2-1-2016

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by

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THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Master of Science
Psychology

The University of New Mexico
Albuquerque, New Mexico

December, 2015

DEDICATION

In loving memory of FJJ – I would not be where I am today without your mentorship and vision.

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ABSTRACT

Behavioral interventions for chronic pain often emphasize altering behavior to maximize effective functioning, particularly by decreasing pain avoidance and increasing engagement with valued activities, a hallmark of Acceptance and Commitment Therapy (ACT). In terms of salient processes within ACT, committed action is considered essential to the pursuit of a meaningful life. To date, however, only one study has examined the association between committed action and salient measures of functioning in the context of chronic pain treatment. The purpose of the present study was to further analyze the reliability of the CAQ in a separate sample of chronic pain patients, confirm the factor structure of the measure, and examine how committed action uniquely contributes to functioning in those with chronic pain. Data were examined from 149 chronic pain patients from an interdisciplinary rehabilitation program in the U.K. who completed the Committed Action Questionnaire (CAQ) and other measures of pain-related functioning. The current study offered several extensions beyond the prior examination of the CAQ in that the two-factor structure of the CAQ was tested using confirmatory factor analysis (CFA) and missing responses were replaced using multiple

imputation, a state-of-the-art method for addressing missing data. The final 17-item scale, as well as the two factor-based subscales that comprise the CAQ, demonstrated good internal consistency. The results of the CFA indicated adequate fit for the two-factor solution, with the subscales exhibiting acceptable discriminant validity. Lastly, the regression analyses indicated that the CAQ had significant associations with important measures of psychological functioning, even after accounting for appropriate covariates. The findings indicate the potential for the CAQ to capture committed action in multiple treatment settings and demonstrate the importance of assessing committed action in treating pain, particularly in the context of patient functioning.

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Chapter 1

Introduction

Chronic non-cancer pain is a significant public health issue that affects millions of people worldwide, with recent prevalence estimates ranging anywhere from 3% to just over 30% of adults in the general population (Hardt, Jacobsen, Goldberg, Nickel, & Buchwald, 2008; Johannes, Le, Zhou, Johnston, & Dworkin, 2010). Further, the prevalence of chronic pain is expected to grow as the population ages (Gatchel, McGeary, McGeary, & Lippe, 2014). Chronic pain is typically defined as pain lasting three months or longer (Noble, Tregear, Treadwell, & Schoelles, 2008) and encompasses a breadth of common and debilitating medical conditions, such as arthritis, persistent back or neck pain, migraine, and neuropathic pain. In addition to the impact chronic pain can have on individual quality of life, it also represents a substantial economic burden. Indirect costs associated with common chronic pain conditions, including decreased productivity at work, days lost to illness, and reduced wages (Gaskin & Richard, 2012), are reported to total in the billions of dollars annually (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003). Recognizing the deleterious effects of chronic pain conditions, various expert groups have called for additional resources channeled toward pain treatment (Hall et al., 2008).

In contemporary rehabilitation settings, chronic pain is typically viewed from a biopsychosocial perspective, which describes the dynamic interplay of factors that are involved in its inception and continuation (Gaskin & Richard, 2012; Gatchel, 2004). Indeed, chronic pain is considered a highly complex condition that can be brought on and maintained by a variety of influences, including nerve stimulation caused by tissue

damage (nociception), emotional responses related to suffering, familial history, social setting, and previously learned pain behaviors (Gatchel, 2004). With regard to interventions, chronic pain is often treated within interdisciplinary teams, which involve groups of specialists that can lend their expertise to the various components subsumed by the biopsychosocial model (Gatchel et al., 2014).

Historically, the introduction of the biopsychosocial perspective on chronic pain began in the 1960s and 1970s as the field began to shift from a strict biomedical approach to a broader conceptualization of chronic pain that included salient psychosocial and behavioral variables (Fordyce et al., 1973; Jensen & Turk, 2014). The behavioral perspective lent itself to elucidating the environmental factors involved in maintaining problematic pain behaviors over an extended period, and a primary objective of behavioral interventions has involved altering behavior to maximize effective functioning. In particular, decades of research have suggested that pain avoidance strategies are problematic, especially when they are frequently implemented and ineffective (Leeuw et al., 2007; Vlaeyen & Linton, 2000). Therefore, psychosocial interventions for chronic pain have traditionally emphasized the principal goal of decreasing pain avoidance (Fordyce, 1976; Vlaeyen & Linton, 2000), especially when avoidance is ineffective (i.e. does not contribute to durable pain reduction) or is associated with disruptions in functioning.

In addition to targeting pain avoidance, recent developments within the cognitive-behavioral tradition have helped highlight the potential benefits of facilitating increased engagement in behaviors consistent with valued activities, even with the ongoing experience of pain. In particular, enhanced engagement in valued activities is a hallmark

feature of Acceptance and Commitment Therapy (ACT; Hayes, Strosahl & Wilson, 2012). The overall outcomes associated with ACT for chronic pain indicate that it is an effective psychosocial intervention for increasing functioning and that gains from ACT can be maintained well after treatment has concluded. At present, the American Psychological Association's Society of Clinical Psychology (2013) has identified ACT as a psychosocial intervention with *strong* research support (the highest grading possible) for the treatment of chronic or persistent pain, regardless of pain location, diagnosis, or source.

Overview of ACT

ACT is part of the emergence of a new generation of behaviorally oriented therapies that have come to fruition in recent years, collectively referred to as the *third wave* (Hayes, 2004b). In many respects, ACT (as well as other third wave behavioral treatments) is firmly positioned within the operant-behavioral and subsequent cognitive-behavioral traditions, which, for instance, emphasized the clinical relevance of avoidance behaviors in human suffering as well as the potential for cognitions to influence behavior in unhelpful ways (Twohig, 2012). Further, ACT focuses on building up repertoires of behavior consistent with values or meaningful living (Hayes, 2004a), which is consistent with the constructionist approach in behaviorism introduced by Goldiamond (1974). The focus on values and the long-term consequences of behavior is intended to increase response options and enhance psychological flexibility (Hayes, 2004a). This emphasis is also rooted within early radical behaviorism, which has pointed to the tendency of humans to respond best to short-term contingencies at the expense of consequences that may be more desirable over the long term (Skinner, 1972).

Although ACT shares many similarities with the traditional cognitive-behavioral framework, it also brings additional considerations to bear on the therapeutic process, including acceptance, mindfulness, spirituality, and emotional deepening (Hayes, 2004b). Furthermore, cognition is viewed within ACT as an outcome of one's experiences in the environment rather than as an independent, uniquely causal variable that affects behavior (Twohig, 2012). Thus, the frequency or intensity of cognitions are not directly targeted for change in ACT, but rather the focus rests on effective responding to cognition (Wilson & Murrell, 2004). This core principle follows the philosophical position set forth by radical behaviorism stating that mental events have no unique causal power or special status (Skinner, 1972), which contrasts with cognitive theory in which thoughts are purported to have a distinct, causal influence behavior (e.g. Hofmann, Asmundson, & Beck, 2013).

ACT for Chronic Pain Conditions

Although initially developed as a broad means of addressing the common forms of psychological suffering seen in clinical practice (McCracken & Vowles, 2014), the core principles of ACT comport with the clinical phenomena that arise in the treatment of chronic pain. In particular, ACT is well suited for chronic pain patients who have a history of unsuccessful attempts to control or relieve their pain or who have experienced suffering as a consequence of pain control strategies (McCracken & Vowles, 2014; Vowles & Thompson, 2011). Attempts on the part of patients to mitigate the experience of chronic pain may generally fall within the domain of the pain-related fear and avoidance model, which has been implicated as a central mechanism involved in developing and maintaining chronic pain (Lethem, Slade, Troup, & Bentley, 1983;

Vlaeyen & Linton, 2000). According to the fear-avoidance model, escape and avoidance behaviors are negatively reinforcing, in that the short-term reduction of pain that follows leads to the strengthening of that behavior. Consistent with the core principles of radical behaviorism, persistent pain-avoidance behaviors in the short term often interfere with daily living over the longer term, in that important role functioning activities are no longer accomplished (Vlaeyen & Linton, 2000). It is also important to note that avoidance often persists because it occurs in anticipation of pain rather than in response, which precludes the opportunity for experiences that violate fear of movement expectancies. Pain avoidance behaviors are problematic because they have been associated with increased disability and distress (Kindermans et al., 2011).

In ACT for chronic pain, helping chronic pain patients increase values clarity and engagement in valued activities is the primary mechanism that is purported to help widen the perspective of the pain sufferer beyond the short-term focus on pain avoidance to include longer-term outcomes considered part of a meaningful and fulfilling life. In particular, ACT-based interventions for chronic pain conditions aim to enable more flexible responding to both pain and pain-related distress with the intention of increasing contact with goals and values and decreasing the frequency of ineffective struggling with the pain experience (Vowles & Thompson, 2011). Further, ACT specifically deemphasizes and undermines the idea that pain reduction is a necessary condition for living a meaningful and vital life.

Values-based action is a key component involved in enhancing psychological flexibility and is one of the defining characteristics of successful ACT treatment. Introducing psychological flexibility to chronic pain conditions means giving individuals

additional choices beyond the narrow focus on pain reduction. Within ACT, psychological flexibility stands at the core of a collection of six processes – including acceptance, cognitive defusion, self-as-context, committed action, values, and contact with the present moment - that serve as a model for healthy functioning (Hayes, Strosahl, & Wilson, 2012). These processes are integrative in that they are not orthogonal and involve common features (McCracken & Vowles, 2014).

In the context of ACT for chronic pain, the core ACT processes provide a means of building up a repertoire of flexible and persistent behavior consistent with what matters most to the individual, even in the presence of ongoing pain and discomfort (Vowles, Sowden, & Ashworth, 2014b). In addition, this treatment involves willingness and openness: a willingness to experience pain and the related distress and an openness to both pleasant and unpleasant present-moment experiences (Vowles, McCracken, Sowden, & Ashworth, 2014a). As treatment targets, the core ACT processes provide both a means of intervention and a framework for understanding domains of behavior that might be contributing to difficulties in chronic pain patients. Flexibility in responding to the chronic pain experience is further characterized by an absence of persistent avoidance behaviors. For example, thoughts and emotions, such as catastrophic or highly fearful thoughts associated with the presence of pain may be willingly experienced in a manner that does not lead to actions inconsistent with what is valued. This final point is consistent with the general ACT theory on cognitions, where the point of intervention is not on changing the content of the thoughts but rather focuses on diminishing their problematic influence on action.

Outcomes Associated with ACT for Chronic Pain

At present, there are a number of RCTs indicating that ACT is an efficacious treatment that results in improvements in functioning, though sample size, the nature of the control condition, and delivery method have varied among the trials (Buhrman et al., 2013; Dahl, Wilson, & Nilsson, 2004; Thorsell et al., 2011; Wetherell et al., 2011; Wicksell, Ahlqvist, Bring, Melin, & Olsson, 2008; Wicksell et al., 2013). In terms of effectiveness studies, data suggest that greater engagement in valued activities is associated with lower levels of disability and distress (McCracken & Vowles, 2008; McCracken & Yang, 2006; Vowles et al., 2014a; Vowles et al., 2014b). Outcome research also indicates that it is possible to increase engagement in valued activities over the course of treatment and that such increases are associated with improved functioning (McCracken & Vowles, 2008; Vowles, McCracken, & O'Brien, 2011; Vowles, Witkiewitz, Sowden, & Ashworth, 2014c). Moreover, research has indicated that reliable gains following ACT for chronic pain can be maintained for up to three years following the conclusion of the treatment, including increased social and physical functioning as well as reductions in the number of medical visits related to pain (Vowles et al., 2011).

Systematic reviews examining a mix of disorders have generally indicated that ACT is a promising treatment that results in small to medium effect sizes on average. For instance, a meta-analytic review that analyzed 18 RCTs indicated the superiority of ACT to wait-list controls, psychological placebos, and treatment as usual (effect sizes ranged from .42 to .68) and that ACT is as effective as established treatments including cognitive behavioral therapy (CBT; Powers, Zum Vorde Sive Vording & Emmelkamp, 2009). A meta-analysis that included 13 studies found an average effect size of .68 for ACT treatments in general, with larger effects (.96) when ACT was compared to waitlist

controls (Öst, 2008). Another systematic review and meta-analysis, which included an examination of 10 controlled studies involving acceptance- or mindfulness-based treatments for pain, demonstrated an effect size of .37 and concluded that the treatments were generally comparable to CBT (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011).

Due to the inherent similarity between CBT and ACT, McCracken and Vowles (2014) have suggested that direct empirical comparisons between these two modes of treatment would require large sample sizes and may not be the best use of resources. As an alternative, investigating the key processes of change closely related to the underlying theory of a treatment may lead to more efficient and effective protocols (Eccleston, Williams, & Morley, 2009). According to ACT theory, psychological flexibility is the primary mechanism of change and is influenced by six interrelated processes (Vowles et al., 2014b). In advancing the science of ACT, it is crucial to develop measures that capture the core processes and demonstrate that they are critical ingredients involved in change. Indeed, much of the empirical work implementing ACT for chronic pain has demonstrated the association between core processes, such as acceptance and mindfulness, and reductions in, for example, anxiety, depression, and disability (e.g. McCracken & Gutierrez-Martinez; McCracken, Vowles and Eccleston, 2005). That notwithstanding, one of the principal processes of ACT that has not yet received significant empirical support is called committed action.

Committed Action and Chronic Pain

Committed action is a core component of ACT and is conceptualized as the practice of behaviors congruent with a meaningful life. Committed action involves facilitating a moment-by-moment ability to discriminate between responses that are

intended to avoid pain and those that are intended to pursue what is valued. Further, committed action requires maintaining a careful balance between persistence and flexibility, where goals underlying meaningful values are pursued even when they are accompanied by discomfort or initial failure, but may be abandoned if they are repeatedly unmet (McCracken, 2013).

In contrast to the many available psychotherapies focused on symptom reduction, ACT involves processes that build up broad and flexible behavioral repertoires, in the spirit of Goldiamond (1974) and early radical behaviorism (Hayes, 2004a). Commitment is a key process involved in expanding behavioral repertoires in ACT, where patterns of action that accord with freely chosen values are actively promoted. In other words, committed action is synonymous with values-based action, and the underlying purpose is to create an ongoing pattern of behaviors that serve one's core values (Hayes et al., 2012). Committed action in ACT involves a dedication to making moment-by-moment decisions that are values consistent. It is important to note that commitment involves action in the present moment, rather than serving as a promise or prediction that pertains to future behavior.

Present Study: Summary and Objectives

Although the overall evidence indicates that ACT with chronic pain populations leads to improved functioning and quality of life, relatively little research has examined the relationship between committed action and measures of functioning. At present, the only instrument designed to measure committed action is the Committed Action Questionnaire (CAQ), the reliability of which was initially examined with 216 chronic pain patients seeking treatment in a tertiary care clinic (McCracken, 2013). Results of the

initial analyses indicated that the CAQ has good internal consistency and that committed action is significantly correlated with acceptance of chronic pain, another facet of the psychological flexibility model in ACT. Moreover, regression analyses demonstrated that the CAQ accounted for significant variance in multiple measures related to behavioral health, including depression and social functioning.

Although the results from the initial study of the CAQ are promising, this instrument requires additional empirical support to demonstrate its reliability and validity. The purpose of the present study was to attempt to replicate the findings of McCracken (2013), further analyze the reliability of the CAQ in a separate sample of chronic pain patients, and examine how this process uniquely contributes to functioning in those with chronic pain. Furthermore, given that values-based activity shares a conceptual overlap with aspects of committed action, a relation not yet examined, whether the CAQ added incremental explanation with regard to the statistical prediction of patient functioning was also evaluated. The current study offered several extensions beyond the prior examination of the CAQ that implemented a principal components analysis to test the factor structure. The two-factor structure of the CAQ was tested using confirmatory factor analysis and missing responses were replaced using multiple imputation, a state-of-the-art method for addressing missing data. In addition, a series of simultaneous regressions were run using each factor as a separate latent predictor variable, which lent itself to examining differences between the two subscales of the CAQ in terms of associations with measures of functioning. It was hypothesized that the results of the present analyses would demonstrate the importance of appropriate and

effective patterns of activity – committed action - in healthy functioning among pain

patients.

Chapter 2

Methods

Participant Characteristics

Participants were 149 adults presenting for an assessment appointment at a specialty pain treatment service in the U.K between March of 2011 and October of 2012. In terms of schooling, participants had an average of 13.9 years of education ($SD = 10.1$) and many had completed only compulsory education (38%) or had dropped out of secondary school prior to graduating (32%). In addition, some had completed some technical or vocational college (13%) or had gone on to a university (14%). Most participants were White European (99%), female (62%) and married or cohabitating with a partner (67%), followed by those who were single (14%), divorced (12%) and widowed (7%). The mean age was 53.6 years ($SD = 14.5$).

The most common primary pain diagnoses among participants with completed data on this question were arthritis (27%) and fibromyalgia (24%), followed by herniated disk (9%) and degenerative disk disease (9%) as well as others such as sciatica or radiculopathy (8%), and spondylosis (5%). Half of participants did not respond to this question, and they generally provided more data on pain location, with 95% and 72% specifying a primary and secondary pain location, respectively. The most common primary pain location identified was lower back, lumbar spine, sacrum and/or coccyx (50%), followed by lower limbs (20%), full body (8%) and cervical region (8%). Participants frequently identified limbs and shoulder (47%) as a secondary pain site. Most participants were not working (66%), followed by those who were working full time (14%) and part time (10%). Many (48%) were receiving some type of incapacity

benefit or wage replacement. The average pain duration was 11.6 year ($SD = 11.6$).

Sampling Procedures

Data were collected from all participants at an assessment visit to initiate a course of treatment. The collection of these data was approved by the regional Humans Subject Protection Board of the National Health Service in the U.K.

Sample Size and Power

In order to guide the data analyses and provide information on observed power, a post-hoc analysis of achieved power was computed based on a multiple regression model with seven predictors, designed to detect a small ($f^2=0.02$), medium ($f^2=0.15$) or large effect size ($f^2=0.35$) (Cohen, 1992) and at an alpha of 0.05 and with a sample size of 149. Based on analyses using G*Power version 3.1.6 (Erdfelder, Faul, & Buchner, 1996), achieved power was calculated at .403, .997, and .999 for a small, medium and large effect size, respectively, suggesting adequate power to detect medium and large, but not small, effects.

Measures

Study participants were assessed at a single point in time with a battery of self-report instruments. In addition to completion of this battery, they also provided information pertaining to demographics (age, gender, and years of education) and pain-related medical information (pain duration and pain intensity as well as pain-related medical visits and number of analgesic medications).

Self-Report Instruments

British Columbia Major Depression Inventory (BCMDI). The BCMDI (Iverson & Remick, 2004) is a 16-item instrument that assesses for the presence and severity of Major Depressive Disorder (MDD), according to the DSM-IV criteria (American Psychiatric Association, 2000). Questions are anchored to a 5-point Likert-type rating scale that measures severity (1, *very mild problem*, to 5, *very severe problem*). Total scores (range 0-80) were calculated and higher scores reflect increased symptom severity. The BCMDI has demonstrated good psychometric properties and excellent sensitivity and specificity for MDD (Iverson & Remick, 2004).

Chronic Pain Values Inventory (CPVI). The CPVI (McCracken & Yang, 2006) measures level of importance and success in six broad areas of valued activity, which comprise family, intimate or close interpersonal relationships, friends, work, health, and personal growth or learning. Importance and success in each valued domain are evaluated separately on a scale ranging from 0 (*not at all important/successful*) to 5 (*extremely important/successful*), which allows for the calculation of values importance, values success and discrepancies between levels of reported importance and success. The discrepancy subscale was used in the current study because of its relation to values-based action and thus its potential as a suitable covariate for the CAQ. This subscale was calculated by subtracting values importance from values success, such that lower numbers (in the negative direction) indicated higher levels of discrepancy. Prior research (McCracken & Yang, 2006) demonstrated that the CPVI has acceptable internal consistency (Cronbach's $\alpha = 0.82$) for the discrepancy scale).

Committed Action Questionnaire (CAQ; Appendix). As noted, the primary

aim of this study was to evaluate the CAQ and expand upon the initial study examining

this measure (McCracken, 2013). The final version of the CAQ included 18 items

(reduced from the original set of 24), in which respondents are asked to report on the

truth of each statement, ranging from 0 (*never true*) to 6 (*always true*). An initial study

of the CAQ supported its internal consistency and demonstrated that it is correlated with

acceptance of chronic pain, another key component of psychological flexibility in ACT

(McCracken, 2013). The prior study explored the factor structure of the CAQ using a

principal components analysis, which revealed two underlying factors. McCracken

interpreted the factor structure based on the wording of the items, with the "positively

worded" items subsumed by the first factor, and the "negatively worded" items falling

under the second. Further, in this initial study, the CAQ explained a significant amount of

variance in important areas of health-related functioning, including depression, social

functioning, and mental health.

Sickness Impact Profile (SIP). The SIP (Bergner, Bobbitt, Carter, & Gilson,

1981) provides indexes of health and includes 136 yes or no questions pertaining to

health-related dysfunction. The three dimension scores of the SIP were used in the

present analyses, which comprise physical, psychosocial, and independence-related

disability. All scores range from 0 to 1, and higher scores indicate greater health-related

dysfunction. Prior research has demonstrated the reliability and validity of the SIP in the

context of chronic pain (Vowles, Gross, & McCracken, 2007).

Pain Anxiety Symptoms Scale-20 (PASS). The PASS (McCracken & Dhingra,

2002) is a 20-item instrument that evaluates fear, anxiety and avoidance behaviors in the

context of pain. This measure is anchored to a frequency scale ranging from 0 (*never*) to

5 (*always*). The PASS has demonstrated good reliability, validity and utility in prior

studies involving chronic pain populations (Roelofs et al., 2004). The PASS has also

demonstrated good internal consistency as well as strong construct and predictive validity

(Vowles et al., 2007).

Data Analysis

    Data screen and item analyses. All CAQ item responses were examined for

missing data, and participants who did not record a single response for this measure ($n =$

21) were eliminated. Bivariate correlations were then examined for evidence of

collinearity as well as for ensuring convergent validity among the scale items. Item pairs

were considered for deletion if bivariate correlations exceeded $r = .85$, indicating

collinearity (Kline, 2011). Next, item-total correlations were assessed, where any item

with a correlation with the remaining scale items below $r = .20$ was considered for

deletion (Everitt & Skrondal, 2010).   Finally, internal consistency and the distribution of

responses by item to evaluate normality were examined.

    Factor structure and regression analyses. Following data screening, structural

equation modeling (SEM) techniques were used to examine the two-factor structure of

the CAQ. Although the prior study by McCracken (2013) explained the two factors as

emanating from wording effects, this conclusion was not tested empirically and research

indicates that wording effects may or may not contribute to the emergence of separate

factors (Fish, Hogan, Morrison, Stewart, & McGuire, 2013; Schriesheim & Eisenbach,

1995). For the present study, and in contrast to McCracken, it was assumed that the two-

factor solution indicated the presence of latent variables underlying the CAQ. Based on

the item content, the subscales were labeled *values persistence* (VP), defined as the

capacity to persist in the pursuit of goals, even when obstacles arise, and *effective*

behavior (EB), which is characterized by avoiding behaviors inconsistent with pursuing

what matters most to the individual (e.g. not abandoning goals prematurely)[1]. A

confirmatory factor analysis (CFA) tested whether the items loaded onto the factors in a

way that is consistent with the underlying theory of committed action in ACT. As a final

step to evaluate the factors, Cronbach's alpha was calculated to determine the internal

consistency of each subscale.

SEM was also implemented to test the associations between the two latent

variables and critical measures of functioning to explore the potential clinical utility in

assessing committed action using the CAQ in the context of chronic pain. The purpose of

the SEM techniques was to examine the meaningfulness of committed action through its

relationship with salient variables in chronic pain treatment. The first component at this

stage of the analyses involved specifying a measurement model where the individual

items (indicators) of the CAQ were loaded onto their respective factors, as reported by

McCracken (2013). The CFA evaluated the degree of concordance between the variance-

covariance matrix produced by the specified model (the population matrix) and the

matrix derived from the present sample. This approach has several distinctions from

exploratory factor analysis (EFA) techniques and was more appropriate for the present

study. EFA is often used to discover the patterns in which items from a measure correlate

with one another in order to create subsets that are combined into factors as well as to

delete the items that are least useful in explaining the latent variable of interest

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[1] The indicators that comprise the second factor of the CAQ, *effective behavior*, were "negatively worded" and reverse scored prior to the analysis.

(Tabachnick & Fidell, 2001). As the name implies, EFA is exploratory in nature and particularly useful in measure development when there is not a clear hypothesis about the underlying factor structure. In contrast, the goals of the present analyses were to evaluate all of the items from the prior study and confirm the two-factor structure with the present sample. Therefore, with an intention of keeping all of the items and confirming a two-factor theory about the associations among the individual items, CFA was considered more appropriate. Using the Mplus software package (Muthén & Muthén, 2012), it was also possible to regress the measures of pain-related functioning on each subscale of the CAQ in a simultaneous regression.

The adequacy of the CFA model was first evaluated using the chi-square statistic, which compares the fit between the sample covariance matrix and the population covariance matrix. A non-statistically significant chi-square indicates good fit for a model overall (Kline, 2011). Following the recommendations put forth by Jackson, Gillaspy Jr, and Purc-Stephenson (2009), the hypothesized model was also evaluated against the comparative fit index (CFI) and Tucker-Lewis index (TLI), incremental fit measures, as well as the root mean square error of approximation RMSEA, a residual-based measure. Established benchmarks indicate that an RMSEA < .05 and < .08 (Browne & Cudeck, 1993) and CFI and TLI > .95 and > .90, characterize models with good fit and acceptable fit, respectively (Hu & Bentler, 1999).

For the second component of this stage of the analyses, the hypothesized CFA model (Figure 1) with two correlated latent factors scaled with unit loading identification was tested with means- and variance-adjusted weighted least squares (WLSMV) estimation using Mplus version 7.3 (Muthén & Muthén, 2012). WLSMV was

implemented because several of the items were not normally distributed, and maximum likelihood estimation may not be appropriate for categorical data with non-normal distributions, particularly for Likert-type scales with less than 10 scale points (Kline, 2011). The latent factors were scaled by fixing the loading of the first item for each factor to 1.0, leaving a total of 206 freely estimated parameters, which resulted in an over-identified model with $df_M = 324$.

Although only a total of 124 responses were missing, representing 4.6% of all possible responses, multiple imputation (MI) was used to replace missing values. MI has demonstrated superiority to single imputation methods, such as mean- or regression-based imputation, and is particularly useful when data are not missing completely at random (MCAR; Baraldi & Enders, 2010). More specifically, MCAR implies that missing data on the variable of interest (in this case, the items that make up the CAQ measure) are unrelated to other observed variables in the analyses or to the would-be values of the missing data points on the variable of interest (Baraldi & Enders, 2010). Data that are not missing completely at random have been categorized as either *missing at random* (MAR) or *missing not at random* (MNAR; Little & Rubin, 2014; Rubin, 1976). Although it is impossible to empirically evaluate whether data are MAR or MNAR (Baraldi & Enders, 2010; Hallgren & Witkiewitz, 2013), MI was conducted under the reasonable assumption that missing data in the sample for the present study may be related to measured variables in the analyses (e.g. pain intensity) other than the CAQ content (MAR) or related to the would-be values of the missing scores in the CAQ (MNAR). In either case, MI will tend to produce more unbiased estimates than complete case analysis or single imputation methods (Baraldi & Enders, 2010). For the present

study, Mplus (Muthén & Muthén, 2012) was employed to create 20 datasets using MI, and an average and range was calculated for each of the fit indexes in order calculate the concordance between the specified CFA model and sample data.

Following the CFA, the regression component of the present analyses was implemented to examine whether the two latent variables that comprise the CAQ were significantly associated with measures of health-related functioning, even after accounting for relations with other relevant variables. To accomplish this objective, a series of simultaneous linear regression equations were created, where each of seven aspects of health-related functioning – three subscales of the SIP (SIP-psychological, -physical and -other), BCMDI, PASS, medical visits and the number of prescribed medications - was regressed on specific background variables, the CPVI and the VP and EB subscales of the CAQ. The background variables in the regression analyses included sex, pain intensity, pain duration, and years of education, and were entered as covariates because of their hypothesized relationship with pain-related functioning. The CPVI was used as an additional covariate because of the potential for shared variance with the CAQ, and, as a measure development study, one of the goals of the present analyses was to examine whether the CAQ provided incremental validity over established instruments in predicting salient measures of functioning. Given the potential overlap between the CPVI and CAQ in terms of measuring values-based action, as according to the ACT model, the CPVI was an appropriate choice for demonstrating incremental validity. The results of the regression analyses included standardized regression coefficients, or *betas*, which indicate the direct effects of predictor variables on the outcome of interest in terms of standard deviation units. These analyses also involved the imputed datasets using MI,

where the single regression coefficients reported in the final results (Table 2) were pooled

across the 20 datasets.

Chapter 3

Results

The final sample size for the following analyses consisted of 149 respondents.

The 18-item scale demonstrated good internal consistency (Cronbach's α = .90) and

corrected item-total correlations were all in the acceptable range (range r = .40 to .75),

with the exception of item 11 (r = .18), *I get stuck doing the same thing over and over*

even if I am not successful. In accordance with the guideline to delete any item with an

item-total correlation below r = .20 (Everitt & Skrondal, 2010), item 11 was dropped

from all subsequent analyses, resulting in a 17-item scale. The final 17-item scale

performed similarly in terms of reliability (Cronbach's α = .91). Item-total statistics also

indicated that the removal of any one item did not substantially impact Cronbach's alpha,

which ranged from α = .90 to .91. Although the skewness and kurtosis indexes did not

show any significant deviations from normality, an examination of the responses revealed

that several items did not approximate a normal distribution, which provided an

additional rationale for using the WLSMV estimation procedure for the CFA (discussed

previously).

The results of the data screening also indicated an absence of collinearity, with all

inter-item correlations falling below the recommended cutoff of r = .85. Items 15 and 16,

however, had the highest degree of association among any item pair (r = .82), which

suggested the potential for shared variance not explained by the latent factors. Therefore,

it appeared that specifying the presence of shared error variance in model specification,

thus allowing the error terms to covary, would possibly improve fit. Given the

conceptual overlap between items 15 (*I am able to pursue my goals both when this feels*

easy and when it feels difficult) and 16 (*I am able to persist in what I am doing or to change what I am doing depending on what helps me reach my goals*), it was considered appropriate to allow for the correlated error terms for CFA model specification.

The results from the hypothesized CFA model (Figure 1) indicated the presence of poor overall fit for the hypothesized two-factor model, χ^2_M (324) = 498.46, $p < 0.001$. However, the incremental fit indexes, CFI = .958 (*SD* = .004, range among imputed datasets |.947, .962|) and TLI = .947 (*SD* = .005, range among imputed datasets |.933, .952|), indicated good fit and reasonable fit, respectively. The RMSEA = .06 (*SD* = .003, range among imputed datasets |.056, .064|) was on the threshold between good and reasonable fit. Furthermore, 11 of the 17 indicators in this model had more than 50% of their variance accounted for by their respective latent factor, which corresponds to a standardized factor loading $\geq$ .707, bolded in Table 1 (range R^2 .22 to .79, all p's < .001). With regard to internal consistency of the separate subscales, Cronbach's alpha for both VP (α = .93) and EB (α = .85) was good.

The regression analyses (Table 2) were constructed to examine the direct effects of the two latent factors that make up the CAQ on various measures of health-related functioning, even after controlling for specific background variables. The results showed that the background variables, which included years of education, pain duration, pain intensity, and gender, were overall weakly associated with the measures of functioning. In particular, the direct effect of pain intensity was only significant on pain distress (β = .46, $p < .001$), and pain duration had a significant direct effect on the SIP physical subscale (β = .47, $p < .001$) and the SIP independence-related subscale (β = .38, $p < .001$). The results did not reveal any other significant direct effects of the background

variables on pain-related functioning (range β -.15 to .14, all p's n.s.). In contrast, the

direct effects of the CPVI were significant in six of the seven regression models tested,

including the physical, psychological, and independence-related subscales of the SIP,

depression (BCMDI), pain anxiety (PASS), and number of medical visits (range β -.38 to

-.82, all p's < .01). Taken together, the results showed that the direct effects of the

background variables on important measures of patient functioning were rather weak, and

the CPVI had robust effects that went in the negative direction (again, controlling for all

other variables in a simultaneous regression). In other words, smaller discrepancies

between values success and importance, thus more consistency in behavior based on

important values, were associated with higher levels of functioning.

Of primary interest were the results pertaining to the direct effects of the two

factors that make up the CAQ on health-related functioning when controlling for all other

variables in the simultaneous regression models. The pattern of results showed that at

least one of the latent variables underlying committed action had significant direct effects

on all of the psychological aspects of functioning analyzed, including EB on the

psychological subscale of the SIP (β = -.39, p = .002), depression (BCMDI; β = -.53, p <

.001), pain anxiety (PASS; β = -.46, p < .001), and pain distress (β = -.20, p = .019).

These findings were all in the expected direction, such that increases in EB were

associated with decreases in measures related to maladaptive psychological functioning.

In addition, the latent variable associated with the VP subscale had a significant direct

effect on pain distress (β = -.18, p = .039). The subscales of the CAQ did not have

significant direct effects on the other measures of functioning, including the physical and

independence-related subscales of the SIP as well as the number of medical visits (range

β -.23 to .26, all p's n.s.). The EB and VP factors, however, were on the verge of significance with regard to the direct effects on the independence-related subscale of the SIP (β = -.23, p = .054) and the psychological subscale of the SIP (β = .25, p = .058), respectively. Taken together, the results suggested that committed action may be an important construct to measure and manipulate when it comes to treating individuals with chronic pain, particularly with regard to the associated psychological distress.

Chapter 4

Discussion

The present study used a CFA to examine the two-factor structure of the CAQ that was demonstrated in a prior exploratory factor analysis.   In addition to confirming the reliability of the items and factors that comprise the CAQ, the aim of the analyses included examining the degree to which the two latent factors that underlie committed action were associated with measures of functioning relevant to chronic pain patients, including depression and pain-related anxiety.   Finally, a goal of the present study was to replicate the findings of the original investigation of the CAQ in a new sample of individuals with chronic pain.

Consistent with the prior study (McCracken, 2013), the item-level analyses indicated that the CAQ performed well in the present sample of patients seeking treatment for chronic pain.   In particular, the results supported the internal consistency of the CAQ by demonstrating that the scale items were sufficiently intercorrelated, without violating established guidelines regarding collinearity.   Evidence of internal consistency suggests that the scale items point to a common underlying variable (DeVellis, 2012), and the analyses produced a pattern of results similar to those of McCracken, which further supports the reliability of the CAQ. Indeed, demonstrating reliability in multiple samples is an important component of measure development, as reliability is dependent on context rather than a fixed property of an instrument. Specific to clinical practice, the reliability of an instrument under consideration should be evaluated in multiple settings and with different samples of research participants drawn from a clinical population. The results of the present study appear to support a preliminary position that the CAQ tends to

produce reliable scores among pain patients in different chronic pain management settings.

In terms of factor structure, the present analyses also provided further evidence that the CAQ captures two processes related to committed action, VP and EB. The former involves working toward important goals, even in the presence of challenges and setbacks, and the latter involves a tendency to avoid actions that are inconsistent with the spirit of committed action. Those who tend more toward VP and EB appear less likely, for example, to let impulsivity or transient mood states coordinate their actions. Together, VP and EB constitute facets of the psychological flexibility model proposed by ACT, where VP involves pursuing valued activities both when it is easy and when challenges are encountered. Further, psychological flexibility involves abandoning unworkable goals rather than rigidly adhering to them and determining alternative actions consistent with the identified value (Luoma, Hayes, & Walser, 2007). The flexibility inherent in committed action may be an especially critical quality among chronic pain patients, who attempt to achieve meaningful behavioral targets as they endeavor to improve in important areas of functioning. The results of the CFA provided preliminary evidence in support of the theory that the CAQ assesses the two aspects of committed action, which is related to the construct validity of the CAQ in that the items are delineated topographically in a manner consistent with ACT principles. Although the chi-square statistic was fairly large, and statistically significant, the incremental and residual-based fit indexes demonstrated adequate fit. Furthermore, the chi-square statistic derived from small samples may not actually follow the chi-square distribution and thus the probability levels regarding overall model fit may not be accurate (Ullman, 2001).

Given the conceptual overlap between the item content in the CAQ, it is also important to examine the discriminant validity between the two factors. More specifically, the factors in a CFA should be only moderately correlated, which suggests that the latent variables examined involve different constructs (Kline, 2011). With regard to the present analyses, the estimated factor correlation between VP and EB (.522) was indeed moderate in size and consistent with the hypothesis that the CAQ captures two separate latent variables. As expected, the association between the two subscales was positive.

The purpose of the regression analyses was to investigate incremental validity and determine whether the CAQ provided information relevant to assessment and treatment above and beyond what is currently available. In examining the incremental validity of the CAQ, it was important to demonstrate significant direct effects after accounting for theoretically similar measures. With regard to the measures available for the current sample, the CPVI appears to share properties with the CAQ, where both generally involve an assessment of success in pursuing valued activities. This demonstrates the clinical utility of using the CAQ in addition to the CPVI during assessment. Overall, after accounting for that which was explained by the CPVI, the EB factor of the CAQ had significant direct effects in the expected direction on all measures of psychological functioning examined, including measures of depression, pain anxiety, and pain distress. Furthermore, the VP factor had a significant direct effect pain distress as well. One unexpected result pertained to the direct effect of the VP factor on the psychological subscale of the SIP ($\beta = .25$, $p = .058$). In this case the beta is positive and on the verge of significance, which implies that increases in VP are potentially associated with increases

in psychosocial disability. Although according to ACT theory higher scores on VP should relate to improved psychological functioning, the result with regard to the SIP may indicate that the pain patients in the present sample were "over doing it" in some way. That said, this result might also be an artifact of measurement noise, given that the pattern of significant results was otherwise in the expected direction.

It is important to note that the nonsignificant findings with regard to the other variables examined in the regression analyses, including the physical and independence-related subscales of the SIP and number of medical visits, is not necessarily unexpected nor problematic from the perspective of underlying theory in ACT. Specifically, engaging in valued activities via committed action, with persistence and flexibility, is not purported to imply reductions in physical disability (though we might expect increases in physical *functioning*, especially over time). In ACT, living a vital and meaningful life is not contingent upon freedom from physical limitations, and indeed ACT therapists may attempt to undermine beliefs that run contrary to this assumption in clinical practice. Furthermore, the ACT model involves confronting patterns of avoidance common to those suffering from chronic pain, which may lead to increased feelings of physical discomfort in the short term.

In terms of limitations, the sample size should be considered small for a CFA. According to Kline (2011), the ratio of cases to model parameters should be at least 10:1, or in absolute terms, at least $N = 200$. In the present study, using WLSMV estimation, the number of estimated parameters was 206 and, given the sample size of 149, the ratio is less than 1:1. The small sample size may have affected the normality of distributions among the items and non-normality precluded using maximum likelihood estimation.

Taken together, the current sample size is somewhat smaller than what is recommended, and future research on the CAQ should replicate the analyses in the present study in a larger sample.

Given that this is in part a measure development study, a consideration for further research involves assessing whether the factor structure of the CAQ is invariant, i.e. remains stable, across different subgroups within a sample. In particular, part of demonstrating the reliability of any measure involves investigating its stability across different groups, based on, for example, gender or ethnicity. Examining the invariance of the CAQ is an important step in determining that a measure is evaluating the same construct across groups and is a prerequisite for unambiguously interpreting between group differences on a measure (Cheung & Rensvold, 2002). With a small overall sample size, however, it is not possible to divide the participants into multiple groups to confirm measurement invariance; the power is inadequate and doing so may also lead to unstable solutions that are not replicable.

Regarding the two-factor solution and discriminant validity, an additional measurement development step for the CAQ might involve further analyses to confirm that the factors represent two meaningful and separate dimensions. Again, using reverse-scored items (present on the EB subscale) within a measure can lead to the appearance of separate factors on the basis of wording effects only (Fish et al., 2013; Schriesheim & Eisenbach, 1995). Although the factors in the present study demonstrated sufficient discriminant validity, future research should investigate the possibility of a method effect from the negatively worded items. Such analyses could mirror those of Fish et al. (2013), who specified two additional CFA models with correlated error terms among the 1)

negatively and 2) positively worded items.

A final limitation pertains to the cross sectional nature of the study design, which does not allow for interpretations of causation of the CAQ factors on the measures of pain-related functioning. Future research efforts using this measure could employ longitudinal designs to explore whether committed action predicts change over time. This could be accomplished, for instance, through the use of latent growth modeling, which can help in advancing the science of ACT processes by showing that committed action is a mechanism of change, such that it is a significant mediator between baseline functioning and outcome in a treatment study.

The present study should be considered part of a preliminary process of developing the CAQ for use in clinical settings. Future investigations of this instrument should focus on chronic pain populations in other medical settings, such as those involved in outpatient treatment with interdisciplinary teams. Further research should also investigate the CAQ with non-pain populations as well, in accordance with the centrality of committed action to ACT and the scope of diagnoses for which ACT treatment is appropriate, from anxiety disorders to tobacco cessation. Lastly, future studies of the CAQ could focus on exploring whether the EB subscale outperforms the VP subscale with additional cohorts of chronic pain patients. Indeed, the benefits of performing the regression analyses based on the two-factor measurement model include providing empirical data that allows for an examination of the predictive power of separate subscales. If future research demonstrates that the EB subscale is a more consistent predictor of salient outcomes in chronic pain management, its use may be justified as a standalone measure.

In summary, it appears that measuring committed action using the CAQ may be

useful in predicting important outcomes related to functioning among chronic pain patients. The results also provide important evidence supporting the validity of the theory underlying committed action in ACT, namely that it involves the key components of persistence, flexibility, and effective behavior in the pursuit of goals. Ultimately, instruments like the CAQ may help researchers and clinicians understand the behaviors that lead to functional improvements in patients, including, but not necessarily limited to, those with chronic pain diagnoses.

Table 1

Standardized Factor Loadings for Scale Items

	Factor		
	Persistence		Effective Behavior
Scale Item	Factor Loading	Scale Item	Factor Loading
Item 1	**0.78**	Item 6	0.60
Item 2	**0.78**	Item 9	0.70
Item 4	**0.82**	Item 12	0.57
Item 5	**0.81**	Item 14	0.47
Item 7	**0.78**	Item 17	**0.77**
Item 8	**0.89**	Item 21	**0.77**
Item 15	**0.81**	Item 22	**0.85**
Item 16	**0.84**	Item 23	0.66
Item 19	0.70		

Note. Standardized loadings that exceed .71, corresponding to a proportion of variance explained in the item by the factor > 50%, are bolded. All *p*'s < .001.

Table 2

Simultaneous Multiple Regression Analyses Predicting Change in Measures of Health

Functioning Scores from Demographic and Self-Report Measures

| Predictor	β	S.E.	P
SIP: Psychological Subscale			
Sex	.10	.08	.213
Pain duration	.18	.15	.226
Pain Intensity	-.02	.10	.829
Years of education	-.07	.14	.634
Values inventory (CPVI)	-.82	.09	<.001
Values Persistence (CAQ factor 1)	.26	.14	.058
Effective Behavior (CAQ factor 2)*	-.39	.13	.002
SIP: Physical Subscale			
Sex	-.09	.08	.254
Pain duration	.47	.13	<.001
Pain Intensity	.03	.10	.770
Years of education	-.05	.10	.598
Values inventory (CPVI)	-.68	.09	<.001
Values Persistence (CAQ factor 1)	.15	.11	.162
Effective Behavior (CAQ factor 2)*	-.16	.12	.181
SIP: Independence-related Subscale			
Sex	.12	.08	.164
Pain duration	.38	.11	.001
Pain Intensity	.04	.09	.641
Years of education	-.05	.11	.657
Values inventory (CPVI)	-.59	.09	<.001
Values Persistence (CAQ factor 1)	.06	.12	.600
Effective Behavior (CAQ factor 2)*	-.23	.12	.054
Depression (BCMDI)			
Sex	.003	.09	.971
Pain duration	.11	.14	.424
Pain Intensity	.03	.08	.709
Years of education	.12	.17	.479
Values inventory (CPVI)	-.69	.09	<.001
Values Persistence (CAQ factor 1)	.19	.13	.139
Effective Behavior (CAQ factor 2)*	-.53	.11	<.001

(table continues)

Table 2 (cont'd)

Pain Anxiety Symptoms Scale (PASS)

Sex	.07	.08	.397
Pain duration	.07	.12	.585
Pain Intensity	.14	.08	.060
Years of education	.02	.11	.874
Values inventory (CPVI)	-.48	.09	<.001
Values Persistence (CAQ factor 1)	.16	.10	.120
Effective Behavior (CAQ factor 2)*	-.46	.10	<.001

Pain distress

Sex	-.07	.08	.414
Pain duration	.01	.08	.852
Pain Intensity	.46	.05	<.001
Years of education	-.01	.10	.886
Values inventory (CPVI)	-.12	.08	.116
Values Persistence (CAQ factor 1)	-.18	.09	.039
Effective Behavior (CAQ factor 2)*	-.20	.09	.019

Number of pain-related medical visits

Sex	-.11	.10	.288
Pain duration	-.07	.11	.517
Pain Intensity	-.04	.12	.761
Years of education	-.15	.13	.264
Values inventory (CPVI)	-.38	.12	.001
Values Persistence (CAQ factor 1)	-.07	.17	.658
Effective Behavior (CAQ factor 2)*	.03	.12	.783

**Note:* The items that comprise factor 2 were reverse scored prior to the data analyses

Figure 1

CFA model representing the two-factor structure of the 17-item version of the CAQ
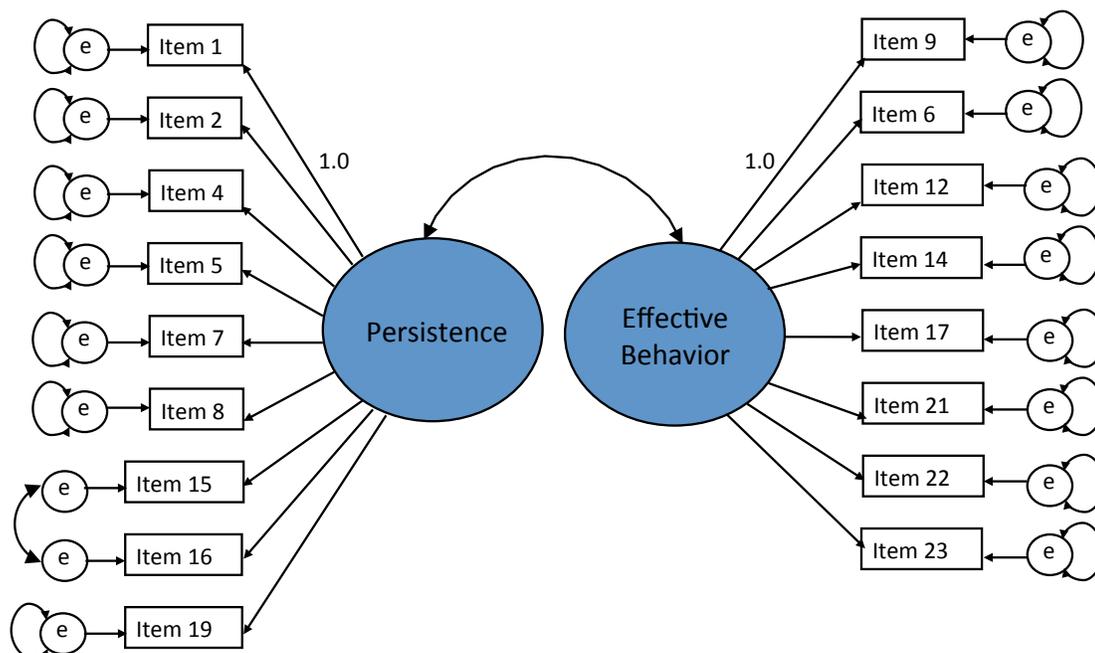
Appendix

Committed Action Questionnaire item content*

<u>Directions:</u>   Below you will find a list of statements.   Please rate the truth of each statement as it applies to you by circling a number.   Use the following rating scale to make your choices.   For instance, if you believe a statement is "Always True," you would circle the 6 next to that statement.

0 Never True	1 Very Rarely True	2 Seldom True	3 Sometimes True	4 Often True	5 Almost Always True	6 Always True

1	I am able to persist with a course of action after experiencing difficulties	0	1	2	3	4	5	6
2	When I fail in reaching a goal, I can change how I approach it	0	1	2	3	4	5	6
4	I can remain committed to my goals even when there are times that I fail to reach them	0	1	2	3	4	5	6
5	When a goal is difficult to reach, I am able to take small steps to reach it	0	1	2	3	4	5	6
6	I act impulsively when I feel under pressure	0	1	2	3	4	5	6
7	I prefer to change how I approach a goal rather than quit	0	1	2	3	4	5	6
8	I am able to follow my long terms plans including times when progress is slow	0	1	2	3	4	5	6
9	When I fail to achieve what I want to do, I make a point to never do that again	0	1	2	3	4	5	6
11**	I get stuck doing the same thing over and over even if I am not successful	0	1	2	3	4	5	6
12	I find it difficult to carry on with an activity unless I experience that it is successful	0	1	2	3	4	5	6
14	I am more likely to be guided by what I feel than by my goals	0	1	2	3	4	5	6
15	I am able to pursue my goals both when this feels easy and when it feels difficult	0	1	2	3	4	5	6
16	I am able to persist in what I am doing or to change what I am doing depending on what helps me reach my goals	0	1	2	3	4	5	6

0 Never True	1 Very Rarely True	2 Seldom True	3 Sometimes True	4 Often True	5 Almost Always True	6 Always True

17	If I make a commitment and later fail to reach it, I then drop the commitment	0	1	2	3	4	5	6
19	I am able to incorporate discouraging experiences into the process of pursuing my long term plans	0	1	2	3	4	5	6
21	If I feel distressed or discouraged, I let my commitments slide	0	1	2	3	4	5	6
22	I get so wrapped up in what I am thinking or feeling that I cannot do the things that matter to me	0	1	2	3	4	5	6
23	If I cannot do something my way, I will not do it at all	0	1	2	3	4	5	6

Note:

   *Item numbering is based on original 24-item measure from McCracken (2013)
** Item 11 dropped prior to the CFA analyses

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