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AUTHOR: Eleuterio F. Limas

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Kim Pulvers, Ph.D. THESIS COMMITTEE CHAIR	SIGNATURE	May 6, 2014 DATE
Wes Schultz, Ph.D. THESIS COMMITTEE MEMBER	SIGNATURE	May 6, 2014 DATE
Spencer McWilliams, Ph.D. THESIS COMMITTEE MEMBER	SIGNATURE	May 6, 2014 DATE

The Effects of a Social Norm Intervention on Smokers' Physical Distress Tolerance and Smoking Behavior

Eleuterio F. Limas

California State University San Marcos

Abstract

Smokers have been regarded as having low distress tolerance, a characteristic shown to be linked to smoking behavior. Individual and population based interventions have proven to be effective in changing behavior; however, no research exists that has investigated the effect of a population based intervention on manipulating distress tolerance and subsequent smoking behavior. The present study utilized a type of population based approach commonly associated with successful behavior change: social norms. Specifically, the effects of a social norm intervention on distress tolerance as measured by pain tolerance during the cold pressor task as well as subsequent smoking behavior (i.e., latency to smoke) was examined. Participants consisted of 128 moderate smokers (at least 12 cigarettes per day). Participants were randomly assigned to one of two groups: social norm treatment and social norm control. Two separate oneway ANCOVA's were conducted to assess the effects of the treatment on distress tolerance and subsequent smoking behavior while controlling for covariates (e.g., gender, pain catastrophizing). Results indicated that individuals who received a social norm message increased pain tolerance compared to those who did not receive a social norm message. However, latency to smoke was similar across both groups. Implications as to how to better experimentally assess smoking variables in future studies are discussed.

The Effects of a Social Norm Intervention on Smokers' Physical Distress Tolerance and Smoking Behavior

Tobacco smoking continues to be the leading cause of preventable death in the United States (Center for Disease Control and Prevention (CDC), 2009; 2011). Despite known health consequences associated with smoking, approximately one in five U. S. adults (45.3 million) smoke (CDC, 2009; 2011). One factor contributing to tobacco use is lower levels of distress tolerance (DT) exhibited by smokers (Ditre & Brandon, 2008; Pulvers, Hood, Limas, & Thomas. 2012). Specifically, smokers are less willing or less able to tolerate physical or psychological distressing stimuli as compared to nonsmokers (Beck, Wright, Newman, & Liese, 1993; Ditre, Brandon, Zale, & Meagher, 2011). This lack of tolerance translates to their inability to sustain and achieve successful quit attempts (Brown et al., 2008).

Given this relationship, traditional individual based interventions such as cognitive behavioral therapy (CBT) and acceptance and commitment therapy (ACT) have been used to improve DT for psychiatric issues which often co-occur with smoking (Assayag, Bernstein, Zvolensky, Steeves, & Stewart, 2012; Batten & Hayes, 2005), as well as for smoking cessation (Bricker, Mann, Marek, Liu, & Peterson, 2010; Hernández-López, Luciano, Bricker, Roales-Nieto, & Montesinos, 2009). On the other hand, population-based interventions through the use of social norms have also been effective in health behavior change (Croker, Whitaker, Cooke, & Wardle, 2009; Kapadia et al., 2012; Perkins, Linkenbach, Lewis, & Neighbors, 2010)

Social norms change behavior by changing the perceived norm. For example, the notion that quitting is extremely hard to do may perpetuate continued smoking. Testimonials about successful smoking cessation, which would serve to change the perceived norm about cessation, may improve quit rates. Additionally, these types of interventions are often more cost efficient

and easier to administer to a large number of people at once. Despite the success of social norms in health behavior change, they have yet to be applied to DT or smoking cessation. The present study investigates the effects of a social norm intervention on smokers' physical distress tolerance and subsequent smoking behaviors.

In this paper, a general overview of tobacco use (i.e., prevalence, morbidity, mortality and risk factors) will first be provided. Second, the relationship between distress tolerance and addiction will be examined. Third, various individual-based approaches to improving distress tolerance will be reviewed. Fourth, a description of social norms and how social norms have been used in prior literature to influence health behaviors will be discussed. Fifth, a description of how the study was carried out will be presented followed by the results of the study. Finally, the paper will conclude with a discussion of the overall findings as well as suggestions for future directions.

Smoking: Prevalence, Morbidity, Mortality and Risk Factors

Adults who smoke put themselves at an increased risk for developing cancer, stroke, heart disease, and lung diseases (i.e., bronchitis, chronic airway obstruction and emphysema) (CDC, 2009; 2011). Additionally, for every person who dies from one of the aforementioned smoking diseases, 20 more people suffer with at least one severe illness as a result of smoking (CDC, 2009; 2011). Despite these known health consequences associated with smoking, approximately one in five adults (45.3 million) smoke (CDC, 2009; 2011). Additionally, for those under the age of 18, approximately 850 begin smoking on a daily basis.

According to the CDC (2011), globally, smoking is responsible for more than 5 million deaths per year, and the CDC expects this number to rise to approximately 8 million deaths annually by 2030. In the United States, nearly one in five adults (443,000) die annually as a

result of smoking, and an estimated 49,000 of these deaths are the result of secondhand smoke exposure. Indeed, even nonsmokers are affected by the negative health effects of tobacco use. The CDC reports that approximately 40.1% of nonsmokers are annually exposed to secondhand smoke. Furthermore, research has identified several risk factors for smoking behaviors such as chronic or acute pain or the occurrence of mood, substance use, or personality disorders.

Despite the dangers associated with smoking, the United States has devoted little money to the creation of effective tobacco interventions and research. For instance, in 2011, the United States collected $25.3 billion from tobacco taxes and legal settlements, but only 2% of this amount was allocated for tobacco control programs (CDC, 2011). The CDC estimates that a 15% ($3.7 billion) investment of the $25.3 billion would fund every state tobacco control program. Indeed, the need for smoking research is especially important given that 68.8% of existing smokers say they want to completely stop smoking, 52.4% of existing smokers say they had made a quit attempt in the past year but only 6.2% of smokers say they had successfully quit in the past year (CDC, 2009; 2011). Given the health risks associated with smoking and the relatively low percentage of successful quit attempts, it is important for research to continually investigate underlying mechanisms related to smoking, which, in turn, could aid in the cessation process.

Theoretical Framework

The theoretical framework for this research is derived from the cognitive theory of substance abuse (Beck et al., 1993). Addicted individuals share characteristics that may make them susceptible to continued drug use. These characteristics include: 1) enhanced sensitivity to distressing emotions; 2) inability to reasonably control behavior; 3) impulsivity; 4) excitement seeking and low tolerance for boredom; 5) low tolerance for frustrating tasks; and 6) an inability

to engage in positive alternative behaviors (Beck et al., 1993). Other factors that may motivate drug use include the need to feel accepted with a particular social group. These characteristics often exacerbate the course of addiction.

The process of addiction usually involves feelings of distress such as anxiety or low mood which, in turn, may lead to self-medication by the use of a drug (Beck et al., 1993). Research has commonly found an overlap between mood and substance abuse (Assayag et al., 2012; Zvolensky Bernstein, Yartz, McLeish, & Feldner, 2008). Specifically, Zvolensky (2008) found that smoking is a risk factor for the development and maintenance of panic disorder. Indeed, smoking is often co-morbid with various forms of mood disorders such as anxiety and depression, which often enacts a cycle for continued substance abuse. This process can negatively affect social, financial, or medical aspects of an individual's life which can produce further distress (Beck et al., 1993). Individuals tend to deny that the problems they are facing are related to their drug use and will subsequently continue to use in order to alleviate distress (Beck et al., 1993). This is commonly seen among addicted individuals in attempting to cope with cravings or urges.

Cravings refer to the wanting of a drug whereas urges refer to the internal conflict of acting upon those cravings or not (Beck et al., 1993). According to cognitive theory of addiction, addicted individuals simply do not have the tools to effectively cope with aversive stimuli that may exacerbate urges. Instead, abusers seek drugs for a sense of relief (Beck et al., 1993). In order to remedy this reciprocal relationship between aversive stimuli and substance abuse it is important for abusers to learn different strategies to help them cope. Indeed, it is even beneficial for abusers to practice being exposed to aversive scenarios in order to practice

appropriate coping techniques. By doing this, it may become easier to determine what specific mechanisms are at work that may be fueling the addiction process.

Distress Tolerance and Addiction

Distress tolerance (DT) is the degree to which an individual is able to tolerate physical or psychological stress and discomfort (Brown, Lejuez, Kahler, & Strong, 2002). Prior literature has consistently found a link between DT and various addictive behaviors such as gambling, eating disorders, alcohol use, and smoking (Brandon et al., 2003; Buckner, Keough, & Schmidt, 2007; Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007; Quinn, Brandon, & Copeland, 1996). It has been commonly found that individuals with addictive behaviors tend to display lower levels of DT such that they are less willing or less able to tolerate physical or psychological distressing stimuli when compared to others without addictive behaviors (Ditre & Brandon, 2008; Pulvers et al., 2012; Quinn et al., 1996;). Lower DT is linked with poorer treatment outcomes, such as pre-treatment attrition for smoking cessation programs (Brandon et al., 2003), fewer and shorter cessation attempts (Brown et al., 2002), smoking lapse following an unaided quit attempt (Brandon et al., 2003), and treatment dropout from substance abuse programs (Hajeck, Belcher, & Stapleton, 1987).

Distress tolerance is typically assessed using laboratory-based procedures to induce physical or psychological distress. Although laboratory-based procedures may not be completely reflective of real-world stressors, they have been used by many researchers and have been shown to be effective in simulating a distressing experience (Ditre & Brandon, 2008; Hajek, Belcher, & Stapleton, 1987; Robinson, Gagnon, Riley, & Price, 2003). For example, in order to induce psychological distress, studies have typically used: a) tasks in which participants trace images reflected by a mirror; b) anagram tasks in which participants solve jumbled word puzzles that

become increasingly difficult; or c) the paced auditory serial addition task in which participants are instructed to add different combinations of numbers together that become increasingly difficult and with shorter amount of time intervals (Brown et al., 2002; Quinn et al., 1996). Researchers have induced physical distress within the laboratory by using either the cold pressor task (CPT) in which participants are instructed to place their hand into a bin of very cold water for as long as tolerable, or a task in which participants are instructed to hold their breath for as long as they can (Ditre & Brandon, 2008; Hajek, et al., 1987). Since DT is defined as an individual's ability to withstand a distressing experience, it is typically measured as the amount of time the individual can perform the tasks before quitting.

Given the pervasiveness of smoking and its addictive qualities, smokers are especially susceptible to having low DT. Despite the established literature revealing the association between DT and behavioral outcomes, studies conducted by Quinn et al. (1996), Pulvers et al (2012), and Ditre and Brandon (2008) are the only studies to date that have experimentally investigated DT among a sample of smokers. Moreover, well known individual-based approaches such as ACT and hope based interventions are currently predominate in the literature as methods to increase DT. Notwithstanding the success of individual-based approaches, they collectively share some weaknesses such as increased cost, time intensiveness, and the limited number of individuals it can affect. Thus, research investigating approaches that can circumvent these weaknesses is warranted.

Individual-Based Approaches

Cognitive behavioral therapy. One of the more commonly used approaches in promoting behavior change is through the use of CBT. CBT uses both cognitive and behavioral techniques to not only change overt behavior but also the thought processes associated with the

behavior. By identifying variables associated with the behavior in question, individuals are able to gain awareness as to what may be a trigger. It is this awareness then that is redirected towards other positive avenues. That is, CBT seeks to alleviate negative behaviors and thoughts by replacing them with positive alternatives (Beck, 1993).

CBT has been shown to be effective in treating various forms of substance abuse including smoking behavior. Thorndike (2005) revealed the effectiveness of CBT in promoting smokers' coping skills. Since CBT is often intensive, consisting of weekly treatments typically lasting more than an hour, it lacks the ability to serve a large number of people in a time efficient manner. That is, although the odds of successful behavior change are well-documented, this process often takes a long amount of time.

Acceptance and commitment therapy. The distinguishing feature of ACT from typical CBT is that it focuses on being aware of the individual's own thoughts whether they are negative or not, accepting their existence, setting a goal for oneself that is based on personal values, and moving in that direction. This is in contrast to learning how to control thoughts and feelings which is typically the goal of cognitive behavioral therapy. By incorporating acceptance and mindfulness strategies, ACT focuses on helping the individual to change their perception of their suffering in a way that is in line with the individual's personal values and goals (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). In sum, ACT emphasizes the ways individuals understand and externalize their suffering through language (Hayes, Strosahl, & Wilson, 1999).

ACT has shown success in the understanding and treatment of smoking behaviors. Bricker et al., (2010) conducted a study to assess the flexibility of delivering acceptance-based treatment via a telephone-delivered protocol. Results revealed that smoking quit rates were double the quit rates associated with standard telephone counseling. ACT has shown success

compared to other forms of smoking cessation therapy such as CBT (Hernández-López et al., 2009) and Nicotine Replacement Therapy (NRT) (Gifford et al., 2004). Gifford (2004) found that in comparison to NRT, smokers had improved smoking outcomes at a one-year follow-up. Furthermore, in cases of co-morbid smoking and mood disorders, ACT has been effective in reducing anxiety related symptoms that usually spur substance abuse (Assayag et al., 2012; Batten & Hayes, 2005). Indeed, the success of ACT is commendable. However, similar to CBT, because ACT is typically characterized as consisting of several weeks of sessions ranging from 60-90 minutes, feasibility may become an issue for some treatment settings. Individuals may not have the time or resources to access such therapy. Thus, a less time consuming method of behavior change may be warranted.

Hope theory. Hope theory focuses on an individuals' ability to create goals for themselves and to attain those goals through the implementation of both pathways and agency (Snyder, 2002). The pathways component of hope theory is an individual's ability to create multiple routes to achieve a desired goal whereas agency is described as an individual's perceived capacity to use his or her pathways to reach the desired goal (Snyder, 2002). High-hope individuals are more able to create multiple distinct pathways to reach a goal. Additionally, they are able to create multiple pathways to reach that goal. In contrast, low-hope individuals are unable to establish clearly defined pathways to achieve goals and lack the ability to remain motivated to follow a particular pathway to a goal. For instance, a smoker demonstrating effective pathways would be able to utilize multiple tools to achieve cessation such as attending a support group or chewing nicotine gum. Furthermore, agency would be demonstrated as the smoker's ability to seek out and regularly attend support groups to achieve his or her goal of cessation.

Given the association hope has with goal attainment, research has investigated the role of hope in health behaviors. Individuals with higher levels of hope are less likely to engage in addictive behaviors and are more likely to tolerate a physically distressing stimulus (Berg, 2008; Snyder, 2002; Snyder et al., 2002). Berg (2008) investigated the effects of a 15 minute hope-based intervention on hope, pain tolerance, and pain ratings during a cold pressor task. Following the hope intervention, pain tolerance increased. Given the relationship between hope and distress tolerance as illustrated in Berg (2008), a brief intervention of this type could be beneficial for smokers. Still, the hope-based intervention is considered an individual-based approach. Individual-based approaches are limited to treating one person at a time, and can prove to be costly and time consuming. Thus, despite positive outcomes associated with a hope intervention, alternative interventions that can be administered to a large number of people, are less time consuming, and are cost effective may be of value. The application of social norms to behavior change embodies this approach. The present study sought to use social norms as a delivery method, but on an individual level so as to establish the initial efficacy of utilizing such a method for a larger number of individuals.

Social Norms

Social norms are perceptions held by members of society that serve to characterize and guide behavior (Schultz, 1999). There are two types of social norms: descriptive and injunctive (Cialdini, Reno, & Kallgren, 1990). A descriptive norm refers to what most people do, and it motivates by providing evidence as to what a typical behavior would look like (Cialdini et al., 1990). Thus, the more an individual sees a particular behavior being performed by others, the more likely that individual is to engage in the said behavior. An injunctive norm refers to what is commonly approved or disapproved of in a given culture (Schultz, 1999). Thus, the more an

individual views a particular behavior as being looked favorably upon by others, the more likely that individual is to engage in the respective behavior. Both types of norms, and the interactions between them, can affect behavior change.

Social normative approaches have been successfully applied to various behaviors such as littering and curbside recycling (Cialdini et al., 1990; Schultz 1999). Cialdini (1990) investigated the effect that descriptive and injunctive norms would have upon littering behaviors. The results revealed that the subjects tended to act in accordance with the norm that was most salient. For example, subjects tended to litter more in areas that contained more litter (descriptive norm) despite the presence of a sign prohibiting littering in the area (injunctive norm). Schultz, Nolan, Cialdini, Goldstein, and Griskevicius, (2007) found that when participants were given information regarding their household energy usage in comparison to others (descriptive norm) they were more inclined to adjust their energy usage to be more in line with the norm. It is clear that the individuals will change their behavior to be more in line with the perceived norm. This effect has shown to persist with health behaviors as well.

Research with social norms has also been applied to changing health related behaviors such as condom use, flu shots, and drinking behaviors (Croker et al., 2009; Kapadiaet al., 2010; Scholly, Katz, Gascoigne, & Holck, 2005; Updegraff, Emanuel, Gallagher, & Steinman, 2011). Studies involving norms and health behaviors have often looked at commonly held misperceptions of norms. For instance, college students tend to underestimate their peers' condom use and overestimate binge drinking (Kapadia et al., 2012; Perkins et al., 2010). In order to correct these perceptions, researchers have implemented social marketing campaigns that convey an accurate estimate of the number of college students that in fact engage in a

particular behavior (Updegraff et al., 2011). As a result, perceptions from studies such as this tend to be more accurate following the social marketing campaign and behavior change ensues.

Presently, there are several studies that have investigated the role of social norms in changing distress tolerance (Jackson & Phillips, 2011; Pulvers, Schroeder, Limas, & Zhu, 2013; Wilson, Chaplin, & Thorn, 1995). The following paper seeks to extend the results of these studies to a smoking population. Theoretically, social normative messages may be useful in increasing an individual's ability to tolerate a physically stressful task. Aside from increasing persistence with a distressing task, the utilization of a social norm may help to correct misperceptions commonly held about cessation outcomes. Thus, smokers may be more motivated to refrain from a particular behavior if they were aware that what they are doing is, in fact, not the norm.

However, social norm campaigns have been criticized for waning results following the social norm intervention. Schultz et al., (2007) found that energy consumption began to increase a few months following the social norm intervention. Similarly, perceptions of health behaviors on college campuses began to be under- and overestimated once again several months after the social marketing campaign (Perkins et al., 2010; Scholly et al., 2005). Thus, although social norms may be useful in changing distress tolerance, it is important to be aware that the results may only be temporary. Despite this limitation a social norm intervention still has merit for changing behavior considering its ease of implementation and cost effectiveness.

Preliminary Study

A preliminary study was conducted with college students to assess the impact of a social norm intervention on pain tolerance, as well as the effect of framing the task as a challenge (Pulvers et al., 2013). Participants were 260 college participants (80 males and 180 females)

recruited from a south western university's human participant pool. Participants watched a video explaining the CPT. Towards the end of the video participants randomly received one of four statements: 1) Norm + challenge statement; 2) No Norm + challenge statement; 3) Norm + no challenge statement; 4) No norm + no challenge statement. The challenge statement was stated as: "Now you're ready for the cold water challenge" whereas the no challenge statement was stated as: "Now you're ready for the experiment." Norms were established based on results from a previous pilot and were set approximately one standard deviation above the mean for men and women respectively (males: 3 and a half minutes /females: 90 seconds). The control group watched the same video but the norm was replaced with a general statement about time ("it varies"). Following condition assignment, participants completed the cold pressor task. The CPT was conducted using an industrial water bath that circulated 0° C water. Participants were instructed to keep their hand in the water for as long as tolerable. Unbeknownst to the participant, there was an uninformed maximum time limit of 300 seconds.

Pain tolerance was the main dependent variable and was measured with a stopwatch in seconds from hand immersion to hand withdrawal. Results indicated that participants who received a social norm message exhibited significantly higher pain tolerance (norm [M = 122.08, SD = 103.16], control [M = 76.96, SD = 84.54]), regardless of the type of challenge statement, F (1, 255) = 26.95, p = .000, η^2 = .10. No significant differences attributed to condition or gender was found for the verbal or pain scale measurements (p > .05). Moreover, the interaction between condition and gender was not significant, F (1, 255) = 3.0, p = .09, η^2 = .01. This preliminary study provides valuable evidence that a social norm approach is effective in increasing pain tolerance times during a CPT. The next step is to test the intervention with smokers and assess how it may affect subsequent smoking behavior.

The Current Study

Primary goal. The primary goal of this research was to assess the effects of a social norm intervention on smokers' physical distress tolerance (pain tolerance, pain threshold, and pain).

Hypothesis one. Distress tolerance would significantly increase for those receiving the social norm intervention in comparison to those in the control group.

Secondary goal. The secondary goal of this study was to assess the effects of the social norm intervention on participants smoking behavior following pain.

Hypothesis two. Latency to smoke following pain would be significantly longer for those receiving the social norm intervention in comparison to those in the control group.

Method

Sample

A power analysis was conducted in order to establish appropriate sample sizes to test all hypotheses. The power analysis was informed by the results from a preliminary study conducted by Pulvers et al., (2012). All analyses were done at a power of .80 and alpha set at .05 in order to avoid the risk of a Type II error (Cohen, 1992). Thus, in order to detect a medium effect, 64 participants per group were needed for a total of 128 participants.

The sample consisted of 128 participants (76% male, 65% Caucasian, 10% African American/Black) haphazardly selected from the local community through those who responded to newspaper and internet advertisements. Ages ranged from 18 – 61 (M = 34.86, SD = 11.66). Although recruitment was focused towards the local community, individuals identifying as school affiliates (3.1%) meeting the inclusion criteria were not excluded. Additionally, the majority of participants indicated having a pre-tax annual household income of less than $34,000 (62.6%) and having completed at least some college (44.9%) as their highest level of education.

A health screening questionnaire was used to exclude participants with pre-existing health conditions (ex. frost bite, lupus, diabetes) that may be have been exacerbated by the CPT (*N* = 64). Further, those who smoked less than 12 cigarettes per day were excluded (*N* = 118). Given that the goal of this study was to assess behavioral change in regular smokers, this cut-off was used as a screener for moderate to heavy smokers as reported by the CDC (2011).

Apparatus

Cold pressor. The cold pressor machine (JeioTech Inc) is a circulating bath that continually circulated water at a freezing temperature of 0° Celsius (see Figure 1). A lid covered a small opening at the top of the machine holding the water. The lid was removed and participants submerged their hand in the water. The cold pressor machine was calibrated using an external thermometer after every five participants to ensure that the temperature reading were accurate.

Measures

All measures used in this study were computer-administered. However, paper and pencil copies were made available to participants who were not comfortable with using the provided computer (none where).

Descriptive variables.

Demographics. Several demographic variables were assessed: 1) age; 2) ethnicity; 3) education; and 4) income.

Smoking history. The Smoking History Questionnaire (Brown et al., 2002) was used to assess smoking behaviors and beliefs. Sample items included: “How old were you when you smoked your first whole cigarette?” and “Do you currently smoke every day, some days, or not at all.”

Intention to quit. The Stages of Change Scale (SOC) (DiClemente et al., 1991) was be used to assess intention to quit. The scale is a two-item measure (i.e., "Are you seriously considering quitting cigarettes within the next 6 months?" and "Are you planning to quit smoking in the next 30 days?") that divides intention to quit across three stages: precontemplation (not considering quitting smoking within the next 3 months), contemplation (considering quitting smoking within the next 6 months, but not in the next 30 days), preparation (considering quitting smoking in the next 6 months and within the next 30 days).

Nicotine dependence. The Fagerström Test for Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerström, 1991) is a six-item questionnaire that measures level of nicotine dependence. Prior research has shown an alpha of .72 and a test-retest value of .82. A sample item is: "How many cigarettes do you smoke per day?"

Control variables.

Gender. Given differences in pain tolerance times found in a similar study conducted by Pulvers et al., (2012), gender was entered in as a covariate.

Hand size. Hand size was controlled for given that a preliminary study conducted by Pulvers et al., (2012) revealed a moderate correlation with pain tolerance during the CPT. Hand size was measured with a tape measure in inches three ways: length, width, and circumference. The measurements were then aggregated in order to create a composite hand measurement score and were then entered in as a covariate.

Pain catastrophizing. Given that lower pain catastrophizing has been linked with less experimental pain (Hood, Pulvers, Carrillo, Merchant, & Thomas, 2012), pain catastrophizing was entered in as a covariate. The Pain Catastrophizing Scale (PCS) (Sullivan, Bishop, & Pivik, 1995) is a 13-item questionnaire developed to identify catastrophic thoughts or feelings in

relation to painful experiences. The PCS contains three subscales; four questions measure rumination (e.g., “I can’t seem to keep it out of my mind”), three questions measure magnification (e.g., “I become afraid that the pain may get worse”) and six questions measure helplessness (e.g., “I feel I can’t stand it anymore”). The items are scored on a five-point Likert scale with scoring possibilities ranging from ‘not at all’ (score = 0) to ‘always’ (score = 4). The Cronbach’s alpha for this study was .86. Additionally, prior research shows that the scale has good construct validity, such that catastrophizers reported a higher frequency of catastrophizing thoughts (M = 2.2, SD = 1.7) than non-catastrophizers (M = .6, SD = 1.3), t (26) = 3.5, $p < .01$ (Sullivan et al., 1995).

Discomfort intolerance. Subjective pain tolerance was entered in as a covariate in order to minimize variability due to previous pain experiences or tolerance levels. The Discomfort Intolerance Scale (Schmidt, Richey, & Fitzpatrick, 2006) is a short 7-item self-report measure of an individual’s ability to tolerate physical discomfort or pain. Scores range from 0 (not at all like me) to 6 (extremely like me). The DIS has two subscales; four questions measure an individual’s ability to tolerate discomfort and pain (e.g., “I can tolerate a great deal of physical discomfort”), and three questions that measure the avoidance of physical discomfort (e.g., “I take extreme measures to avoid feeling physically uncomfortable”). The Cronbach’s alpha for this study was .67 (ability to tolerate discomfort and pain) and .69 (avoidance of physical discomfort). Test-retest reliability for the scale has been shown to be acceptable for both factor loadings, r = .63 and r = .66 respectively (Schmidt et al., 2006).

Markers of distress (pre- and post-experimental measures.)

Positive and negative affect. Positive affect (PA) and negative affect (NA) has been shown to be a marker of distress as individuals tend to report lower levels of PA and higher

levels of NA following distressing stimuli (Abrantes et al., 2008; Zvolensky & Otto, 2007). Thus, it was important to capture the change of both, before and after the CPT. Change in PA and NA affect was measured by calculating a change score (i.e., difference between pre/post PA/NA scores). The Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) consists of two 10-item scales. Five items on the scale measured PA (e.g., interested, excited, alert); while the five remaining items measured NA (e.g., distressed, nervous, afraid). Participants were required to indicate to what extent they generally experience that 'feeling' or 'emotion' on a five-point scale ranging from 1 ("very slightly/not at all") to 5 ("extremely"). The possible scores on both scales range from 10 to 50. Higher scores indicate higher affect. Coefficient alphas for the PA and NA scale in the present study were .85 and .90 respectively. Additionally, the scale has been shown to have good discriminant validity between NA and PA, $r = -.12$. Pre-existing levels of positive and negative affect were controlled; however, changes in positive and negative affect as a result of the intervention were also assessed.

Craving. Subjective tobacco craving was measured in order to capture change as a result of the CPT. Craving was used as a marker of distress given past research that has shown that smokers show increased urges to smoke following distressing stimuli (Ditre & Brandon, 2008; Pulvers et al., 2013). Change in craving was measured by calculating a change score (i.e., difference between pre/post craving scores).The Questionnaire of Smoking Urges – Brief (QSU-B) is a 10-item measure that measures craving to smoke (Cox, Tiffany, & Christen, 2001). Participants respond according to a 100-point scale ranging from 0 (strongly disgree) to 100 (strongly agree). The QSU-B has two subscales; five questions measure intention to smoke with smoking anticipated as pleasurable (e.g., "A cigarette would taste good now"), and five questions that measure an anticipation of relief from negative affect and nicotine withdrawal, with an

urgent desire to smoke (e.g., “I am going to smoke as soon as possible”). The Cronbach’s alpha for this study was .91.

Outcome variables.

Pain tolerance. Pain tolerance was measured as the amount of time elapsed from hand immersion to hand withdrawal. Time elapsed was measured in seconds with a stopwatch.

Latency to smoke. Following the CPT, the researcher informed the participant that they would need 10 minutes to prepare for the next phase of the study. During that time the participant was informed that they were free to smoke if they so choose. Latency to smoke was measured as the amount of time until participants took their first puff of a lit cigarette following the CPT. Time elapsed was measured in seconds with a stopwatch.

Pain rating. Pain rating was assessed by a verbal pain rating ranging from 0 – 100 pain index, with zero being “no pain” and 100 being the “worse pain imaginable”. Additionally, the short·form McGill Pain Questionnaire (Melzack, 1987) was used. The measure is used for measuring sensory, affective, and evaluative dimensions of pain. It consists of a pain rating index (PRI) with 15 adjectives (ex: “throbbing” or “shooting”), a visual analogue scale, and a present pain index. The PRI has two dimensions: 1) the sensory dimension consisting of 11 items, and 2) the affective dimension consisting of 4 items. The PRI is rated on an intensity scale ranging 0 (none) to 3 (severe); higher score indicates more severe pain. Prior research has shown alpha coefficients ranging from .85 to .94.

Procedure

Recruitment. Researchers published ads in local newspaper outlets and internet websites in order to recruit participants. The ad provided both email and phone number contact information for participation inquiry. Additionally, the ad briefly explained several components

of the study: participant inclusion criteria (smoker and 18 years of age or older), time commitment (approximately 30 minutes), and monetary incentive ($10.00 or $20.00). Due to low recruitment and time constraints the incentive for the study was raised from $10.00 to $20.00. No significant differences were found between those who received $10.00 in comparison to those who received $20.00 on both the pain tolerance $t(126) = 1.17$, $p = .24$ and latency to smoke $t(109) = -.83$, $p = .41$ measures.

Screening. Participants were screened via a telephone conference with a researcher in order to ensure inclusion criteria were met. At that time, researchers determined the number of cigarettes smoked per day with the prospective participants as well as their age (participants had to be 18 years or older to participate). Additionally, a health screening questionnaire was administered to ensure that the participant was medically eligible to participate in the experiment. Health exclusion criteria included: 1) having ever been told to have arthritis, circulatory problems, peripheral neuropathy, thyroid problems, diabetes, systemic lupus erythematosis, scleroderma, other types of connective tissue disorders, cardiovascular disorder, hearing impairment/persistent ringing in ears, or high blood pressure/hypertension; 2) having had a history of fainting or seizures, frostbite, or any trauma to the non-dominant hand. Additionally, participants were excluded if they were currently pregnant or currently taking pain medications. Once the participant was deemed eligible, the researcher scheduled a time for the participant to complete the study. Participants were randomly assigned to condition prior to the scheduled study time.

At the end of the phone interview, as well as the morning of each participant's scheduled appointment time, participants were reminded to refrain from coming under the influence of any substances during their study time. In order to control for nicotine exposure prior to the

experiment, participants were instructed to smoke a cigarette one hour before their scheduled appointment and none thereafter. Expired carbon monoxide was measured at the beginning of the session using a breathalyzer (Bedfont Scientific) to verify a level of at least 8 ppm. All participants met this requirement.

Conditions. The current study was an experiment with two conditions: social norm intervention (treatment) versus social norm control. All participants and research assistants were matched on gender. Blocked random assignment was used to assign participants to condition. This was done to ensure that an equal proportion of male and female participants received both conditions.

Social norm intervention. Participants were instructed to watch a video describing the CPT. The experimenter played the video, left the room, and returned when it had finished (this was done in order to keep the experimenter unaware of condition assignment). The video was narrated by a female professor. The video was comprised of three parts: 1) participants were thanked for their participation; 2) a demonstration of the CPT was shown; and 3) participants were given a norm as to how long most men/women could keep their hand in the water. The norms stated were specific to male (3 minutes) and female (90 seconds) smokers' times during the CPT as demonstrated in a preliminary study. The norm was set approximately one standard deviation above the mean in order to encourage overall persistence. Additionally, a statement stating: "Those who keep their hand in for 3 minutes (males)/90 seconds (females) have better psychological resilience and tend to meet the goals they set for themselves," followed the presentation of the norm. This is an empirically supported statement given an association between positive traits, such as hope and optimism, with CPT performance in previous studies. The purpose of the statement was to enhance the social desirability aspect of achieving the norm.

Social norm control. The same video described in the social norm intervention group was used except for a slight modification in the norm stated. Instead of a specific time given, the statement said was: "The length of time between when people state pain and withdraw their hand varies."

Day of the study.

Once participants arrived for their scheduled study time they were verbally read an informed consent form and asked to sign it indicating their understanding of the study. Next, hand measurements were taken and participants were asked to complete the pre-experimental survey. Following the survey, participants watched the CPT video (control or manipulation) and then immediately completed the CPT. After the completion of the CPT, participants were given the opportunity to smoke. Once the participant was finished smoking or the allotted time for the smoking portion had expired (10 minutes), participants completed the post-experimental survey, were debriefed, and compensated. The markers of distress measures were administered during the post-experimental procedure and served as an indirect way of assessing relief of craving and negative affect following the CPT and smoking portion of the study.

Knowledge gained from the preliminary study has indicated that the integrity of the study would not be threatened following a full debrief, provided we request confidentiality. That is, participants typically do not disclose the manipulation associated with the study to other individuals.

Post-experimental manipulation check. In order to evaluate other potential confounds, participants completed a questionnaire assessing: 1) effort ("how hard did you try?"); 2) importance ("how important was the task to you?"); 3) believability of the social norm ("how

believable was the video message?”); and 4) recall of the message (“What did the message in the video say?”). All items were rated on a scale from 0 – 10.

Results

All statistical analyses were conducted using Statistical Package for the Social Sciences 18 software (SPSS Inc., Chicago, Illinois, U.S.A). Following data collection and data entry, descriptive analyses were conducted in order to assess floor effects, ceiling effects, normality, skewness, kurtosis, distribution, missing data, and outliers. As a result, in order to lessen the positive skewness to the pain rating distribution, one participant’s pain rating time was winsorized. Additional preliminary analyses included conducting zero order correlations among all predictors, covariates, and outcome variables.

Primary analyses consisted of conducting two separate one-way ANCOVAs. Specifically, to test the hypothesis that distress tolerance would significantly increase for those receiving the social norm intervention in comparison to those in the control group, a one-way ANCOVA was used with experimental condition as the predictor variable and pain tolerance as the outcome variable, with gender, hand size, pain catastrophizing, discomfort intolerance, and markers of distress (change in positive and negative affect, and change in craving,) entered in as covariates. Similarly, to test the hypothesis that latency to smoke following pain would be significantly longer for those receiving the social norm intervention in comparison to those in the control group, a one-way ANCOVA was used with experimental condition as the predictor variable and latency to smoke as the outcome variable, with gender, hand size, pain catastrophizing, discomfort intolerance, and markers of distress (change in positive and negative affect and change in craving) entered in as covariates. However, due to missing data points across several of the subscales that encompass the covariates, the overall *N* for the analysis was

significantly reduced. In order to maintain an adequate sample size for the primary analysis, a separate ANCOVA was conducted for each covariate.

The statistical assumptions for the ANCOVA are: 1) normal distribution; 2) equal variances assumed; and 3) independence of observations. For all examined variables, normality was met according to histograms. According to Levene's test of equality of error variances, equal variances assumed was met ($p > .05$) for all variables except the Discomfort Intolerance Scale. Given that equal variances assumed were violated, caution must be used. However, the ANCOVA is robust to this type of violation. For all variables, independence of observations was met because each data point was not affected by another.

Descriptive Analysis

Table 2 presents data from the pre-experimental survey. All participants indicated they smoked every day at an average rate of 18.42 cigarettes per day (*SD* = 5.93), and the majority (79%) indicated they had been smoking at this rate for at least four years or more. The mean age of first cigarette consumption for participants was 15.18 (*SD* = 4.35). Most participants were in the precontemplation stage (47.2%) of the readiness to change scale. The average score on the FTND scale was 3.24 (*SD* = 1.21) (low dependence).

Zero-order correlations between study variables are presented in Table 1. The primary outcome variables did not correlate with many of the covariates or demographic variables. Distress tolerance was significantly correlated with discomfort intolerance ($r = -.42$, $p < .01$) and income ($r = .19$, $p < .05$). Latency to smoke was significantly correlated with change in craving ($r = -.24$, $p < .05$) and intention to quit ($r = .24$, $p < .01$). Additionally, gender was shown to be correlated with many of the variables, hand size ($r = -.69$, $p < .01$), pain catastrophizing ($r = .27$, $p < .01$), discomfort intolerance ($r = .27$, $p < .01$), and change in craving ($r = -.23$, $p < .05$)

Primary Analysis

Distress tolerance.

Table 3 displays seven separate ANCOVAs that were tested with gender, hand size, pain catastrophizing, discomfort intolerance, change in positive affect, change in negative affect, and change in craving entered in as covariates in each model respectively. As seen in Figure 2, the experimental condition was significant in all models ($p < .05$), indicating that those receiving a social norm message had significantly higher distress tolerance ($M = 135.09$, $SD = 117.34$) than those in the control group ($M = 89.28$, $SD = 92.96$) (see Table 4). One covariate model was significant with two main effects: the Discomfort Intolerance Scale, $F(1, 121) = 27.82$, $p < .001$, $\eta^2 = .19$ and the social norm condition $F(1, 121) = 8.17$, $p < .05$, $\eta^2 = .06$.

Latency to smoke.

The average latency to smoke time for participants who did smoke ($N = 111$) was 25.21 seconds ($SD = 49.55$). Seventeen participants did not smoke at all. Table 5 displays seven separate ANCOVAs that were tested with gender, hand size, pain catastrophizing, discomfort intolerance, change in positive affect, change in negative affect, and change in craving entered in as covariates in each model respectively. The experimental condition was non-significant in all models ($p > .05$), such that those receiving a social norm message had similar latency to smoke times ($M = 240.08$, $SD = 107.36$) as those in the control group ($M = 253.40$, $SD = 107.36$) (see Table 4). The experimental condition $F(2, 99) = 3.44$, $p < .05$, $\eta^2 = .07$ was significant when controlling for change in craving and change in craving was also a significant predictor $F(1, 99) = 6.57$, $p < .05$, $\eta^2 = .06$.

Secondary Analysis

Verbal pain rating.

Table 6 displays seven separate ANCOVAs that were tested with gender, hand size, pain catastrophizing, discomfort intolerance, change in positive affect, change in negative affect, and change in craving entered in as covariates in each model respectively. The experimental condition was significant in the gender $F(1, 125) = 5.26$, $p < .02$, $\eta^2 = .04$, hand size $F(1, 125) = 5.20$, $p < .02$, $\eta^2 = .04$, discomfort intolerance $F(1, 121) = 5.64$, $p < .02$, $\eta^2 = .05$, and change in positive affect $F(1, 114) = 4.48$, $p < .04$, $\eta^2 = .04$ models, indicating that those in the control group ($M = 54.93$, $SD = 26.73$) had significantly higher pain intensity following the CPT than those who received a social norm message ($M = 47.38$, $SD = 28.63$). One covariate model was significant: the Discomfort Intolerance Scale, $F(1, 121) = 4.55$, $p < .05$, $\eta^2 = .04$.

McGill pain questionnaire.

Table 7 displays seven separate ANCOVAs that were tested with gender, hand size, pain catastrophizing, discomfort intolerance, change in positive affect, change in negative affect, and change in craving entered in as covariates in each model respectively. The experimental condition was non-significant in all models ($p > .05$), such that those receiving a social norm message had similar pain intensity at the conclusion of the study ($M = 14.54$, $SD = 9.76$) as those in the control group ($M = 12.09$, $SD = 7.41$). Both pain catastrophizing $F(1, 105) = 10.67$, $p < .05$, $\eta^2 = .09$ and discomfort intolerance $F(1, 105) = 12.32$, $p < .05$, $\eta^2 = .10$ were also significant predictors.

Post-experimental manipulation check

Table 8 displays the results of the post-experimental manipulation check. In general, participants rated highly in terms of effort placed on the CPT as well as perceived importance of

the CPT. Additionally, participants found the message in the video to be somewhat believable. Table 9 displays the results of the markers of distress variables. Following the experimental procedure, both groups reported a relief in craving and negative affect.

Discussion

The primary goal of this study was to assess the effects of a computer delivered social norm intervention on smoker's physical DT. This was accomplished by an experimental procedure in which participants were tasked with submerging their hand in a bin of very cold water for as long as they could withstand the pain (CPT). As hypothesized, individuals who received a social norm message that provided an elevated time as to how long most people could keep their hand in the water were able to do so longer than those in the control group. The secondary goal of this study was to assess the effects of the social norm message intervention on smokers' latency to smoke immediately following the experimental procedure. Contrary to hypothesis, those receiving a social norm message had similar latency to smoke times as those in the control group. An in-depth analysis of the results of each hypothesis is discussed.

Distress Tolerance

The present study was able to replicate results of Pulvers et al. (2013) by demonstrating that a computer-delivered social norm message providing an elevated norm about pain tolerance is effective in increasing pain tolerance. Additionally, this study extends the research conducted by Pulvers et al. (2013) by implementing a similar experimental design but with the addition of a sample that is characterized as having low distress tolerance: cigarette smokers (Ditre & Brandon, 2008). Indeed, as mentioned previously, individuals with addictive behaviors are particularly susceptible to low levels of DT and as a result use their addiction as a way to resolve negative experiences (Beck et al., 1993; Brandon, et al., 2003; Buckner et al., 2007; Corstorphine

et al., 2007; Quinn et al., 1996). However, despite this predisposition to low distress tolerance, in the present study smokers' were able to keep their hand in the cold water longer when they believed that most people could do so in comparison to a control group receiving no normative statement.

A key part to this study was the utilization of a brief computer-delivered social norm intervention as a way to increase DT. Common behavioral approaches to understanding addiction such as CBT have focused on changing the thought processes associated with addiction and replacing those thoughts with more constructive thinking or behaviors (Beck, 1993). Social norms may not work as explicitly but rather motivate behavior change by providing evidence as to what a particular behavior would look like (Cialdini et al., 1990). Individuals are likely to not deviate from the norm and alter the behavior as to be part of the majority. It is likely that this phenomenon is what took place in this study as smokers' were more likely to last longer when presented with a norm.

An additional finding of interest was that despite increased performance on the CPT for the social norm group, pain ratings on the McGill Pain Questionnaire remained comparable across both groups. Moreover, the experimental group reported less verbal pain than the control group immediately following the CPT despite being exposed to the painful stimulus longer. This finding is similar to Pulvers et al. (2013) in which pain intensity was similar in both the social norm and control group despite those in the social norm group being exposed to the CPT longer. This is also consistent with the broader literature in which distress tolerance and pain ratings have been uncorrelated (Cassens, Stalling, & Ahles, 1988; Dolce, Doleys, Raczynski, & Lossie, 1986; Jackson, 2007; Jackson & Phillips, 2011; Mitchell, MacDonald, & Brodie, 2006). Pulvers et al., (2013) has suggested that normative messages may shape participants' appraisal of

the painful stimulus as well as enhance their perceived sense of control. Indeed, research has shown that enhanced perceived control of a painful stimulus has been shown to decrease pain intensity ratings (Feldner, & Hekmat, 2001; Janssen, Spinhoven, & Arntz, 2004; Vancleef, & Peters, 2011)

Several other reasons may exist as to why the social norm was particularly effective. Goal setting was enacted by giving participants an implicit time to strive for. Goal setting is a core component in many behavioral interventions such as ACT and hope theory (Hayes et al., 2006; Berg, 2008; Snyder, 2002). The inclusion of an implicit goal coupled with the immediacy required to attain the goal may have served to enhance the effectiveness of the intervention. Another possible explanation is that participants' sense of control was enhanced by the inclusion of the norm. Studies among smokers have shown that enhanced perceived sense of control was related to better perceptions and attitudes related to managing withdrawal symptoms and cessastion attempts (Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008; Schnoll et al., 2011; Waltenbaugh, & Zagummy, 2004). Given the nature of the experiment in that participants had complete autonomy to decide when they would remove their hand from the bin, as a result, it is likely that their sense of control was enhanced.

Latency to Smoke

The present study was unable to show any significant effects of the social norm intervention on latency to smoke times. Participants in both conditions had comparable times. Given that smoking and pain tend to have a reciprocal relationship, it was expected that by increasing DT, individuals would wait longer to smoke (Ditre & Brandon, 2008; Ditre et al., 2011). That is, by increasing one's ability to withstand distress individuals should then be able to cope on their own without having to seek the immediate analgesic effects of a cigarette.

However, this result was not seen in this study. It could be that while there was evidence of an increase in CPT performance for the social norm group, this may not directly be related to increasing the DT construct or that the connection was not made by participants. As demonstrated in CBT, clients often take several sessions before they realize the faultiness of their negative thinking, until they are able to build effective coping strategies (Beck et al., 1993). Additionally, it is possible that the latency to smoke variable was flawed, as the latency to smoke variable did not correlate with distress tolerance as expected. Indeed, it would be expected that at least among the control group, there would be a relationship between how long participants submerged their hand in the water and how long they waited to smoke their cigarette. This is especially concerning given that pain tolerance was negatively correlated with the discomfort intolerance measure, indicating that performance on the CPT was a valid measure of distress tolerance.

There are several additional explanations that could account for why the hypothesized result was not found. First, the nature of how the CPT was administered may not be effective in inducing behavioral responses for increased smoking. That is, participants may subjectively report increased cravings but this may fail to translate to actual smoking behavior following the CPT. Additionally, while the control group reported more pain than the experimental group, there were no significant differences on the McGill Pain Questionnaire. Thus, since the experimental group did not report higher pain ratings despite having been exposed to the CPT longer, it would be understandable why no significant differences were found on the latency to smoke measure. Berg (2008) found a similar result in which participants who received the hope intervention increased their performance on the CPT without necessarily reporting significant changes in pain. Additionally, Ditre and Brandon (2008) mentions using others measures that

better mimic chronic painful experiences, such as thermal heat, electrical stimulation, or tourniquet ischemia which may better resemble this experience as opposed to solely measuring pain sensitivity. Additionally, Ditre and Brandon (2008) mentions that small reductions in the water temperature as opposed to a constant cold temperature, could potentially lead to higher pain intensity ratings which may exacerbate cravings to smoke. Second, in contrast to Ditre and Brandon (2008), participants in this study were not asked to at least take one puff during the smoking portion of the study. Instead, participants were merely given the option to smoke (some did not). It is possible that by mandating at least one puff, greater variability between groups could have been seen. Indeed, the initial satisfaction from nicotine may have exacerbated participants' cravings and led to quicker smoking. Third, participants may have not made the connection that their ability to withstand a distressing experience could be translated to other experiences such as resisting the urge to smoke. This could be due to the lack of specificity in reference to latency to smoke in the message delivered. Finally, latency to smoke may not be sufficient in determining if there was successful behavioral change following the CPT. Instruments (e.g., smoking topography) that can assess changes in the number of puffs taken or depth of inhalations could provide a more detailed view of differences in smoking patterns among the two experimental groups.

Strengths and Limitations

This study is the first to use a computer-delivered social norm intervention among a sample of smokers in order to increase DT. A significant strength of this study was the application of a previously tested experimental procedure with a sample of smokers. Quitting smoking is difficult and individuals often seek out assistance through more common behavioral interventions such as CBT and ACT. These interventions can be time consuming with a single

session often lasting one hour with the addition of subsequent sessions spanning several weeks. Additionally, these interventions can costly and its effects often extend to only a single individual. The social norm message delivered in this study was delivered easily by simply directing participants to a short, pre-recorded video of the social norm message.

Experimenter effects were avoided as a potential limitation in that experimenters conducting the study were not tasked with verbally delivering the norm to the participant. Instead, depending on condition assignment, each participant viewed the same video. Additionally, experimenters were blind to condition assignment. This removed any other subtle influences that the experimenter may have had on the participant's time during the CPT. Furthermore, experimenters viewed participants from a separate room which may have helped to remove any unwarranted to pressure on the participant to perform better on the CPT.

There are several limitations worth noting in the present study. First, smoking topography equipment was originally supposed to be used to corroborate the research findings. However, technical difficulties with the equipment coupled with financial and time constraints prohibited the use of the equipment. Smoking topography is useful in that in can provide information such as number of puffs taken, duration of each puff, and depth of inhalation. Blank, Disharoon, and Eissenberg, (2009) and Perkins, Karelitz, Giedgowd, and Conklin (2012) have shown that subjective and observational accounts of smoking behavior are limited in the type of information they can provide. Instead, the authors recommend the use of smoking topography to assist in understanding the underlying mechanisms involved in particular smoking behaviors. For instance, latency to smoke alone may be hard to interpret in itself given that depth of inhalation could be more indicative of nicotine withdrawal. That is, smokers might be taking bigger depths of inhalation as to quickly recoup the lack of nicotine in their system.

Second, similar to the previously stated limitation, biofeedback markers would have provided a more comprehensive picture of the results. Although subjective pain rating was not a primary variable of interest, it would be useful to corroborate perceptions of pain with biofeedback markers such as heart rate and galvanic skin response. This type of information could also provide insight into participant's physical state during and immediately following the CPT. In the current study there was no objective way of determining whether participants were physically distressed.

Finally, the social norm message used in the study may have not been explicit enough in order to affect latency to smoke. The message used only referred to the CPT and made no mention to smoking latency. Both Schultz (1999) and Cialdini et al., (1990) emphasize that for a social norm to be effective, the referent group and the desired behavior change should be explicit. Another issue related to the use of a social norm message is their relative short-lived results as mentioned by Schultz (1999). This study was not longitudinal in nature nor was there a follow-up, and was therefore unable to assess whether the results persisted beyond the initial experiment session.

Future Directions

Future studies may seek to extend this study by including smoking topography and biofeedback equipment. For example, while it was clear that the CPT performance was a valid measure of distress tolerance, it would also be interesting to know how the magnitude of the distress experienced during the CPT dissipates once the task is over. As seen in the present study, the transition from the CPT to the smoking portion may have diminished participants' desire to have a cigarette given that the painful stimulus had surpassed. If this was an issue, future studies should consider giving participants the freedom to smoke anytime during the CPT.

This modification would allow researchers to capture how smokers respond when they are at their most heightened level of distress.

Researchers should also explore different distressing experiences. This study utilized the CPT which is characterized as an acute form of physical distress. The use of psychological stressors such as anagram tasks and the paced auditory serial addition task may produce different results. Additionally, while ethically difficult to administer, it would be useful to utilize a task that induces a chronic form of pain.

Finally, future studies should continue to explore the effectiveness of a social norm message for increasing latency to smoke following a distressing experience. First, researchers should seek to use a normative message that addresses how long most smokers wait before having a cigarette following a distressing experience. Similar to the norm delivered regarding hand submersion, the time used for latency to smoke should be artificially elevated in order to capture actual persistence above and beyond the norm. Second, researchers should incorporate a follow-up session following the initial experimental session. Given the criticism regarding the short-lived results of social norms, a follow-up session in which participants were asked to perform the CPT task again and also smoke could provide useful information as to whether the intervention indeed has lasting results. However, it would be important to consider how practice effects could confound the results if a follow-up session was employed

Conclusion

In summary, this study provides evidence that a computer-delivered social norm intervention is effective in increasing DT during a physically distressing task. However, this effect did not translate to increased latency to smoke times. The initial finding that a social normative message is effective in increasing DT times is consistent with findings from Pulvers et

al., (2013). While the present study was not able to translate this result to increased latency to smoke times, it is important to consider that slight modifications in the delivery of the norm could change this result. Social norms continue to be a cost effective, time efficient, and effective way to effect behavior change. Clinicians should consider how they make norms salient in the types of behavioral interventions they employ and consider their use when employing goal setting in therapy.

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Tables

Table 1: *Correlation matrix (r) of outcome variables and covariates*

Outcome Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Distress Tolerance[1]	1														
Latency to Smoke[2]	.03	1													
Gender[3]	-.13	-.06	1												
Hand Size[4]	.13	.05	-.69**	1											
Pain Catastrophizing[5]	-.09	-.06	.27**	-.29**	1										
Discomfort Intolerance[6]	-.42**	-.16	.27**	-.17	.45**	1									
Change in Positive Affect[7]	-.01	-.08	-.01	.10	-.14	-.14	1								
Change in Negative Affect[8]	.07	-.13	.07	-.15	.28**	.10	.14	1							
Change in Craving[9]	.01	-.24*	-.23*	.07	.20*	.08	.14	.14	1						
Education[10]	.13	-.07	.12	-.02	.07	.01	.07	-.04	-.03	1					
Income[11]	.19*	.04	-.23*	.20*	-.18	-.20*	.22*	.02	-.02	.26**	1				
Nicotine Dependence[12]	.05	-.10	-.13	.06	.17	.07	.05	.24*	.30**	-.07	.10	1			
Stages of Change[13]	-.11	.27**	-.01	-.04	.17	-.03	-.10	-.06	-.23*	-.12	-.04	.04	1		
Verbal Pain Rating[14]	-.43**	-.08	.13	.04	.14	.18*	.04	-.15	.04	-.11	-.03	.19*	.21*	1	
McGill Pain Questionnaire[15]	-.23*	-.08	.10	-.10	.29**	.31**	-.06	-.11	.02	.17	.04	.12	-.11	.39**	1

*$p < .05$, **$p < .01$

Table 2: *Pre-experimental survey measures*

Measure	*M*	*SD*	*N*	α
Current Number of Cigarettes Smoked	18.42	5.93	128	*
Hand Size	7.05	.44	128	*
Pain Catastrophizing Scale	30.88	12.90	118	.86
McGill Pain Questionnaire	13.34	8.78	116	.90
Discomfort Intolerance Scale	12.60	6.34	124	.67[a] - .69[b]

[a] Ability to tolerate discomfort and pain; [b] Avoidance of physical discomfort

Table 3: *Distress tolerance results when controlling for each covariate separately*[1]

Covariate	Outcome								
	Distress Tolerance								
	Corrected Model			Condition Model			Covariate Model		
	F	*p*	η^2	*F*	*p*	η^2	*F*	*p*	η^2
Gender	4.07	.02*	.06	6.05	.02*	.02	2.10	.15	.02
Hand Size	4.13	.02*	.06	6.01	.02*	.05	2.21	.14	.02
Pain Catastrophizing	3.26	.04*	.05	5.50	.02*	.02	.65	.42	.01
Discomfort Intolerance	17.70	.00**	.23	8.17	.01*	.06	27.82	.00**	.19
Change in Positive Affect	3.44	.04*	.06	6.87	.01*	.06	.09	.77	.00
Change in Negative Affect	3.12	.05	.05	5.74	.02*	.05	.23	.63	.00
Change in Craving	2.56	.08	.04	5.11	.03*	.04	.13	.72	.00

[1] Due to missing data points, a separate ANCOVA was conducted for each covariate.
*$p < .05$, **$p < .01$

Table 4: *Post-experimental survey measures*

	Norm			Control		
Measure	*M*	*SD*	*N*	*M*	*SD*	*N*
Pain Threshold	25.87	18.89	52	25.33	19.97	58
Pain Tolerance	135.09	117.34	64	89.28	92.96	64
Latency to Smoke	23.21	41.60	55	27.16	56.60	56
Duration of Smoking	240.08	107.36	55	253.40	119.58	56
Verbal Pain Rating	46.86	27.19	64	57.44	25.17	64

Table 5: *Latency to smoke results when controlling for each covariate separately*[1]

Covariate	Outcome								
	Latency to Smoke								
	Corrected Model			Condition Model			Covariate Model		
	F	*p*	η^2	*F*	*p*	η^2	*F*	*P*	η^2
Gender	.31	.73	.01	.17	.68	.00	.45	.51	.00
Hand Size	.20	.82	.00	.16	.69	.00	.22	.64	.00
Pain Catastrophizing	.29	.75	.01	.26	.61	.00	.36	.55	.00
Discomfort Intolerance	1.42	.25	.03	.16	.70	.00	2.65	.11	.03
Change in Positive Affect	.40	.67	.01	.19	.66	.00	.57	.45	.01
Change in Negative Affect	1.12	.33	.02	.52	.47	.01	1.56	.22	.02
Change in Craving	3.44	.04*	.07	.74	.40	.01	6.57	.01*	.06

[1] Due to missing data points, a separate ANCOVA was conducted for each covariate.
*$p < .05$

Table 6: *Verbal pain rating results when controlling for each covariate separately*[1]

Covariate	Outcome								
	Verbal Pain Rating								
	Corrected Model			Condition Model			Covariate Model		
	F	*p*	η^2	*F*	*P*	η^2	*F*	*P*	η^2
Gender	3.71	.03*	.05	5.26	.02*	.04	2.15	.15	.02
Hand Size	2.70	.07	.04	5.20	.02*	.04	.21	.65	.00
Pain Catastrophizing	2.73	.07	.05	3.11	.08	.03	1.88	.17	.02
Discomfort Intolerance	4.99	.01*	.08	5.64	.02*	.05	4.55	.04*	.04
Change in Positive Affect	2.36	.10	.04	4.48	.04*	.04	.39	.53	.00
Change in Negative Affect	2.58	.08	.04	2.66	.11	.02	2.02	.16	.02
Change in Craving	2.13	.12	.04	4.11	.05	.03	.02	.90	.00

[1] Due to missing data points, a separate ANCOVA was conducted for each covariate.
*$p < .05$

Table 7: *McGill pain questionnaire results when controlling for each covariate separately*[1]

Covariate	Outcome								
	McGill Pain Questionnaire								
	Corrected Model			Condition Model			Covariate Model		
	F	*p*	η^2	*F*	*p*	η^2	*F*	*P*	η^2
Gender	1.62	.20	.03	2.18	.14	.02	.95	.33	.01
Hand Size	1.68	.19	.03	2.20	.14	.02	1.08	.30	.01
Pain Catastrophizing	6.21	.01*	.11	2.81	.10	.03	10.67	.01*	.09
Discomfort Intolerance	7.62	.01*	.12	2.77	.10	.02	12.32	.01*	.10
Change in Positive Affect	1.37	.26	.03	2.30	.13	.02	.55	.46	.01
Change in Negative Affect	1.50	.23	.03	1.68	.20	.02	1.58	.21	.02
Change in Craving	1.50	.23	.03	2.94	.09	.03	.24	.63	.00

[1] Due to missing data points, a separate ANCOVA was conducted for each covariate.
*$p < .05$

Table 8: *Manipulation Check*

Question	Mean	SD
Effort: “How hard did you try?”	8.04	2.38
Importance: “How importance was the task to you?”	7.58	2.37
Believability: “How believable was the message to you	6.48	2.88

Table 9: *Markers of Distress*

Condition	Pre PA		Post PA		Pre NA		Post NA		Pre QSU-B		Post QSU-B	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Norm Group	32.38[a]	6.84	27.92[a]	8.46	15.83[b]	6.81	13.59[b]	4.46	27.94[c]	19.78	9.31[c]	13.18
Control Group	31.18[d]	8.02	27.97[d]	9.11	14.98[e]	7.75	13.15[e]	5.19	32.47[f]	20.31	8.20[f]	13.72

Note. Shared letter superscripts indicate significant differences. [a, c, d, f] $p < .001$; [b] $p < .01$; [e] $p < .05$

Figures

Figure 1

Figure 2

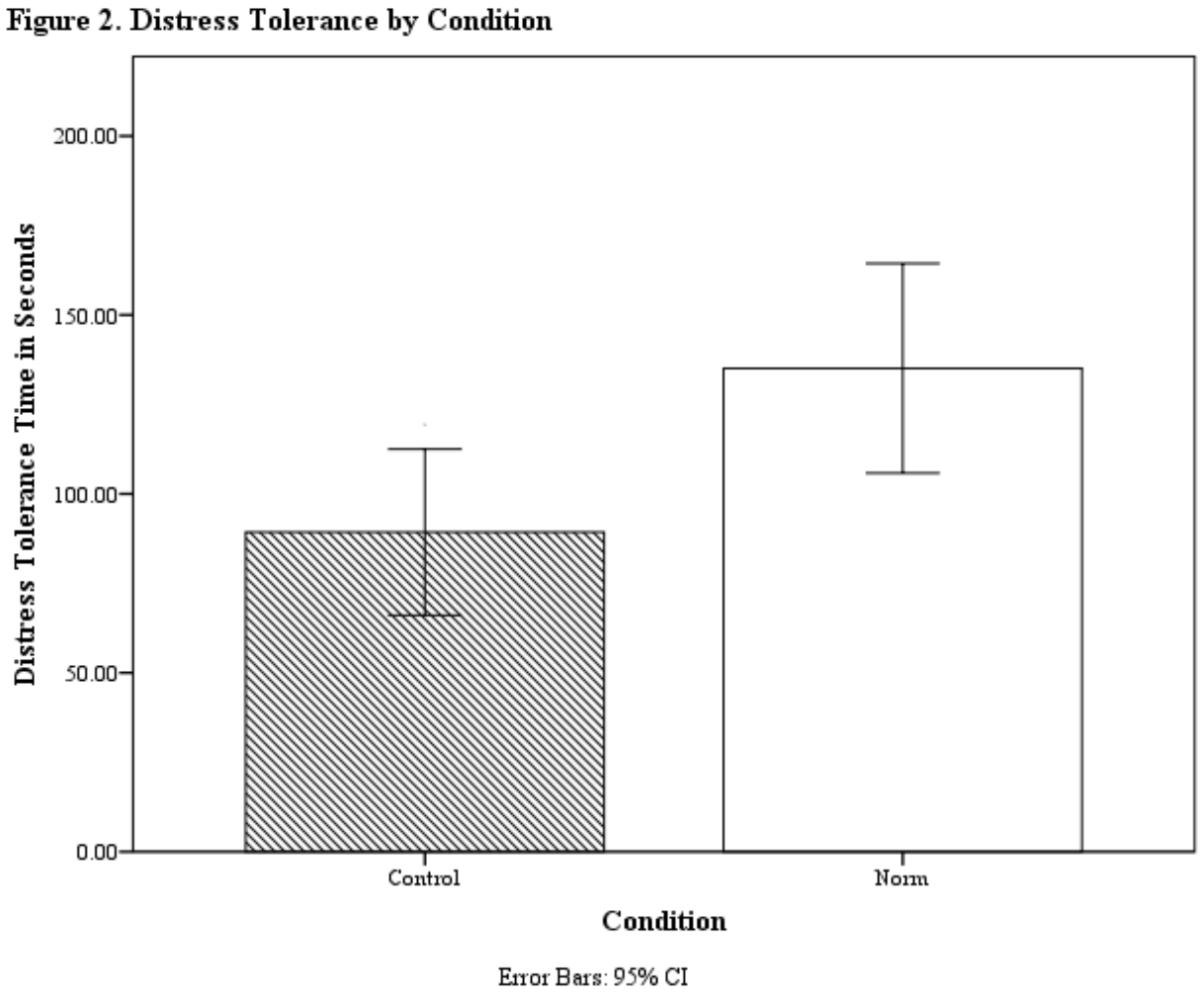
Figure 2. Distress Tolerance by Condition
Distress Tolerance Time in Seconds
200.00
150.00
100.00
50.00
0.00
Control
Norm
Condition
Error Bars: 95% CI