Change (e.g. Prochaska et al., 1988; Hoeppner et al., 2006; Heather & Hönekopp,
2008). In this study, the component pattern for the PCQ-OP differed from the PCQ measure from
which it was adapted. If a future study performs a confirmatory factor analysis of the PCQ-OP
measure, it may reveal alternative ways of conceptualizing the relation between the observed
three scales of the PCQ-OP identified in the current study and the theorized Processes of Change.
This confirmatory analysis could be completed on another treatment-based sample or with other
large clinical samples of opioid users.

Second, although this study established internal consistency for the measures piloted,
several other psychometric properties of these measures should be tested before they are
disseminated for clinical use. For example, confirmation of internal and external validity is
recommended, particularly if established with larger, heterogenous samples. Also, the inclusion
of longitudinal designs, as was used in previous TTM research is also recommended for
establishing predictive validity for the RCQ-OP and PCQ-OP measures. Predictive validity could
be demonstrated by comparing RCQ-OP and PCQ-OP scores at 3, 6 and 12 month follow up,
with baseline measurements, as was done for previous TTM measures (e.g. Hoeppner et al.,
2006; Heather & Hönekopp, 2008). While the measures piloted in this study are satisfactory for
future research applications, further data are needed before these instruments can be used in clinical applications. The data in the present study are based only on a development sample and are not population norms. These data should therefore not be used to represent clinical norms.

The interpretation of the PCA for both study measures is potentially limited by the influence of outliers on the data set. Removing outliers and/or removing items would provide different results for the factor loadings for each item. As mentioned, the decision to remove neither outliers nor certain items from the model was guided by our decision to avoid potentially biasing results due to deleting these data (Liu & Zumbo, 2012).

The current study proposes two measures of TTM variables which both serve to profile distinct aspects of motivation to change in opioid users. The RCQ-OP profiles the Stage of Change indicated by the opioid user, which roughly quantifies the time between an opioid user’s intention to reduce opioid use and their self-reported likelihood of acting on this intention. The PCQ-OP measure profiles opioid users according to the activities they associate with their current efforts to change. These two measures, when used together, could therefore quickly profile an opioid user via the traditional means of measuring intention to abstain from use and by measuring psychosocial variables in the Processes of Change. For example, an opioid user profiled as Action stage / Action Processes may endorse Counterconditioning and Contingency Management. This profile communicates that the opioid user is engaging in psychosocial processes such as taking a stable methadone dose (Contingency Management) and attending group therapy instead of isolating (Counterconditioning) to change their pattern of illicit opioid use. Measuring these psychosocial processes via the Processes along with Readiness to Change via the Stages of Change thus adheres to the guidelines for SUD research identified by Tiffany and colleagues (2012).
The present pilot of two TTM measures on a sample of opioid users is offered to advance ongoing research investigating the assessment of behavioral change in this population. The current study provides a rationale to further establish the psychometric properties of two brief, self-report measures designed for ease of clinical use and interpretation. Evaluating simultaneously both the Stage of Change in which opioid users report being and the Processes of Change they appear to be using provides clinical information relevant to treatment planning. Moreover, this research furthers the generalization of TTM principles to the treatment of Opioid Use Disorder. We consider both the RCQ-OP and the PCQ-OP to be potentially useful assessment instruments for providing information to opioid users on current level of motivation they are reporting, along with the activities related to that motivation to change anything. We therefore offer this pilot study of the RCQ-OP and PCQ-OP as the first step towards eventually creating brief assessment instruments intended to facilitate treatment for opioid users in need of quality healthcare.
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Appendix A: The Opioid Use Readiness to Change Questionnaire – RCQ-Op

The following questions are designed to identify how you personally feel about your opioid use right now. Please think about your current situation and opioid use, even if you have given up using opioids completely.

“Opioid use” refers to the use of heroin and the nonmedical use of substances such as oxycodone (OxyContin®), oxycodone/acetaminophen (Percocet®), methadone, buprenorphine (Subutex®), buprenorphine/naloxone (Suboxone®), hydromorphone (Dilaudid®), morphine and fentanyl.

Read each question below carefully and then decide whether you agree or disagree with the statements. Please circle the answer of your choice to each question.

<table>
<thead>
<tr>
<th>Key:</th>
<th>SD = Strongly disagree</th>
<th>D = Disagree</th>
<th>U = Unsure</th>
<th>A = Agree</th>
<th>SA = Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>4</td>
<td>5</td>
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<td>6)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>7)</td>
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<td>2</td>
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<td>4</td>
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<td>2</td>
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<td>9)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>10)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Office Use Only

Please enter the subject’s scores below.

Scale Scores:

<table>
<thead>
<tr>
<th>PC Score</th>
<th>C Score</th>
<th>A Score</th>
</tr>
</thead>
</table>

Appendix A2: Scoring for RCQ-OP

The scale score codes represent each of the stages of change:

**PC = Precontemplation; C = Contemplation; A = Action.**

Items numbered 1, 3, 6, 10 = Precontemplation, items numbered 2, 4, 7, 11 = Contemplation, items numbered 5, 8, 9, 12 = Action.

All items should be scored on a 5-point scale ranging from:

<table>
<thead>
<tr>
<th>-2 = Strongly Disagree</th>
<th>-1 = Disagree</th>
<th>0 = Unsure</th>
<th>1 = Agree</th>
<th>2 = Strongly Agree</th>
</tr>
</thead>
</table>

To calculate the score for each scale, simply add the item scores for the scale in question. The range of each scale is -8 through 0 to +8. A negative scale score reflects an overall disagreement with items measuring the stage of change, whereas a positive score represents overall agreement. The highest scale score represents the Stage of Change Designation.

Note: If two or more scale scores are equal, then the scale farthest along the continuum of change (Precontemplation-Contemplation-Action) represents the subject’s Stage of Change Designation.

For example, if a subject scores 6 on the Precontemplation scale, 6 on the Contemplation scale and -2 on the Action scale, then the subject is assigned to the Contemplation stage. If one of the four items on a scale is missing, the subject’s score for that scale should be pro-rated (i.e. multiplied by 4/3 or 1.33).

If two or more items are missing, the scale score cannot be calculated. In this case the Stage of Change Designation will be invalid.

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**References**

Appendix B: The Opioid Use Process of Change Questionnaire – PCQ-Op

Each statement below describes a situation or thought that you might use to help you not use opioids.

“Opioid use” refers to the use of heroin and the nonmedical use of substances such as oxycodone (OxyContin®), oxycodone/acetaminophen (Percocet®), methadone, buprenorphine (Subutex®), buprenorphine/naloxone (Suboxone®), hydromorphone (Dilaudid®), morphine and fentanyl.

There are five possible responses to each of the items in the questionnaires:

1=Never True for Me  2=Seldom True for Me  3=Occasionally True for Me  4=Frequently True for Me  5=Always True for Me

Please read each statement and circle the number on the right to indicate how often a particular situation or thought is true for you. Remember, these statements refer to situations or thoughts you might have used during the past week to help you not use opioids.

<table>
<thead>
<tr>
<th>Item</th>
<th>Never True for Me</th>
<th>Seldom True for Me</th>
<th>Occasionally True for Me</th>
<th>Frequently True for Me</th>
<th>Always True for Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) I reward myself when I don’t give in to my urge to use opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2) I have someone to talk with who understands my problems with my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3) I get upset when I think about health problems caused by my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4) I am considering the idea that people around me would be better off without my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5) I find stories in the news that may help me quit using opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6) I try to think about other things when I feel like using opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7) I find society changing in ways that make it easier for me to stop using opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8) I become disappointed with myself when I think about my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9) I look for information related to my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10) I use reminders to help me not to use opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11) I have someone whom I can count on to help me when I’m having problems with my opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12) Stories about opioids and their effects upset me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13) I tell myself that if I try hard enough I can keep from using opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14) I stop to think about how my opioid use is hurting people around me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15) I feel more competent when I decide not to use opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16) I stay away from places where I would generally use opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Item</td>
<td>Never True for Me</td>
<td>Seldom True for Me</td>
<td>Occasionally True for Me</td>
<td>Frequently True for Me</td>
<td>Always True for Me</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
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<td>--------------------------</td>
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</tr>
<tr>
<td>17) I find that keeping myself busy is a good substitute for opioid use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18) I spend time with people who reward me for not using opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19) I make commitments to myself not to relapse on opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20) I see advertisements on television about how society is trying to help people who use opioids.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix B2: Scoring for PCQ-OP

<table>
<thead>
<tr>
<th>Process</th>
<th>PCQ-H item #</th>
<th>Process</th>
<th>PCQ-H item #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiential</td>
<td></td>
<td>Behavioral</td>
<td></td>
</tr>
<tr>
<td>Consciousness Raising</td>
<td>5, 9</td>
<td>Contingency Management</td>
<td>1, 18</td>
</tr>
<tr>
<td>Dramatic Relief</td>
<td>3, 12</td>
<td>Counter Conditioning</td>
<td>6, 17</td>
</tr>
<tr>
<td>Environmental Re-evaluation</td>
<td>4, 14</td>
<td>Helping Relationships</td>
<td>2, 11</td>
</tr>
<tr>
<td>Self Reevaluation</td>
<td>8, 15</td>
<td>Self Liberation</td>
<td>13, 19</td>
</tr>
<tr>
<td>Social Liberation</td>
<td>7, 20</td>
<td>Stimulus Control</td>
<td>10, 16</td>
</tr>
</tbody>
</table>

To obtain a mean overall Process of Change score, sum scores from all items and divide by 20.

To obtain a mean Experiential Process score, sum item scores from all Experiential subscales and divide by 10. This includes items 3, 4, 5, 7, 8, 9, 12, 14, 15, and 20.

To obtain a mean Behavioral Process score, sum item scores for all Behavioral subscales and divide by 10. This includes items 1, 2, 6, 10, 11, 13, 16, 17, 18, and 19.

To obtain mean scores for individual subscales, sum item scores for each subscale and divide by 2.

References


Figure 1

The Transtheoretical Model of Change
Figure 2
Scree Plot for the RCQ-OP

Figure 3
Scree Plot for the PCQ-OP
Table 2
Item loadings for the first three components extracted from Varimax rotation of the RCQ-OP with percentage variance accounted for each

<table>
<thead>
<tr>
<th>Item</th>
<th>Component I (32.4%)</th>
<th>Component II (18.0%)</th>
<th>Component III (8.9%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “It's a waste of time thinking about my opioid use because I do not have a problem” (PC)</td>
<td></td>
<td></td>
<td>.710</td>
</tr>
<tr>
<td>2. “I enjoy my opioid use but sometimes I use too much” (C)</td>
<td></td>
<td></td>
<td>.706</td>
</tr>
<tr>
<td>3. “There is nothing seriously wrong with my opioid use” (PC)</td>
<td></td>
<td></td>
<td>.750</td>
</tr>
<tr>
<td>4. “Sometimes I think I should quit or cut down on my opioid use” (C)</td>
<td>.370</td>
<td></td>
<td>.527</td>
</tr>
<tr>
<td>5. “Anyone can talk about wanting to do something about their opioid use, but I'm actually doing something about it” (A)</td>
<td></td>
<td></td>
<td>.718</td>
</tr>
<tr>
<td>6. “My opioid use is fairly normal” (PC)</td>
<td></td>
<td></td>
<td>.661</td>
</tr>
<tr>
<td>7. “My opioid use is a problem sometimes” (C)</td>
<td></td>
<td></td>
<td>.728</td>
</tr>
<tr>
<td>8. “I am actually changing my opioid use right now (either cutting down or quitting)” (A)</td>
<td>.761</td>
<td></td>
<td>.348</td>
</tr>
<tr>
<td>9. “I have started to carry out a plan to cut down or quit using opioids” (A)</td>
<td></td>
<td></td>
<td>.794</td>
</tr>
<tr>
<td>10. “There is nothing I really need to change about my opioid use” (PC)</td>
<td></td>
<td>-.358</td>
<td>.591</td>
</tr>
<tr>
<td>11. “Sometimes I wonder if my opioid use is out of control” (C)</td>
<td></td>
<td></td>
<td>.770</td>
</tr>
<tr>
<td>12. “I am actively working on my problem with opioid use” (A)</td>
<td></td>
<td></td>
<td>.729</td>
</tr>
</tbody>
</table>

PC= precontemplation; C=contemplation; A=action
Table 3

Item loadings for the first three components extracted from Varimax rotation of the PCQ-OP with percentage variance accounted for each

<table>
<thead>
<tr>
<th></th>
<th>Components</th>
<th>I (27.7%)</th>
<th>II (8.1%)</th>
<th>III (6.7%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Action Processes</td>
<td>Precontemplation Processes &amp; Contemplation Processes</td>
<td>Social Engagement Processes</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>“I reward myself when I don’t give in to my urge to use opioids” (BH)</td>
<td>.373</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>“I have someone to talk with who understands my problems with my opioid use” (BH)</td>
<td></td>
<td>.785</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>“I get upset when I think about health problems caused by my opioid use” (EX)</td>
<td></td>
<td>.595</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>“I am considering the idea that people around me would be better off without my opioid use” (EX)</td>
<td></td>
<td>.590</td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>“I find stories in the news that may help me quit using opioids” (EX)</td>
<td></td>
<td></td>
<td>.423</td>
</tr>
<tr>
<td>26.</td>
<td>“I try to think about other things when I feel like using opioids” (BH)</td>
<td></td>
<td>.597</td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>“I find society changing in ways that make it easier for me to stop using opioids” (EX)</td>
<td></td>
<td></td>
<td>.385</td>
</tr>
<tr>
<td>28.</td>
<td>“I become disappointed with myself when I think about my opioid use” (EX)</td>
<td></td>
<td></td>
<td>.735</td>
</tr>
<tr>
<td>29.</td>
<td>“I look for information related to my opioid use” (EX)</td>
<td></td>
<td>.537</td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>“I use reminders to help me not to use opioids” (BH)</td>
<td></td>
<td>.649</td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>“I have someone whom I can count on to help me when I’m having problems with my opioid use” (BH)</td>
<td></td>
<td></td>
<td>.795</td>
</tr>
<tr>
<td>32.</td>
<td>“Stories about opioids and their effects upset me” (EX)</td>
<td></td>
<td>.561</td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>“I tell myself that if I try hard enough I can keep from using opioids” (BH)</td>
<td></td>
<td>.510</td>
<td>.316</td>
</tr>
<tr>
<td>34.</td>
<td>“I stop to think about how my opioid use is hurting people around me” (EX)</td>
<td></td>
<td>.341</td>
<td>.614</td>
</tr>
<tr>
<td>35.</td>
<td>“I feel more competent when I decide not to use opioids” (EX)</td>
<td></td>
<td>.540</td>
<td>.390</td>
</tr>
<tr>
<td>36.</td>
<td>“I stay away from places where I would generally use opioids” (BH)</td>
<td></td>
<td>.663</td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>“I find that keeping myself busy is a good substitute for opioid use” (BH)</td>
<td></td>
<td>.695</td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>“I spend time with people who reward me for not using opioids” (BH)</td>
<td></td>
<td>.585</td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>“I make commitments to myself not to relapse on opioids” (BH)</td>
<td></td>
<td>.633</td>
<td></td>
</tr>
<tr>
<td>40.</td>
<td>“I see advertisements on television about how society is trying to help people who use opioids” (EX)</td>
<td></td>
<td></td>
<td>.475</td>
</tr>
</tbody>
</table>

BH= behavioral; EX= experiential
Table 4  
**Descriptive Statistics for Key Study Variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>M (SD)</th>
<th>Median</th>
<th>Frequency Reported</th>
<th>% of N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M)</td>
<td>-</td>
<td>-</td>
<td>160</td>
<td>53.3</td>
</tr>
<tr>
<td>Age</td>
<td>43.53 (11.81)</td>
<td>40</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Age Opioid</td>
<td>19.27 (6.87)</td>
<td>18</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Employed</td>
<td>-</td>
<td>-</td>
<td>77</td>
<td>25.7</td>
</tr>
<tr>
<td>HH Income</td>
<td>5001 - 10000</td>
<td>5001 - 10000</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Educ.</td>
<td>12</td>
<td>12</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>DAST-10</td>
<td>5.65 (3.57)</td>
<td>6</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>DUQ Opioid</td>
<td>15.36 (28.68)</td>
<td>-</td>
<td>111</td>
<td>37</td>
</tr>
</tbody>
</table>

Note. N=300. Age Opioid = Age of first use of opioids (prescribed, not prescribed, or heroin). Educ. = years of education. HH Income = household income range (USD). DAST-10 = score on DAST-10 measure. DUQ Opioid = days used opiates in past 30 days, per the DUQ measure.

Table 5  
**Summary Statistics for the three scales of the RCQ-OP and PCQ-OP Inventories**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of Items</th>
<th>Coefficient Alpha</th>
<th>N</th>
<th>% of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RCQ-OP (N = 300)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation (Component I)</td>
<td>4</td>
<td>.69</td>
<td>19</td>
<td>6.3</td>
</tr>
<tr>
<td>Contemplation (Component II)</td>
<td>4</td>
<td>.68</td>
<td>59</td>
<td>19.7</td>
</tr>
<tr>
<td>Action (Component III)</td>
<td>4</td>
<td>.79</td>
<td>229</td>
<td>76.3</td>
</tr>
<tr>
<td><strong>PCQ-OP (N = 300)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiential</td>
<td>10</td>
<td>.82</td>
<td>99</td>
<td>33</td>
</tr>
<tr>
<td>Behavioral</td>
<td>10</td>
<td>.72</td>
<td>201</td>
<td>67</td>
</tr>
<tr>
<td>Component I</td>
<td>10</td>
<td>.83</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Component II</td>
<td>5</td>
<td>.68</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Component III</td>
<td>5</td>
<td>.60</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 6

Correlations

<table>
<thead>
<tr>
<th>Variable</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precontemplation</td>
<td></td>
<td>-.33**</td>
<td>-.57**</td>
<td>-.29**</td>
<td>-.39**</td>
</tr>
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<td>Contemplation</td>
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<td></td>
<td>.18**</td>
<td>-.04</td>
<td>.15**</td>
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<tr>
<td>Action</td>
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<td></td>
<td></td>
<td>.47**</td>
<td>.43**</td>
</tr>
<tr>
<td>Behavioral</td>
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<td></td>
<td></td>
<td></td>
<td>.61**</td>
</tr>
<tr>
<td>Experiential</td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. * ≤ .05, ** ≤ .01,