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\*Corresponding author: Janice Y. Tsoh, Psychiatry, University of California San Francisco School of Medicine, San Francisco 401 Parnassus Ave, San Francisco, CA 94143, USA  
E-mail: [janice.tsoh@ucsf.edu](mailto:janice.tsoh@ucsf.edu)

Reviewing editor:  
Graziano Pinna, University of Illinois at Chicago, USA

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## PSYCHIATRY | SHORT COMMUNICATION

# An emotion regulation-focused theoretical framework for co-occurring nicotine addiction and PTSD: Comments on existing treatments and future directions

Chia-Ying Chou<sup>1</sup>, Ellen Herbst<sup>1,2</sup>, Marylene Cloitre<sup>3</sup> and Janice Y. Tsoh<sup>1\*</sup>

**Abstract:** The prevalence of smoking among those with posttraumatic stress disorder (PTSD) is 2–6 times higher than the general adult population. Smoking intensifies PTSD symptoms, which in turn, contribute to heavier smoking and even more difficulty quitting. The benefit of integrating smoking cessation interventions into PTSD treatment has been increasingly recognized. However, current treatment programs are either limited in their efficacy or by the challenges of implementation. This commentary presents a theoretical framework depicting emotion regulation mechanisms shared by nicotine addiction and PTSD. We trust that the proposed theoretical framework will promote systematic and mechanism-focused investigation of the existing treatments. Based on this model, we propose a novel smoking cessation treatment model incorporating an emotion regulation focused and empirically supported treatment for PTSD, Skills Training in Affective and Interpersonal Regulation, and standard smoking cessation techniques. We suggest that this novel treatment may be a promising next treatment to investigate.

### ABOUT THE AUTHOR

Dr. Chia-Ying Chou is a licensed clinical psychologist in private practice in San Francisco. She obtained PhD from the Department of Clinical, Educational, and Health Psychology, University College London prior to relocating to San Francisco for her postdoctoral fellowship (2014 to 2017) at the Department of Psychiatry, University of California, San Francisco. Dr. Chou's research and clinical interest has been focusing on the psychological and psychophysiological impacts of trauma. Her doctoral thesis examined how the body's stress systems, such as the Autonomic Nervous System, respond to traumatic stimuli, and how these responses are associated with different psychological reactions to trauma. Dr. Chou started to extend her research interest to the associations between emotion regulation difficulties and substance use as well as hoarding behaviors during her postdoctoral training. This paper is a collaborative effort of Dr. Chou, and three seasoned researchers in the field of Nicotine Addiction and/or Posttraumatic Stress Disorder.

### PUBLIC INTEREST STATEMENT

Smoking prevalence in the US is currently at its lowest (15%) in the last 50 years. Yet, the standard of care has not yielded satisfactory efficacy among smokers with mental health diagnoses, especially those with Posttraumatic Stress Disorder (PTSD), a population with a smoking prevalence rate: >45%. PTSD already places individuals at higher risk of complex health problems. Smokers with PTSD are even more vulnerable to the adverse health consequences of smoking such as heart diseases and premature death. Since emotion regulation has been identified as one of the under-addressed issues in co-occurring nicotine addiction and PTSD, this commentary presents a theoretical framework and a novel treatment model addressing emotion regulation mechanisms shared by the two clinical conditions. We trust that these innovative suggestions will facilitate systematic and mechanism-focused treatment studies, and promote improvement in smoking cessation treatment for those with PTSD.

**Subjects: Mental Health; Post-traumatic Stress Disorder in Adults; Addiction Disorders - Adult; Addiction & Treatment**

**Keywords: PTSD; nicotine addiction; emotion regulation**

This commentary provides a brief summary of behavioral interventions, including emotion-regulation focused treatments, for smoking cessation among individuals with Posttraumatic Stress Disorder (PTSD). The primary interest of this commentary is to promote systematic research to further the understanding of the relationship between emotion regulation and smoking in individuals with PTSD. The authors propose a theoretical framework hypothesizing key emotion regulation pathways through which PTSD symptoms may exacerbate and/or maintain smoking behaviors. Guided by the proposed framework with consideration of known and speculated limitations of the existing interventions, the authors also propose a novel smoking cessation treatment model for smokers with PTSD as a potential next treatment to investigate.

### **1. The current nicotine cessation treatment for individuals with PTSD**

The prevalence rate of cigarette smoking, among individuals with posttraumatic stress disorder (PTSD) is at least twice as high as the general population (34–86% vs. 15%) (Jamal et al., 2016; Kelly, Jensen, & Sofuoglu, 2015). With the current standard of care, the smoking abstinence rates for 30 days or more among smokers with PTSD are approximately 50% lower than that of smokers without a psychiatric diagnosis (Kelly et al., 2015). Smoking not only worsens costly physical conditions associated with PTSD, which includes cardiovascular diseases and premature death (Dennis et al., 2014), but also intensifies negative psychological symptoms, such as emotional reactivity and startle responses, among individuals with PTSD (Calhoun et al., 2011; Froeliger, Beckham, Dennis, Kozink, & McClernon, 2012). The latter processes exacerbate the urge to smoke as an attempt to regulate emotions, and further smoking-related morbidities and mortalities in this population (Calhoun, Dennis, & Beckham, 2007; Dennis et al., 2014; Olff et al., 2006). Investigation and development of effective and tailored smoking cessation intervention for smokers with PTSD are urgently needed.

Given the interrelated nature of the pathological pathways and high co-occurring rates of substance use disorder (SUD) and PTSD, growing research has focused on specialized treatments addressing the two conditions concurrently. For example, Seeking Safety (Najavits, 2007) is a present-focused intervention focusing on skills training to improve safety from trauma and substance use; and the Trauma Recovery and Empowerment Model (Fallot & Harris, 2002), a group therapy for women with sexual or physical abuse-related PTSD, has also been modified to incorporate treatment for SUD. These interventions have provided conceptual advances in the treatment of dual diagnoses and showed positive outcomes. However, the efficacy of these treatments has been mixed, with relatively modest treatment outcomes in SUD and PTSD symptom reduction (Fallot, McHugo, Harris, & Xie, 2011; Wolff et al., 2015). One plausible reason for this is that the treatments are not designed for a specific type of SUD.

In contrast, Integrated Care (IC), was designed specifically for smoking cessation among military veterans with PTSD (McFall et al., 2010). In the IC model, clients receiving PTSD treatment receive cognitive behavioral smoking cessation treatment and evidence-based pharmacotherapy during the same period, but in separate sessions, from the same mental health-care provider (McFall et al., 2010). This model improves treatment compliance, and has yielded better efficacy (17–21%) than standard smoking cessation counseling (7–10%) in biochemically verified 7-day point prevalence abstinence (i.e., no smoking for the past 7 or more days) at 6-month follow-up (McFall et al., 2010). However, emotion regulation has been identified as a major missing piece in IC, which focuses primarily on traditional smoking cessation interventions such as psychoeducation and behavioral skills for quitting and relapse preventions (Kelly et al., 2015). Moreover, since the interventions for smoking cessation and PTSD are independent but parallel treatments (i.e., two sets of treatment delivered in different sessions by the same clinician over the same period of

time), the required time and other resources can cause greater burden on clinicians and clients, and hence implementation challenges (Kelly et al., 2015).

## 2. An emotion regulation-focused theoretical framework

Disruption in emotion regulation is often observed in both nicotine addiction and PTSD (Kelly et al., 2015). This section summarizes recent findings on several key psychological and psychophysiological emotion regulation mechanisms associated with nicotine addiction and PTSD, and provides a theoretical framework hypothesizing emotion regulation pathways through which PTSD may maintain smoking behaviors.

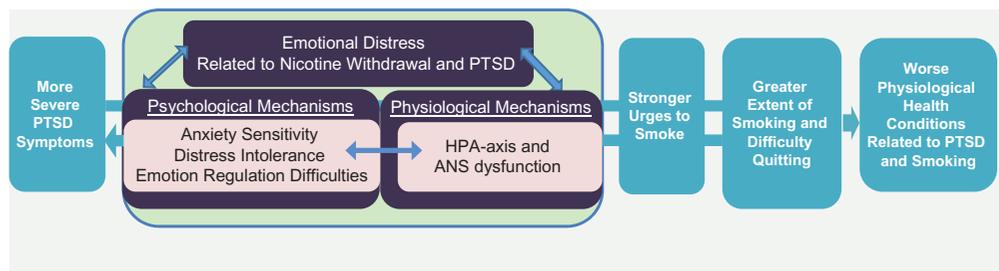
*Psychological mechanisms associated with emotion regulation.* Anxiety sensitivity, defined as fear that anxiety-related sensations have harmful consequences, has been associated with more severe PTSD symptoms regardless of smoking status (Kirby et al., 2008; Marshall, Miles, & Stewart, 2010; Taylor, 2003). Moreover, among smokers with PTSD, anxiety sensitivity was found to mediate the severity of PTSD symptoms and intensity of urges to smoke to relieve negative emotion reduction (Mathew, Cook, Japuntich, & Leventhal, 2015). Two mechanisms associated with worse PTSD symptoms (Kelly et al., 2015): distress intolerance, defined as perceived incapacity to withstand distress, and poor emotion regulation skills, such as inability to understand, attend to, or apply strategies to cope with emotions, are increasingly studied. To date, evidence has suggested that both distress intolerance and poor emotion regulation skills are predictive of drug-seeking behaviors (Farris, Metrik, Bonn-Miller, Kahler, & Zvolensky, 2016), and may intensify the effects of negative emotions on smoking behaviors for those with PTSD (Kelly et al., 2015). In sum, smokers with PTSD have shown stronger nicotine withdrawal symptoms, such as negative emotions and urges to smoke (Kelly et al., 2015). It is possible that anxiety sensitivity, distress intolerance, poor emotion regulation skills may exacerbate the experience of nicotine withdrawal symptoms and lead to more severe nicotine addiction.

### 2.1. Psychophysiological mechanisms associated with emotion regulation

Cigarette smoking and PTSD are both associated with the brain's stress systems (Bruijnzeel, 2012). One of the most widely studied stress systems is the hypothalamic-pituitary-adrenal (HPA) axis, with its dysregulation typically indexed by alterations of cortisol and corticotropin releasing hormone (CRH) (Bruijnzeel, 2012). In the general adult population, heightened activation of the HPA axis, a sign of elevated stress, has been observed during smoking abstinence and associated with more severe withdrawal symptoms and smoking relapse (al'Absi, Hatsukami, Davis, & Wittmers, 2004; Cohen, al'Absi, & Collins, 2004; Frederick et al., 1998). In the PTSD population, since HPA axis dysregulation has been associated with the pathogenesis of the disorder (Chou, La Marca, Steptoe, & Brewin, 2014a; Fu et al., 2007; Meewisse, Reitsma, de Vries, Gersons, & Olff, 2007), several physiological alterations associated with HPA axis dysregulation have been suggested to be moderators between PTSD and more severe nicotine addiction, and vice versa (Bruijnzeel, 2012; Fu et al., 2007; Kutlu & Gould, 2015). For example, an increased stress-related reactivity of CRH in PTSD activates the mesolimbic dopamine system, which increases the reinforcing effects of nicotine, and may thereby worsen nicotine addiction (Bruijnzeel, 2012; Kelly et al., 2015). In animal studies, rodents injected with CRH have shown drug-seeking behaviors including nicotine (Shaham et al., 1997; Zislis, Desai, Prado, Shah, & Bruijnzeel, 2007). Empirical investigations in human are needed to further test this hypothesis.

Another widely studied stress system is the autonomic nervous system (ANS). The ANS measures, such as heart rate and heart rate variability, have been investigated as physiological correlates of emotion regulation (Chou, La Marca, Steptoe, & Brewin, 2014b; Musser et al., 2011). Impaired ANS functioning (e.g., dysregulation of the sympathetic and parasympathetic nervous systems) has been observed among smokers in general, as well as among individuals with PTSD, irrespective of smoking status (Chou et al., 2014b; Dennis et al., 2014; Harte & Meston, 2014; Sherin & Nemeroff, 2011). One of the physiological outcomes of sympathetic nervous system dysregulation, noradrenergic hyperactivity, is associated with anxiety during nicotine withdrawal states (Benowitz, 2008). It has been suggested that ANS dysfunction may be a shared pathological

**Figure 1. Theoretical model of emotion regulation related mechanisms in co-occurring nicotine addiction and PTSD.**



condition by nicotine addiction and PTSD that exacerbates anxiety (Eddie, Vaschillo, Vaschillo, & Lehrer, 2015), particularly during nicotine withdrawal, and thereby increases the risk of relapse after quitting. Overall, while smoking briefly decreases subjective stress levels through the above-mentioned psychophysiological mechanisms, evidence has suggested that it leads to further dysregulation of these brain stress systems (Bruijnzeel, 2012; Tian et al., 2008).

Stemming from the literature reviewed above, we propose an emotion regulation-focused theoretical framework for nicotine addiction and PTSD (Figure 1). This framework describes putative relationships between the psychological and psychophysiological mechanisms reviewed above, and suggest potential pathways PTSD may exacerbate nicotine addiction, and vice versa. Specifically, the model hypothesizes: (1) as a system, emotional distress, as well as the psychological (i.e., heightened anxiety sensitivity, distress intolerance, poor emotion regulation skills) and psychophysiological mechanism (i.e., dysregulation of the HPA axis and ANS) listed in Figure 1 may intensify smoking urges, behaviors, and smoking and PTSD related health conditions among individuals with PTSD. (2) Similarly, a greater extent of smoking may contribute to stronger urge to smoke; and with greater emotional distress, and vulnerabilities in the listed psychological and physiological mechanisms, those who smoke may experience worse PTSD symptoms. (3) Dysfunctions in the psychological and physiological mechanisms included in the model may be positively associated. For example, elevated anxiety sensitivity may be associated with heightened reactivity of the HPA axis to a stressor and distress intolerance may be associated with poorer flexibility (lower capacity to fluctuate and regulate the physiological impact of a stressor) in the ANS functioning. (4) These psychological and physiological dysfunctions in emotion regulation may exacerbate the severity or the negative subjective experiences of nicotine withdrawal symptoms (e.g., irritability, anxiety, headaches, heart rate changes), as well as emotional distress associated with PTSD. Similarly, emotional distress associated with withdrawal symptoms and PTSD may intensify these emotion regulation mechanisms.

Overall, this framework is an initial step to stimulate systematic and framework-based examination of how emotion regulation operates within the context of co-occurring nicotine addiction and PTSD. Findings of such future research will contribute to more accurate identification of treatment targets, and, based on that, more mechanism-specific treatment evaluation and development.

### **3. Addressing nicotine addiction and PTSD concurrently—existing treatments and suggestions for future directions**

#### **3.1. Existing treatments and limitations**

As mentioned in section 1, the IC model may be limited for its implementation challenges due to the design as two independent sets of treatment (for smoking cessation vs. PTSD) delivered in different sessions by the same clinicians over the same period of time, and its lack of focus on emotion regulation. Speaking to these limitations, there have been emerging treatments that integrate interventions for smoking cessation and PTSD to greater extents by addressing them concurrently (i.e., in the same sessions by the same therapist). All of these interventions recognize smoking as a maladaptive emotion regulation strategy in the PTSD population, but vary in the degree emotion regulation is emphasized as

the treatment target and the way it is addressed for both clinical conditions. Among these interventions, Integrated PTSD and Smoking Treatment (IPST) (Powers et al., 2016) has less direct emphasis on emotion regulation. IPST is a 12-session treatment combining standard cognitive behavioral and pharmacological treatments for smoking cessation with prolonged and interoceptive exposure techniques to address PTSD symptoms. Interventions with greater emotion regulation focus are Smoke-Free to Overcome PTSD: An Integrated Treatment (STOP-IT) (Feldner, Smith, Monson, & Zvolensky, 2013), and Acceptance and Commitment Therapy for Individuals with PTSD and Tobacco Addiction (ACT-PT) (Kelly et al., 2015). STOP-IT is a 12-session treatment that includes emotion regulation skills training in response to smoking urges, and Cognitive Processing Therapy techniques (Resick & Schnicke, 1992), such as reviewing index trauma and stuck points in treating PTSD (Feldner et al., 2013). ACT-PT focuses on the development of acceptance, mindfulness, and commitment to change to facilitate smoking cessation and address PTSD symptoms (Kelly et al., 2015).

The efficacy of IPST has not been tested, whereas STOP-IT and ACT-PT have each been examined in one one-arm clinical trial ( $N = 6$  for STOP-IT (Feldner et al., 2013);  $N = 25$  for ACT-PT (Kelly et al., 2015)). The retention rate for STOP-IT was 67%. The treatment yielded a reduction in smoking, but none of the participants remained smoking abstinence at two-month follow-up (Feldner et al., 2013). ACT-PT showed a retention of 74%, and a promising quit rate at the end of treatment (50%) (Kelly et al., 2015). However, the abstinence rate at 3 months did not exceed the abstinence rate yielded by IC at 6-month follow-up (20% vs. 17 ~ 21%) (Kelly et al., 2015; McFall et al., 2010). While continuing to investigate these existing treatments is warranted, the preliminary findings suggest that improvement on these treatments may be a next step.

To this end, the theoretical framework proposed in Figure 1 is recommended to (1) facilitate identification of the degree to which mechanisms are effectively addressed by each of these treatments and (2) thereby inform treatment refinement. In addition, the current article raises two aspects that may worth consideration in the process of refining existing treatments or developing new ones:

First, exposure (i.e., recalling traumatic memories) and its timing: Despite evidence supporting its efficacy, exposure-based therapies have been associated with greater treatment drop-out especially among those with co-occurring SUD and PTSD (Belleau et al., 2017; Imel, Laska, Jakupcak, & Simpson, 2013; Najavits, 2015). This may be because exposure tends to induce strong trauma-related emotions. The addition of emotion regulation skills before exposure therapy has been shown to reduce symptom exacerbation and drop-out (Belleau et al., 2017; Cloitre et al., 2010; Imel et al., 2013; Najavits, 2015; Powers et al., 2016). Consistent with these data, skills training designed to enhance emotion regulation and self-efficacy preceding exposure has been recommended for treatments for co-occurring SUD and PTSD (Harris & Fallot, 2001). Treatments such as STOP-IT, which includes exposure interventions after only two sessions of emotion regulation training (Feldner et al., 2013), and IPST, which begins exposure in the first session (Powers et al., 2016), may not be providing optimal outcomes. In fact, drop-out prior to the introduction of exposure was identified as a limitation in the clinical trial examining STOP-IT (Feldner et al., 2013). Accordingly, we are proposing an intervention in 3.2 in which psychoeducation about the role of emotion regulation challenges in both nicotine addiction and PTSD is central, and where the number of sessions dedicated to emotion regulation skills training is substantially increased.

Second, these programs use a specific and uniform set of emotion regulation skills. For example, STOP-IT introduces diaphragmatic breathing, skills to enlist social support, and cognitive restructuring (Feldner et al., 2013); IPST applies cognitive restructuring to address anxiety sensitivity and distress tolerance (Powers et al., 2016); whereas ACT-PT focuses on enhancing emotional awareness and acceptance of symptoms (Kelly et al., 2015). Research suggests that a personalized and flexible approach to skills training optimizes outcomes. For example, depression research has found greater symptom reduction when patients select skills in which they already have some competency than when they are taught skills in which they are deficient (Cuijpers et al., 2012).

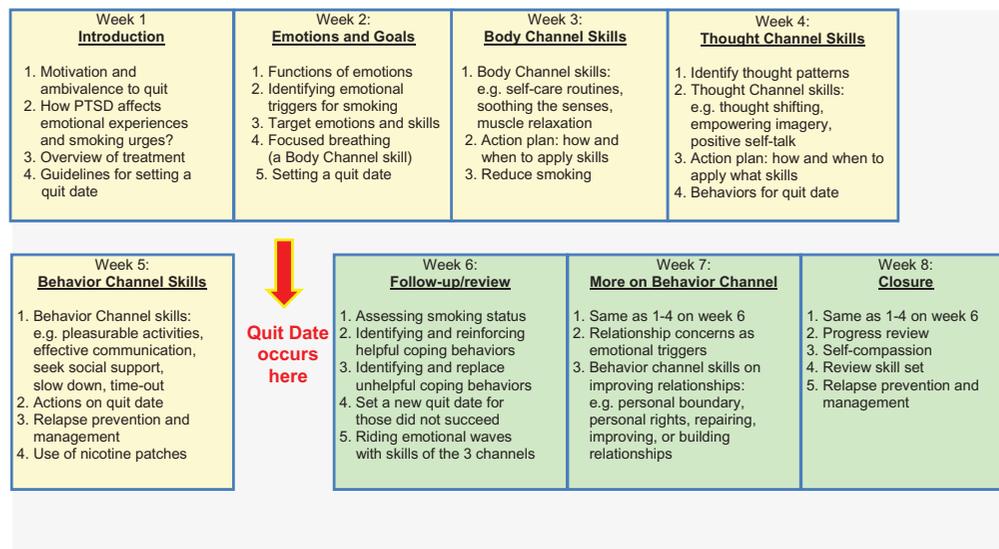
There are several skills that can address each of the emotion regulation mechanisms associated with SUD and PTSD, as proposed in Figure 1. Research examining the effectiveness of ACT, one of the more emotion regulation-focused approach among the existing concurrent treatments introduced in this section, in treating PTSD alone has yielded mixed findings (Pohar & Argáez, 2017). Accordingly, it is possible that treatments which provide flexibility in the selection of emotion regulation skills may be more empowering and effective than those with a specific and uniform set of interventions. We, therefore, propose a treatment in 3.2 that incorporates the flexible implementation of emotion regulation skills training.

### **3.2. Skills training in affective and interpersonal regulation for smoking cessation: A potential next treatment to investigate**

As indicated above, we have developed a treatment, Skills Training in Affective and Interpersonal Regulation for Smoking Cessation (STAIR-SC), that provides a number of sessions focusing on emotion regulation education and flexible, patient-tailored skills training. STAIR-SC is a trauma-informed and emotion regulation-focused treatment designed to concurrently address nicotine addiction and PTSD. STAIR-SC incorporates an empirically supported treatment for PTSD, STAIR (Hassija & Cloitre, 2015), with standard smoking cessation techniques. STAIR is a component of an evidence-based treatment for PTSD focused on the development of emotion regulation skills and interpersonal capacities (Hassija & Cloitre, 2015). The interventions draw from the cognitive behavioral tradition, with each session presenting a set of skills related to different aspects of emotional experiencing (bodily, cognitive, and behavioral) (Hassija & Cloitre, 2015). STAIR was chosen because of evidence supporting its (1) strong efficacy in improving emotion regulation and reducing PTSD symptoms (Cloitre, Gimeno, Ortigo, Weiss, & Jain, 2018; Cloitre, Koenen, Cohen, & Han, 2002; Cloitre et al., 2010; Hassija & Cloitre, 2015; Kevitt, Malta, Martin, Davis, & Cloitre, 2007; MacIntosh, Cloitre, Kortis, Peck, & Weiss, 2016), (2) effect in reducing substance use and increasing utilization of social support in PTSD (Kevitt et al., 2007), (3) implementation feasibility and acceptability in community settings (MacIntosh et al., 2016), and (4) effectiveness among female with PTSD (Hassija & Cloitre, 2015; MacIntosh et al., 2016), an even-harder-to-treat population concerning smoking cessation (Young-Wolff et al., 2014).

As shown in Figure 2, STAIR-SC includes an eight-week skills training and present-focused smoking cessation intervention for smokers with PTSD. The treatment begins by enhancing the motivation to quit, describing the relationships between smoking, PTSD, and emotion regulation challenges, and providing an overview of the treatment and quit date plans. In session two, participants identify emotions that often trigger smoking urges for them. They are also introduced to the only emotion regulation skill that is required of all participants, focused breathing, and guided to set a quit date. In sessions three to five, they are supported to continue practicing recognizing emotional triggers, and are introduced to the three different emotion regulation channels: The Body, Thoughts, and Behavior Channels. Each of these channels has a set of emotion regulation skills. Participants are encouraged to identify skills that suit their strengths and target their main emotional triggers. Participants are asked to attend therapy sessions nicotine-deprived and gradually reduce smoking starting session three. They are coached to apply the identified skills to cope with emotions related to nicotine withdrawal or PTSD symptoms in sessions, which is meant to prepare them to do so in daily life. Standardized smoking cessation techniques, including health education, smoking trigger identification, and management, are incorporated with the treatment. Participants are guided to receive standardized pharmacotherapy for smoking cessation such as nicotine replacement therapy and prepare for the quit date between sessions 5 and 6. Sessions following the quit date focus on reinforcing the successful application of emotion regulation skills and addressing obstacles to quit and to the application of learned skills. Since relationship challenges are one of the most significant sources of negative emotions for individuals with PTSD (Hassija & Cloitre, 2015), a set of skills that emphasize emotion regulation in the context of interpersonal and social difficulties are introduced in session five as relevant to the patient's specific problems and strengths. Skills training in the context of social and interpersonal interactions continue through session seven. Lastly, self-compassion is emphasized as an advanced

**Figure 2. Treatment goals and weekly agenda for STAIR-SC.**



learning objective toward the end of the treatment for its clinical relevance to risk of relapse in both nicotine addiction and PTSD symptoms (Hassija & Cloitre, 2015).

Overall, STAIR-SC attempts to address the aforementioned limitations of the existing treatments by incorporating a trauma-informed, present-focused intervention that provides clients with effective strategies to cope with difficult emotions as they reduce nicotine intake. While some individuals may experience burden of skills practice and clinicians will need to be trained to apply both STAIR and standard smoking cessation techniques, overall, the challenges of implementing STAIR-SC may be significantly less than the IC model. Examination of the effects of STAIR-SC, in terms of its resulted quit rate, PTSD symptom reduction, and effectiveness on the mechanisms included the emotion regulation-focused theoretical framework for nicotine addiction and PTSD (Figure 1), is warranted.

In sum, nicotine addiction disproportionately impacts individuals with PTSD, and current treatment models are of limited efficacy for this population. Improved understanding of how emotion regulation interacts with and exacerbates both smoking and PTSD, and developing treatment targeting this mechanism will be crucial goals for future studies to improve treatment for smokers with PTSD.

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**Author details**

Chia-Ying Chou<sup>1</sup>  
 E-mail: [dr.chiyaying@gmail.com](mailto:dr.chiyaying@gmail.com)  
 Ellen Herbst<sup>1,2</sup>  
 E-mail: [Ellen.Herbst@va.gov](mailto:Ellen.Herbst@va.gov)  
 Marylene Cloitre<sup>3</sup>  
 E-mail: [Marylene.Cloitre@nyumc.org](mailto:Marylene.Cloitre@nyumc.org)  
 Janice Y. Tsoh<sup>1</sup>  
 E-mail: [janice.tsoh@ucsf.edu](mailto:janice.tsoh@ucsf.edu)  
 ORCID ID: <http://orcid.org/0000-0003-0989-7187>

<sup>1</sup> Department of Psychiatry, University of California, San Francisco 401 Parnassus Ave, San Francisco, CA 94143, USA.

<sup>2</sup> Mental Health Services, San Francisco Veterans Affairs Health Care System, 4150 Clement St, San Francisco, CA 94121, USA.

<sup>3</sup> National Center for PTSD Dissemination and Training Division, Veterans Affairs Palo Alto Health Care System, 4951 Arroyo Rd., Livermore, CA 94550, USA.

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