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Life events and treatment outcomes among individuals with substance use disorders: A narrative review

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Keywords: Life events, substance use disorders, clinical

Abstract

Substance use disorders are characterized by a variable course, in which multiple treatment attempts and relapses are typical. Consistent with conceptualizations of substance use and relapse, life events have been implicated in contributing to poor substance use disorders treatment outcomes. However, inconsistencies in empirical findings regarding the life events-substance use disorders outcome literature have been previously observed. This review provides an updated critique of the literature since the previous review published in 1987 (O'Doherty & Davies, 1987), examining the relationship between life events and substance use disorders treatment outcome among clinical samples of individuals. Review of 18 peer-reviewed articles suggested that data on the life events-outcome relationship continue to be inconclusive. Inconsistencies across studies in the operationalization of life events and substance use treatment outcomes and lack of theoretically driven designs may be contributing to differences in findings. Recommendations for future research that will increase the clinical utility of the life events construct are provided. [end of pg. 470]

1. Introduction

Substance use disorders (SUDs) 1 have been characterized by multiple relapses and multiple treatment attempts (Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Litman, 1980). Theoretical models of substance use and relapse have attempted to describe the rocky course of SUDs by identifying potential determinants of poor treatment outcome (Connors, Maisto, & Donovan, 1996). The hypothesized relationships within these models have been studied empirically, with the goal of informing treatments that are based on a respective model. A negative effect of life events (LEs) 2 on SUDs treatment outcome is one relationship that has been hypothesized within multiple conceptualizations of substance use and relapse and has informed clinical practice (Brown et al., 1990; Brown, Vik, Patterson, & Grant, 1995; Connors, Maisto, & Donovan, 1996; Marlatt & Gordon, 1985; Witkiewitz & Marlatt, 2004). However, despite the apparent acceptance of the association between the occurrence of LEs following SUDs treatment initiation and poor treatment outcome for substance use, as evidenced by continued inclusion of LEs in conceptual models, such a relationship has not received consistent empirical support (e.g., Morrissey & Schuckit, 1978; O'Doherty & Davies, 1987). A review of the association between LEs and SUDs treatment outcome, conducted in 1987 by O'Doherty and Davies, highlighted the inconsistencies of research findings, identified theoretical and methodological limitations, and set forth recommendations for future research. The current review aims to provide an update regarding the status of this literature in order to progress the field and inform clinical practice.

In order to first provide context for the LEs-SUDs treatment outcome relationship, the review begins with a description of definitions of both SUDs treatment outcomes and LEs, followed by a consideration of the hypothesized role of LEs within existing conceptualizations of substance use and relapse. We then present O'Doherty and Davies's (1987) critiques of this literature to aid in the evaluation of the studies under review. Next, we present the findings on the relationship between LEs and SUDs treatment outcome that were published since the 1987 review. Conclusions and future directions are provided.

1.1 Defining SUDs treatment outcomes

Treatment for UDS focuses on the reduction of substance use and related consequences and the prevention of relapse, defined as a return to substance use following a period of abstinence. Relapse is a frequently predicted outcome, and although the conceptual definition tends to be consistent within the literature, operational definitions vary due to the number of elements within the construct (Miller, 1996). Specifically, operational definitions of relapse differ in terms of (a) the minimum length of abstinence prior to use, (b) the minimum level, i.e., quantity and duration of use, (c) the minimum level of substance-related negative consequences, and (d) the substance of interest

(Chung & Maisto, 2006; Miller, 1996). For example, relapse may refer to the consumption of a single alcoholic beverage or it may describe a pattern of heavy use that is similar to pretreatment use and occurs following a period of moderate use. Lapse has also been described in the literature and is generally defined as the initial use of a substance following a period of abstinence (Miller, 1996). In this regard, relapse would be the continued use of a substance following the initial use, or lapse (Marlatt & Gordon, 1985). Although the literature has differentiated between the constructs of relapse and lapse (Marlatt & Gordon, 1985), the operational definitions frequently overlap. For example, the most liberal definition of relapse (i.e., any use of any substance following any length of abstinence) in one study could be considered a lapse in another study. Thus, relapse may represent a variety of patterns of use, and the operationalization may have different implications for the evaluation of treatment outcome.

Despite the attention that relapse has received both clinically and theoretically (Moos, 2007; Witkiewitz & Marlatt, 2004), the SUDs treatment outcome literature has not restricted itself to predicting relapse, but has expanded to include investigating patterns of post treatment substance use. Thus, SUDs treatment outcomes have been described by both dichotomous (e.g., relapse) and continuous (e.g., frequency and quantity) variables that pertain to substance involvement and substance-related consequences. Continuous substance use variables typically describe the quantity, frequency, and severity of substance use during a specific time period (e.g., average drinks per drinking day three months post treatment), and/or relapse severity (e.g., number of consecutive days of substance use).

Traditionally, continuous treatment outcomes have been aggregated over a specific time period and are represented by a single data point. This method of defining treatment outcomes has limitations in that it may miss more nuanced changes in an individual's substance use behavior over time, thereby reducing the ability to identify predictors of change. Thus, researchers have also examined predictors of SUDs' clinical course, or the progression of substance use behavior (e.g., substance use, substance-related consequences, treatment involvement) over time. Likewise, while relapse has traditionally been considered a dichotomous variable, more recently, relapse has increasingly been considered a process in which changes in substance use behavior occur over time through nonlinear interactions among multiple variables (Witkiewitz & Marlatt, 2004). Moreover, recommendations have been made to include other domains of functioning related to SUDs, such as craving and quality of life, as indicators of treatment outcome (Tiffany, Friedman, Greenfield, Hasin, & Jackson, 2012). Describing SUDs treatment outcome through various operational definitions increases the heterogeneity of research findings and may affect the interpretation of findings and the evaluation of treatment outcomes

1.2 Defining life events

Within the context of health research, the construct of life events was originally defined by Holmes and Rahe (1967) as “occurrences that were likely to bring about readjustment-requiring changes in [end of pg. 471] people's usual activities.” Since Holmes and Rahe's (1967) inaugural study of the impact of LEs on health outcome, which suggested that LEs frequently precede the onset of illness, there has been a large body of research focusing on the relationship between the occurrence of LEs and psychological and physical health outcomes (Paykel, 2001). Within the psychological health outcome literature, the occurrence of LEs has been linked, though inconsistently, to onset of major depression (e.g., Brown & Harris, 1989), recurrence of major depressive episodes (e.g., Monroe, Kupfer, & Frank, 1992), substance abuse (e.g., Billings & Moos, 1983), and psychosis (cf., Phillips, Francey, Edwards, & McMurray, 2007).

The definition of LEs provided by Holmes and Rahe (1967), which refers to events that bring about life changes requiring readjustment, continues to be the dominant conceptual definition in the literature. However, similar to the operationalization of relapse, LEs encompass a broad range of operational definitions, which may contribute to inconsistent findings in the LEs-psychological outcomes literature. McQuaid, Monroe, Roberts, and Johnson (1992) described the scope of the definitions as those that include all life experiences and more nuanced definitions that describe LEs in terms of magnitude (e.g., major or minor events), dimensionality (e.g., desirable or undesirable events), or chronicity (e.g., acute or chronic).

The operational definition used in a study is often determined by the assessment method. For example, checklist inventories typically provide a broad operationalization of LEs, and include major and minor events, and positive and negative events. Narrative-rating methods, however, typically focus on major events that are negative, and distinguish between acute and chronic experiences (McQuaid et al., 1992).

Thus, within the literature, terms such as life stress (i.e., negative LEs or ongoing difficulties) and daily hassles fall under the broad conceptual definition of life events. This range and lack of consensus in operational definitions has implications for

1.3 Life events within conceptualizations of substance use and relapse

Multiple conceptualizations of substance use and relapse have been formulated and provide a framework for understanding the clinical course of SUDs. LEs are implicated as contributing to the variable course of SUDs in a subset of these conceptualizations. Those that have been discussed in this context include the cognitive-behavioral model of relapse (Marlatt & Gordon; Witkiewitz & Marlatt, 2004), the stress vulnerability model of substance use and relapse (Armeli, Carney, Tennen, Affleck, & O'Neil, 2000; Armeli, Dehart, Tennen, Todd, & Affleck, 2007; Brown et al., 1995; Cooper, Russell, & Frone, 1990; Cooper, Russell, Skinner, Frone, & Mudar, 1992; Ingram & Luxton, 2005), the self-medication hypothesis of substance use (Khantzian, 1985, 1997), stress buffering effects of alcohol hypothesis (Neff, 1985), and behavioral theories of choice (Rachlin, Green, Kagel, & Battalio, 1976; Vuchinich & Tucker, 1996). These conceptualizations fall within three general approaches to describing the LEs-SUDs treatment outcome relationship

The cognitive-behavioral model of relapse (Marlatt & Gordon, 1985; Witkiewitz & Marlatt, 2004) and the stress vulnerability model of substance use and relapse (e.g., Cooper et al., 1992) are models that view the occurrence of LEs as producing a state that increases the likelihood of relapse when specific moderating variables are present or absent. Specifically, in the cognitive-behavioral model, LEs produce an intrapersonal (e.g., negative or positive affect) or interpersonal (e.g., conflict with others) state, i.e., a high-risk relapse situation, that, given his/her use history, increases the likelihood of relapse for an individual who, for example, has poor coping strategies or low self-efficacy to remain abstinent. In this regard, coping and self-efficacy moderate the association between the high-risk situation (produced by a LE) and relapse. For example, an individual has a major argument with a loved one (LE), which produces negative affect (high-risk situation) within the individual, and the individual lacks effective coping strategies (moderator), so he/she drinks alcohol (outcome).

Both the cognitive-behavioral model and the stress vulnerability model assume that LEs produce a state that increases the risk of relapse in the context of moderating variables. However, they differ in that the cognitive-behavioral model allows for a broader operational definition of LEs (e.g., positive and negative) while the stress vulnerability model is constrained to negative LEs. In addition, for LEs to affect outcomes in the cognitive-behavioral model, the LE must first produce a high-risk relapse situation, which, by definition, is individually specific. Similarly, in the stress vulnerability model, the experience of stress must result from a LE. This suggests that the operational definition of LEs, combined with individual factors, will influence the degree of the LEs-SUDs treatment outcome relationship.

The self-medication hypothesis (Khantzian, 1985, 1997) and stress buffering effects of alcohol hypothesis (Neff, 1985) are hypotheses that conceptualize LEs as producing a negative state, which results in the consumption of substances to reduce the negative state. Thus, negative state mediates the relationship between LEs and patterns of substance use. These hypotheses are both constrained in that they only pertain to the occurrence of negative LEs.

Behavioral theories of choice (Rachlin et al., 1976) represent the third theoretical approach to describing the LEs-SUDs treatment outcome relationship. This theory states that individuals choose highly preferred or valued reinforcers (e.g., meaningful relationship). In addition, the environmental context of other reinforcers influences a given reinforcer's value. Thus, according to this theory, the likelihood of substance use is greatest in situations that lack substance-free sources of reinforcement. In this regard, LEs that reduce a reinforcer's value (e.g., the end of a meaningful relationship reduces value of relationship) predict an increase in the reinforcement value of a substance, and increase the likelihood of relapse.

These conceptualizations of substance use and relapse generally predict that LEs increase the likelihood of substance use. However, the mechanism by which this occurs differs across the models. The cognitive-behavioral model is the only model that conceptually allows the inclusion of both positive and negative events, as a high-risk relapse situation can precipitate from a positive event. For example, reuniting with a loved one (positive event) may result in wanting to celebrate (high-risk situation). The remaining models rely on a negative or stressful state in predicting use, thus are constrained to include only negative LEs. In addition, in all of the conceptualizations, LEs are not a core aspect, but rather potentially produce a core aspect of the model (e.g., high-risk situation or negative internal state), which could also occur in the absence of a LE. In this regard, these models have not been explicitly developed to provide a framework for testing the LEs-SUDs treatment outcome relationship. However, this relationship is delineated in the greatest detail for the cognitive-behavioral model, the stress-vulnerability model, and for behavioral theories of choice, suggesting that these conceptualizations seem to provide a better framework for how LEs might affect SUDs treatment outcomes compared to the other existing hypotheses. **[end of pg. 472]** Thus, providing a proper theoretical framework from which to view the effect of LEs on SUDs treatment outcomes is essential in that it will guide the operationalization of LEs and outcome, study design, and interpretation of findings.

1.4 The LEs-SUDs relationship

Given that individuals with SUDs experience a higher prevalence of LEs compared to non-SUD individuals (Dudley, Mules, Roszell, Glickfeld, & Hague, 1976; Tatossian, Charpy, Remy, Prinquey, & Poinso, 1983), and that LEs are included within conceptualizations of substance use and relapse, it is not surprising that the LEs–SUDs treatment outcome relationship has received substantial empirical attention. In 1987, O'Doherty and Davies conducted a review of the literature on the relationship between LEs and addiction and concluded that the data were inconclusive and the relationship not well understood. The authors' critiques were primarily methodological and included (a) problems with retrospective collection of data, (b) absence of control groups, (c) the use of a single research paradigm, (d) absence of theory and hypotheses guided by theory, and (e) conceptual weakness of the life event construct

Consistent with criticisms within the LEs literature, O'Doherty and Davies (1987) highlighted the need for prospective studies that minimize length of recall and reduce the likelihood of reporting events after the outcome of interest (e.g., relapse to substance use) has occurred. However, they also noted that, in cases where retrospective analyses cannot be avoided, methods of data collection need refinement. A major criticism was the lack of a theory clearly relating LEs to addiction. The authors noted that studies seemed to interpret any finding as confirmation of the hypothesis, because hypotheses tended to be non-directional and not based in theory. Consistent with this argument, O'Doherty and Davies discussed the lack of meaning in the conceptualization of life events. Specifically, they noted that an individual's "life course is not to be understood from merely adding up, counting, weighting and otherwise manipulating the individual events of which it is formed" (p. 135), and that LEs need to be considered within a deeper structure (i.e., context) of life course

1.5 The current review

The examination of determinants of poor SUDs treatment outcome continues to be a focus of empirical study. LEs have been implicated as a potential predictor of poor SUDs outcome, though this association has lacked reliable empirical support. There is a lack of consensus in the literature regarding the operationalization of both LEs and treatment outcomes for SUDs, which is likely also represented within the LEs–SUDs treatment outcome literature. This may have negative implications for understanding the relationship, specifically within conceptualizations of substance use and relapse that inform treatment of SUDs. A better understanding of how LEs function within the clinical course of SUDs could inform both theory and clinical practice. Thus, given the continued assumption that LEs negatively affect SUDs treatment outcome despite the lack of consistent empirical support, and given the concerns raised in the LEs–addiction literature

(O'Doherty & Davies, 1987), an update on the status of the LEs–SUDs treatment outcome relationship is needed.

Since the previous review, there have been advancements in methodology, measurement of LEs and SUDs treatment outcome, development of more powerful analytic techniques, and enhancement of theory. These changes may have contributed positively to the investigation of the LEs–SUDs treatment outcome relationship, or may have had little effect. In this regard, this review examines the extent to which studies published since the previous review improved upon methodology and seeks to clarify whether there is support for the association between LEs and SUDs treatment outcome. Strengths and limitations of the existing literature are described, particularly as they relate to the critiques provided by O'Doherty and Davies (1987), recommendations for future research are provided, and clinical implications are discussed.

2. Method

Literature for review was selected by searching the psycINFO and PubMed databases. All possible combinations of the following keywords were used in a Boolean search: "life events", "stress", "life stress" with "relapse", "alcohol", "substance", "drug", "substance relapse", "alcohol relapse", and "drug relapse." Articles were included in the review if they met the following inclusion criteria: published in a peer-reviewed journal from 1988 (i.e., the year after the year that the last review of this nature was published) to the present, written in English, participants were adolescent (ages 13–18 years) or older, the study included a priori defined predictors and outcome variables of interest, and participants were receiving treatment for an SUD. Given that the duration of treatment involvement and programs vary, and to accommodate studies that used a longitudinal design, studies met inclusion criteria if participants were connected with a treatment program at any point during their participation in the study, and data on treatment outcome could be collected. Because the purpose of this review was to understand whether the occurrence of LEs among individuals in SUDs treatment is related to treatment outcomes, articles were excluded if they compared treatment-seeking and non-treatment-seeking groups in terms of number of LEs and/or experience of life stress. Further, studies examining the role of LEs in the naturalistic course of SUDs among non-treatment-seeking individuals were also excluded, because non-treatment-seeking individuals represent a distinct subset of the SUDs

population. Based on review of an article's Abstract, a total of 105 unique articles were identified as potentially meeting the inclusion criteria. Articles with Abstracts that did not provide sufficient information to exclude them were also retained. Closer examination of the articles resulted in 18 articles that met all inclusion criteria.

2.1 Predictors

A measure of LEs was a required predictor for included articles. LEs could be assessed using an inventory checklist, narrative-rating method, or other approach. Other methods were included in order to assess the frequency of their use in the literature. Because of the variability in the operational definitions of LEs, as long as life events referred to a life occurrence, any definition was acceptable for inclusion in this review. Thus, articles that defined LEs as negative affect within the context of a relapse precipitant were excluded.

2.2 Outcomes

The outcome measure of interest was any measure of substance use following initiation of or discharge from SUDs treatment. Because operationalizations of SUDs treatment outcome are wide-ranging and vary within and across studies (Donovan, 1996; Rahill, Lopez, Vanderbiest, & Rice, 2009), any operationalization of lapse, relapse, and continuous outcome that reflected patterns of substance use, was an acceptable outcome measure. These criteria for outcome measures are broad in order to be as inclusive of the literature in this area as possible and to accommodate studies that use various definitions of outcome.

3. Results

3.1 Study characteristics

Table 1 summarizes characteristics of the 18 articles that met all inclusion criteria. Articles were published between the years of [end of pg. 473] 1988 and 2010, and nine of the articles were published prior to the year 2000. Four of the studies were conducted outside of the United States, and five of the studies were conducted with veterans of US military service. The sample size of the studies ranged from 26 to 400 participants, with a mean of 145 (SD=107.8). Seventeen of the 18 articles used an adult sample, and one study used an adolescent sample. With the exception of the study that used an adolescent sample, all of the studies had a predominately male sample, with four of the 17 adult-sample studies having an all-male sample and three studies having greater than 90% males. Alcohol was the primary substance of choice for participants in eight studies; other specific substances (e.g., opiates, cocaine) were the primary substance in three of the studies, two studies had multiple groups of substance users, and in five studies the primary substance was any substance. Sixteen of the studies used a longitudinal design, and two studies used a cross-sectional design. A total of 11 studies framed the hypotheses and/or findings within a conceptualization of substance use or relapse. The most common model cited as guiding the research was the cognitive-behavioral model of relapse (Marlatt & Gordon, 1985), which was discussed in six of the studies. Other conceptualizations were the stress vulnerability model of substance use and relapse (Cooper et al., 1992), the stress buffering effects of alcohol hypothesis (Neff, 1985), the self-medication hypothesis (Khantzian, 1985, 1997), and behavioral theories of choice (Rachlin et al., 1976). Studies varied in the degree to which the respective conceptualization informed the hypotheses, design, and interpretation of findings.

3.2 Relationship between LEs and SUDs treatment outcomes

The 18 studies varied in terms of measurement of LEs and outcomes, which are provided in general terms in Table 1. Five studies used a narrative-rating method for assessing LEs, nine studies used a standardized inventory checklist, and the remaining four studies assessed LEs using other methods. In regards to SUDs outcome variables, 14 studies predicted relapse or described differences between participants who relapsed and those who abstained; however, the definition of relapse varied across studies. Continuous measures of outcome (e.g., drinks per drinking day) were used in ten studies. Thus, multiple studies used both measures of relapse and continuous outcomes. Given the use of a wide range of specific measures of LEs, the results of the studies are divided into three main sections based on type of LEs assessment: (a) narrative-rating methods, (b) standardized checklist inventories, and (c) other LEs measures.

3.2.1 Narrative-rating methods

Table 2 provides information on the five studies that used a narrative-rating method to assess LEs (Brown et al., 1990; Canton, Giannini, Magni, & Bertinaria, 1988; Tate, Brown, Glasner, Unrod, & McQuaid, 2006; Tate, McQuaid, & Brown, 2005; Tate et al., 2008). Two narrative-rating methods were used across these studies, the Interview for Recent Life Events (IRLE; Paykel, 1983, 1997), and a combination of the Psychiatric Epidemiological

Research Interview—Modified (PERI-M; Hirschfield et al., 1977) and the Bedford College Life Events and Difficulties Schedule (LEDS; Brown, Bifulco, Harris, & Bridge, 1986). These instruments have demonstrated high reliability and validity across medical and psychiatric samples (Brown & Harris, 1978, 1989; Paykel, 1997)

The IRLE defines LEs as “dateable occurrences involving changes in the external social environment” (Paykel, 1997; p. 302). It consists of 64 events covering 10 categories: work, education, finance, health, bereavement, migration, courtship and cohabitation, legal, family and social relationships, and marital. Each event on the list is described in detail, minimizing intracategory variability. During a semi-structured interview, respondents identify relevant events from the list, and an interviewer probes for additional information.

Table 1
Characteristics of reviewed articles (N = 18).

Authors	Theory	N	Sample characteristics	Primary substance	Type of life events assessment	Type of outcome
Anderson et al. (2006)	Stress vulnerability	80	54% female; Adolescents	Any substance	Inventory checklist w/rating component	Continuous outcome
Bottlender and Soyka (2005)	None	102	60% male; Germany	Alcohol	Other method	Relapse
Brown et al. (1990)	None	111	All male; Veterans	Alcohol	Narrative-rating method	Relapse & continuous outcome
Canton et al. (1988)	Stress-buffering	43	77% male; Italy	Alcohol	Narrative-rating method	Relapse
Connors, Maisto, and Zywiak (1996)	Cognitive-behavioral model	142	54% male	Alcohol	Inventory checklist	Continuous outcome
Hall et al. (1990)	None	225	60% male	Alcohol (n=85) Opioids (n=72) Cigarettes (n=68)	Inventory checklist	Relapse
Hall et al. (1991)	None	104	73% male	Cocaine	Inventory checklist	Relapse
Mattoo et al. (2009)	Cognitive-behavioral model	60	All male	Alcohol (n=29) Opioids (n=31)	Inventory checklist	Relapse
Maisto et al. (2006)	Cognitive-behavioral model	400	55% male	Alcohol	Inventory checklist	Continuous outcome
McMahon (2001)	Stress vulnerability	302	All males	Cocaine	Inventory checklist	Relapse & continuous outcome
Miller et al. (1996)	Cognitive-behavioral model	122	69% male	Alcohol	Inventory checklist	Relapse
Noone et al. (1999)	None	61	69% male; Australia	Alcohol	Other method	Relapse & Continuous outcome
Nordfjærn et al. (2010)	None, maybe self-medication	352	70% male; Norway; included waitlist patients	Any substance	Other method	Continuous outcome
Tate et al. (2005)	None	195	90% male; Veterans	Any substance	Narrative-rating method	Relapse & Continuous outcome
Tate et al. (2006)	Cognitive-behavioral model	102	96% male; Veterans	Any substance	Narrative-rating method	Relapse & Continuous outcome
Tate et al. (2008)	Cognitive-behavioral model	113	95% male; Veterans; Co-morbid Axis I	Any substance	Narrative-rating method	Relapse
Vuchinich and Tucker (1996)	Behavioral theory of choice	26	Male; Veterans	Alcohol	Other method w/rating component	Relapse & Continuous outcome
Wasserman et al. (1998)	None	74	60% male; Methadone Maintenance Program	Opioids	Inventory checklist	Relapse

[end of pg. 474]

Table 2
Findings for studies using narrative-rating methods of assessing life events.

Authors	Design	Life events variable(s)	Outcome(s)	Analysis	Primary findings
Brown et al. (1990)	Longitudinal • Intake • 3-month FU	• # severe LEs (I, R) • # severe difficulties (I, R) • # total events & difficulties (I)	Relapse • Relapsers vs. Abstainers Continuous • Length of initial abstinence • Relapse severity	ANOVA Correlations	• Relapsers experienced more severe LEs (I) & severe difficulties (I) • Sum of severe events & difficulties (I & all) positively related to relapse severity • Relapsers experienced negative LEs most frequently
Canton et al. (1988)	Longitudinal • Intake 6-month FU	• # negative LEs (I)	Relapse • Relapsers vs. Moderate Drinkers vs. Abstainers	Chi-square	
Tate et al. (2005)	Longitudinal • Intake • 8 FUs over 12 months	Presence/absence: • Health events (I) • Health difficulties (I) • Severe non-health events (I) • Severe non-health difficulties (I)	Relapse • Lapse • Relapse Continuous • # days using after initial use • # drinks in 30 days after initial use	Logistic regression Linear Regression	• Presence of severe non-health difficulties increased odds of lapse • Presence of health events & severe non-health events individually decreased odds of lapse • Those with a health difficulty used for fewer days
Tate et al. (2006)	Longitudinal • Intake • 8 FUs over 12 months	Presence/absence: • Severe events (I) • Severe difficulties (I) Moderator: Length of abstinence	Relapse • Relapse Continuous • # days using after initial use • # drinks in 30 days after initial use	Logistic regression Multiple regression	• Presence of severe difficulties increased risk of relapse. • Those with a difficulty used for fewer days
Tate et al. (2008)	Longitudinal • Intake • 12-week FU • 24-week FU	• Trichotomized difficulties (I) • Dichotomized severe events (I) Moderator: Self-efficacy	Relapse • Time to first use	Cox's survival analysis	• High levels of difficulties & presence of severe events independently increased risk of relapse

Note. FU = Follow-up; I = Independent of substance use, R = Related to substance use; LEs = Life Events.

Next, the interviewer, or an independent rater, codes the month of the occurrence, independence, and objective negative impact for each endorsed event. Ratings of independence and objective negative impact were derived and modified from the LEDS system. An event is coded as independent if “it appears unlikely that the event was a consequence or potential consequence of psychiatric illness” (p. 303). Objective negative impact is rated according to the objective degree of negative impact, stress or threat that would be expected from the event. It is rated on a 5-point scale: severe, marked, moderate, mild, no negative impact.

Canton et al. (1988) used the Italian translation of the IRLE (Fava & Osti, 1981), which has demonstrated high reliability (Baratta, Colorio, & Zimmerman-Tansella, 1985). In Canton and colleagues' study, blind raters coded the independence of events, and only independent events were used in analyses. Although the authors make note of “life events with objective negative impact” in their discussion of the findings, the events' degree of severity of negative impact is not reported. The results indicated that experiencing more than one independent LE during the six months post treatment was dependent on drinking category, such that relapsers (n=11), defined as individuals who consumed more than 60 g of alcohol on all post treatment days, experienced events most frequently compared to moderate drinkers (n=10), and abstainers (n=22). The authors interpreted this finding as supporting stress-buffering effects of alcohol use.

Similar to the IRLE, the PERI-M provides a list of 133 LEs and chronic difficulties in 12 categories: health, personal, confrontation or disaster, school, family and household, love, death, childbirth, residence, crime or legal, and money or financial. However, the events and difficulties are not described in detail. Rather, additional objective information on each endorsed event is obtained through a semistructured interview. Following this, interviews are presented to trained raters according to objective, standardized guidelines provided in the LEDS manual (Bifulco et al., 1989). The manual contains detailed instructions and guidelines for rating the severity of an occurrence's impact, with hundreds of examples of rated events and difficulties across all categories (e.g., work). First, raters determine whether the occurrence should be categorized as an event or a difficulty. Events are defined as acute occurrences with a discrete onset (e.g., job loss), while difficulties are ongoing chronic stressors lasting at least four weeks (e.g., trouble finding a new job). Raters then assign a threat rating based on objective characteristics for each identified event and difficulty that reflects the likelihood of serious threat to the individual's personal or social wellbeing. Events are rated on a scale from 1 to 4, and difficulties are rated from 1 to 7, with lower ratings on each scale reflecting greater threat. Thus, events and difficulties can be categorized as severe, not severe, or not posing adequate threat to warrant rating. Events and difficulties are also rated as independent or dependent of psychiatric illness, such as substance dependence. The combined method of using the PERI-M in conjunction with the LEDS was used in four of the five studies discussed in this section (Brown et al., 1990; Tate et al., 2005, 2006, 2008).

Brown et al. (1990) examined how LEs' severity and relation to alcohol use affect the LEs–alcohol relapse association. Similar to Canton et al. (1988), they found that relapsers (n=35), defined as individuals who reported any alcohol or drug use during the follow-up period, had a greater number of severe LEs and severe difficulties compared to individuals who remained abstinent (n=76). In addition, relapsers experienced more alcohol independent severe stress (i.e., sum of events and difficulties) prior to initial substance use compared to what abstainers experienced during the 3-month period. The authors also examined LEs' association with length of initial abstinence and severity of relapse, defined as drinking days multiplied by the average number of drinks per drinking day. Correlations indicated that the sum of post treatment severe events and difficulties and the sum of post treatment independent severe events and difficulties were positively related to severity of relapse, but not length of abstinence.

Tate et al. (2005) examined the effect of presence of health-related events and difficulties on substance lapse and relapse 12 months post treatment. Lapse was defined as initial substance use of any amount, and relapse was defined as three or more consecutive days of drug use or heavy alcohol use (≥ 6 drinks for men, ≥ 4 drinks for women). Of the 123 participants who used, 31 experienced a relapse [end of pg. 475] in the initial use episode. Results indicated that having at least one severe non-health difficulty increased the odds of lapse; however, presence of health events and severe non-health events independently decreased the odds of lapse. Health difficulties did not predict lapse or relapse. In addition, there was no participant in the study who experienced a health event and relapsed, suggesting that health events may function as a protective factor. Additionally, among participants who used, those who experienced a health difficulty had fewer days of substance use following initial use. Severe non-health events and difficulties did not predict relapse, and health events and severe non-health events and difficulties were not related to continuous outcome variables

In a 2006 study, Tate and colleagues examined additive and interactive relationships among independent severe events, difficulties, and substance availability on substance relapse, defined as initial use of any substance, in order to identify whether these relationships are more consistent with behavioral theories of choice or the cognitive–behavioral model. The authors analyzed the same continuous outcome measures as in their 2005 study. Results,

which were comparable to those reported in the 2005 study, indicated that among individuals who resumed use during the follow-up period (n=70), those who experienced any independent difficulty used fewer days compared to individuals with no difficulties. They also found that substance dependent veterans who experienced at least one severe difficulty post treatment were five times more likely to relapse. The authors concluded that these results are consistent with the cognitive-behavioral model of relapse because the model distinguishes between processes of initiation and continuation of use while the behavioral theory of choice assumes one process. For instance, consistent with the cognitive-behavioral model, chronic stressors increased the likelihood of use (initiation process), but did not predict use severity (continuation process), suggesting that other mechanisms (e.g., negative internal attributes such as "I'm worthless") may be involved in continuation of use. Behavioral theories of choice, however, predict that the use of substances would continue following the initial use episode because the reinforcing value of a substance would be maintained in the context of the ongoing chronic stressor, which was not demonstrated in this study. Occurrence of events was not associated with resumption of substance use during the follow-up period. Also, presence of difficulties did not alter the events-relapse association, which did not support the hypothesis of an interaction between difficulties and events. In addition, although substance availability independently predicted relapse, it did not strengthen the relationship between difficulties or events and relapse. It is unclear from the article whether this nonsignificant finding was due to lack of adequate statistical power, or whether the occurrence of events and difficulties was not contiguous with substance availability, resulting in a lack of statistical support for the interactive relationship.

In a later investigation with depressed substance dependent veterans enrolled in a randomized clinical trial, Tate et al. (2008) used Cox's survival analysis to examine whether self-efficacy, LEs, and difficulties decreased time to initial substance use during the 24 weeks after treatment initiation. Severe and non-severe difficulties independent of substance use and unrelated to health were summed and trichotomized into no difficulties, low difficulty levels, and high difficulty levels. Independent severe events were coded as present or absent, and when present, were coded as affecting the participant for 30 days after the event start date. The results indicated that the risk of relapse more than doubled for individuals with high levels of difficulties compared to those with no difficulties. Presence of severe events nearly tripled the risk of relapse. In addition, inconsistent with the cognitive-behavioral model, the interaction between self-efficacy to abstain from substances and life stressors (i.e., events and difficulties) was not significant. As noted by the authors, the absence of a significant interaction may be due to low statistical power resulting from low variability in self-efficacy at later time points, because participants with low self-efficacy relapsed earlier, and, thus, were not analyzed across the 24-week study period.

3.2.2. Standardized inventory checklists

Table 3 provides information on the nine studies that used a standardized inventory checklist for assessing LEs (Anderson, Ramo, & Brown, 2006; Connors, Maisto, & Zywiak, 1996; Hall, Havassy & Wasserman, 1990, 1991; Maisto, Zywiak, & Connors, 2006; Mattoo, Chakrabarti, & Anjaiah, 2009; McMahon, 2001; Miller, Westerberg, Harris, & Tonigan, 1996; Wasserman, Weinstein, Havassy, & Hall, 1998). Five different inventories were used across these studies, and several studies used multiple inventories. Inventories included the Life Events Questionnaire, modified (LEQ; Billings & Moos, 1982; Hall et al., 1990), the Hassles Scale, abbreviated (Kanner, Coyne, Schaefer, & Lazarus, 1981), the Life Experiences Survey (LES; Sarason, Johnson, & Siegel, 1978), a modified version of the Inventory of Drinking Situations (IDS; Annis, 1982), and the Presumptive Stressful Life Events Scale (PSLES; Singh, Kaur, & Kaur, 1984). Note that the original versions of the inventory checklists described here have been shown to be valid and reliable (IDS: Annis, 1982; LEQ: Billings & Moos, 1982; Hassles Scale: Kanner et al., 1981; LES: Sarason et al., 1978; PSLES: Singh et al., 1984). However, with the exception of the adult LES and the PSLES, all of the measures have been modified from their original forms, and reliability and validity have not been systematically established.

The LEQ is a 23-item self-report measure that includes both negative and positive LEs. Events are scored dichotomously and summed for a total LEs score. In two studies discussed here (Hall et al., 1990, 1991), the LEQ was modified to a 16-item version to eliminate items redundant with the Hassles Scale, which was also used in those studies. Wasserman and colleagues used the Stressful Life Events Scale, which was also adapted from the LEQ, but included a total of 26 positive and negative events. The Hassles Scale assesses the occurrence and severity of everyday negative events. Respondents rate each item on a 5-point Likert-type scale, where 0 = did not occur and 5 = occurred and extremely severe. Items are summed for a total score. The two studies that used the Hassles Scale (Hall et al., 1990, 1991) used an abbreviated 65-item version

Hall and colleagues (Hall et al., 1990, 1991; Wasserman et al., 1998) investigated the LEs-relapse relationship prospectively and [end of pg. 476] retrospectively among adults with different primary addictions. Table 3 provides information on LEs and outcome variables. These three studies are similar in methodology used.

Hall et al. (1990) assessed LEs using the LEQ and the Hassles Scale among individuals in treatment for alcohol, opiate, or nicotine dependence. Cox's survival analysis was used to examine the relationship retrospectively (i.e., LEs and use assessed in the same week) and prospectively (i.e., LEs from the week prior to use). No significant findings were obtained for any outcome variable. In a subsequent study, Hall et al. (1991) assessed the same relationship among individuals in treatment for cocaine dependence. Findings indicated that both hassles and presence of LEs increased the likelihood of cocaine use, but only in retrospective analyses. Wasserman et al. (1998) employed similar methodology among a sample of opiate dependent individuals. Findings indicated nonsignificant results for the LEs-use relationship, both retrospectively and prospectively.

Miller et al. (1996) assessed LEs using the LES and a modified version of the IDS, and examined the effect on alcohol relapse within the framework of the cognitive-behavioral model of relapse (Marlatt & Gordon, 1985). The LES provides a list of 46 events and extra space for the respondent to add additional events. The respondent rates the perceived desirability/undesirability of the identified events on a Likert-type scale from -3 to 3, where -3 = extremely negative, 0 = neutral, and 3 = extremely positive. The number of negatively rated and positively rated events can be summed to reflect total negative and positive events, respectively, or the actual ratings can be summed to reflect the degree of LE desirability/undesirability. The IDS, a 50-item self-report measure originally designed to assess antecedents of actual alcohol use, was modified to assess the occurrence of events. Specifically, the wording of items was adjusted from "I drank when I had an argument with a friend" to "I had an argument with a friend." The article was unclear regarding scoring of items. In the study by Miller et al. (1996), LEs were one of five predictor domains and consisted of total negative LEs from the LES and eight subscale scores from the modified IDS. Relapse was defined as any heavy drinking day (based on standard ethanol content consumed, gender, and weight) following at least four days of abstinence. Results indicated that the LEs domain was not a significant predictor of subsequent relapse.

Connors, Maisto, and Zywiak (1996) and Maisto et al. (2006) used a subset of the same dataset used by Miller et al. (1996) to examine the direct effects of a latent indicator of stressors on post-treatment functioning variables within multiple structural equation models using the framework of the cognitive-behavioral model of relapse. Connors, Maisto, and Zywiak (1996) constructed a latent stressors variable comprised of frequency and intensity of hassles derived from the Hassles Scale. Stressors in the first six months of treatment did not predict percent days abstinent, drinks per drinking day, and drinking consequences in the subsequent six months. Maisto et al.

Table 3
Findings for studies using standardized inventory checklists for assessing life events.

Authors	Design	Life events variable(s)	Outcome(s)	Analysis	Primary findings
Anderson et al. (2006)	Longitudinal • Intake • 3-month FU • 6-month FU	• # negative LEs Moderator: Coping	Continuous • # substances used in last 90 days (recoded use/no use) • # days using/month	Logistic regression Linear regression	No significant findings
Connors, Maisto, and Zywiak (1996)	Longitudinal • Intake • 6-month FU • 12-month FU	• Latent variable: # hassles & average intensity of hassles	Continuous • Percent days abstinent • Drinks per drinking day • Drinking consequences	Structural equation modeling	No significant findings
Hall et al. (1990)	Longitudinal • Weekly FUs over 12 weeks	• # total LEs • Total Hassles score	Relapse • Time to first use • Time to relapse • Time between first use & relapse (categorical)	Cox's survival analysis Logistic regression	Prospectively: No significant findings Retrospectively: No significant findings
Hall et al. (1991)	Longitudinal • Weekly FUs over 12 weeks • 6-month FU	• Presence/absence of LEs • Total hassles score	Relapse • # weeks until first cocaine use • Use vs. no use	Cox's proportional hazards regression	Prospectively: No significant findings Retrospectively: • Presence of LEs & hassles independently increased likelihood of use
Maisto et al. (2006)	Longitudinal • Intake • 6-month FU • 12-month FU	• Latent variable: # negative LEs & average rating of negative LEs	Continuous • Percent days abstinent • Drinks per drinking day • Monthly volume	Structural equation modeling	• Higher stress levels predicted more drinks per drinking day & greater monthly volume
Mattoo et al. (2009)	Cross-sectional	• # desirable events • # undesirable events • Total events • Total stress score • Lifetime stress score • Sum of negative LEs ratings	Relapse • Relapser vs. abstainer	t-tests	• Relapsers had more undesirable events
McMahon (2001)	Longitudinal • Quarterly FUs over 12 months	• Composite variable: Dependent & detached personality, social support • # negative LEs & # events on IDS	Relapse • Group membership Continuous • ASI drug composite score	Logistic regression Linear regression	• Higher negative LEs scores increased the likelihood of belonging to the relapse group • Higher negative LEs scores related to higher ASI scores No significant findings
Miller et al. (1996)	Longitudinal • 6 FUs over 12 months	• Composite variable: • # negative LEs & # events on IDS	Relapse • Slip/relapse vs. other	Discriminant function analysis	No significant findings
Wasserman et al. (1998)	Longitudinal • Biweekly over 8 weeks • 6-month FU	• # negative LEs	Relapse • Use vs. no use	Cox's proportional hazards regression	Prospectively: No significant findings Retrospectively: No significant findings

Note. ASI = Addiction Severity Index; FU = Follow-up; IDS = Inventory of Drinking Situations; LEs = Life Events.

[end of pg. 477]

(2006) replicated the Connors, Maisto, and Zywiak (1996) study and replaced the stressors indicator with a latent variable comprised of frequency and valence of negative LEs as assessed by the LES. In this study, stressors in the first six months of treatment were positively related to monthly volume of alcohol use and drinks per drinking day in the subsequent six months. It may be that negative LEs are more likely than daily hassles to influence alcohol use behavior, which may in part explain the discrepancy in findings between these two studies (Maisto et al., 2006).

McMahon (2001) examined the interactive effects of personality, social support, and LEs on cocaine treatment outcome from a stress vulnerability perspective. Relapsers (n=172; 112 lost) were defined as participants who reported cocaine use on at least seven days in the previous 90 days and participants who were lost to follow-up. Nonrelapsers (n=123) averaged less than one day of use during the follow-up periods. Individuals who used three to six days were excluded from analyses predicting relapse (n=7). Results suggest that higher negative LEs scores increased the likelihood of belonging to the relapse group in the subsequent 3-month period. Interactions between detached and dependent personality, perceived social support quality and social network size, and LEs were not significant predictors of use category, and, thus, did not provide support for the stress-vulnerability model. Failure to support the stress vulnerability model may be due to a lack of internal consistency of use groups. Specifically, lost participants (n=112) were included in the relapse category and represented 65% of that group. Prospective analyses indicated that higher negative LEs scores were significantly positively related to the Addiction Severity Index (ASI; National Institute on Drug Abuse, 1985) drug composite score obtained during the three months following assessment of LEs.

A modified version of the LES, the Adolescent Life Events Survey, which includes adolescent-specific events adapted from the Coddington Life Stress Scale (Coddington, 1972), was used by Anderson et al. (2006). In an adolescent sample, the authors examined the stress-vulnerability model of relapse by testing the interaction between coping, number of negative LEs, and (a) the number of days using substances per month and (b) number of substances used in the last 90 days. Given low base rates, the latter outcome was dichotomized to reflect use versus no use. Raters coded whether endorsed LEs were negative, neutral, or positive, and only negative LEs were used in the analyses. No significant relationships between LEs and outcome were obtained, thus the moderating effect of coping with offers to drink and coping with interpersonal distress on the LEs-outcome relationship could not be tested.

The PSLES, an Indian adaptation of the Social Readjustment Rating Scale (Holmes & Rahe, 1967), provides a checklist of 52 desirable and undesirable events. Using the PSLES, Mattoo et al. (2009) demonstrated that among patients in India, those who relapsed (n=30), defined as meeting ICD-10 diagnostic criteria for their primary substance (alcohol or opioids) for at least one month, had significantly more undesirable LEs compared to abstinent patients (n=30). Although Mattoo and colleagues framed the purpose of their investigation within the cognitive-behavioral model of relapse, methodology and analyses were not consistent with the framework, but rather demonstrated differences between relapsers and abstainers on measures of relapse precipitants, coping, self-efficacy, social support, and LEs using a cross-sectional design.

3.2.3. Other life events measures

Table 4 provides information on the four studies selected for this review (Bottlender & Soyka, 2005; Noone, Dua, & Markham, 1999; Nordfjærn, Hole, & Rundmo, 2010; Vuchinich & Tucker, 1996) that assessed LEs using a measure that has not been validated, is not derived from a validated measure, or whose psychometric properties are unclear given the description provided in the article.

Vuchinich and Tucker (1996) assessed LEs through daily self-monitoring logs that instructed participants to “record any events or occurrences that have an impact on your thoughts or feelings, or that change your usual day-to-day activities” (p. 22). Examples of events were provided. Independent raters then coded events as negative or positive, and assigned each event to one of six health-life areas (e.g., family relations). Consistent with behavioral theories of choice, Vuchinich and Tucker (1996) hypothesized that for participants who reported greater pretreatment alcohol-related disruption in any of six life-health areas (family relations, intimate relations, social relations, vocational functioning, financial status, and physical health), post-treatment disruption in the respective life-health area would increase the likelihood of any alcohol consumption within three days of the event. They tested this prospectively in a sample of 26 alcohol dependent men during six months post-treatment using daily self-monitoring logs that were returned weekly. Results from correlated group t-tests suggested that given pretreatment disruption in life-health areas of intimate relations, family relations, and vocational functioning, the more likely post-treatment negative events in intimate relations and total events in family relations and vocational functioning were followed by drinking. However, the inverse relationship was found for positive and negative events in physical

health and financial status areas, respectively. The authors explain the inverse findings as being artifacts of small sample size within those analyses and potential outliers. Results also indicated that event-related drinking episodes (i.e., drinking episodes that occurred within three days after an event) were more severe compared to event-unrelated episodes in terms of duration, total drinks consumed, and drinks per drinking day.

Noone et al. (1999) assessed stress by asking participants to report their hassles in relation to health, work, financial, family, environment, and social areas for the last month and since treatment discharge. Results indicated that neither number of hassles in the past month nor during the follow-up period predicted alcohol relapse. Additionally, number of hassles reported in the past month was positively related to the daily average number of drinks consumed in the past month and the number of heavy drinking days (≥ 6 drinks) in the past month.

Bottlender and Soyka (2005) reported that they assessed the number of positive and negative LEs using the guidelines provided by the German Society for Addiction Research and Therapy. No additional information was provided. Findings indicated that alcohol dependent patients who relapsed ($n=58$), defined as consuming any alcohol during a three year follow-up period, experienced significantly fewer positive LEs compared to patients who abstained ($n=44$).

Nordfjærn et al. (2010) asked participants to list a maximum of five positive and five negative LEs that “strongly influenced their life situation in the past year” (p. 1166). Examples of LEs were provided. Positive and negative LEs were scored separately and were assigned scores that could range from zero to five. The authors used structural equation modeling to predict a latent substance use variable derived [end of pg. 478]

Table 4
Findings for studies using other methods of assessing life events.

Authors	Design	Life events variable(s)	Outcome(s)	Analysis	Primary findings
Bottlender and Soyka (2005)	Longitudinal • 5 FUs over 36 months	• # negative LEs • # positive LEs	Relapse • Any use vs. no use	t-test Logistic regression	• Relapsers had fewer positive LEs
Noone et al. (1999)	Longitudinal • Intake • Average 20-month FU	• # hassles past month & during FU period	Relapse • Any use Continuous • Average drinks/day past month • # days ≥ 6 drinks consumed past month	Multiple regression	• More hassles (past month) related to more drinks/day and more days drinking
Nordfjærn et al. (2010)	Cross-sectional	• # negative LEs • # positive LEs Moderator: Gender	Latent substance use variable: DAST-20, AUDIT scores for past month	Structural equation modeling	• Among men, negative LEs positively related to use
Vuchinich and Tucker (1996)	Longitudinal • Daily for 6 months	In specific life-health areas: • # negative LEs • # positive LEs • # total events	Relapse • Any drinking episode Continuous • # days drinking • # drinks consumed • Drinks/drinking day	Correlated group t-tests	Given pretreatment disruption in respective life-health area: • # negative Intimate Relations events, total Family Relations & Vocational events = greater likelihood of drinking • # positive Physical Health events & # negative Financial Status events = lower likelihood of drinking • Event-related drinking episodes more severe than event-unrelated episodes

Note. AUDIT = Alcohol Use Disorders Identification Test; DAST-20 = Drug Abuse Screening Test; FU = Follow-up; LEs = Life Events.

from Drug Abuse Screening Test-20 (DAST-20; Skinner, 1982) and Alcohol Use Disorder Identification Test (AUDIT; Saunders, Aasland, Babor, & de la Fuente, 1993) scores obtained for the past month. There was a positive direct relationship between negative LEs and the latent substance use variable. When this model was examined separately for men and women, the negative LEs–substance use relationship was significant only among men. Men and women did not differ on number of reported events. It should be noted, however, that endorsed LEs included substance lapse, relapse, and use. Additionally, this study used a cross-sectional design, in which participants were patients at multiple levels of care (i.e., new patients and patients who completed treatment), including individuals ($n=63$) who were on the waitlist for treatment. This resulted in less ability to draw conclusions regarding the relationship between LEs and SUDs treatment outcome. Thus, the results from this study should be considered within the context of these methodological concerns.

3.2.3.1. Summary. Results from these studies suggest that more negative, and fewer positive LEs are related to poorer SUDs treatment outcome. However, the results should be interpreted with caution given that the methods of assessing LEs have not been validated and in two studies were unclear. With the exception of Vuchinich

and Tucker (1996), who framed their study within a clear theoretical heuristic, no other studies reported in this section attempted to use a theoretical framework.

4. Discussion

4.1. Overall findings

Consistent with the literature on the relationship between LEs and other psychological outcomes (Kessler, 1997; McQuaid, Monroe, Roberts, Kupfer, & Frank, 2000), the studies reviewed here reflect inconsistent findings regarding the LEs–SUDs treatment outcome relationship. Of the 18 studies included in the review, 12 reported an inverse relationship between value of the LEs measure and SUDs treatment outcome, such that greater life event value predicted worse treatment outcome. Three studies reported a direct relationship, i.e., lower life event value predicted worse treatment outcome. Additionally, nine studies reported a nonsignificant relationship between a measure of LEs and treatment outcome. The most straightforward explanation for the variability in results within and across studies points to the variation in operational definitions of LEs and SUDs treatment outcomes.

As has been noted, studies varied in how LEs were defined and assessed. Given the nature of narrative-rating methods, the five studies that used this technique were able to ascertain nuanced information about life occurrences and provided a more detailed operational definition of LEs, including distinctions in magnitude, severity, chronicity, and independence of substance-related influence. Thus, the questions examined in these studies tended to be more specific compared to studies that used other assessments of LEs. This is especially true of the studies that used the PERI-LEDS method, which were conducted within the same general lab group (Brown et al., 1990; Tate et al., 2005, 2006, 2008). It is difficult to compare the findings from these studies with findings reported in studies using other LEs assessments, because the operational definition of LEs differs. With the exception of Hall et al. (1990), who used presence/absence of events, the studies that used a checklist inventory or other method of assessing LEs calculated the sum of negative, positive, and total events, and did not systematically assess other aspects of the LEs. In addition, checklist inventories and other methods that have not been empirically validated were used in the majority of studies. Interestingly, just over 50% of the studies that used a standardized inventory checklist did not find a significant relationship between LEs and SUDs treatment outcome. The lack of specificity of LEs inherent in inventory checklists may be contributing to null findings (McQuaid et al., 1992).

Studies also varied in the operationalization of SUDs treatment outcome. Outcomes were dichotomous variables, categorizations based on continuous measures, and continuous outcomes of substance use. Within each of these categories, the actual outcome variables differed. For example, Canton et al. (1988) reported that relapsers experienced a greater number of LEs, when in fact the definition of relapsers fit more closely with continuous heavy drinkers. This becomes a problem when the findings from this study [end of pg. 479] are compared to results from other studies that categorized relapsers as individuals who resumed substance use to an a priori defined level after a period of abstinence. Conceptually, these two relapse groups are different and may be related to LEs in different ways. The definition of relapse also varied across studies; this is the case in literature on SUDs treatment outcomes in general (Rahill et al., 2009) and makes the findings from different studies difficult to compare.

Therefore, despite the passage of 25 years since publication of the previous review, recent research provides no conclusive evidence to support a direct association between the occurrence of LEs and increased likelihood of poor treatment outcomes. However, specific studies stand out in terms of strengths and limitations, and an examination of these may elucidate the LEs–SUDs treatment outcome relationship.

4.2. Strengths and limitations

4.2.1. Conceptualization of life events

A major criticism from O'Doherty and Davies (1987) review of this literature was the lack of meaning of the LEs construct, because operational definitions of LEs tended to be broad (e.g., sum of all events) and removed from the context of an individual's life course. The lack of conceptual meaning of life events is still problematic due to the continued use of inventory checklist assessment approaches. However, through the use of narrative-rating methods, the conceptualization of LEs within the SUDs treatment outcome literature has improved, thereby increasing the extent to which the operational definition of LEs is meaningful within an individual's life. The use of narrative-rating methods has also allowed the LEs construct to be described in greater detail, further increasing its relevance in an individual's life. Specifically, aspects of LEs such as severity, chronicity, and quality have been shown to have different effects on substance use treatment outcome even within the same study (Tate et al., 2005, 2006, 2008). This methodology in assessing LEs has been shown to improve reliability and validity (Dohrenwend, 2006). However, only five of the 18 studies reviewed here used the narrative-rating method

Additionally, despite the evidence that negative LEs, as opposed to positive LEs, seem to be related to negative health and psychological outcomes (Grant, Sweetwood, Yager, & Gerst, 1981), studies continue to incorporate positive LEs. In fact, the results from two studies suggested that positive LEs were related to better SUDs treatment outcome (Bottlender & Soyka, 2005; Vuchinich & Tucker, 1996), suggesting that positive events may represent a different construct. This also highlights the point that operational definitions of LEs need to be consistent with the conceptual definition and LEs' role within a greater theoretical framework. The cognitive-behavioral model of relapse, for example, predicts that, for certain individuals and under certain conditions, positive events would predict greater likelihood of substance use.

4.2.2. Use of theory

Another major criticism in the 1987 review was the lack of a clear, testable theory relating LEs to addiction outcome. Since the publication of the review, theories of substance use and relapse have evolved and include LEs within their frameworks. Although an explicit theory of LEs and addiction has not been presented, several theoretical models allow for the explicit investigation of the LEs-addiction relationship. A total of 11 studies mentioned theory, though the extent to which theory influenced the hypotheses and methodology varied. Six studies were the most explicit in framing the hypotheses within a theoretical framework and using appropriate analytic techniques. Three studies (Connors, Maisto, & Zywiak, 1996; Maisto et al., 2006; Miller et al., 1996) investigated the influence of LEs within the framework of cognitive-behavioral model, Vuchinich and Tucker (1996) tested behavioral theories of choice, and Anderson et al. (2006) and McMahan (2001) tested the stress vulnerability model. Only Maisto et al. (2006) and Vuchinich and Tucker (1996) found partial support for their hypotheses. Failure to find consistent support for the LEs-SUDs treatment outcome relationship within the cognitive-behavior model and the stress vulnerability model may be due to lack of specificity in how the models were tested. Specifically, no study explicitly examined whether LEs produced the state (e.g., high-risk situation or high stress) hypothesized to be associated with relapse within the models.

Tate et al. (2006, 2008) also framed their hypotheses within the cognitive-behavioral model of relapse, though it was less explicit, particularly in terms of study design and data analysis. This was also the case for Canton et al. (1988) and Nordfjærn et al. (2010), who only mentioned theory very briefly and used methods and analyses that did not appropriately address the theory. The remaining seven studies made no mention of theory.

Eight of the 11 studies that mentioned theory framed their aims within the cognitive-behavioral model or the stress-vulnerability model. Recall that both of these models describe the occurrence of LEs as engendering a state that increases the likelihood of relapse in the presence or absence of specific moderating variables. However, only four (Anderson et al., 2006; McMahan, 2001; Tate et al., 2006, 2008) of the eight studies tested an interaction effect, and no study found support for the hypothesized moderating relationship. Nonsignificant findings may be due to absence of support for the LE-outcome relationship (Anderson et al., 2006), poor operationalization of outcome (McMahan, 2001), lack of adequate statistical power (Tate et al., 2006, 2008), and lack of contiguity between the predictor and moderator (Tate et al., 2006). Thus, these studies' limitations may have reduced the likelihood of finding support for the theoretical models of interest. Although there has been an increase in framing hypotheses within a theoretical perspective, the use of theory and appropriate methodology to test the theory continue to be lacking.

4.2.3. Retrospective versus prospective analyses

In their 1987 review of this literature, O'Doherty and Davies criticized the overuse of retrospective and cross-sectional designs and recommended more prospective studies that would reduce problems with event recall and post hoc attribution of LEs to substance use. With the exception of two studies that used a cross-sectional design (Mattoo et al., 2009; Nordfjærn et al., 2010), the studies in the review sample used a longitudinal design, in which LEs and outcomes were assessed at multiple time points. However, the length of time between follow-ups varied greatly (one day to 20 months), and analyses were not consistently prospective, meaning that there was temporal overlap between the LEs that were used (predictor) and substance use (outcome) (Noone et al., 1999). In a series of studies, Hall and colleagues (Hall et al., 1990, 1991; Wasserman et al., 1998) analyzed their data both prospectively and retrospectively and consistently found nonsignificant relationships between LEs and outcomes prospectively. Overall, there has been a clear increase in the use of prospective designs and analyses since 1987, and it is recommended that future studies continue to use this methodology.

4.2.4. Use of control groups

Another criticism in the 1987 review was that of a lack of control groups within this literature. This is especially important when using LEs to predict subsequent substance use with standard regression analyses, because analyses

cannot theoretically include LEs that occurred after the substance use. This creates a bias, because individuals who abstained throughout the designated follow-up period would have more time to experience LEs compared to individuals who relapsed during the follow-up period. Tate et al. (2005, 2006) attempted to reduce this bias by including a ‘control group’ of abstainers who reported a ‘near miss’ episode (McKay, Alterman, Mulvaney, & Koppenhaver, 1999). Near miss episodes are episodes [end pg. 480] in which individuals were exposed to a high-risk relapse situation but did not use. Thus, Tate and colleagues were able to match relapsed individuals with near miss individuals and eliminate the bias for greater likelihood of exposure to LEs for the abstaining group. With the use of longitudinal approaches to data analysis, the ‘control group’ could be re-conceptualized as groups of individuals representing various substance use trajectories defined by growth curves. For instance, prior research has demonstrated that the post treatment clinical course of alcohol use disorders is heterogeneous across individuals and tends to be represented by at least three distinct groups: infrequent moderate drinkers, frequent heavy drinkers, and drinkers who drink heavily and reduce their drinking frequency overtime (Witkiewitz & Masyn, 2008). The use of these comparison groups has the potential for increasing our understanding of how LEs are differentially related to various clinical courses and may have substantial clinical utility.

4.3. Future directions

Despite the research that has been conducted investigating the relationship between LEs and SUDs treatment outcome, the nature of the relationship continues to be unclear. The inconsistencies in this literature need to be addressed through more systematic research. At a basic level, future research in this area would benefit from expanding the studies to include more women and adolescents, because these populations seem to be underrepresented in this literature. Also, in line with the findings that health-related stressors may be protective against relapse (Tate et al., 2005), examining individual domains of LEs (e.g., relationships) may provide greater insight into how LEs affect outcomes. In addition, the use of a single standardized approach to assessing LEs would advance the field. Recommendations have been made in the LEs literature to move away from checklist inventories and toward the use of narrative-rating methods (McQuaid et al., 1992); however, checklist inventories continue to be used and narrative-rating methods are time and labor intensive. In this regard, it is suggested that a thoughtful consideration be made regarding the investigation of LEs, such that the adopted operational definition fits within a specified theoretical framework. Likewise, because treatment outcome variables may reflect unique information regarding post treatment functioning (e.g., frequency and severity of use), it is suggested that future studies incorporate multiple indicators of outcome and examine the effects of LEs on each outcome separately within the same sample, thereby facilitating direct comparison among bivariate associations.

Given that less than half of the studies under review did not purposefully approach the research question from a theoretical perspective, a push towards greater theory testing is recommended. Research in this field is currently in a piecemeal state, meaning that researchers continue to investigate the relationship between LEs and SUDs treatment outcomes with the apparent assumption that this association has been consistently empirically supported, despite clear inconsistencies across studies. In addition, it seems as though LEs tend to be included as a post-hoc predictor, without much conceptual consideration in how this construct should be defined and measured, and not in the context of other conceptually-relevant predictors. This may be due, in part, to the absence of a clear theory specifically relating LEs to SUDs treatment outcome. The first step toward developing such a theory could be through more explicit tests of the LEs–SUDs treatment outcome relationship within existing conceptualizations.

The cognitive–behavioral model of relapse (Marlatt & Gordon, 1985; Witkiewitz & Marlatt, 2004), the prominent relapse model studied today, has most consistently informed treatment for SUDs (Donovan & Witkiewitz, 2012). Thus, this model could provide a starting point for the process of systematically testing the LEs–SUDs treatment outcome relationship. As mentioned previously, this model predicts that LEs produce high-risk relapse situations that, by definition, increase an individual's likelihood of relapse. In this regard, an initial question could be “Does the occurrence of LEs predict specific high-risk relapse situations at the individual and aggregate levels?” This could be examined longitudinally in order to determine how this relationship functions within and across individuals. The original question could then be expanded upon to test how and when LEs predict high-risk situations by testing specific mediators and moderators, respectively. A potential mediator of the relationship between LEs and high-risk relapse situations may be the subjective experience evoked by the LE. Along these lines, it would be interesting to test whether LEs that are rated as severe using objective information evoke a subjective response in the individual that is consistent with the severe, objective rating. For instance, does a severe LE rating, as determined by the LEs objective rating system, correlate with an individual's subjective experience of the event? Moderators may include various aspects of a LE (e.g., type, prior exposure to event) and time between the event and high-risk situation. Next, this relationship could be examined within the greater framework of the model,

through the investigation of moderators of the high-risk situation-relapse relationship, such as self-efficacy, coping, and social support.

Further, given that individuals are dynamic beings who interact with their environment in ways that do not typically follow a linear trajectory, application of more sophisticated analytic techniques to the study of LEs and SUDs treatment outcomes may provide a more accurate picture of this association and place LEs in more meaningful context within an individual's life course (O'Doherty & Davies, 1987). This is especially relevant given the updated cognitive-behavioral model of relapse, referred to as the dynamic model, which describes substance use behavior as a nonlinear, dynamic process (Witkiewitz & Marlatt, 2004). The dynamic model proposes that determinants of substance use occur at different degrees of proximity to substance use. In this regard, the dynamic model views high-risk situations within the context of fairly stable, slow-changing processes (e.g., family history) and transient proximal risks (e.g., negative affect) that influence and interact with each other to predict changes in substance use behavior. The model proposes that proximal risks and substance use behavior are reciprocally related. For instance, increases in negative affect predict an increase in alcohol consumption, and alcohol consumption increases negative affect (Witkiewitz & Villarroel, 2009). Moreover, the dynamic model describes predictors of substance use behavior, as opposed to relapse, which has implications for SUDs treatment outcome research. The shift in terminology was due, in part, to the high variability in the operational definitions of relapse that have been used clinically and empirically (Donovan, 1996; Miller, 1996). By expanding the definition to substance use behavior (i.e., quantity and frequency), the model provides a more flexible framework that accommodates the variability in individuals' clinical course (Witkiewitz & Masyn, 2008).

Following the framework of the dynamic model, future research on the relationship between LEs and SUDs treatment outcome should use longitudinal designs that are suited to examine reciprocal associations across time. One suggestion is through the use of associative latent transition analysis (ALTA; Flaherty, 2008), which allows for the testing of the reciprocal relationship between two dynamic processes and has been successfully applied to testing the association between negative affect and alcohol lapses within the context of the dynamic model (Witkiewitz & Villarroel, 2009). In this regard, the occurrence of LEs may be associated with a change in substance use, and the change in substance use may influence the occurrence of subsequent LEs, increasing the use of substances, and so forth; ALTA can model this dynamic association. The use of this and other advanced statistical models, however, would require a reconsideration of the utility in differentiating between substance-related and unrelated events, further affecting the debate about how the LEs construct is operationalized. These next-steps in the investigation of **[end of pg. 481]** the LEs–SUDs treatment outcome relationship will advance theory and contribute to improvements in SUDs treatment.

4.4. Clinical implications

The current state of the LEs–SUDs treatment outcome literature provides little support for the clinical importance of LEs in the course of SUDs, and thus, has not provided clinicians with a clear understanding of the conditions under which LEs pose increased risk for substance use relapse. As previously stated, the majority of studies have tested a direct, linear association between LEs and treatment outcome, which may not reflect the real-life dynamic process between these constructs. Given that the theorized association between LEs and outcome is indirect in all of the conceptualizations of substance use and relapse, testing the direct relationship does not provide theoretically or clinically useful information. It may be that understanding the mediating and moderating variables of this relationship has greater clinical utility. For example, the importance of knowing that the experience of a LE might result in relapse may be secondary to knowing which and how the LE affects a client emotionally and in which contexts (e.g., without social support), which in turn, might result in relapse.

Advancements in the study of this relationship may provide clinically useful information, such as which clients are most susceptible to reacting to LEs, individual differences in the reactions among clients, and how these reactions may be related to SUDs treatment outcomes. This information could then be used towards refining, developing, and implementing treatments for SUDs. For instance, mindfulness-based relapse prevention (MBRP; Bowen, Chawla, & Marlatt, 2011; Witkiewitz, Marlatt, & Walker, 2005) has been shown to be effective in reducing substance craving and use (Bowen et al., 2009). MBRP uses mindfulness meditation to increase awareness and acceptance of emotional and physical distress by teaching the individual to observe, rather than react to, emotional, physical, and cognitive states. Thus, clinical interventions, such as MBRP, that focus on changing reactions to experiences may be especially relevant for individuals who experience and are affected by LEs. Likewise, understanding the mechanisms by which interventions like MBRP reduce substance use may elucidate the relationship between LEs and SUDs treatment outcomes.

4.5. Conclusions

It seems obvious that the experience of a LE that requires major readjustment for an individual would contribute to a behavior change, such as the return to substance use. However, the data on this relationship continue to be inconclusive, which may be due to the variability in operational definitions of LEs and outcomes, absence of theory, and other methodological differences across studies. Since the 1987 review of this literature, there have been improvements in terms of increased use of narrative-rating methods of assessing LEs, more prospective designs, improved analytic techniques, and greater use of theory. Despite these developments, the research on LEs and SUDs treatment outcomes would benefit from continued improvements in these areas. In addition, examination of different aspects of LEs, and systematic testing of the dynamics of LEs within an explicit theoretical model would advance the field. Through these advancements, theories can be further developed and refined, resulting in the improvement of treatment for SUDs.

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