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Low Dispositional Mindfulness Predicts Self-Medication of Negative Emotion with Prescription Opioids

Eric L. Garland, PhD,

University of Utah

Adam W. Hanley, BA,

Florida State University

Elizabeth A. Thomas, MSW,

University of Utah

Paul Knoll, PhD, and

Tallahassee Memorial Hospital Recovery Center

Jeffrey Ferraro, MD

Tallahassee Memorial Hospital Recovery Center

Abstract

Objectives—Although evidence is mounting that opioids are abused to self-medicate negative emotions, little is known about the traits and factors linked to opioid self-medication. One potentially crucial psychological correlate is dispositional mindfulness. Thus, the purpose of this study was to describe the prevalence of opioid self-medication among a treatment-seeking sample of prescription opioid dependent individuals, and to specifically examine the relationship between dispositional mindfulness and opioid self-medication.

Methods—Participants in acute detoxification or intensive outpatient treatment for prescription opioid dependence ($n = 79$) were recruited from a regional hospital's addictions treatment unit for this cross-sectional study. Sociodemographic data were collected along with surveys of opioid self-medication, pain level, and dispositional mindfulness.

Results—Self-medication of negative affective states with opioids was quite common - with 94.9% of individuals sampled reporting self-medication behaviors. In adjusted analyses, individuals engaging in more frequent opioid use tended to self-medicate negative emotions with opioids more often ($\beta = -.33, p < .05$). Importantly, irrespective of opioid use frequency and other clinical and sociodemographic covariates, dispositional mindfulness was inversely associated with opioid self-medication ($\beta = -.42, p < .001$), such that less mindful individuals reported using opioids more frequently to self-medicate negative emotions.

Conclusions—Self-medication of negative emotions with opioids was prevalent in this sample and related to low dispositional mindfulness. Plausibly, increasing mindfulness may decrease

Correspondence to: Eric L. Garland, Huntsman Cancer Institute, 395 South, 1500 East, University of Utah, Salt Lake City, UT 84112.

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opioid self-medication. Addictive automaticity and emotion regulation are discussed as potential mechanisms linking low dispositional mindfulness and self-medication.

Keywords

mindfulness; self-medication; opioid dependence; addiction; chronic pain

Nonmedical use of prescription opioids is the fastest growing substance abuse problem in the United States (Centers for Disease Control, 2012), with over 12 million Americans reporting use of prescription painkillers nonmedically in 2010 (Substance Abuse and Mental Health Services Administration, 2011). An estimate of the total cost of nonmedical use of prescription opioids in the United States in 2006 was \$53.4 billion, with \$42 billion attributable to lost productivity, \$8.2 billion to criminal justice costs, \$2.2 billion to substance abuse treatment, and \$0.9 billion to medical complications (Hansen et al., 2011). Moreover, it is estimated that well over a million Americans meet diagnostic criteria for current prescription opioid dependence (Manubay, Muchow, & Sullivan, 2011). In order to effectively address this pervasive and costly threat to public health, research is needed to elucidate the etiology of opioid dependence, the function of addictive behaviors, and how maladaptive patterns of nonmedical opioid use are maintained.

One reason why people may initiate and maintain nonmedical opioid use is to relieve emotional suffering. The self-medication hypothesis (SMH) suggests that negative affective states and related psychiatric disorders can lead to the development of substance use disorders (Hall and Queener, 2007; Khantzian, 1985). According to the SMH, underlying deficits in positive coping skills and impairments in emotion regulation confer susceptibility to heightened negative affective states and limit the capacity to effectively manage those states, leading individuals to seek relief from painful emotions through substance use (Khantzian, 1985). The original SMH posited that the drug of choice is specific to the type of psychiatric disorder the individual suffers from. Although this specificity hypothesis of the SMH has been challenged due to lack of empirical support (Lembke, 2012), numerous studies have supported the general proposition of the SMH that individuals use drugs to self-medicate negative affect by demonstrating that affective disorders predict later substance abuse and dependence (e.g., Bolton et al., 2009; Leeies et al., 2010; Robinson et al., 2011). This relation may be partly explicated by neurobiological research on the allostatic model of addiction, which suggests that individuals compulsively seek and consume drugs to allay dysphoric mood states stemming from dysregulation of stress and reward circuitry in the brain (Koob & LeMoal, 2001; 2008).

While there is an extensive body of research on self-medication and substance use disorders generally, the literature on self-medication with prescription opioids is much more limited. Several studies have demonstrated a correlation between prescription drug dependence with depression and anxiety symptoms (Conway et al., 2006; Dowling et al., 2006; Huang et al., 2006; McCabe et al., 2005), and early prevalence estimates indicated that 45% of individuals with prescription opioid use disorders met full DSM-IV diagnostic criteria for depression or anxiety (Sullivan et al., 2005). A more recent survey of over 26,000 respondents indicated that approximately 80% of individuals engaging in nonmedical use of

prescription opioids had a history of depression and anxiety (Green et al., 2011). This comorbidity suggests that opioids may be used to self-medicate negative emotional states; however, in the absence of longitudinal data or direct assessment of opioid self-medication, it is difficult to discern whether prescription opioid dependence and nonmedical use of opioids are causes, correlates, or consequences of negative affectivity. In the largest longitudinal study on this topic to date, analysis of data from over 34,000 adult participants in Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) revealed that baseline mood disorders and anxiety disorders significantly predicted the incidence of nonmedical opioid use and opioid dependence several years later (Martins et al., 2012). Complementing these findings, qualitative research indicates that self-medication of emotional pain is a leading reason for nonmedical use of and dependence on prescription opioids (Merlo et al., 2013).

Although evidence is mounting opioids are used to self-medicate negative emotions, little is known about the traits and factors linked to opioid self-medication. One potentially crucial psychological correlate is dispositional mindfulness, the propensity to exhibit a present-oriented, nonjudgmental awareness of cognitions, emotions, and habitual behavioral reactions in daily life (Baer et al., 2006). Studies suggest that high levels of dispositional mindfulness are associated with enhanced ability to effectively regulate negative affective states (Coffey and Hartman, 2008). In contrast, individuals with a low degree of dispositional mindfulness experience more severe substance craving (Garland and Roberts-Lewis, 2013; Garland et al., 2014a), consume larger quantities of substances (Garland et al., 2012) and exhibit greater attentional fixation on substance-related cues (i.e., attentional bias, see Garland et al., 2012). As a naturally-occurring trait, dispositional mindfulness is roughly normally distributed among adults without clinical levels of psychopathology (Walach et al., 2006). This dispositional may be strengthened through participation in mindfulness-based interventions (Carmody and Baer, 2008), and studies (e.g., Bowen et al., 2009; Witkiewitz et al., 2012) have demonstrated effects of mindfulness training on facets of dispositional mindfulness among persons with substance use disorders (though a small number of investigations have found null effects of mindfulness-based interventions on dispositional mindfulness in addictive populations, e.g., Garland et al., 2010). Hence, because this psychological factor is linked to substance use risk and malleable to intervention, low levels of dispositional mindfulness may be a clinically-important marker of vulnerability to opioid self-medication.

The purpose of the present retrospective study was twofold: first, to describe the frequency of opioid self-medication among a treatment-seeking sample of persons with prescription opioid dependence, and second, to examine the association of dispositional mindfulness with opioid self-medication. We hypothesized that dispositional mindfulness would be significantly inversely associated with opioid self-medication, even after controlling for other sociodemographic and clinical characteristics.

METHODS

Participants and Procedures

Participants seeking treatment for prescription opioid dependence ($N = 79$) were recruited from an addictions treatment unit of a regional hospital located in medium-sized Southeastern city. This unit provided treatment services including acute detoxification as well as intensive outpatient treatment and long-term supportive care for persons with substance use disorders. The majority of participants ($n = 47, 59.5\%$) in the present study sample were either in acute detoxification or transitioning into intensive outpatient treatment, with the remainder ($n = 32, 40.5\%$) in long-term supportive care. Participants gave informed consent and volunteered to complete all survey instruments in a single session while on the treatment unit. Procedures followed were in accordance with the ethical standards of the Helsinki Declaration and the study was approved by the Florida State University human subjects committee.

Measures

Opioid self-medication—A single item asked participants to identify their primary prescription opioid drug of dependence. An additional item asked participants to report the number of days they used prescription opioids in the month before entering treatment. Three dichotomous question items adapted from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Grant and Kaplan, 2005) and validated in prior studies (Leeies et al., 2010; Robinson et al., 2011) tapped self-medication of negative affective states with opioids: “Did you ever use opioids not prescribed or in greater amounts than prescribed to help you reduce your anxiety or fear?” “Did you ever use opioids not prescribed or in greater amounts than prescribed when you felt sad, blue, down, depressed, or didn’t care about things or didn’t enjoy things for more than 2 weeks?” “Did you ever used opioids not prescribed or in greater amounts than prescribed to help you reduce your feelings of anger or frustration?” Three additional Likert-type items tapped the frequency of opioid self-medication of anxiety, depression, and anger in the 30 days prior to treatment (1 = never, 3 = sometimes, 5 = very often). A global negative affect self-medication frequency score was computed by summing the three separate emotion measures ($\alpha = .91$).

Dispositional mindfulness—Dispositional mindfulness was assessed with the Mindful Attention Awareness Scale (MAAS; Brown and Ryan, 2003). The MAAS is a 15-item trait measure of one’s propensity to attend to present-moment experiences in the midst of everyday activities. The MAAS uses a Likert-type scale ranging from 0 (almost always) to 6 (almost never) to evaluate responses on items like “It seems I am “running on automatic” without much awareness of what I’m doing”, “I could be experiencing some emotion and not be conscious of it until sometime later”, and “I find it difficult to stay focused on what’s happening in the present.” A MAAS total score is created by summing responses across all 15 items. In normative samples, the MAAS exhibits adequate psychometric characteristics (Brown and Ryan, 2003), and in prior studies of substance users, the MAAS total score demonstrated good internal consistency ($\alpha = .91-.93$) and medium-to-large, statistically significant test-retest correlations (Black et al. 2012). The MAAS demonstrated reliable internal consistency in the present sample ($\alpha = .92$).

Average pain level—On a single item extracted from the Brief Pain Inventory (Cleeland, 1994), participants were asked to rate their average pain levels on a scale ranging from no pain (0) to pain as bad as you can imagine (10). Single item 0–10 pain ratings have been widely validated in the literature (e.g., Jensen et al., 1999) and are commonly used in pain research due to their clinical relevance and minimal subject burden.

Statistical analysis

Frequencies were reported for use of opioids to self-medicate each negative affective state (i.e., anxiety, depression, anger), as well as to characterize the prevalence of any form of opioid self-medication in the sample. Pearson correlations assessed unadjusted, zero-order associations between dispositional mindfulness and opioid self-medication. Three separate hierarchical regression models were tested to analyze predictors of opioid self-medication frequency - one for each of the negative affective states, as well as the index of global negative affect. In each of these models, participant age, gender, and income level was entered as the first step. In the second step, average pain level, frequency of opioid use in the 30 days prior to entering treatment, and total number of days abstinent from opioid use were entered into the model. In the third step, dispositional mindfulness was entered into the model. A fourth hierarchical regression model assessed predictors of the global negative affect opioid self-medication frequency variable.

RESULTS

Sample characteristics

Sample characteristics are detailed in Table 1. Approximately half of the sample was female (56.4%), with a mean respondent age of 35 ($SD = 12.5$). The most frequently reported ethnicity was Caucasian (91.1%), followed by African American (6.3%). The sample was largely low-income; the majority of participants estimated their approximate yearly income at less than \$20,000 (60.3%), or \$20,001–40,000 (26.9%), with the remainder reporting incomes above \$40,000.

All participants met DSM-IV diagnostic criteria for prescription opioid dependence, as assessed by a board-certified, licensed psychiatrist and Addiction Medicine specialist. A minority of participants ($n = 10$, 12.7%) also met DSM-IV diagnostic criteria for dependence on cocaine or marijuana in addition to opioids (i.e., met criteria for polysubstance dependence). The median number of days abstinent was 9, though because a substantial minority of participants were in long-term supportive care and had abstained from opioids for a longer period of time, the mean number of months abstinent from opioids was 4.5 months ($SD = 7.8$). Approximately two-thirds of participants (63.5%) reported at least low-moderate levels of pain (≥ 3 on the 0–10 scale).

Opioids used by participants

The most commonly reported opioid used by study participants was oxycodone ($n = 30$, 38.0%), followed by hydrocodone ($n = 23$, 29.1%), morphine ($n = 6$, 7.6%), and tramadol ($n = 5$, 6.3%). Fentanyl ($n = 1$, 1.3%), methadone ($n = 1$, 1.3%), and buprenorphine ($n = 2$,

2.5%) were rarely abused. Approximately 14% of participants ($n = 11$) did not specify their primary opioid of dependence.

Frequency of opioid use

The mean number of days per month that opioids were used before entering treatment was 21.7 ($SD = 12.0$).

Prevalence of opioid self-medication

The use of prescription opioids to self-medicate negative affective states was quite prevalent in the sample: 88.6% of participants reported using opioids to self-medicate anxiety or fear; 84.2% reported using opioids to self-medicate depression or sadness; and 87.3% reported using opioids to self-medicate anger or frustration. Nearly all participants (94.9%) reported using opioids to self-medicate one of these three kinds of negative affective states.

Table 2 reports the frequencies with which participants engaged in self-medication. More than 80% of participants reported using opioids to self-medicate negative emotions at least “sometimes,” and more than 30% reported using opioids “very often” to self-medicate negative emotions. Paired t -tests were used to determine whether participants engaged opioid self-medication more frequently for anxiety, sadness, or anger. There were no significant differences in self-medication frequency for these affective states (p 's $> .10$). Similarly, there were no significant differences in opioid self-medication frequency for these affective states between individuals in active opioid addiction treatment/detoxification and those in long-term supportive care/recovery (p 's $> .10$).

Zero-order associations between dispositional mindfulness and opioid self-medication

Pearson correlations indicate that dispositional mindfulness was significantly associated with opioid self-medication for anxiety ($r = -.29, p = .01$), depression ($r = -.29, p = .01$), and anger ($r = -.36, p = .001$), as well as the index of opioid self-medication for global negative affect ($r = -.37, p < .001$).

Regression analysis of opioid self-medication

Separate hierarchical regression models were tested to investigate the predictors of opioid self-medication for three negative emotional states (anxiety, depression, and anger) as well as the global self-medication frequency score (Table 3). In each of the four regression models, dispositional mindfulness was found to be significantly inversely associated with use of opioids to self-medicate negative emotional states (anxiety $\beta = -.28, p < .05$; depression $\beta = -.34, p < .01$; anger $\beta = -.43, p < .001$), after controlling for sociodemographic and clinical characteristics. With regard to opioid self-medication of global negative affect, demographics predicted 6% of variance in this variable in step 1, clinical characteristics predicted an additional 8% of variance in step 2, and dispositional mindfulness ($\beta = -.42, p < .001$) predicted an additional 16% of the variance in step 3. In contrast, in each of the models, opioid use frequency in the month prior to treatment was positively associated with self-medication, significantly predicting opioid self-medication of global negative affect ($\beta = -.33, p < .05$). No other factors were significantly associated with opioid self-medication.

DISCUSSION

Study findings indicate that among this high risk sample of persons in treatment for prescription opioid dependence, self-medication of negative affective states with opioids was quite common - with 94.9% of individuals sampled reporting self-medication behaviors. While age, gender, income level, duration of abstinence, and average pain levels were not significantly correlated with opioid self-medication, individuals who engaged in more frequent use of opioids tended to self-medicate negative emotions with opioids more often than those who engaged in more intermittent opioid use. Importantly, irrespective of opioid use frequency and other clinical and sociodemographic covariates, dispositional mindfulness was inversely associated with opioid self-medication, such that individuals reporting lower levels of mindfulness used opioids more frequently to self-medicate negative emotions than their more mindful counterparts. There was general consistency of this relationship across anxiety, depression, and anger, although low dispositional mindfulness was more strongly associated with more frequent self-medication of anger than self-medication of other affective states. Globally, dispositional mindfulness independently predicted 16% of the variance in opioid self-medication of negative emotion.

The observed inverse relationship between dispositional mindfulness and opioid self-medication accords with prior research demonstrating a link between mindfulness and addiction-related factors (Garland et al., 2013). In contrast to mindfulness, which is associated with cognitive and behavioral flexibility, addiction may be characterized by *mindlessness* (Langer, 1992), i.e., habitual or stereotyped responses that may be executed automatically without conscious volition or strategic regard for distal consequences. Though there is some discrepancy between the social psychological construct of mindfulness/mindfulness as defined by Langer (1992) and definitions of mindfulness found in ancient contemplative traditions, both converge on the notion that maladaptive automatic cognitive and behavioral responses undergird a wide array of psychopathological conditions (Greeson et al., 2014). In that regard, the appetitive drive that motivates drug seeking may emerge mindlessly in the form of obsessional thoughts of using and compulsive urges that seem to arise intrusively in opposition to rational decision making.

Moreover, the behavioral routines that subserve drug administration can become automated and deployed habitually in much the same way as other complex behavioral repertoires can be activated without intention by conditioned contextual cues (Bargh and Chartrand, 1999). In the case of opioid dependent individuals who have a history of using opioids in response to negative emotions, the occurrence of negative affect and stressful experiences may become a conditioned cue that elicits the habit of opioid use (Garland et al., 2013). Further, stress and negative affect strengthen habitual responding while impairing executive function (Dias-Ferreira et al., 2009). Indeed, the compulsivity of addictive behavior may derive, in part, by the motivation to alleviate dysphoric affective states; this compulsive behavior may be driven by interconnections between the extended amygdala and striatum (Koob & LeMoal, 2001; 2008). Lastly, recurrent opioid use over time may decrease dispositional mindfulness itself - indeed, chronic exposure to opioids is associated with dysregulated function in brain areas involved in self-regulation of attention and emotion (e.g., prefrontal cortex; for a review, see Garland et al., 2013), brain areas which are known to be associated

with dispositional mindfulness (e.g., Modinos et al., 2010). To be clear, these cognitive and neurobiological interpretations of the present study results remain purely speculative given the self-report nature of the findings.

Alternatively, individuals with higher dispositional mindfulness might have a greater capacity for emotion regulation than individuals with lower levels of dispositional mindfulness, and therefore be less inclined to self-medicate negative affective states with opioids. Indeed, in healthy samples, dispositional mindfulness has been significantly associated with emotion regulatory capacity (Baer et al., 2006), and among chronic pain patients receiving long-term opioid pharmacotherapy dispositional mindfulness was significantly correlated with reappraisal as a means of coping with stress and negative affect (Hanley & Garland, 2014). If mindful individuals are indeed better able to regulate their negative emotions by nonjudgmental and nonreactive awareness and acceptance of affective experience, they may be less likely to engage in self-medication with opioids than their less mindful (and more emotionally dysregulated) counterparts. From the perspective of the SMH, individuals with high dispositional mindfulness may not have the underlying coping skill deficits and emotion regulation impairments which confer susceptibility to self-medication of negative affective states.

To be clear, because we did not assess for psychological variables other than dispositional mindfulness in this study, it is unknown whether the observed association between dispositional mindfulness and opioid self-medication might be explained by these and other potential psychologic correlates, such as neuroticism, impulsiveness, coping strategies, or personality traits. In prior studies, dispositional mindfulness (as measured by the MAAS) has been shown to be a correlated but independent construct from neuroticism, thought suppression, alexithymia, emotion dysregulation, and psychological symptoms, with correlations ranging from $r = -.24$ to $-.54$ (Baer et al., 2006). Nonetheless, it is quite possible that the observed inverse association between mindfulness and opioid self-medication might be explained by hitherto unmeasured psychological variables. Future studies should include an array of self-report, cognitive task, and neurobiological measures to redress this limitation. For instance, the opioid dot probe task (Garland et al., 2013) could be used to assess cognitive automaticity as a mediator of the relation between dispositional mindfulness and opioid self-medication, or an affect-modulated cue-reactivity protocol (Garland et al., 2012) could be used to assess whether mindful individuals evidence attenuated autonomic reactivity to opioid cues when primed by stress stimuli.

Beyond the general limitations of self-report data, this study was also limited by a modest sample size and the cross-sectional nature of the study design. In the absence of longitudinal and experimental research, we cannot ascertain whether dispositional mindfulness is the cause, correlate, or consequence of opioid self-medication. Moreover, the measure of opioid self-medication used in this study did not distinguish negative affect induced by life stressors or mood disorders from negative affect induced by opioid withdrawal. It may be that mindful individuals are better able to tolerate the distress associated with withdrawal than individuals with low mindfulness, and therefore engage in less opioid self-medication. Thus, while low mindfulness and opioid self-medication were significantly associated in the present study, the causal relation between these constructs cannot be discerned from the

available data, and in all likelihood, these factors likely magnify one another over time through positive feedback processes.

In conclusion, study findings suggest that among this sample of persons in treatment for prescription opioid dependence, the tendency to self-medicate negative emotions with opioids was common and linked to a dispositional propensity toward low mindfulness. Plausibly, increasing mindfulness may decrease opioid self-medication; in that regard, results from a recent randomized controlled trial indicate that a Mindfulness-Oriented Recovery Enhancement intervention can significantly reduce nonmedical use of prescription opioids (Garland et al., 2014b). In light of Tiffany's (1990) classical proposal that automaticity drives addictive responses, mindfulness of one's automatized behavioral and emotional reactions may allow for greater self-regulation of habitual opioid abuse elicited by negative affective states.

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Table 1

Baseline demographic and clinical characteristics of patients with prescription opioid dependence (N = 79).

Measure	
Female, n (%)	15 (56.4%)
Age, M (SD)	35.1 (12.5)
Race, n (%)	
White	72 (91.1%)
Black	5 (6.3%)
Other	2 (2.5%)
Income, n (%)	
< \$20,000	47 (60.3%)
\$20,001–40,000	21 (26.9%)
\$40,001–60,000	6 (7.7%)
\$60,001–80,000	3 (3.8%)
>\$80,001	1 (1.3%)
Average pain level, M (SD)	4.1 (2.9)
Individuals with average pain ≥ 3, n (%)	50 (63.2%)
Number of months abstinent from opioids, M (SD)	4.5 (7.8)
Opioid use frequency in month prior to treatment (days), M (SD)	21.7 (12.0)
Participants in active addiction treatment/detoxification, n (%)	47 (59.5%)
Participants in long-term supportive care, n (%)	32 (40.5%)
Comorbid polysubstance dependence dx (opioid primary), n (%)	10 (12.7%)

Table 2

Frequency of self-medication of negative affective states with opioids among a sample of persons in treatment for opioid use disorder (N = 79).

	Anxiety	Sadness	Anger
Never	11 (13.9)	7 (8.9)	6 (7.6)
Seldom	6 (7.6)	6 (7.6)	6 (7.6)
Sometimes	12 (15.2)	16 (20.3)	18 (22.8)
Often	18 (22.8)	16 (20.3)	16 (20.3)
Very Often	31 (39.2)	34 (43.0)	31 (39.2)

Table 3

Hierarchical linear regression of predictors of opioid self-medication of negative affective states in a sample of prescription opioid dependent individuals (N=79).

Variable	Anxiety			Depressed Mood			Anger			Global Negative Affect		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
	β	β	β	β	β	β	β	β	β	β	β	B
Step 1												
Age	-.01	-.09	-.08	-.19	-.24	-.23	-.14	-.17	-.16	-.15	-.15	-.10
Gender	-.17	-.14	-.10	-.15	-.14	-.10	-.14	-.14	-.09	-.17	-.18	-.09
Income	-.09	-.03	-.05	-.10	-.07	-.09	-.07	-.06	-.09	-.07	-.07	-.15
Step 2												
Average pain		.23	.19		.15	.10		.10	.03		.11	.06
Days abstinent		-.09	-.08		-.02	-.01		-.00	.01		-.02	.03
Days of opioid use in month prior to treatment		.31**	.37**		.26*	.33**		.23	.32**		.28*	.33*
Step 3												
Dispositional mindfulness			-.28*			-.34**			-.43***			-.42***
R^2	.03	.17	.24	.07	.14	.25	.04	.10	.27	.06	.13	.29
R^2 change	.03	.13*	.07*	.07	.08	.10*	.04	.06	.17**	.06	.08	.16***

* $p < .05$.** $p < .01$.*** $p < .001$.