



Factor structure and measurement invariance of the Brief Addiction Monitor

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ABSTRACT

Substance use disorders (SUDs) are of great concern for health care providers working with military veteran populations. Systematic evaluation of progress and outcomes within the Veterans Affairs (VA) is a critical component of care provided for the veteran population. The Brief Addiction Monitor (BAM) is a 17-item instrument used within VA to assess substance use and related constructs among veterans participating in SUD care. Initial evaluations, using a version containing continuous items, suggested that the items form three factors reflecting substance use, risk factors, and protective factors. Subsequent work, using the BAM version containing Likert-style items collected from a single VA Medical Center sample, did not support the proposed 3-factor solution. The current study used a nationwide sample of 4955 veterans to evaluate the factor structure of the BAM and its usefulness over time. Exploratory factor analyses conducted did not provide evidence of the originally proposed BAM factor structure but instead supported a 4-factor model (reflecting alcohol use, stress, risk, and stability) formed from 13 of the items. Further analyses conducted within a structural equation modeling framework showed that the four-factor model exhibited invariance across occasions of measurement, although internal consistency was found to be low for most subscales. Results provide caution against using BAM subscale scores to track treatment outcomes over time.

1. Introduction

Heavy alcohol and marijuana use and risky substance-related behaviors, such as drinking and driving, are significantly higher among veterans than non-veteran samples matched on demographic characteristics (Wagner et al., 2007). Also, in data spanning 2000 to 2010, Seal et al. (2011) found rates of addictive disorders that were much higher among Operation Enduring Freedom or Operation Iraqi Freedom (OEF/OIF) veterans, indicating that rates are likely increasing as more veterans return from recent conflicts in the Middle East. Therefore, among the veteran population, substance use disorder may be increasing in prevalence over time.

Within the VA healthcare system, treatment of alcohol and substance use disorders (AUD/SUD) is an ongoing focus due to their association with a wide array of negative symptoms and outcomes, including adverse effects on physical and mental health, legal concerns, loss of important relationships, loss of employment, financial difficulties, and increased need for the substance which interferes with almost every aspect of one's daily life. Between 2001 and 2010, 32,881 veterans who served in Operation Iraqi Freedom or Operation Enduring Freedom sought services at VA Medical Centers nationwide for AUD/SUD (Seal et al., 2011). Among veterans of all eras who received mental

health care in 2007–2008 at a VA for a mood disorder, PTSD, schizophrenia, or an anxiety disorder, 21–35% were also diagnosed with an AUD/SUD (Petrakis, Rosenheck, & Desai, 2011).

In VA, there is an emphasis on repeated assessment of veteran progress through mental health treatment, including the treatment of problematic alcohol or substance use. VA published the most recent national guidelines in 2015 for the treatment of alcohol and substance use disorders outlining evidence-based practices (Department of Veterans Affairs & Department of Defense, 2015). These guidelines note that though there is currently weak evidence for periodic assessment of treatment response for AUD/SUD, and that therefore a formal “recommend for” or “recommend against” statement regarding this kind of assessment cannot be made, that patient progress be monitored nevertheless. The Work Group recommended that progress be measured with a standardized, valid instrument throughout treatment to inform treatment-related decisions. This information is intended to help keep patients accountable, to monitor response to treatment, and to ensure adherence to the expectations of accrediting agencies. The guidelines also suggest that in the event periodic assessment indicates a lack of progress or back-sliding, that adjustments to the treatment plan be made at that time.

Despite the lack of evidence for or against assessment of treatment

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response for AUD/SUD specifically, repeated measurement of progress in mental health treatment can help clients improve more quickly, help those improvements be more stable over time, and reduce the overall cost of care, suggesting that the creation or identification of a measure for tracking progress in substance and alcohol use disorder treatment would be of benefit (Goodman, McKay, & DePhilippis, 2013). Goldman and colleagues recommend that such a measure assess substance use, risk, and cravings as well as positive social support, quality of therapeutic alliance, engagement in positive activities, and improved management of other psychiatric symptoms as the concept of “recovery” from AUD/SUD is larger than simply using less or none of a substance. Ideally, such a measure would be relatively short but comprehensive, easy to score and interpret, and able to produce feedback for the client that is clear and indicates progress, stagnation, or setbacks without much ambiguity.

In response to the need for a brief, simple measure that could be used repeatedly through treatment to track client progress, the Brief Addiction Monitor (BAM, Center of Excellence in Substance Abuse Treatment and Education [CESATE], 2010; Cacciola et al., 2013) was developed. The developers' goals were to create a measure that would be brief and easily administered, would assess both risk and protective factors related to substance abuse treatment, and could be used repeatedly over the course of a treatment program. The BAM is a 17-item measure of alcohol and drug use, craving, abstinence confidence, physical health, sleep problems, psychological symptoms, engagement in recovery support, relationships, engagement in risky situations, and income. Two of the items, frequency of binge drinking (item 5) and identification of specific drugs taken in the last 30 days (item 7), are contingent on other items. An exploratory factor analysis in the original validation study of the BAM conducted by Cacciola et al. (2013) revealed three factors formed from 11 of the items: a *protective* factor composed of four items (item 9: confidence for remaining abstinent, item 10: self-help group attendance, item 12: religion/spirituality support, and item 17: recovery satisfaction); a *physical and psychological problems* factor composed of three items (item 1: physical health perception, item 2: sleep problems, and item 3: psychological problems); and a *substance use and risk* factor composed of four items (item 4: past 30-day alcohol use, item 6: past 30-day drug use, item 8: craving, and item 11: involvement in risky situations). Items that did not load onto a factor included number of days spent at work, school, or volunteering (item 13); adequate income (item 14); arguments with family or friends (item 15); and number of days spent with supportive family or friends (item 16).

According to Cacciola et al. (2013), over the course of treatment and afterwards (baseline to three-month follow-up), the frequency and severity of alcohol/substance use decreased and ratings of protective items increased for 11 of the 15 non-contingent items. The items that did not show improvement through treatment and after discharge were item 9, confidence in one's ability to remain abstinent; item 12, religion/spirituality support; item 15, arguments with family/friends; and item 16, days with supportive family/friends. The test-retest reliability for most of the items was excellent to fair, except for item 11, number of days encountering risky situations. Additionally, predictive validity for the recovery protection, substance use, and risk subscales were supported, with these subscale scores incrementally predicting treatment drop out.

The BAM was implemented as a measure of treatment progress in the VA; however, because of the nature of the infrastructure of VA's computerized records system, the BAM could not be presented as it was originally designed. The difference was in the response set of the continuous items that appeared in the BAM. Providers of mental health services in VA use a program called Mental Health Assistant (MHA) that is built on an underlying infrastructure called Veterans Integrated System Technology Architecture (Vista) that could not at that time support continuous measures (Kivlahan, 2011, personal communication cited in Nelson, Young, & Chapman, 2014). Therefore, changes were

made to the BAM to make those items discrete by using Likert scale response set; for example, for item 4, “In the past 30 days, how many days did you drink any alcohol?”, in the version used by Cacciola et al., any response from 0 to 30 was allowed. In the version initially made available to VA healthcare providers through MHA (hereafter this version will continue to be referred to simply as the BAM, and can be located at www.mentalhealth.va.gov/providers/sud/docs/BAM_Scoring_Clinical_Guidelines_01-04-2011.pdf), the response options were 0, 1–3, 4–8, 9–15, or 16–30. More recently, perhaps following updates to the underlying Vista system, a revised version of the BAM (BAM-R; available at www.mirecc.va.gov/cih-visn2/Documents/Clinical/BAM_2017.pdf) is now available in MHA. The BAM-R contains the item response options as they were in the version used by Cacciola and colleagues. For the current study, the BAM (with discrete item response options) was used as it has been in use for the longest period of time in the VA, and this version will be referred to as “BAM” throughout the remainder of this manuscript. The BAM-R, with continuous response options, was added relatively recently as an option for use in the VA system, and this instrument version will be referred to as “BAM-R” when referenced hereafter.

Nelson et al. (2014) conducted a follow-up study to investigate whether the factor structure identified in the original BAM validation study (Cacciola et al., 2013) could be replicated using Principle Components Analysis (PCA) with the discrete response set in a sample of veterans engaged in inpatient and outpatient addiction treatment programs across a Midwestern VA healthcare system. The authors found that no clear factor structure emerged for responses from an inpatient sample of veterans, and a single scale emerged for an outpatient sample that was comprised of items related to alcohol/substance use and risk items. Their inpatient and outpatient samples were drawn from just one small region of the country, and their sample was primarily African-American (54%) or Caucasian (43%) – results of their study may have been constrained by geographical and diversity limitations.

The use of PCA by Nelson and colleagues may have produced a different result than an exploratory factor analysis (EFA) would have produced since PCA is used to reduce the number of dimensions or items associated with a larger set of items whereas EFA is used to describe the factor structure underlying a set of items. The current study is primarily concerned with describing the factor structure of the BAM and the invariance of this structure across two occasions of measurement. Therefore, the structure resulting from the PCA by Nelson and colleagues was not chosen for attempted replication in the analyses conducted here.

We hypothesized that, in a nationwide sample of veterans receiving care across all VA Medical Centers, the three-scale factor structure proposed by the developers of the BAM would be confirmed. It was also hypothesized that this factor structure would be confirmed across timepoints of assessment, consistent with the proposed use of the BAM as a tool for assessing meaningful change over the course of SUD treatment. Results will provide VA SUD treatment providers with additional information regarding the utility of the BAM in assessing changes in SUD-relevant constructs over time. Further, results from this study will provide researchers and treatment providers who wish to use the BAM as a treatment outcome indicator with valuable information regarding use of the BAM for treatment planning purposes and treatment outcome measurement among veterans. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

2. Method

2.1. Participants

In the current study, we investigate the factor structure of the BAM used in VA settings in an ethnically and geographically diverse sample of veterans seeking treatment for alcohol and/or substance use

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