Addictive Behaviors 59 (2016) 72–79

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Identifying treatment response subgroups for adolescent cannabis use

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HIGHLIGHTS

- Response to outpatient adolescent substance use treatment is heterogeneous.
- Cluster analysis was utilized to identify response subgroups for cannabis use.
- Low Use Responders, High Use Responders, Relapsers, and Non-Responders were found.
- Cannabis dependence, cannabis uses per day, and SES predicted cluster membership.
- These clusters provide insight into study outcomes.

ARTICLE INFO

Article history:
Received 12 October 2015
Received in revised form 23 February 2016
Accepted 29 March 2016
Available online 2 April 2016

Keywords:
Cluster analysis
Subgroup analysis
Adolescents
Cannabis use
Substance abuse

ABSTRACT

Introduction: Outpatient treatments for adolescent substance use demonstrate clinically meaningful reductions in substance use, but effect sizes are often low, relapse rates are high, and response to treatment is heterogeneous across participants. The present study utilized cluster analysis to identify subgroups of treatment response among adolescents from three randomized clinical trials evaluating behavioral treatments for substance use.
Methods: Analyses were performed on a sample of 194 adolescents (average age = 15.8, 81.4% male) who reported cannabis use during the past 30 days or had a cannabis-positive urine test. Clustering was based on percent days cannabis use at 5 time periods (intake, end of treatment, 3, 6, and 9 months post-treatment). Participants in the identified subgroups were then compared across a number of variables not involved in the clustering (e.g., substance use, demographics, and psychopathology) to test for predictors of cluster membership.
Results: Four clusters were identified based on statistical indices and visual inspection of the resulting cluster profiles: Low Use Responders (n = 109, low baseline level, sustained decrease); High Use Responders (n = 45, high baseline level, sustained decrease); Relapsers (n = 25, medium baseline level, decrease, rapid increase post-treatment); and Non-Responders (n = 15; consistently high level of use). Cannabis dependence, mean cannabis uses per day, and socioeconomic status were predictive of cluster membership.
Conclusions: Cluster analysis empirically identified different patterns of treatment response over time for adolescent outpatients. Investigating homogenous subgroups of participants provides insight into study outcomes, and variables associated with clusters have potential utility to identify participants that may benefit from more intensive treatment.

1. Introduction

Among adolescents admitted to substance use treatment, 76% report cannabis as the primary substance (Substance Abuse and Mental Health Services Administration (SAMHSA), 2014). Outpatient treatments for cannabis use disorders have demonstrated effectiveness at reducing substance use (Tanner-Smith, Wilson, & Lipsey, 2013; Waldron & Turner, 2008; Williams & Chang, 2000). Although treatments demonstrate clinically meaningful reductions in substance use, treatment effect sizes are often low in magnitude. Rates of relapse in the year following treatment are also high (Brown, Vik, & Creamer, 1989; Williams & Chang, 2000), with an average of about one-third of adolescents demonstrating sustained post-treatment abstinence, and about one-half of adolescents sustaining a level of reduced substance use compared to pre-treatment levels.

One step towards improving substance use treatment is to better understand relations among participant characteristics and treatment response. Response to treatment across participants is heterogeneous, but although each individual may respond differently, patterns of similar

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http://dx.doi.org/10.1016/j.addbeh.2016.03.033
0306-4603/

responses are likely also present (Maisto, Pollock, Lynch, Martin, & Ammerman, 2001; Spear, Ciesla, & Skala, 1999; Waldron, Turner, & Ozechowski, 2005). Demographic, psychopathological, and treatment-related variables have been extensively explored in past studies as predictors of adolescent substance use treatment outcome. Variables such as age, gender, race, substance use severity, treatment length, conduct disorder, oppositional defiant disorder, depression, anxiety, family conflict, and school attendance have predicted outcomes (Crowley, Mikulich, MacDonald, Young, & Zerbe, 1998; Dakof, Tejeda, & Liddle, 2001; Friedman, Terras, & Kreisher, 1995; Hendriks, van der Schee, & Blanken, 2012; Latimer, Newcomb, Winters, & Stinchfield, 2000; Latimer, Winters, Stinchfield, & Traver, 2000; Rowe, Liddle, Greenbaum, & Henderson, 2004; Williams & Chang, 2000).

Exploratory statistical techniques, such as cluster analysis, can be used to empirically identify homogenous subgroups; this creates new opportunities to test predictors of treatment response, particularly when treatment response is on a continuum, such as percent days of substance use, rather than categorical, such as abstinent versus not abstinent. Waldron et al. (2005) utilized cluster analysis to identify subgroups of adolescents that received outpatient treatment for substance use. Four clusters, based on percent days cannabis use across treatment assessment points, were identified: Improvers (rapid improvement and continued low use), Slow Improvers (gradual improvement), Relapsers (rapid improvement followed by increasing use), and Resistant (continuous heavy use). Trajectories of post-treatment continued low use, continued high use, and relapse, based on measures of cannabis use severity, have been identified in additional studies (Brown et al., 1989; Godley, Dennis, Godley, & Funk, 2004; Henderson, Dakof, Greenbaum, & Liddle, 2010) and suggest these may be common long-term responses to substance use treatment. The present study was conducted to complement the findings of Waldron et al. (2005), in a new sample involving different types of treatment, to contribute to evidence for common treatment response patterns of cannabis use.

The goals of the present study were to identify treatment response subgroups in a combined sample of adolescents that received outpatient therapy for substance use and to identify predictors of these subgroups. Cluster analysis, based on percent days cannabis use measured at five assessment points, was utilized to identify homogenous subgroups of treatment response. Baseline variables, including other substance use variables, demographics, and psychopathology, were tested as predictors of the identified clusters. We hypothesized that empirically distinct patterns of cannabis use over time would emerge from cluster analyses, and that these patterns would be comparable to those reported by Waldron et al. (2005).

2. Method

2.1. Participants

Data were combined from three randomized clinical trials that evaluated outpatient behavioral treatments for adolescent substance use (Stanger, Budney, Kamon, & Thostensen, 2009; Stanger, Ryan, Scherer, Norton, & Budney, 2015; Stanger et al., 2016). In these trials, all adolescents received individual Motivational Enhancement Therapy/Cognitive Behavioral Therapy (MET/CBT; Sampl & Kadden, 2001; Webb, Scudder, Kaminer, & Kadden, 2002). At least one treatment arm in each study also included an abstinence-based contingency management (CM) intervention.

Two studies, Arkansas 1 (AR-1) and Arkansas 2 (AR-2), were completed at the University of Arkansas for Medical Sciences, and one (Vermont; VT) was completed at the University of Vermont; each study was conducted in compliance with the Institutional Review Board of the corresponding university. Youth were enrolled in VT between April 2003 and April 2005, with follow-up assessments completed by April 2006; youth were enrolled in AR-1 between December 2007 and October 2011, with follow-up assessments completed by June 2012; and youth in AR-2 were enrolled between December 2007 and March 2011, with follow-up assessments completed by July 2012. Inclusion criteria consistent across all studies included: age 12–18 (if 18, in high school) and living with a parent or guardian who agreed to participate. Additional inclusion criteria for AR-2 (N = 153) and VT (N = 69) involved cannabis use in the past 30 days or a cannabis-positive urine test. Criteria for AR-2 also included a diagnosis of cannabis abuse or dependence. Additional details about these two studies are available elsewhere (Stanger et al., 2009; Stanger et al., 2015). Additional inclusion criteria for AR-1 (N = 75) included alcohol use during the past 30 days or an alcohol-positive urine test and meeting criteria for alcohol abuse or dependence or reporting one or more binging episodes (5 or more drinks) in the past 90 days. Cannabis use disorders were not exclusion criteria. Additional details about this study are available elsewhere (Stanger et al., 2016).

For the present analyses, we included only participants who, at intake, had used cannabis during the past 30 days or had a cannabis-positive urine test, and had data at all assessment time points. This resulted in a sample size of N = 194 (out of a possible N = 297), with 12, 49, and 20 participants excluded for missing data at any follow-up assessments from AR-1, AR-2, and VT, respectively. An additional 22 participants were excluded from AR-1 due to no cannabis use at intake. Baseline characteristics are included in Table 1. Included participants (N = 194) did not significantly differ from excluded participants (n = 103) across these baseline characteristics.

2.2. Procedure

Study procedures were similar across the three studies. Adolescents received 14 weeks of individual MET/CBT. Additional treatment components included a CM intervention, which involved a combination of clinic and home-based incentives for abstinence from all substances, and a parent training (PT) intervention which targeted conduct problems. Therapists included master's level and postdoctoral level clinicians for AR-1 and VT, and master's level clinicians for AR-2. In each study, treatment integrity was assessed by videotaping sessions and discussing each session in weekly supervision. In AR-1 and AR-2, adherence to the Family Management Curriculum was assessed using the Fidelity of Implementation (FIMP; Forgatch, Patterson, & DeGarmo, 2005), and adherence to MET/CBT was assessed using the Yale Adherence Competence Scale (YACS; Carroll et al., 2000). Fidelity scores were in acceptable ranges and were similar across studies (Stanger et al., 2015, 2016).

Adolescents attended an intake to complete an assessment battery, and eligible adolescents were then assigned to treatment condition. Across studies adolescents were randomized to one of three conditions: MET / CBT (n = 77), MET / CBT + CM (n = 34), or MET / CBT + CM + PT (n = 83). Overall, 117/194 received treatment that included CM. Those in AR-1 received once-weekly urine drug testing while those in AR-2 and VT received twice-weekly drug testing; other drug testing details were identical. Parents/guardians were informed of drug toxicology results across all conditions. All families were offered an additional 12 weeks of once-weekly urine drug testing after treatment. At the end of treatment (ETx) and at 3, 6, and 9 months post-treatment, adolescent and parent(s) completed a follow-up assessment.

Each of these trials demonstrated statistically significant decreases in cannabis use during treatment and demonstrated stronger effects for MET / CBT + CM than MET / CBT alone (Stanger et al., 2009, 2015, 2016). The addition of the PT intervention was not associated with additional change in cannabis use compared to MET / CBT + CM (Stanger et al., 2015). Thus, the treatment group predictor variable is the present study was defined as CM vs. no CM. Post-treatment maintenance of these decreases in cannabis use was poor, with increases in cannabis use at follow-up time points.