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Linguistic analysis to assess the effect of a mindfulness intervention on self-change for adults in substance use recovery

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Abstract

Substance use is a pervasive health problem. Therapeutic community (TC) is an established substance abuse treatment but TC environments are stressful and dropout rates are high. Mindfulness-based TC (MBTC) intervention was developed to address TC stress and support self-change that could impact treatment retention. Self-change was assessed through feeling and thinking word-use in written stories of stress from 140 TC residents in a historical control group and 253 TC residents in a MBTC intervention group. Data were collected 5 times over a 9-month period. Linguistic analysis showed no differences between the groups over time; however, over all time points, the MBTC intervention group used fewer negative emotion words than the TC control group. Also, negative emotion ($p<.01$) and anxiety ($p<.01$) word-use decreased while positive emotion word-use increased ($p<.05$) over time in both groups. Descriptive data from linguistic analyses indicated that sustained self-change demands participation in mindfulness behaviors beyond the instructor-guided MBTC intervention.

Keywords

mindfulness; therapeutic community; mindfulness-based therapeutic community; linguistic analysis

Introduction

Substance use is a pervasive health problem for the American population and worldwide. More than 20 million Americans abuse substances (1) and the cost to the nation extends beyond personal health, affecting families and communities. There are effective treatments for substance abuse including pharmacologic and behavioral approaches (2). Therapeutic community (TC), a behavioral approach, has an established place in the repertoire of substance abuse treatment (3,4). TC provides a highly structured social learning environment, where the community is the key agent for behavioral change. Studies have shown that people who complete TC treatment have lower levels of substance abuse, criminal behavior, unemployment and depression than they had prior to treatment (5-8). However, dropout rates can be as high

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as 50% and dropout is most prevalent in the first 30 to 60 days of treatment (9). It is critical to improve treatment retention and to begin to understand self-change processes affecting it.

Stress is one factor that demands consideration when assessing dropout in TC settings. Although there is little data linking stress to the TC environment, studies of similar restrictive hierarchical settings, such as prisons (10) and military training camps (11), have identified chronic stress as an inherent dimension of these environments. With stress as a therapeutic goal, a Mindfulness-Based Therapeutic Community (MBTC) intervention was developed (12,13), merging mindfulness-based stress reduction (MBSR) (14) and TC treatment (12) modalities. MBSR is commonly used for physical and mental health problems, including stress-related conditions (15). The TC and MBSR philosophies share common ground principles, such as a focus on the present moment, nonjudgmental acceptance and attention to the whole person (12). For individuals who have continually tried to alter their circumstances with psychoactive substances, the present-centered, nonjudgmental way of being, endorsed by the MBTC intervention, can be a major whole-self-shift that demands exploration. Within the context of TC treatment, the underlying assumption regarding the “whole person” nature of substance use disorders suggests that self-change is necessary in areas of socialization, cognitive and emotional skills and psychological development (16) if sustained recovery is to occur. TC treatment generally requires between 6 to 12 months of living in a residential community, where thoughts, feelings and behaviors are regularly discussed. While change in behavior is observable as it is enforced through the TC “rules and tools of right living,” changes in thoughts and feelings are more elusive and seldom documented beyond anecdotal evidence. Formally-collected stories may provide a perspective on thinking and feeling self-change. Stories are an integral dimension of many substance abuse treatments (17), and stories of stress are particularly relevant for people who are moving into the restrictive TC environment.

If change in thoughts and feelings could be documented through stories of stress, it may be possible to understand the self-change processes necessary for TC retention and, therefore, TC treatment success. In this instance, it may also be possible to evaluate the contribution of a MBSR-based program to the self-change experience of TC residents. Pennebaker and colleagues have proposed word-use as empirical evidence of one's personality characteristics (18). They have developed a linguistic analysis method which can be readily applied in practice settings, enabling evaluation of “thinking” and “feeling” words (19), thereby providing perspective regarding self-change processes.

The purpose of this analysis was to explore effects of the newly-developed MBTC intervention, a tailored therapy merging MBSR with TC treatment, on self-change processes (“thinking” and “feeling” word-use in written stories of stress) in the TC setting, over a 9-month study period.

Methods

Design

This manuscript reports findings of linguistic analysis applied to stress stories written by participants of a phase one behavioral therapies trial (12,13). Primary focus of this trial was to evaluate whether the MBTC intervention was efficacious for reducing stress and improving retention among TC residents. The trial used a longitudinal historical control design. Data collection for the historical control phase of the trial was completed before the MBTC intervention phase was initiated. Standard-of-care TC treatment was delivered during the historical control phase of the study. In the MBTC intervention phase, , a six week, instructor-guided mindfulness intervention was added to standard-of-care TC treatment (12,13), Comparable data collection occurred during each phase of the trial. The historical control phase provided standard-of-care data for TC residents prior to implementation of the MBTC

intervention. Therefore, each group, both the historical control and the MBTC intervention, had baseline data collected as well as 1, 3, 6 and 9-month data. Self-change, measured through word-use in written stories of stress, was one of the outcome indicators for this trial.

Sample

All adults, 18 years and older, who entered a single TC facility in Southern United States were invited to participate in the study within the first 72 hours of their TC residency. The study was explained by one of the researchers (LG or DC) and informed consent was signed prior to data collection. Historical control subjects were enrolled from January 2005 thru January 2006; intervention subjects were enrolled from February 2006 thru November 2006. The study was approved by the University of Texas, Health Science Center at Houston Institutional Review Board.

Outcome Measures: Stories of stress as indicators of self-change

At each data collection point (baseline, 1, 3, 6, and 9 months post-entry), participants were asked to write a story about the stress they were experiencing. The writing instructions, following the Pennebaker's et al. protocol, (19), were:

For the next 15 minutes write about thoughts and feelings regarding stressful issues in your life. Tell us about the issues; what do you think about them; what do you feel about them; and, tell us how you are managing them. Don't worry about grammar or spelling or sentence structure. The most important thing is to let us know how things are going for you in relation to stress in your life. All your writing will be completely confidential. The only rule is that once you begin writing, continue to do so until your time is up. If you run out of things to write, just repeat what you've already written. It is important to keep writing for the entire time.

Preparing stories of stress for analysis

The written stories of stress were transcribed and prepared for analysis using Linguistic Inquiry and Word Count (LIWC) software (19), a word-based computerized text analysis that discerns 72 linguistic categories The validity of word categories has been extensively tested using panels of judges, factor analysis methods and criterion-related validity procedures (20). The LIWC program reports word-use in percentages, indicating the number of words used in a particular category, relative to all the words used by a particular participant. In this analysis, the positive and negative emotion (feeling), and the cognitive process (thinking) word categories were included as outcome indicators, In addition, the anxiety word category, and a combined inhibition and insight word category were used to better understand self-change processes related to stress. In previous research, the combined category of inhibition and insight had a positive correlation (r=.71) with recovery outcomes for a substance abuse population in a residential treatment facility (21). Table 1 provides examples of words in the LIWC dictionary associated with each selected word category; it also includes alpha reliabilities for each category estimated with a similar sample of participants (20).

Analysis

Descriptive statistics, including means, standard deviations, frequencies and percentages, were calculated for demographic and word-use variables at each time point. Repeated measures analyses of change over time in word-use categories were conducted with linear mixed models (22) using SAS for Windows, version 9.1 (23). The level of significance for all statistical tests was set at two-tailed $p < .05$. Values for positive emotion, negative emotion, and anxiety word-use did not follow a normal distribution, therefore, a square root transformation (24) was applied to adjust these variables prior to repeated measures analysis.

Results

Figure 1 provides a flow chart indicating the participant numbers over the study course. The average age of participants at study entry was 35.1 (10.0) years. The majority was White (56%) and male (82%); 30% were Black and 13% were Hispanic. Over the nine months of the study, retention rates were 58%, 29%, 16% and 12% for the TC control group, and 60%, 36%, 27% and 16% for the MBTC intervention group at 1, 3, 6 and 9 months, respectively.

Thinking and feeling word-use was explored over a nine month period (Table 2) as an indicator of personal change for adults receiving the TC control condition or the MBTC intervention. No statistically significant differences occurred between the groups over time in thinking and feeling word-use. Positive emotion word-use increased ($p < 0.05$), and negative emotion ($p < 0.01$) and anxiety ($p < 0.01$) word-use decreased over time regardless of group status. Overall, without consideration for time (e.g., average word-use across all data collection points), the MBTC intervention group used a smaller percentage of negative emotion words ($p < 0.05$) in stories of stress than the TC control group. There were no within or between group differences for thinking word-use, including the combined inhibition-insight word category.

Discussion

The MBTC intervention did not significantly change feeling and thinking word-use over time; however, during the study period, the MBTC intervention group used altogether fewer negative emotion words when writing about stress compared to the TC control group. Over time, all participants, regardless of group status, used fewer negative emotion words and more positive emotion words when writing about stress.

The negative findings for differences between the TC control group and the MBTC intervention group over time can be viewed through at least two perspectives. The first suggests that the MBTC intervention was no more effective than TC alone in promoting self-change. Another perspective suggests that word-use in stories of stress was not sensitive to the MBTC intervention effect. If the first perspective is the chosen stance, concerns about the dwindling sample size and the possibility of a Type II error surface. Perhaps, if the entire sample had been retained over time, differences would reach statistical significance. Descriptive statistics, summarizing word-use data, indicate that the greatest differences between the groups occurred at the three-month measurement. These differences consistently favored the MBTC intervention group but differences disappeared by the nine-month measurement point.

Of note, the three-month descriptive data collection time point coincided with a shift in the TC program activities when the scheduled instructor-guided mindfulness classes ended and the residents, regardless of group status, began employment outside the TC setting. This contextual information leads to questions about translating the instructor-guided MBTC intervention into everyday use. It is possible that the traditional TC environment, as it is currently configured, did not allow time or energy for formal and/or informal practice when participants resumed employment. Although guided meditation CDs were available, records indicated infrequent use by residents following the instructor-guided MBTC intervention. Like any behavioral therapy, participants must engage in the behavior if the effect is to be documented. Kabat-Zinn (15) addresses this point by noting that people do not have to like mindfulness practice, they "just have to do it" (p. 41-42). At the very least, these findings indicate a need for a better weaving of mindfulness practice into TC treatment throughout the resident's course of stay. The fact that the MBTC intervention group used fewer negative emotion words overall, while there were no significant group differences in word-use at baseline, may indicate that the MBTC participants differentially related to stress and negative emotions suggesting that further study of the MBTC intervention is warranted.

The second perspective for considering insignificant differences between the groups is the possibility of lack of sufficient sensitivity of the word-use outcome measure. This explanation would be more plausible if it was inconsistent with other data measured at the same time points in this trial. However, the pattern of word-use change is consistent with the direction of change in other measures assessed in this study (13). For instance, self-reported stress level (reported elsewhere (13), measured by the Symptoms of Stress Inventory) decreased significantly over the study period regardless of group assignment with the three-month differences between the TC and the MBTC groups being most pronounced (13). Although it may be too early to dismiss linquistic analysis as an insensitive outcome indicator, our results do not provide strong support for its use in assessing the effect of the MBTC intervention.

The overall findings indicate significant changes in feeling word-use in both groups, unaccompanied by changes in thinking word use. In the current study, there was an a priori expectation that the MBTC intervention would facilitate more complex thinking, as reflected by increased thinking word-use, and improvement in positive and negative emotion word-use. Smyth and Pennebaker (25) report that expressive writing enables identification and labeling of feelings, a simple action that often results in a more "complex cognitive representation (p. 3)" of a circumstance. This composite of feeling and thinking self-change has been shown to correlate with improved health outcomes (25). Although negative emotion word-use decreased and positive emotion word-use increased in both groups over time, these changes in feeling word-use did not translate into significant changes in thinking word-use. The absence of thinking self-change leads to questions about "reperceiving," a cognitive capacity identified as central to mindfulness and essential to self-management activities (26).

> "By developing the capacity to stand back and witness emotional states such as anxiety, we increase our "degrees of freedom" in response to such states, effectively freeing ourselves from automatic behavioral patterns. Through reperceiving, we are no longer controlled by states such as anxiety or fear but are instead able to use them as information. We are able to attend to the emotion, and choose to self-regulate in ways that foster greater health and well being" (26, p. 380).

Reperceiving is a complex cognitive process that is considered developmental in nature. It is a "rotation in consciousness" (26) where subjective becomes objective. Reperceiving may not yet have become a habit for the MBTC intervention group by the three-month time point, making it unlikely that the feeling word-use changes could be expressed as a measurable change in thinking word-use.

In conclusion, in this study, linguistic analysis of stress stories, written by the TC residents over the nine month study period, did not reveal significant differences between the historical control group and experimental group that received the MBTC intervention. However, consideration of three-month differences suggests that mindfulness must be practiced if its effect is to be noted. Care providers are challenged to identify manageable approaches to help TC residents sustain the practice of mindfulness. When this challenge is addressed, a more meaningful evaluation of the MBTC intervention, as a vehicle for creating self-change for adults in substance use recovery, can be pursued.

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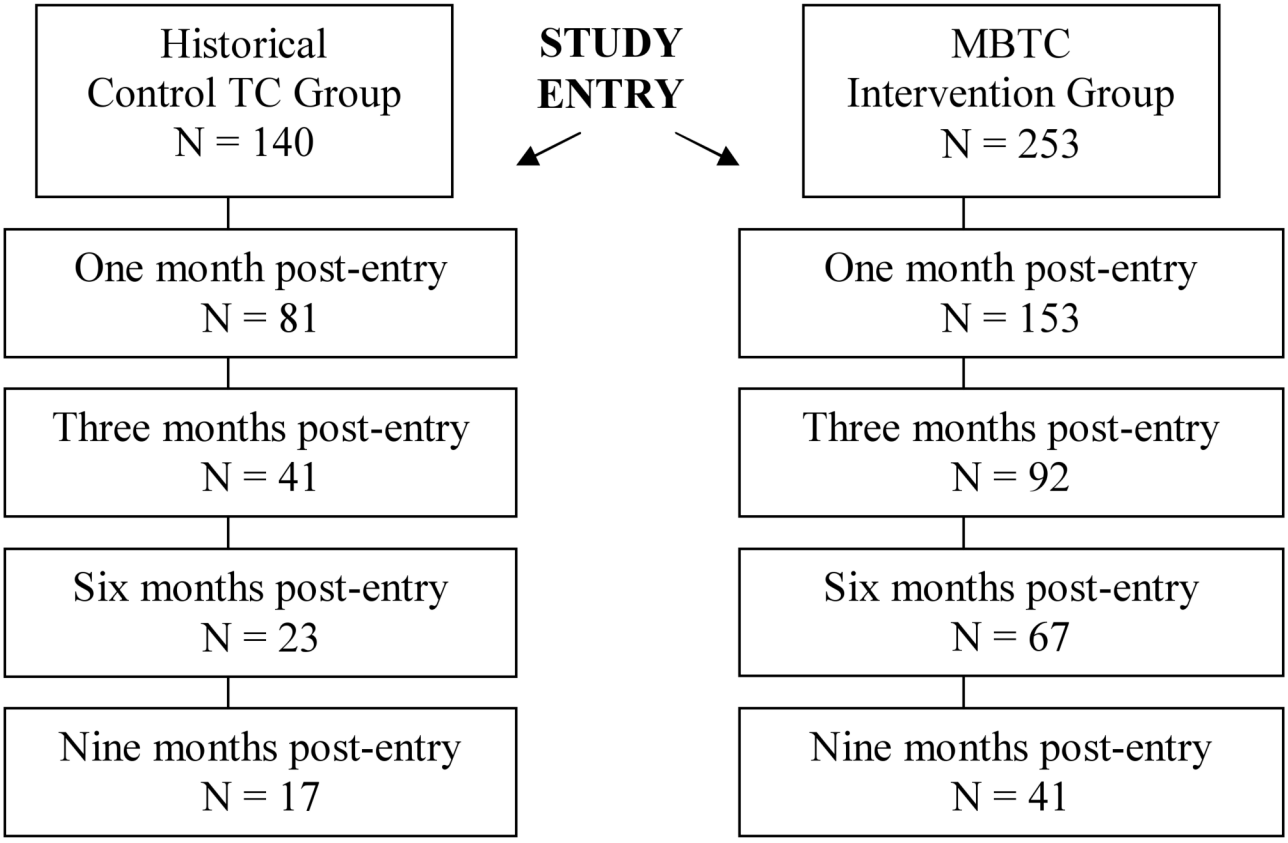

Figure 1.
Flowchart of participant numbers over time for the Historical Control Therapeutic Community (TC) Group and the Mindfulness-Based Therapeutic Community (MBTC) Group

Table 1

Selected word categories from the Linguistic Inquiry and Word Count (LIWC) narrative analysis program with associated alpha reliabilities (calculated ? in a separate study or this study…? If separate, provide reference; if possible to do it easily, please add N number for the sample these alphas were calculated for – or describe it in more detail in the text) and example words

Word category	alpha	example words
Positive emotion	.84	fun, grateful, vigor, love, secure, comfort
Negative emotion	.84	Whine, dislike, tense, neglect, worry, argue
• anxiety	.77	Unsure, upset, restless, pressure, confused
Cognitive process	.84	Cause, discover, recognize, wonder, think
• inhibition	.74	Control, forbid, hesitate, wait, stop
• insight	.77	Accept, admit, analyze, examine, understand

Table 2

Percentage of feeling and thinking words used over time: presented as means and (standard deviations).

Word category	Baseline	1 month	3 months	6 months	9 months
Positive emotion word-use *					
TC	2.1(2.2)	2.6(2.7)	2.4(1.1)	2.1(1.2)	2.4(1.4)
MBTC	2.1(1.6)	2.3(1.6)	2.6(1.7)	2.3(1.3)	2.2(1.3)
Negative emotion word-use **					
TC	4.4(3.0)	3.4(2.1)	3.3(1.8)	2.5(1.5)	2.7(1.4)
MBTC	4.0(4.3)	3.3(2.6)	2.5(1.6)	2.4(1.6)	2.5(1.7)
Anxiety word-use **					
TC	2.4(2.8)	1.7(1.9)	1.6(1.4)	1.4(1.5)	1.5(1.5)
MBTC	2.0(2.6)	1.8(2.2)	1.2(1.2)	1.2(1.4)	1.3(1.3)
Cognitive process word-use (thinking word-use)					
TC	7.9(3.0)	8.5(2.6)	8.3(2.7)	8.2(2.7)	8.7(2.5)
MBTC	8.0(3.0)	7.9(2.3)	8.8(2.8)	8.0(2.4)	7.4(2.4)
Inhibition & Insight word-use					
TC	2.9(1.6)	3.1(1.5)	3.0(1.4)	2.5(1.5)	3.2(1.2)
MBTC	2.9(1.6)	2.7(1.4)	3.0(1.6)	2.8(1.5)	2.7(1.6)

TC: standard of care therapeutic community; MBTC mindfulness-based TC

* significant change over five time points ($p < 0.05$);

** significant change over five time points ($p < 0.01$), as evaluated using repeated measure analysis.