Mindfulness in Adolescents: Its Effect on Psychological Distress Leading to Suicidal Thoughts and Behaviors

Mindfulness in Adolescents: Its Effect on Psychological Distress Leading to Suicidal Thoughts and Behaviors

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Abstract

Psychological distress perceived as inescapable can lead to suicidal thoughts and behavior in individuals with emotion dysregulation and ruminative disorders. Mindfulness has been shown to improve emotion regulation and reduce rumination in adolescents and can therefore be a protective factor against suicidal thoughts and behavior. In this study, the (negative) association between trait mindfulness and intense psychological distress, as a proxy for suicidal thoughts and behavior, was tested in a sample of suicidal adolescents in an inpatient clinical setting at the Franciscan Children's Hospital. Psychological distress was measured with button presses on the wristband provided to subjects. Mindfulness was measured at intake with two self-report measures: Mindful Attention Awareness Scale - Adolescents (MAAS-A) and Comprehensive Inventory of Mindfulness Experiences - Adolescents (CHIME-A). Multi-Level Modeling was used to model the dependent variable, distressed button presses by day, within the context of each subject. The CHIME-A based model predicted increasing psychological distress as hypothesized whereas the MAAS-A model predicted otherwise. Neither of the models was significant so the hypothesis wasn't confirmed.

Dedication

I dedicate this thesis to my parents, Jodha Kodumal Singhani and Sheila Jodha Singhani, and my children, Gautam Sagar Singhani and Kamal Geet Singhani, for their love, support and encouragement. Special thanks to my father, Jodha, for his unshakable belief in me and his positive attitude towards life.

I believe “It takes a village” or more appropriately “It takes a universe” so I want to thank all the people who have crossed paths with me for helping me along the way. Thank you for taking the time!

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Chapter I

Introduction

Suicide is the second leading cause of death in adolescents and young adults in the US (Centers for Disease Control and Prevention, Web-based Injury Statistics Query and Reporting System, 2016). From the same data source, it is reported that between 500,000 and one million young people aged 15 to 24 attempt suicide each year. These data indicate that this is a serious problem among adolescents and more research is needed to understand the risk factors and interventions to prevent suicidal thoughts and behaviors.

Often, distress becomes unbearable when the individual lacks the ability to cope with or regulate his or her emotions, referred to as emotion dysregulation. Several interventions have been designed to improve emotion regulation (Cameron & Jago, 2008) indicating that emotion regulation is modifiable. Mindfulness, which is the ability of non-judgmentally paying attention to thoughts, emotions and body sensations in the present moment (Kabat-Zinn, 1990), has been used as an effective intervention for emotion regulation in youth (Broderick & Metz, 2009; Mendelson et al., 2010).

The following sections look in more detail at the risk factors for suicidal thoughts and behavior (STBs), conceptualization of emotion dysregulation and its relationship to STBs, state and trait mindfulness and their relationship to STBs, mechanisms of mindfulness and their relationships to emotion dysregulation, rumination and its association with mindfulness, mindfulness-based interventions in general and specifically for suicidal behavior.

Risk Factors for Suicidal Thoughts and Behaviors

It is important to examine the risk factors for suicidal thoughts and behaviors to understand the effectiveness of mindfulness to address any of them. Several of the risk factors have been studied such as hopelessness, poor social support, psychopathology, self-injurious behavior and depression.

In a meta-analysis of suicide risk factors, Franklin et al. (2016) examined 50 years of research. They classified risk factors for suicide into sixteen broad categories as shown in Table 1. Unfortunately, none of these are considered to be strong or accurate predictors of STBs. The weighted mean odds are approximately 1.5 for all outcomes. The odds of suicide in any given year is 0.013 per 100 people, for suicide attempts is 0.33 per 100 people and for suicide ideation is 2 per 100 people. If these weighted odds ratios are applied at the population level, having one risk factor that confers the average risk (odds ratio of 1.5) would increase the 1-year odds of suicide death from 0.013 to 0.019 (that is, 0.013 x 1.5 = 0.019) per 100 people; suicide attempt from 0.33 to 0.49 per 100 people; and suicide ideation from 2 to 3 per 100 people. These do not represent clinically meaningful effects. This may be because the studies examine distal predictors, that is over 6 months. These risk factors that predict changes in STBs over months/years may not predict changes over shorter periods that is hours/days (Kleiman & Nock, 2018).

Some of the broad risk factor categories are relatively stronger predictors than others with weighted odds ratios of over 1.5. Among them is Internalizing Psychopathology, which covers psychopathology characterized by negative emotion. Krueger and Markon (2006) built a model for common forms of psychopathology, and they further subdivided the Internalizing Psychopathology into Distress and Fear.

Table 1. Broad STB Risk and Protective Factor Categories (adapted from Franklin et al. (2016))

	Broad Risk and Protective Factor Categories	**Examples**
1	Biology	CSF metabolites; dexamethasone suppression test; genes; hormones; peripheral physiology
2	Screeners	Specific STB screening instruments; clinician prediction; patient prediction
3	Cognitive problems (and cognitive abilities)	Cognitive difficulties; intelligence; mental state; problem- solving ability; school performance
4	Demographics	Age; education; employment; ethnicity; gender; marital status; religion; socioeconomic status
5	Externalizing psychopathology	Aggressive behaviors; impulsivity; incarceration history; antisocial behaviors; substance abuse
6	Family history of psychopathology or self-injurious behaviors	Maternal depression; paternal alcoholism; first-degree relative suicide attempt
7	General psychopathology	Presence or number of psychiatric symptoms; presence or number of psychiatric diagnoses
8	Implicit/explicit processes	Implicit/explicit attentional bias; implicit/explicit identification
9	Internalizing Psychopathology	Ruminative disorders like anxiety disorders and mood disorders; hopelessness; emotion dysregulation; sleep disturbances
10	Normative personality traits	Type A personality; extraversion; openness; assertiveness; masculinity; agreeableness
11	Physical illness (and physical health/characteristics)	Height; weight; asthma; heart disease; cancer; allergies; migraines; physical disability
12	Psychosis	Schizophrenia; positive, negative, or disorganized psychotic symptoms
13	Prior self-injurious thoughts or behaviors	Prior deliberate self-harm, nonsuicidal self-injury, suicide attempt, suicide ideation
14	Exposure to self-injurious thoughts and behavior	Suicide attempt or completion by a friend, schoolmate, or acquaintance
15	Social factors	Abuse history; family problems; isolation; peer problems; stressful life events
16	Treatment history	Prior psychiatric assessment, hospitalization, or treatment

The Distress subspectrum is characterized by ruminative disorders, such as depression, anxiety, and dysthymia. The Fear subspectrum is characterized by uncontrollable phenomena such as panic disorder and phobia. Rumination has also shown

to be a transdiagnostic factor in depression and anxiety (McLaughlin & Nolen-Hoeksema, 2011).

Franklin et al. (2016) also looked at the subcategories within these sixteen broad categories. Among the top five subcategories that conferred risk for suicidal ideation, there are Depression (weighted odds ratio = 2.45) and Anxiety (weighted odds ratio = 1.79), and among the top five suicidal death subcategories is Stressful life events (weighted odds ratio = 2.18). The specific risk factors of depression, anxiety (ruminative disorders) and stressful life events are highlighted because these areas have been effectively targeted by mindfulness-based interventions (Depression: Chiesa & Serretti, 2011; Anxiety: Hoge et al., 2013; Stress: Kearney et al., 2012), and they are relatively stronger risk predictors compared to other risk factors with weighted odds ratios over 1.5.

For all the risk factors, the effects are weak, but it may not be because the factors do not confer risk/resilience but rather that: (1) we may not be studying them in the right population, because we should study high risk populations like those who have been hospitalized for a suicide attempt or severe suicidal ideation, and (2) we may not be studying them in the right way, because we should study these factors as they occur in real time.

Internalizing psychopathology goes beyond specific mental disorders and also includes specific emotional symptoms. Among these, emotion dysregulation, or the inability to modify or ameliorate acute distress has been studied as it relates to suicidal ideation and suicide attempts (Pisani, Wyman, Petrova, Schmeelk-Cone, Godston, Xia, & Gould, 2013; Rajappa, Gallagher, & Miranda, 2012). Emotion dysregulation may have above average effects, if studied in real-time in high-risk populations. It is important to

study emotion dysregulation in real-time because it may be difficult to recall over longer periods, the effects of emotion dysregulation or the factors that cause emotion dysregulation (for example, stress).

Emotion Dysregulation

Gratz and Roemer (2004) developed a conceptualization of emotion dysregulation that includes six dimensions: lack of awareness of and attention to emotions (Awareness); lack of clarity about which emotions are being experienced (Clarity); non-accepting reactions to emotional distress (Nonacceptance); inability to control behavioral impulses in response to negative emotions (Impulse); inability to concentrate and continue to pursue goals when emotionally distressed (Goals); and perceived lack of access to effective regulatory strategies in response to distress (Strategies). These dimensions were reflected in their Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004) instrument as the six factors relating to emotion dysregulation. The Awareness factor captures those situations when individuals ignored their feelings when they were upset (for example, “When I’m upset, I acknowledge my emotions.” (reverse-coded)). This was distinct from the Clarity factor when individuals acknowledged their emotions but were not able to name them or were confused about them (for example, “I have difficulty making sense out of my feelings.”). The Nonacceptance factor is meant for the situations when the negative emotions were judged as being wrong and were avoided because they brought up secondary negative emotions, such as guilt, shame, or anger (for example, “When I’m upset, I become angry with myself for feeling that way.”). The Impulse factor captures those situations where the emotions becomes overwhelming and the individual loses control (for example, “When I’m upset, I have difficulty controlling

my behaviors."). The Goals factor encompasses the situations where the emotions derail the individual from goal directed or focused behavior (for example, "When I'm upset, I have difficulty thinking about anything else."). If the emotions are overwhelming enough to keep the individual mired in them for hours or days because they lack the coping strategies, those situations are captured in the Strategies factor (for example, "When I'm upset, I believe that I will remain that way for a long time."). These fine-grained factors allow aspects of mindfulness and suicidal thoughts and behaviors to be related to them in a detailed manner. Hence, these dimensions will be utilized for those discussions in the rest of the document.

Emotion Dysregulation and Suicidal Thoughts and Behaviors

Linehan's (1993a) work with Borderline Personality Disorder (BPD) patients has shown that nonacceptance of unbearable emotions and trying to escape from them due to lack of coping strategies is good predictor for suicidal attempts. From Linehan's perspective, suicidal behaviors serve a maladaptive emotion regulation function. This nonacceptance of unbearable emotions ties up with the Nonacceptance dysregulation dimension of Gratz and Roemer's model of emotion dysregulation, and the lack of coping strategies ties up with the Strategies dimension. Hence, these two dimensions of emotion dysregulation, Nonacceptance and Strategies, have specific overlap with Linehan's research on BPD patients.

Weinberg and Klonsky (2009) studied adolescents with the DERS scale to tie the dimensions of emotional dysregulation with symptoms of suicidal ideation, depression, anxiety, eating disorders and substance and alcohol abuse using the 83-item Patient Health Questionnaire – Adolescent (PHQ-A; Johnson, Harris, Spitzer, & Williams, 2002)

measure. Their sample consisted of high school students (n=428), ages 13-17. They found that five of the six dimensions, excluding Awareness, to be associated with suicidal ideation, with Strategies showing the strongest relation, followed by Impulse, Nonacceptance, Clarity, and Goals.

Based on Linehan's research and theoretical implications, Rajappa, Gallagher and Miranda (2012) hypothesized that Strategies, Nonacceptance and Impulse dimensions would differentiate people with suicidal ideation, suicide attempters (single and multiple) and people without any STBs (controls). They conducted a study with undergraduate students, ages 18-30 (M=19.0, SD=2.2) using the DERS scale to measure the emotion dysregulation factors. The participants were split into controls (n=42), suicide ideators (n=17), single suicide attempters (n=20) and multiple suicide attempters (n=17). They found that controls and single/multiple suicide attempters differed on the Strategies dimension, and controls and multiple suicide attempters differed on the Nonacceptance dimension. In addition, hopelessness was found to statistically mediate the relation between Strategies and suicidal ideation, as measured by the Beck Hopelessness Scale (BHS; Beck, Lester, & Trexler, 1974). These results are consistent with Linehan's and Weinberg and Klonsky's research implicating the Nonacceptance and Strategies dimensions of Gratz and Roemer's model of emotional dysregulation as associated with STBs.

What is Mindfulness?

Mindfulness has been defined as paying attention to the present moment, non-judgmentally and with a purpose (Kabat-Zinn, 1990). This concept can be separated into three aspects: a) Intention (with a purpose), b) Attention, and c) Attitude (non-

judgmentally) as elucidated by Shapiro, Carlson, Astin, and Freedman (2006). Bishop et al. (2004) suggest two components of mindfulness – a) regulating attention on the immediate experience and b) bringing curiosity, openness and acceptance to the experience regardless of the desirability.

Mindfulness practice is divided into formal practice and informal practice (Kabat-Zinn, 1996; Santorelli, Kabat-Zinn, Blacker, Meleo-Meyer, & Koerbel, 2017). The formal practice includes sitting meditation and mindful movement. In the sitting meditation, there are three main types of meditations that are practiced – body scan, awareness of breath and choiceless awareness. A body scan meditation involves bringing attention to each body segment from toe to head and noticing the sensations in that area. The sensations can relate to heaviness, dampness, tingling, warmth, tightness, itchiness, aches, pains and any other sensations. The intention is to observe these sensations non-judgmentally thereby training the mind to be attentive, non-judgmental, curious and staying with the body. In the awareness of breath, the breath is used as an anchor for attention. The breath is observed with curiosity at a point that it is felt most prominently by the person, for example, the nostrils, back of the throat, chest, or belly, without trying to control or manage it, and as the mind wanders, attention is gently and non-judgmentally brought back to the breath. Again, this is a training in attention regulation with curiosity. The choiceless awareness meditation, the attention is trained to be with whatever comes up in the moment among the five anchors – body sensations, sounds, breath, thoughts and emotions. As any of these five anchors arise in awareness, attention is brought to it and that item is observed with curiosity and non-judgement. For example, as some ambient sound grabs the attention, the mind is brought to listening of all sounds

in the environment without trying to analyze the sound; similarly, if the mind wanders with thoughts, the metacognitive process is used to observe the thoughts without engaging in the thinking. The choiceless awareness meditation is the key open monitoring type of meditation which is the hallmark of Mindfulness Meditation (Lutz, Slagter, Dunne, & Davidson, 2008).

The above three are the main sitting meditations. Other kinds of sitting meditations include loving kindness, mountain meditation, and lake meditation. These involve some visualization, and their purpose can vary – practicing self-compassion, forgiveness, non-attachment, flexibility and equanimity.

Mindful movement is a version of yoga which is part of the formal practice. The focus of this yoga practice is neither on the poses nor on improving the body's flexibility, rather it is to bring non-judgmental attention to the body while moving deliberately and slowly. The mind is trained to bring the attention to the sensations in the body and any thoughts that may be arising in the moment.

The informal practice of mindfulness includes mindful eating, mindful walking, mindful communication, and practically all other activities in daily life. In all these activities, the intent is pay attention to the activity as it's happening. In mindful eating, attention is brought to the sight, smell, taste and touch of the food being ingested, as is the attention brought to the entire process of eating. Mindful eating increases the enjoyment of eating and also avoids overeating which happens so often when the mind is distracted. Mindful walking is practiced with deliberate slow or regular pace movement by bringing careful attention to all body parts involved and their relative movement to enable the act of walking. Mindful walking can be first practiced as a formal practice

with slow deliberate movement. It is then practiced in daily life, as part of informal practice, by being aware of the surroundings using the senses of sight, sound, smell and touch. Mindful walking promotes mindfulness by regulating attention on the body with acceptance and openness. Mindful communication is practiced by deep and empathetic listening and using mindful responses. In deep or active listening, the attention is brought to the speaker's words, tone, facial expressions and body language to get a complete sense of the speaker's communication. Responses are categorized into passive, avoidant, aggressive and assertive, and choosing the appropriate one for this moment in done mindfully. These mindful communication practices train the mind in attention regulation and intentionality of speech.

All these practices enable non-judgmental attention to be focused on the present moment experience with curiosity and openness. With these practices, the thoughts and emotions are observed, as they arise. Sometimes these are self-critical thoughts about the body or mind's inability to perform the task asked of it. By observing these thoughts and not engaging with them or acting on them, and then coming back to the present moment, again and again, promotes non-identification with thoughts and emotions, which can theoretically lead to exposure and extinction of habitual patterns (Hölzel et al., 2011).

Trait and State Mindfulness

Trait mindfulness refers to the general attitude and tendency to practice mindfulness. State mindfulness refers to the mindfulness at a given moment in time. That is, trait mindfulness can be thought of as a baseline around which state mindfulness varies. As much as the moment-to-moment mindfulness may vary depending on internal

and external circumstances (state), a person's emotional response to a situation and the emotion regulation will generally depend on their baseline (trait) mindfulness.

Theoretically, state mindfulness improves with formal practice of mindfulness and sufficient improvement in state mindfulness over time can lead to increased trait mindfulness. The studies on various Mindfulness Based Interventions (MBIs) seem to suggest this outcome as they measure the pre/post mindfulness with self-report measures to show the improvement. Kiken et al. (2015) set out to measure this explicitly. They hypothesized that: a) there would be significant variability in the individual trajectories of state mindfulness changes with mindfulness-based interventions, b) the individualized state mindfulness trajectories would predict the overall change in trait mindfulness from pre to post-intervention, and c) the individualized state mindfulness trajectories would also predict the change in distress from pre to post-intervention. They recruited participants (n=235) from an eight-week community MBSR program (Kabat-Zinn, 1990), with characteristics: 75% female; 83% White; M_{age} = 44.83, SD_{age} = 14.32. The trait mindfulness was measured pre/post intervention using the 39-item Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006), and the state mindfulness, post a 10-min meditation session at home every week, was measured with the 13-item Toronto Mindfulness Scale (TMS; Lau et al., 2006). The distress was measured pre/post intervention using the 90-item Symptom Checklist 90 – Revised (SCL-90-R; Derogatis, 1983). Approximately 57% of participants completed at least four weekly assessments and pre-post measures. The experiment confirmed all three hypotheses. These findings confirm that increasing state mindfulness over time with repeated formal practice of meditation would lead to higher trait mindfulness, and the trajectory of state mindfulness

would predict the change in trait mindfulness. Also, the reduction is distress is predicted by the trajectory of state mindfulness.

The FFMQ scale measures five facets of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. The observing subscale gauges respondents' attention to internal and external experiences; the describing subscale gauges respondents' ability to label internal experiences; the acting with awareness subscale gauges respondents' attention to activities in the moment; the nonjudging of inner experience subscale gauges respondents' ability to remain nonevaluative about their internal experiences; the nonreactivity to inner experience subscale gauges respondents' ability to allow internal experiences to come and go (Baer et al., 2008). In theory, the self-report measures of trait mindfulness, like FFMQ, and the ones used in the present study, measure all the facets of mindfulness to be able to measure the overall mindfulness construct accurately. However, in reality, that is the best approximation of mindfulness that is available at this time until better ways are devised to measure mindfulness.

Several Mindfulness Based Interventions (MBIs) exist to improve an individual's trait mindfulness. The MBIs which are specifically useful in raising the trait mindfulness to target suicidal thoughts and behaviors are discussed in a later section.

Trait Mindfulness and Suicidal Thoughts and Behaviors

Recent research has examined the association of trait mindfulness to suicidal thoughts and behaviors in cross-sectional studies. Cheng et al. (2018) studied the moderating role of the facets of mindfulness in the relationship of Post-Traumatic Stress Disorder (PTSD) symptom severity to suicidal ideation. They used the 39-item FFMQ

scale (Baer et al., 2006) to measure the five facets of mindfulness, as elaborated in the previous section, and the 21-item Beck Scale for Suicidal Ideation (BSS; Beck and Steer, 1991) to measure suicidal ideation. In this sample of adult psychiatric inpatients with PTSD (n=119) ages 18-65 (M=33.3, SD=11.0), they found that facets of observing, acting with awareness and non-judging of inner experience have significant moderating effect on the association of PTSD symptoms with suicidal ideation, and the facet of non-judging of inner experience had a significant main effect with respect to suicidal ideation. Interestingly, the observing facet had a positive moderation, that is higher level of observing increased the suicidal ideation severity. According to the authors, this may have been due to PTSD symptoms causing hypervigilance for trauma-inducing triggers in the environment. However, the facet of non-judging of inner experience had a negative effect on suicide ideation severity suggesting that increase in trait mindfulness may decrease suicidal ideation.

Another study (Anastasiades, Kapoor, Wootten, & Lamis, 2017) examined the relationships between levels of stress, depressive symptoms, suicidal thoughts, and mindfulness in a sample of undergraduate women (N=928), ages 18-26 years (M=19.92, SD=1.58). Mindfulness was measured with the 15-item Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), stress with the 11-item College Student Stress Scale (CSSS; Feldt, 2008), depression with the 21-item Beck Depression Inventory-II scale (BDI-II; Beck, Steer, & Brown, 1996) and suicidal ideation with the 21-item Beck Scale for Suicide Ideation (BSS; Beck and Steer, 1991). A moderated-mediation analysis was conducted to study the complex associations between these variables. They found that the mediated effect of depressive symptoms on perceived stress and suicidal ideation

was moderated by trait mindfulness. Specifically, depressive symptoms mediated the effect of stress on suicidal ideation and higher mindfulness reduced the strength of the mediated effect of depressive symptoms.

The above studies indicate that trait mindfulness, directly or indirectly, has an inverse relationship with suicidal ideation severity.

Mechanisms of Mindfulness and Their Relationships to Emotion Dysregulation

Several theories have been proposed to explain the mechanisms of mindfulness (Shapiro, Carlson, Astin & Freedman, 2006; Brown, Ryan & Creswell, 2007; Baer, 2003; Hölzel et al., 2011). From this set, two key theories were examined due to their higher level of detail which could be easily mapped to the detailed dimensions of emotion dysregulation. The dimensions were explained in a section on emotion dysregulation above. These theories are useful in explaining the effects of mindfulness practice, so they can be related to emotion dysregulation, thereby examining their possible effectiveness in addressing psychological distress leading to less risk of STBs.

Shapiro, Carlson, Astin, and Freedman (2006) used the components of Intention, Attention and Attitude to explain mindfulness, as mentioned in the Mindfulness section above. The Attitude is one of curiosity, non-judgement and openness. Using mindfulness, the attention component can be directed to body sensations, thoughts and emotions to gain clarity, which can address the Clarity dimension of the emotion dysregulation model (Gratz & Roemer, 2004). With the component of non-judgmental attitude, these thoughts and emotions can be accepted, which can address the Nonacceptance dimension of the emotion dysregulation model. With an open and curious attitude, the thoughts and emotions can be examined without identification or reactivity, thereby avoiding any

impulsive reactions to the thoughts or emotions. The latter process can address the Impulse dimension of the emotion dysregulation model.

Figure 1 depicts the proposed conceptualized mapping of components of mindfulness, according to Shapiro et al.'s model, and the emotion dysregulation dimensions that they address. The relevant mindfulness component from the mindfulness model is shown addressing the appropriate emotion dysregulation dimension. In turn, emotion dysregulation (or regulation) moderates the relationships of Stressors to Psychological distress, and Psychological distress to STBs.

Hölzel et al. (2011) propose another model for the mechanisms of mindfulness from a conceptual and neural perspective. In this model they describe five components: 1) Attention regulation, by maintaining focus on an attentional anchor, 2) Body awareness, by bringing attention to body sensations, 3) Emotion regulation with reappraisal, by bringing non-judgmental acceptance to the experience, 4) Emotion regulation with exposure, extinction and reconsolidation, by exposure to the emotions and thoughts and experiencing them in the body while refraining from reactivity, 5) Change in perspective on self, by non-identification with the thoughts arising in the mind. With the attention regulation and body awareness components of the mindfulness model, the emotion can be felt and identified in the body, which can address the Clarity dimension of the emotion dysregulation model (Gratz & Roemer, 2004). The emotion regulation with reappraisal component of the mindfulness model can lead to the non-judgmental acceptance of the emotion, which can address the Nonacceptance dimension of the emotion dysregulation model. Finally, the emotion regulation component with exposure and extinction of the mindfulness model can lead to non-reactivity and non-

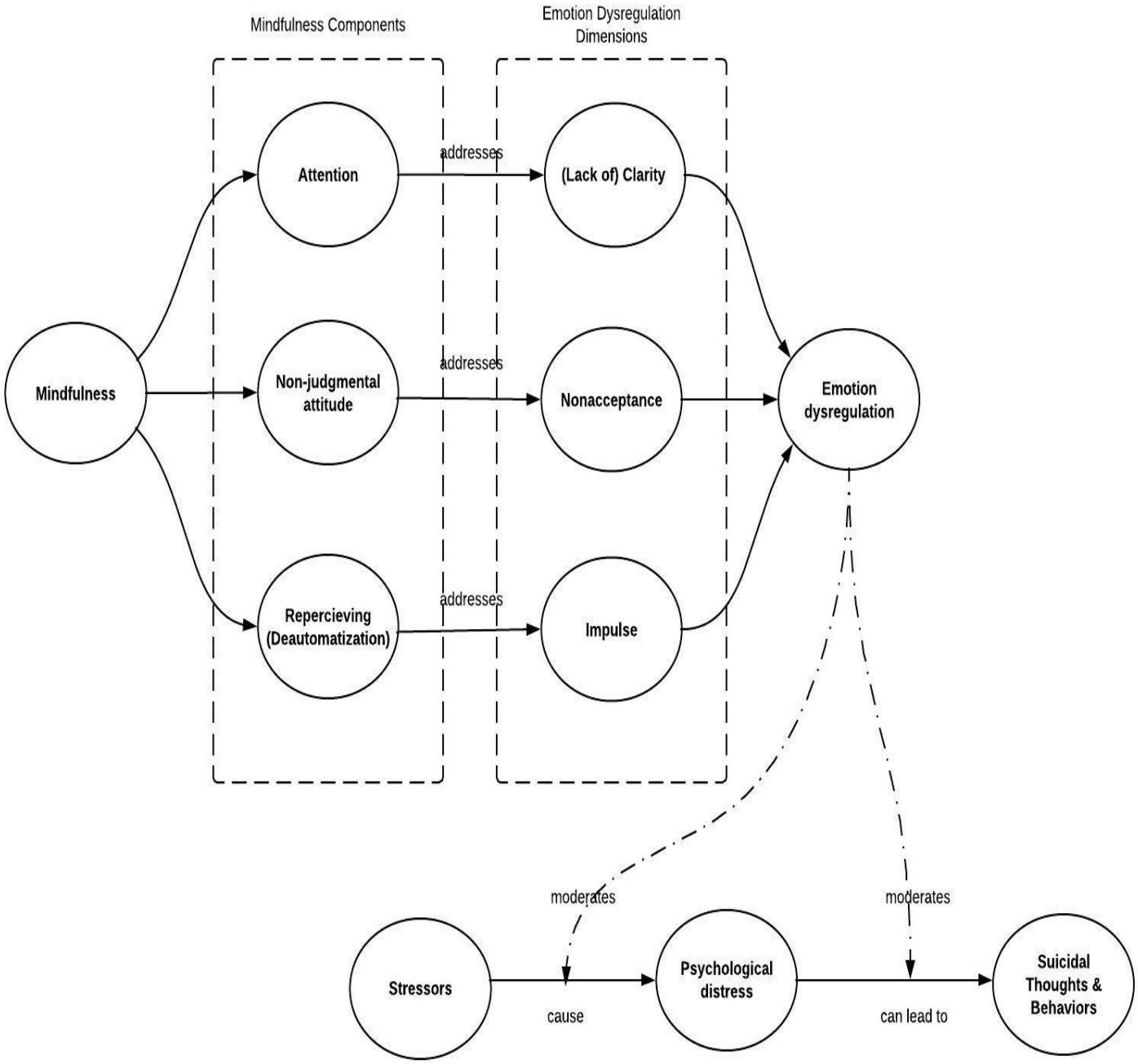

Figure 1. Shapiro et al. model interactions with emotion dysregulation dimensions, psychological distress and STBs

impulsive responding, which can address the Impulse dimension of the emotion dysregulation model.

Figure 2, shown on the next page, depicts the proposed conceptualized mapping of components of mindfulness, according to Hölzel et al.'s model, and the emotion dysregulation dimensions that they address. The relevant mindfulness component from the mindfulness model is shown addressing the appropriate emotion dysregulation dimension. In turn, emotion dysregulation (or regulation) moderates the relationships of Stressors to Psychological distress, and Psychological distress to STB.

The nonidentification aspect of mindfulness can cause a shift in the perspective. Shapiro et al. call this meta-mechanism as Reperceiving, while Hölzel et al. term it as change in perspective on self. To illustrate reperceiving with a real-life example, let's say a teacher makes a critical comment to a student which triggers the emotion of shame in the student. With mindfulness, the shame emotion can be observed non-judgmentally by the student, without identification with it. The mindful self-talk could be – "Shame is occurring. Hmm.. this is how shame feels like.. interesting.". In theory, the process of reperceiving can lead to new insights and better coping strategies, and hence lead to lesser rumination as discussed in the next section.

Rumination and Mindfulness

In the section on Risk Factors for Suicidal Thoughts and Behaviors, two of the stronger subcategories of risk factors for STBs were – depression and anxiety. These were classified as ruminative disorders under Internalizing psychopathology. This section will explore the effect of mindfulness on rumination.

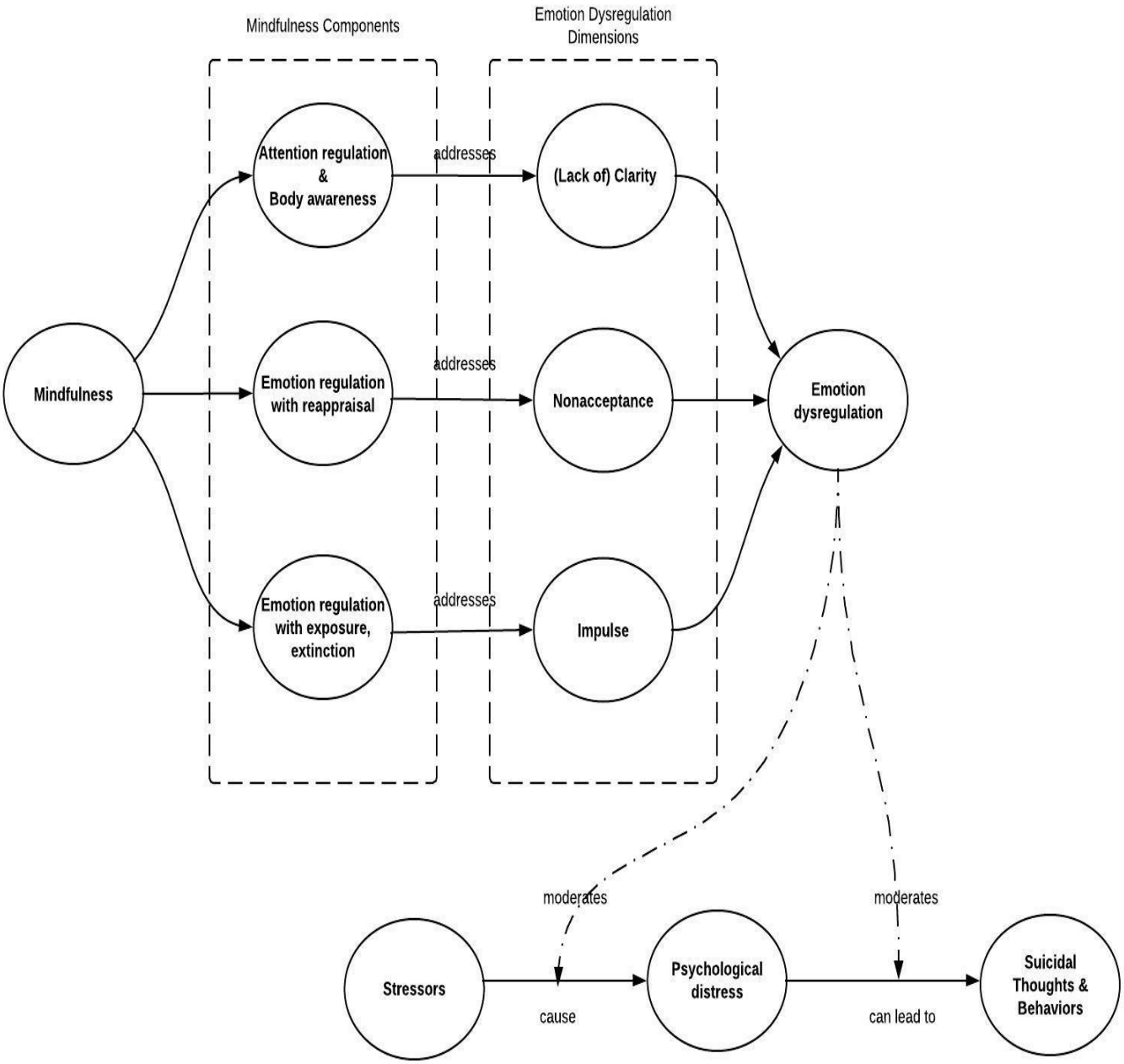

Figure 2. Hölzel et al. model interactions with emotion dysregulation, psychological distress and STBs

Rumination has been defined by Nolen-Hoeksema (1991) as a coping strategy for distress by the repetitive focusing of attention on negative feelings and thoughts in response to negative mood. Rumination can prolong negative affective states like depression. Some studies on adolescents and adults have suggested that distraction, that is, focusing on neutral or pleasant thoughts and activities, can reduce the negative affect (Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Although distraction works to lower distress, some consider that as a temporary and unskillful solution (Linehan, 1993a). Using the above models of mindfulness, it can be theorized that attention regulation and reperceiving components of mindfulness could reduce rumination.

The association of mindfulness and rumination was tested by a study comparing rumination, distraction and mindfulness meditation as coping strategies (Broderick, 2005). This study was done with undergraduate students (n=177, females=139), mean age of 20.9 years, with ethnicities as 91% Caucasian, 4% African American, 2% Hispanic, 2% Asian American and 1% Other. Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure mood. The sample was divided into three groups of coping: rumination (n=55), distraction (n=61) and mindfulness meditation (n=61). All the groups had a negative mood induced at the start and then each participant had a different intervention depending on the assignment. PANAS was used to measure the positive and negative affect at three stages – prior to experiment start, end of sad mood induction and end of experimental intervention. The experimental interventions lasted eight minutes. The rumination intervention group sat and thought about self-focused statements, the distraction intervention group focused on other distracting images and thoughts, while the meditation intervention group were led

through a guided meditation. The experiment showed that distraction led to less dysphoric mood compared to rumination and meditation led to significantly less dysphoric mood compared to the other two conditions. This suggests that a state mindfulness intervention or a generally higher trait mindfulness baseline, implying better attention regulation and reperceiving, would reduce the incidence of rumination.

Raes and Williams (2010) sought to examine the relationship between trait mindfulness and uncontrollability of ruminative thinking. They hypothesized that a) trait mindfulness would be negatively correlated to rumination, and b) mindfulness would be particularly negatively correlated with the uncontrollability aspect of rumination, whereas it would not (or to a lesser extent) be related to rumination itself (i.e., the causal analytic and understanding aspects of rumination). The cross-sectional study was done on a youth population (n=164, women=130), ages 18-25 (M=19.21, SD=0.91). They used the 46-item Extended version of the Kentucky Inventory of Mindfulness Skills (KIMS-E; Raes, Dewulf, Van Heeringen, & Williams, 2009) to measure mindfulness, and the 17-item Leuven Adaptation of the Rumination on Sadness Scale (LARSS; Raes et al. 2008) to measure rumination on sadness. The LARSS consists of three subscales: causal analysis (for example, 'I repeatedly analyze and keep thinking about the reasons for my sadness'), understanding (for example, 'I repeatedly think about what might be the meaning of my sad feelings'), and uncontrollability (for example, 'If I start thinking about my sad feelings, I have difficulty controlling these thoughts'). After controlling for prior history of depression and current depressive symptoms, their data showed that not only mindfulness was negatively associated with rumination but it was specifically negatively associated with uncontrollable rumination. This aligns well with the concept that greater

trait mindfulness, either naturally occurring or cultivated in formal mindfulness practice, does not mean that people do not ruminate, but that they are better at noticing it and non-identifying with it, thereby being able to control it.

Given that ruminative disorders are strong risk factors for STBs, the above studies suggest that mindfulness may help in reducing STBs.

Mindfulness-Based Interventions (MBIs)

As the study by Kiken et al. (2015) had shown, increasing state mindfulness over time with repeated formal practice would lead to higher trait mindfulness, and higher trait mindfulness can lead to reduction in STBs by various mechanisms – addressing emotion dysregulation, reducing rumination or moderating the mediated effect of depressive symptoms on perceived stress. Mindfulness-based interventions increase state mindfulness over the duration of the interventions hence leading to higher trait mindfulness. This section discusses the research on MBIs for the adolescent population and their therapeutic outcomes and the subsequent section dives into the MBIs that have been efficacious for reducing STBs.

There has been increased research on mindfulness and Mindfulness-Based Interventions (MBIs) for treating clinical disorders, improving well-being (Carmody & Baer, 2008; Chiesa & Serretti, 2009) and enhancing cognitive functioning (Jha, Krompinger, & Baime, 2007; Ortner, Kilner, & Zelazo, 2007; Pagnoni & Cekic, 2007; Slagter et al., 2007) in the past decade. In terms of clinical disorders, mindfulness has been shown to be efficacious in treating anxiety (Hofmann, Sawyer, Witt, & Oh, 2010; Roemer, Orsillo, & Salters-Pedneault, 2008), depression (Hofmann et al., 2010; Teasdale

et al., 2000), eating disorders (Tapper et al., 2009), and chronic pain (Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper, 2007).

The most recent meta-analysis by Klingbeil et al. (2017) on youth populations showed improvements in both therapeutic processes and therapeutic outcomes, across clinical and non-clinical studies. Using Shapiro et al.'s (2006) theoretical model, the therapeutic processes were divided into first-order and second-order processes. Core mindfulness itself was conceptualized as a first-order therapeutic process. The second level of therapeutic processes were considered to be facilitated by mindfulness: a) attention, b) meta-cognition and cognitive flexibility and c) emotion and behavior regulation. Therapeutic outcomes included: a) academic achievement and school functioning, b) externalizing behaviors, c) internalizing behaviors, d) negative emotions and subjective distress, e) positive emotions and self-appraisal, f) physical health, and g) social competence and prosocial behaviors. They used this three-level structure (that is, first-order therapeutic processes, second-order therapeutic processes and therapeutic outcomes), as a heuristic for organizing and interpreting the effects of MBIs across different outcomes domains. They found that the effect size for mindfulness was the largest and the second order processes had smaller effect sizes. The therapeutic outcomes of academic achievement, externalizing problems, internalizing problems, negative emotions and subjective distress, positive emotions and self-appraisal, physical health, and social competence and prosocial behaviors all showed improvement albeit with small effect sizes. A subset of studies also examined the effects of MBIs after a follow-up period, with results showing a slightly larger average treatment effect relative to post-treatment, which suggests that continuation of mindfulness practices leads to more

improvement. This meta-analysis suggests that MBIs are effective with adolescent populations in improving mindfulness and delivering several beneficial therapeutic outcomes.

Mindfulness-Based Interventions for Suicidal Behavior

Several forms of MBIs have also been targeted to reduce suicidal behaviors, primarily among adults; the research to address suicidal behaviors among youth is still in its infancy. The three forms of formal mindfulness-based practices used for this purpose are – Dialectical Behavior Therapy (DBT; Linehan, 1993a), Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams & Teasdale, 2002). These therapies can be targeted toward populations vulnerable to suicidal behavior.

Dialectical Behavioral Therapy

DBT is made up of four skills modules. Patients are trained in: mindfulness, emotion regulation, interpersonal effectiveness and distress tolerance (Linehan, 1993b). Mindfulness is core to all the other modules and is taught first. The mindfulness skills are broken down into "What" and "How" skills. The "What" skills define what needs to be done while practicing mindfulness. The "What" skills teach observing, describing and participating. Observing implies observing the external and internal environment. The external environment is perceived with the five senses of sight, smell, sound, taste and touch. The internal environment is perceived by observing the body sensations, thoughts and emotions by "stepping back" and not identifying with them. Describing means putting into words what was observed without giving it any extra meaning. Since the

thoughts, intentions and emotions of another person cannot be observed, they cannot be described. Similarly, concepts cannot be observed so they cannot be described. Participating is the act of being completely absorbed in the activity at hand without judgement. It is the considered to be the goal of mindfulness, that is, to be completely involved in life in the present moment. This is also considered being in the "flow" state (Csikszentmihalyi, 1997).

The "How" skills define how mindfulness is practiced. They teach people to a) practice non-judgmentally, b) practice one-mindfully, and c) focus on what works. To practice non-judgmentally means to not evaluate things as good or bad, or to expect things to be a certain way, but rather to accept things just as they are. The kind of judgement required for discernment or comparison of two entities is considered fine but the evaluative judgement is considered counterproductive. To focus on what works means to know the goal and then using effective and skillful means to get there. This may entail giving up a principle to achieve a goal that may reduce suffering and bring happiness.

The "What" and "How" skills train people to attend to the present moment in a non-judgmental way and use problem solving instead of wishful thinking to address any issues. If thoughts of aversion or craving arise in the moment, the person is trained to notice the thoughts, accept them and then let them go. Suicidal thinking and behavior are generally the result of perceived unbearable psychological distress with no means of escape deemed available leading to helplessness and hopelessness. The mindfulness skills allow people to observe and feel the strong emotions and thoughts non-judgmentally and let them go and figure out the best way to address the current situation.

DBT has been used mainly for people with Borderline Personality Disorder with chronic suicidal tendencies. In a randomized controlled trial with patients (n=44), ages 18-45, who had attempted suicide or made "suicide gestures" (Linehan et al., 1991), DBT was used as the treatment condition (n=22) while the control group (n=22) received non-behavioral psychotherapy (treatment as usual). In this study, it was found that the treatment group, which received DBT for one year, had significantly less frequency and medical risk of suicidal behavior compared to the control group. Subjects who received DBT had a median of 1.5 parasuicide acts (that is, suicide attempt or suicide gesture) per year compared with nine acts per year for control subjects. In a similar randomized controlled trial (Linehan et al., 2006) at a university outpatient clinic and community practice, women patients (n=101), ages 18-45, with suicidal behavior and borderline personality disorder were assigned to a DBT treatment (n=52) or a control group (n=49) with community based non-behavioral therapy treatment. The study period included one year of randomized controlled trial or non-behavioral treatment, and one year of posttreatment follow-up. Subjects who received DBT were half as likely to make a suicide attempt at post-intervention and follow-up. Both these studies indicate the effectiveness of DBT for reducing suicidal behavior.

Albeit less stringent than the other studies cited above, two studies have also found DBT to be successful at reducing suicide risk among adolescents, the focus of the present study (Fleischhaker et al., 2011; Miller et al., 1997). They have utilized Dialectical Behavioral Therapy for Adolescents (DBT-A; Rathus & Miller, 2002), which is DBT adapted for suicidal adolescents with borderline personality traits for its strategies of keeping patients committed to treatment and its focus on reducing both, suicidal and

quality of life interfering, behaviors. DBT-A is a manualized, 16-week behavioral treatment, that includes concurrent individual therapy once a week, family therapy as needed and a multifamily skills training group in an outpatient setting.

Mindfulness-Based Stress Reduction

MBSR (Kabat-Zinn, 1990) is an 8-week group program with a two and a half hour meeting every week and an eight-hour silent retreat between weeks six and seven. It consists of practices of sitting meditation, walking meditation, body scan meditation, mindful eating, mindful movement (hatha yoga) and mindful communication. There's didactic instruction and discussion on stress physiology, stress reactivity and response mechanisms and subjective perception. The participants are also required to do home practice of forty-five minutes to an hour of a combination of meditations, mindful daily activities, mindful movement, noting pleasant, unpleasant, and stressful events, and mindful communication. The homework is discussed in class and the principles are elucidated in an experiential manner.

MBSR was used as an intervention in a pre-/post-assessment study (Serpa, Taylor and Tillisch, 2014) with 79 veterans (M_{age}=60, SD_{age}=7) at an urban Veterans Health Administration medical facility. The study was investigating the effects of MBSR on depression, anxiety, suicidal ideation, physical and mental health functioning. Significant reductions in depression, anxiety and suicidal ideation were observed after the MBSR program. Suicidal ideation was measured using item 9 on the Patient Health Questionnaire-9 (PHQ-9; Kroenke & Spitzer, 2002) and results showed that the frequency of suicidal ideation decreased by almost half, from 24.05% to 12.66%

(McNemar χ^2 statistic = 4.26, p = 0.049). This study suggests that MBSR is a viable intervention to reduce suicidal ideation.

Mindfulness-Based Cognitive Therapy

MBCT (Segal, Williams & Teasdale, 2002) was developed as a variation of Mindfulness-Based Stress Reduction (MBSR). MBCT incorporates cognitive therapy techniques into the MBSR program to target depressive thoughts. Psychoeducation about depression and the cognitive model of depression (i.e., how thoughts, feelings, and behaviors are interrelated and contribute to mood), and relapse prevention planning are the main cognitive therapy techniques included in MBCT. The goals of MBCT are: a) to improve present moment awareness and b) to increase non-judgmental awareness of reactions to the present moment. Suicidal thinking starts with losing present moment awareness and resorting to habitual patterns of thinking in an automatic manner. Automatic thoughts are followed by ruminating over thoughts leading to negative affect, which leads to psychological distress. The self-critical judgement associated with these thoughts is so strong that the person wants to escape from them leading to suicidal behaviors. MBCT helps to make the person aware of the automatic thoughts and to observe them non-judgmentally without reacting to them. Mindfulness brings the attention back to the present moment, with intention, which avoids the rumination following the judgmental thoughts. Thus, suicidal thoughts and behaviors can be avoided with MBCT techniques.

MBCT was developed to prevent relapse in depressed people. Hence it is most effective in addressing people with depressive suicidal symptoms. In a randomized controlled trial (Forkmann et al., 2014), patients (n=130) were recruited from outpatient

mental health care facilities in Maastricht, Netherlands, and assigned to either the MBCT treatment condition (n=64) or a wait list control condition (n=66). The participants had residual depressive symptoms based (≥7) on the 17-item Hamilton Depression Rating Scale (HDRS; Hamilton, 1960) after at least one episode of major depression. Suicidal ideation was measured using the an item from the self-rating form of the Dutch version of the Inventory of Depressive Symptoms (Rush et al., 1996). This item asks for thoughts about death and suicide in the past seven days. The results showed significant reduction of suicidal ideation in the MBCT-group ($t = 2.73$; $p = 0.008$; $d = 0.42$) but not in the waiting list control-group ($t = 0.83$; $p = 0.41$; $d = -0.08$). This effect was mediated in part by participants' reduction in worrying thoughts.

Barnhofer et al. (2015) conducted a randomized controlled trial (n=194) with people having a history of suicidal depression using MBCT as an intervention (n=77). This study had two control groups – an active control with cognitive psychoeducation without meditation (n=78), and another control group (n=39) with treatment as usual (TAU). At entry into the study, patients in this trial subsample had a mean age of 43.7 years (SD =12.1). Severity of depression was measured using the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). Current levels of suicidal cognitions were measured using the Suicide Cognitions Scale (SCS; Rudd, Joiner, & Rajab, 2001). The active control group received the same kind of didactic instruction as the MBCT group, without the experiential practices. The results indicated that in patients with minimal to moderate symptoms at the time of assessment, comparisons of the correlations between depressive symptoms and suicidal ideations showed significant differences between the groups. Although suicidal ideations were significantly related to

levels of symptoms in the two control groups, there was no such relation in the MBCT group. These results suggest that MBCT intervention can reduce the effect of depressive symptoms on suicidal ideation.

Chesin et al. (2016) used MBCT-S (Mindfulness-Based Cognitive Therapy with Safety planning), a variation of MBCT with Safety Planning intervention (Stanley & Brown, 2012), in a study with outpatients (n=10) with a 6-month history of suicide attempt or active suicidal ideation plus suicidal ideation at study entry. They received the MBCT-S training over 9 weeks and pre/post measurements were done for mindfulness and STBs, among other elements. Mindfulness was measured with the FFMQ scale and STBs were measured with the Hopelessness/Suicidality subscale of The Leiden Index of Depression Sensitivity–Revised (LEIDS-R; Van der Does, 2002) scale. The results showed that LEIDS-R-Hopelessness/Suicidality scores fell significantly by 3 points and the Acting with awareness subscale scores of FFMQ increased significantly by 3.3; the other 4 subscale scores didn't show a significant difference. These findings suggest that treatment with MBCT-S may improve mindfulness and reduce suicide thinking and behavior among depressed patients.

All of the above studies suggest that improvements in mindfulness can lead to lower suicidal thinking and/or behavior thus supporting the idea that it is worthwhile to study mindfulness as a malleable predictor of suicide risk.

Differences between DBT and MBCT

Due to the similarity between MBSR and MBCT, both are grouped together in this section for differentiation with respect to DBT. Although DBT and MBCT use mindfulness as the core skill for intervention, they differ in several ways (Williams &

Swales, 2004). DBT uses mindfulness as one of the four skills but it also places emphasis on problem solving skills which may help people with intense situations. DBT combines group format and individual psychotherapy whereas MBCT is done only in a group format. Formal practice is not a requirement in DBT but encouraged, however MBCT is built on formal practice. Both therapies direct people to apply the mindfulness in daily life. DBT specifically targets problematic behaviors for change and monitors those targets in a formal manner. MBCT uses mindfulness as an approach to whatever comes up instead of specific problems. Despite their differences, both therapies have been effective in reducing STBs.

Hypothesis

Among the risk factors for suicidal thoughts and behaviors, ruminative disorders and emotion dysregulation are relatively stronger predictors. Rumination and emotion dysregulation can potentially be targeted with MBIs. MBIs can improve state mindfulness and increasing state mindfulness over time with repeated formal practice of mindfulness would lead to higher trait mindfulness. So, it stands to reason that trait mindfulness would be inversely associated with suicidal thoughts and behaviors. As discussed in the section on Trait Mindfulness and Suicidal Thoughts and Behaviors, there is some recent evidence for this, especially for the relationship of trait mindfulness with suicidal ideation.

This study tests the hypothesis that adolescent inpatients with suicidal thoughts and behaviors will show a negative association between trait mindfulness at intake and the self-reported intense psychological distress. Intense psychological distress is being used as a proxy for suicidal thoughts and behaviors.

Chapter II

Method

This study was done as part of a larger National Institute of Mental Health-funded study at Franciscan Children's Hospital (1R21MH115293, Principal Investigator: Evan Kleiman), which was examining whether ambulatory physiological monitoring can improve detection of harmful behaviors. To that end, the participants wore wrist monitors (Empatica E4; www.empatica.com), which in addition to sensors for physiological factors such as skin conductance, heart rate, and physical activity, have buttons for reporting acute distress. The mindfulness self-report measures were added to this study and the number of distressed button presses from the study were used as the outcome variable.

Participants

Male and female adolescents (ages 12 to 19) were recruited from the Child and Adolescent Inpatient Mental Health Program (Unit 1) at Franciscan Children's Hospital. Out of the 50 participants that were enrolled, 38 participants completed the protocol. For this study, a completed participant was defined as a participant completing the self-report measures and wearing the wrist monitor (Empatica E4) for at least 20 hours in one 24-hour period.

Participants had to be fluent in English. They also needed to have one wrist with unbroken skin (in order to wear the wristband). The presence of gross cognitive

impairment due to florid psychosis, intellectual disability, dementia, acute intoxication, or the presence of extremely agitated or violent behavior would have been a cause for exclusion from the study.

There was no payment to subjects, due to hospital requirements, and nor were there any charges to participate in this study.

Recruitment

The hospital's behavioral health research staff reviewed all admissions, ages 12-19 for study eligibility. Potential participants and/or their parents (if <18 years) were approached by research staff, who described the goals and procedures of the study and assessed their willingness to participate. If patients/participants were interested in the study, research staff obtained a written consent and assent. Parents/guardians (or participants if they are 18+) provided written consent for this study and youth (<18 years) will give written assent.

Materials

Physiological data were collected using an Empatica E4 wrist monitor (https://www.empatica.com/en-eu/research/e4) worn by participants (preferably on their non-dominant wrist) for the duration of their inpatient stay. The E4 is a research grade wrist-worn behavioral and psychophysiological monitor. Its case is 44mm long (~1.73 inches), 40mm wide, and 16mm deep. This means that it is larger than commercially available devices (for example, the Fitbit Charge HR 2 is 22.86mm long, and 12.7mm wide, and 11.0mm deep). It has four main sensors: (1) an LED-based photoplethysmograph (PPG) used to derive heart rate from blood flow, (2) a pair of

silver-plated EDA/skin conductance sensors, (3) a three-axis accelerometer, and (4) an infrared thermopile used to determine temperature. The E4 collects these data in real-time and stores them on the device. The E4 is then connected to a computer via a USB cradle and synced to a secure cloud server through the "E4 Connect" software. It is also equipped with an event marker button that participants can use to report the experience of some psychological event/outcome of interest. Such a feature allows researchers to examine physiological data leading up to (and following) events of interest; in this case, intense psychological distress. Only the number of button presses were used for this particular study (EDA and HRV were part of the larger study).

Participants were asked to wear the wrist monitor day and night except when it might get wet (for example, shower). The E4 wrist monitor enables continuous monitoring for up to 48 hours, but was charged and synced daily (which was done by a member of the research staff).

Measures

Two self-report mindfulness measures were used to quantify mindfulness: Mindful Attention Awareness Scale - Adolescents (MAAS-A) and Comprehensive Inventory of Mindfulness Experiences - Adolescents (CHIME-A). Psychological distress was measured by the number of button presses, per day, on the wrist band during times of distress.

The MAAS-A (Brown, West, Loverich & Biegel, 2011) is a 14-item scale designed to assess a core characteristic of mindfulness, namely, a receptive state of mind in which attention, informed by a sensitive awareness of what is occurring in the present, simply observing what is taking place. The measure takes 5 minutes or less to complete.

To score the scale, a mean of the 14 items is computed. Higher scores reflect higher levels of mindfulness. The MAAS-A showed good internal reliability (α = .82–.84) in a normative sample of adolescents (ages 14–18, *n* = 595) and good internal reliability (α = .86) in a sample of primarily anxiety- and mood disordered adolescents (ages 14–18, *n* = 102) (Brown et al., 2011). From the same study, MAAS-A scores were shown to be inversely correlated with the big five (Lounsbury et al., 2003) personality trait of neuroticism and positively correlated with agreeableness, conscientiousness, and to a lesser degree, openness to experience. Positive correlations were reported between the MAAS-A and greater life satisfaction, positive affect, happiness, and wellness, and negative correlations are reported with negative affect and substance use as a means of coping with stress.

The CHIME-A (Johnson, Burke, Brinkman & Wade, 2017) is a 25-item scale to rate how often each item is true for the subject using a 5-point scale (1 never true; 5 always true). The original CHIME (Bergomi, Tschacher & Kupper, 2014) scale for adults was modified for use with adolescents by simplifying the language and removing some of the questions. It measures eight factors of mindfulness: 1) Awareness of emotions (for example, “I notice the emotions I am feeling as they are happening”), 2) Awareness of environment (for example, “I pay attention to the feeling of things like the wind in my hair or sunshine on my face”), 3) Awareness of present moment as opposed to being caught up in thinking about the past/future (for example, “I get distracted by memories or daydreams” (reverse-coded)), 4) Self-kindness with mistakes and perceived weaknesses (for example, “I notice my mistakes without giving myself a hard time”), 5) Ability to step back from difficult thoughts and emotions and not react immediately (for example,

"I am able to notice my thoughts and feelings without getting tangled up in them"), 6) Capacity to allow presence of difficult emotions and thoughts (for example, "I don't like it when I am angry or scared and try to get rid of these emotions" (reverse-coded)), 7) Recognition of thoughts as transient and subjective (for example, "I realise my thoughts aren't always facts"), 8) Recognition that subjective interpretation of situations can create or compound difficulty (for example, "When I have given myself a hard time without needing to, I can laugh about it"). To score the scale, first items 18 - 25 are reversed by changing 1 to 5, 2 to 4, 4 to 2, and 5 to 1 (3 stays unchanged). Then all items are added. Higher scores correspond to higher levels of mindfulness. The CHIME-A has sound internal consistency across all eight subscales (α = .65–.77); however, poor overall internal consistency was found (Johnson et al., 2017). CHIME-A total scores positively correlated with the CAMM (r = .35) and negatively correlated with measures of emotional dysregulation (r = −.61) and perfectionism (r = −.45), as measured by the Difficulties in Emotional Regulation Scale (DERS; Gratz & Roemer, 2004) and 11 items related to self-criticism from the Dysfunctional Attitudes Scale (DAS; Cane et al., 1986) respectively.

Procedure

Participants were recruited as described above. The study consisted of two parts for participants. First, participants were asked to wear a monitor on their wrist for the duration of inpatient care. Second, towards the end of their inpatient stay, participants completed a short battery of questions regarding their opinions on wearing the monitor, which was not part of this study. Data linking was done using study identifiers to maintain the privacy and confidentiality of the subjects.

The inpatient data collection period began with a brief (30 minute) meeting with study staff. First, they were shown how to wear and adjust the E4. This took about 5 minutes. Second, they completed a series of self-report measures, which included the two mindfulness measures (MAAS-A and CHIME-A). This took about 30 minutes.

A daily log was maintained by the research team to record 1) charging and syncing of the monitor and 2) irritation or discoloration of the patient's skin at the monitor site. A member of the research team visually inspected the patent's wrist for skin irritation or discoloration. If irritation was present, the patient could choose to transfer the monitor to the other wrist or discontinue wearing the monitor.

Participants were instructed to press the button on the wrist monitor when they were feeling distressed. The button press did not send a distress signal to the staff. If they needed help, they needed to contact the staff directly. Consistent with hospital policy, the staff monitored the patients in the unit every 5 mins.

Analysis

A Multi-Level Model (MLM) was built to model the relationship between mindfulness scores and distress. MLMs allow researchers to model data where repeated observations are nested within people, which is the case with the data for this study. Doing this is important because an individual's responses are inherently more correlated with their own responses than others, and statistical models must account for this. This nonindependence of responses presents a challenge for ordinary least squares (OLS) regression models that assume data are not related in this manner. Accordingly, multilevel modeling is a category of analyses that extend traditional OLS regression to

accommodate the nonindependence of responses in multilevel data, such as data collected in a real-time monitoring study.

Each mindfulness score, MAAS-A and CHIME-A (total and subscales), was modeled separately as the independent variables. CHIME-A has eight subscales. This led to a total of ten models, one for MAAS-A score, another for CHIME-A total score, and eight others for the CHIME-A subscale scores. The daily button presses, indicating distress, was the dependent variable for each of these models.

Each individual MLM was a two-level model built with button presses per day as the dependent variable at the daily level (level-1), nested within subjects (level-2). The independent variable, the mindfulness score, was measured at the subject level. The analysis was conducted using the *lme4* R package (Bates, Mächler, Bolker & Walker, 2015). Random effects modeling was used for the two-level MLM. This allowed the relationship of mindfulness score, MAAS-A or CHIME-A (total and subscales), to button presses, to vary across subjects.

Chapter III

Results

The final sample contained 38 subjects. The button press data were collected from May 15, 2018 to September 29, 2018. The sample was 78% female and 92% White. The mean age was 16.3 years (SD=1.6). The mean MAAS-A score was 3.22, with a standard deviation of 0.85. The mean CHIME-A score was 66.38, with a standard deviation of 12.18. Pearson's correlation coefficient for the MAAS-A and total CHIME-A scores was 0.386 (p = .008, 95% CI = 0.129 to 1.000).

A scatterplot of the average daily button presses by MAAS-A score is shown in Figure 3 to display the correlation between these two variables. Each point on the scatterplot represents a subject.

A scatterplot of the average button presses per day by CHIME-A score is shown in Figure 4 to display the correlation between these two variables. Each point on the scatterplot represents a subject.

MLM models were built separately for MAAS-A score, total CHIME-A score and all eight subscale scores of CHIME-A. In all the two-level models, the dependent variable, button presses, was nested within subjects. For all the models, the independent variables were MAAS-A score, total CHIME-A score or the respective subscale CHIME-A score respectively, for each subject. These were measured at intake and treated as constants for the period of subject stay in the inpatient unit.

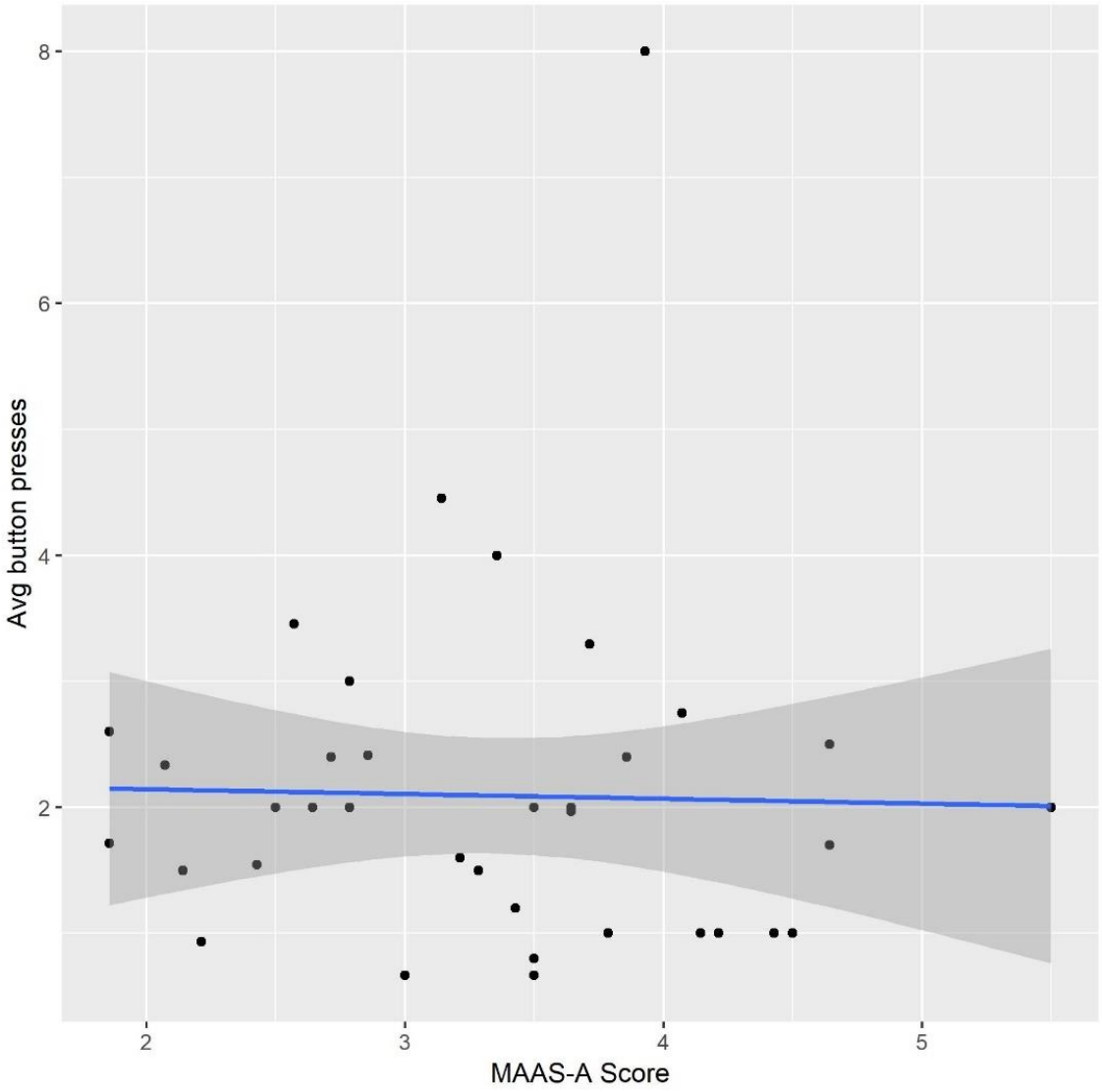

Figure 3. Scatterplot of Average button presses per day by MAAS-A score

Table 2 depicts the random effects model for MAAS-A score. Table 3 depicts the random effects models for the CHIME-A subscale scores.

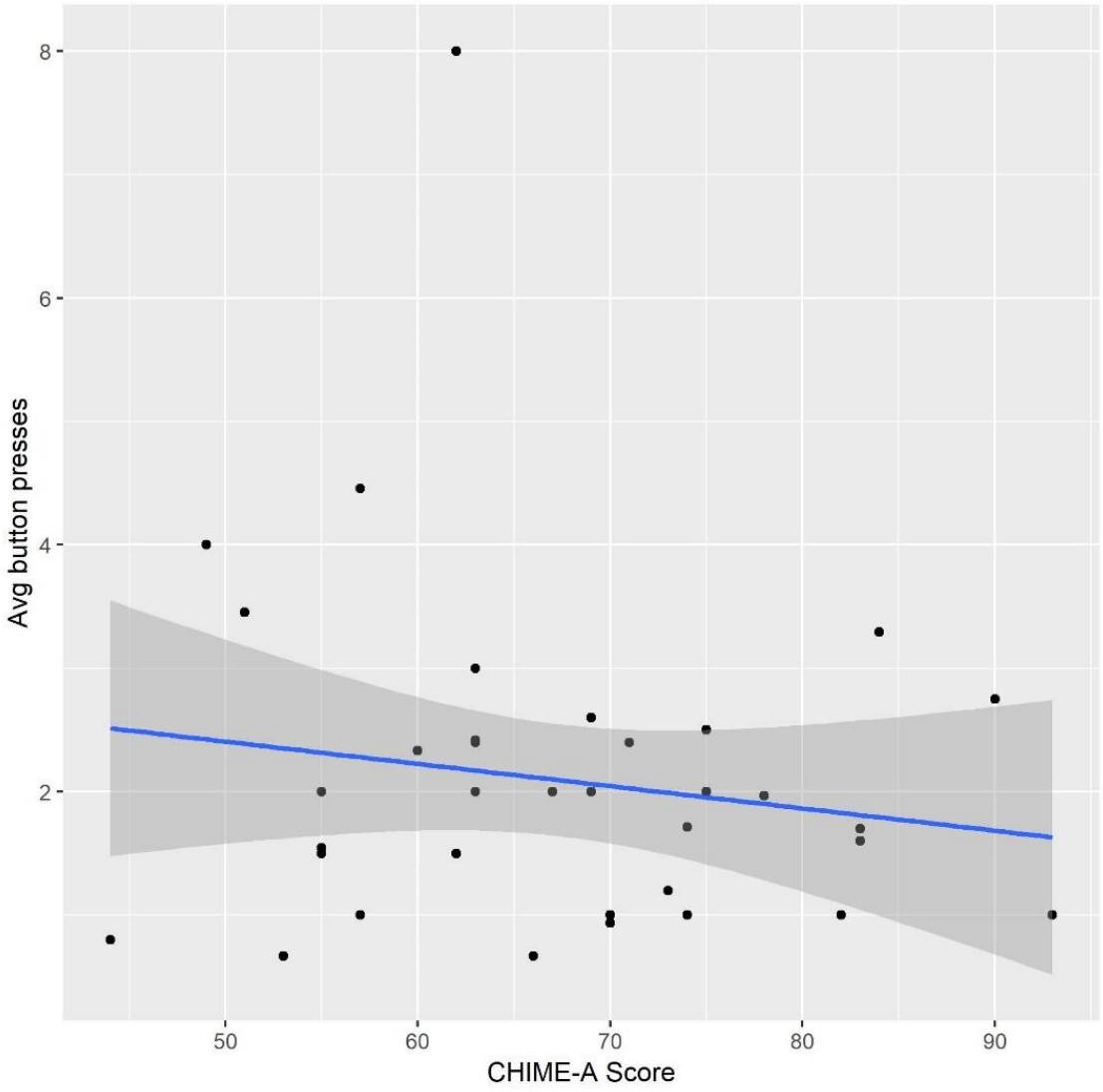

Figure 4. Scatterplot of Average button presses per day by CHIME-A score

Table 2. Two-level random effects MLM predicting daily number of button presses using MAAS-A score

Predictors	*Estimates*	*Confidence Interval*	*p*
(Intercept)	2.23	0.60 – 3.86	**.007**
MAAS	0.02	-0.49 – 0.54	.926
Random Effects			
σ^2	4.34		
$\tau_{00\ ID}$	0.05		
$\tau_{11\ ID.MAAS\_SCORE}$	0.06		
ICC_{ID}	0.01		
Observations	361		

The Random Effects terms output from a general Level-1 effects MLM have the following explanations: σ^2 : Within-person residual variance; $\tau_{00\ ID}$: Between-person variance, refers to the variation in intercepts across people; $\tau_{11\ ID.MAAS\_SCORE}$: refers to the variance across different levels of MAAS scores ; ICC_{ID} : Between-group ICC (intra-class correlation), proportion of variance explained by between-person difference.

As Table 2 shows, the MAAS-A model indicates that there's a slight positive relationship between MAAS-A score and number of presses per day. However, the p-value of .926 indicates that this relationship was not significant. The slight positive relationship is not in line with the hypothesis which claims that the number of presses would decrease as the mindfulness increases.

As Table 3 shows, the full CHIME-A model indicates that there's a slight negative relationship between CHIME-A score and the number of presses per day.

Table 3. Two-level random effects MLM predicting daily number of button presses using CHIME-A score

Predictors	*Estimates*	*Confidence Interval*	*p*
(Intercept)	2.78	-0.19 – 5.74	.067
CHIME SCORE	-0.01	-0.05 – 0.03	.707
Random Effects			
σ^2	4.29		
$\tau_{00\ ID}$	39.42		
$\tau_{11\ ID.CHIME\_SCORE}$	0.01		
ICC_{ID}	0.90		
Observations	361		

However, the p-value of .707 indicates that this relationship was not significant. The slight negative relationship is aligned with the hypothesis which asserts that the number of presses would decrease as mindfulness increases.

Table 4 has results for the following subscales of CHIME-A: 1) Awareness of Internal Experiences, 2) Awareness of External Experiences, 3) Acting with Awareness, 4) Acceptance/Non-judgement, 5) Decentering/Non-reactivity, 6) Openness to Experience, 7) Relativity of Thoughts, 8) Insight. Since each of these subscales measure a different facet of mindfulness, a separate MLM model was built to check the association between the subscale score and number of button presses per day.

As Table 4 shows, the CHIME-A subscale MLM models indicate that there's a slight negative relationship between each of the subscales Awareness of External Experiences, Acting with Awareness, Acceptance/Non-judgement, Insight and the number of button presses per day which are in line with the hypothesis, while subscales Awareness of Internal Experiences, Decentering/Non-reactivity, Openness to Experience,

Table 4. Two-level random effects MLM models predicting daily number of button presses using CHIME-A subscale scores

Subscale	Aware of Int Exp	Aware of Ext Exp	Act with Aware	Accept/ Non-judge	Decenter/ Non-react	Open to Exp	Rel of Thoughts	Insight
Intercept	2.25	2.41	3.15	2.93	2.33	2.15	1.7	2.56
$p_{Intercept}$	0.023	0.009	<0.001	<0.001	0.001	0.009	0.11	<0.001
$CI_{Intercept}$	0.31 - 4.19	0.59 - 4.22	1.61 - 4.70	1.40 - 4.47	0.96 - 3.70	0.54 - 3.77	-0.38 - 3.79	1.39 - 3.72
CHIMEx	0.01	-0.01	-0.1	-0.08	0	0.02	0.06	-0.04
p_{CHIMEx}	0.948	0.908	0.234	0.393	0.97	0.836	0.589	0.633
CI_{CHIMEx}	-0.17 - 0.18	-0.15 - 0.14	-0.27 - 0.07	-0.27 - 0.10	-0.17 - 0.16	-0.15 - 0.18	-0.16 - 0.29	-0.21 - 0.13
σ^2	4.35	4.34	4.22	4.27	4.42	4.36	4.27	4.29
$\tau_{00\ ID}$	2.76	3.71	8.2	6.28	2.65	2.08	15.21	4.59
$\tau_{11\ ID.CHIMEx\_SCORE}$	0	0.01	0.07	0.05	0.01	0	0.18	0.07
$\rho_{01\ ID}$	-1	-1	-1	-1	-1	-1	-0.99	-0.95
ICC_{ID}	0.39	0.46	0.66	0.6	0.37	0.32	0.78	0.52

Relativity of Thoughts have a positive relationship with the number of button presses per day which are not in line with the hypothesis. However, none of the subscales have a p-value less than .05 indicating that these relationships are not significant.

Chapter IV

Discussion

Recent research (Cheng et al.,2018; Anastasiades, Kapoor, Wootten, & Lamis, 2017) with clinical adults in non-clinical settings has suggested that trait mindfulness is directly or indirectly (negatively) associated with suicidal thoughts and behaviors. In this study we sought to examine that relationship in inpatient suicidal adolescents, with a history of severe suicidal ideation or some suicidal attempts, using real-time monitoring. A sample of suicidal adolescents (n=38) from an inpatient unit was asked to fill out two self-report mindfulness measures, MAAS-A and CHIME-A, at intake, and their intense self-reported psychological distress was measured using button presses on wrist monitors, in real-time, during their stay in the unit on a daily basis.

A two-level MLM was built to predict the relationship between self-reported mindfulness and daily button presses. The MAAS-A based MLM predicted an increase of 0.02 daily button presses with a unit increase in mindfulness (p=.926), which does not support the hypothesis, because the results aren't significant. The full CHIME-A measure based MLM predicted a decrease of 0.01 daily button presses with a unit increase in mindfulness (p=.707) which is in the hypothesized direction but does not support the hypothesis, because the results aren't significant. The eight CHIME-A subscale based MLM models had varying results with half of them in line with the hypothesized direction and half of them not, but all of them didn't support the hypothesis because the results weren't significant.

General Discussion

Previous research has shown that increases in trait mindfulness, through MBIs, like MBSR, can reduce emotion dysregulation (Robins, Keng, Ekblad, & Brantley, 2012). Based on the theoretical mechanisms of mindfulness (Shapiro, Carlson, Astin, and Freedman, 2006), it was theorized that the attention regulation, non-judgmental attitude and non-identification aspects of mindfulness can address various dimensions of emotion dysregulation. Emotion dysregulation is one the relatively stronger risk factors for suicidal thoughts and behaviors, as part of internalizing psychopathology. Studies have further confirmed the linkage of emotion dysregulation with suicidal thoughts and behaviors in different populations. Linehan's (1993a) work with people with Borderline Personality Disorder had shown that nonacceptance of unbearable emotions and trying to escape from them due to lack of coping strategies is good predictor for suicidal attempts. Similarly, Weinberg and Klonsky (2009) found emotion dysregulation to be associated with suicidal ideation among a sample of adolescents, and Rajappa, Gallagher and Miranda (2012) found the same relationship in a sample of undergraduates.

Ruminative disorders, such as depression and anxiety, are another subcategory of internalizing psychopathology, which are relatively stronger risk factors for suicidal thoughts and behaviors. Broderick (2005) showed that a state mindfulness intervention could reduce rumination in a sample of undergraduate students, and Raes and Williams (2010) showed that trait mindfulness would be even better at reducing uncontrollable rumination in a sample from the youth population.

Mindfulness is a modifiable trait and several MBIs are available to improve mindfulness. Kiken et al. (2015) showed that MBIs can improve state mindfulness

leading to an improvement of trait mindfulness over time. Three of these MBIs – DBT, MBSR and MBCT, have been shown to reduce suicidal thoughts and behaviors among adults by improving trait mindfulness. With the above associations of trait mindfulness with emotion dysregulation and rumination, two of the stronger risk factors for suicidal thoughts and behaviors, it would follow that improving trait mindfulness would reduce suicidal thoughts and behaviors, in general.

The relationship of trait mindfulness and suicidal thoughts and behaviors in an inpatient suicidal adolescent population had not been studied in the past. This study sought to examine this relationship by using intense psychological distress as a proxy for STBs. It was hypothesized that trait mindfulness would be negatively associated with psychological distress, measured in real-time and aggregated on a daily basis. Mindfulness was measured at intake using two scales, MAAS-A and CHIME-A. The results indicated that none of the models, using MAAS-A or CHIME-A with all its subscales, were significant so the hypothesis was not supported. This could be due to various factors.

Firstly, this study was examining suicidal adolescents who may have severe emotion dysregulation issues. This could make them more prone to pressing the distress button without specific suicidal thinking or behavior, thereby causing more false positives in the data. A more precise indicator of suicidal thoughts and behaviors in real-time would be more appropriate.

Secondly, trait mindfulness was measured only at one time point, that is, at intake. As much as trait mindfulness is relatively stable over a short period of time, like the inpatient stay, the state mindfulness can change on a moment to moment basis. The

mindfulness scores at intake may be poor proxies for trait mindfulness. So it would make more sense to get mindfulness scores on a daily basis and average them out to get a better measurement of the trait mindfulness.

Lastly, adolescents in the inpatient unit undergo some treatment in form of therapy and/or medication. These treatments may affect the level of mindfulness for a subject on a given day. It would make sense to model the daily medication and therapy as control variables. This would obviously require tracking these in detail in the study. However, it's important to control for them in the model as it may influence the results.

Based on previous studies, it is understood that improving mindfulness reduces emotion dysregulation. With that in mind, mindfulness-based interventions can be used in this setting to improve emotion regulation and reduce psychological distress. As discussed above, MBCT, MBSR and DBT would be the most effective MBIs for individuals with suicidal thoughts and behaviors. By introducing such MBIs, the risk of suicide can be lowered. The inpatient and outpatient units at Franciscan's and other hospitals treating suicidal patients should explore the benefits of mindfulness-based interventions.

There were several strengths of this study. The study employed a real-time mechanism to monitor psychological distress which provides better accuracy compared to instruments that don't record emotion dysregulation issues in real-time and depend on the participant's memory at a future time. This kind of real-time recording can be helpful, in general, for measuring emotion regulation in other studies, not just mindfulness related studies.

This was the first study done in an inpatient setting with adolescents having suicidal thoughts and behaviors to investigate the relationship of trait mindfulness with psychological distress. By introducing short mindfulness-based interventions in this setting, future experiments could monitor improvements in state and trait mindfulness in this population.

This study used a relatively new mindfulness scale, CHIME-A (Johnson, Burke, Brinkman & Wade, 2017), for measuring the trait mindfulness of subjects. With its eight subscales, it provides a finer perspective of the various facets of mindfulness. This allows for more detailed analyses based on the individual facets of mindfulness and to model them separately to see what aspects of mindfulness may relate better to the suicidal thoughts and behaviors.

The present study conceptualized a mapping of two mechanisms of mindfulness to the dimensions of emotion dysregulation. These were based on the theories of mindfulness and emotion dysregulation. These mappings can be explored further in a separate cross-sectional study where the mindfulness facets (subscales) from an appropriate mindfulness scale with multiple facets, such as FFMQ or CHIME, can be mapped onto the subscales of the DERS scale. In addition, the moderating effect of emotion dysregulation to the association between psychological distress and STBs can be explored.

Limitations and Future Research

Mindfulness was only measured at intake and assumed to be a good proxy for trait mindfulness for the subject's entire hospital stay. To track the mindfulness on a more frequent basis, it would make sense to administer a mindfulness scale on a daily basis. As

long as the scale can be filled out within five minutes, it would be advisable to do so. CHIME-A would be the recommended scale, as it is a more comprehensive scale.

The subjects from the inpatient unit may be undergoing some treatment therapy and possibly taking medications for comorbid conditions. These weren't controlled in the study. These could be modeled as control variables for a future study.

This study used the number of button presses by the subject in a given day as the measure of distress, which assesses only if someone was experiencing distress, not how distressed the participant was. To get to a finer grain of distress, it may have been useful to get them to provide a severity of distress for example 1 to 10. This could have been achieved easily if the subjects were carrying smartphones. But the inpatient unit does not allow the subjects to carry smartphones, to prohibit increased distress, so this level of distress measurement was not possible.

The problems associated with measuring mindfulness by self-report have been documented before (Bergomi et al., 2013; Grossman & Van Dam, 2011; Sauer et al., 2013). Biases in self-perception limit the reliability of all self-report measures used in behavioral research (Baumeister et al., 2007). Self-report is also subject to the effects of social desirability and demand characteristics.

Conclusion

This study was limited in scope and ambition due to time, resource and cost constraints. Due to these limitations, data gathering was limited and could not include information about daily medication, inpatient therapeutic treatment and groups, daily mindfulness measurements, prior suicidal and self-harm history, emotion dysregulation measures (for example, DERS), rumination measures (for example, LARSS) and more

demographic data. A larger sample size would be beneficial to enhance the power of the study. With the limited resources and data gathering, this study made an attempt to associate trait mindfulness to suicidal thoughts and behaviors in an inpatient suicidal unit for adolescents using real-time distress tracking mechanisms. This was the first attempt of its kind. However, the evidence was inconclusive. Future experiments can learn from this and address the limitations to get better results.

Appendix A

MAAS-A Questionnaire

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6

I find myself preoccupied with the future or the past.	1	2	3	4	5	6
I find myself doing things without paying attention.	1	2	3	4	5	6
I snack without being aware that I'm eating.	1	2	3	4	5	6

Appendix B

CHIME-A Questionnaire

Click tick the box that fits you best **based on the last two weeks.**

		Never True	Rarely True	Some times True	Often True	Always True
1.	When my mood changes, I notice it straight away					
2.	I notice details in nature (like the color of the sky, or the shape of trees and clouds)					
3.	I notice my mistakes without giving myself a hard time					
4.	When I am tangled up in uncomfortable thoughts and feelings, I notice this quickly, and can "take a step back"					
5.	I realize my thoughts aren't always facts					
6.	When I notice that I have made things more complicated than they really are, it makes me smile					
7.	When I talk to other people I notice what emotions I am feeling (for example, if I am angry or happy)					
8.	I pay attention to the feeling of things like the wind in my hair or sunshine on my face					
9.	Even when I make a big mistake, I am kind and patient with myself					
10.	I am able to notice my thoughts and feelings without getting tangled up in them					
11.	I realize that my point of view is not always based on facts					

		Never True	Rarely True	Some times True	Often True	Always True
12.	When I have given myself a hard time without needing to, I can laugh about it					
13.	I notice the emotions I am feeling as they are happening					
14.	I notice sounds in my environment, such as birds chirping or cars passing					
15.	I notice my thoughts and feelings, and can also "step back" and watch them from a distance					
16.	I am aware that my point of view could change					
17.	I am able to smile to myself when I notice I have made a big deal out of a small problem					
18.	I break or spill things because my thoughts are elsewhere					
19.	I try to stay busy to keep certain thoughts or feelings out of my mind					
20.	I get distracted by memories or daydreams					
21.	When I feel difficult emotions, I try to do something to take my mind off them					
22.	At school, when I walk from class to class my mind is elsewhere					
23.	I don't like it when I am angry or scared and try to get rid of these emotions					
24.	I get angry with myself for my mistakes and weaknesses					
25.	I try to avoid emotional pain as much as possible					

Scored 1-5

Items 18 – 25 are reverse scored, and clustered at end to reduce confusion for youth

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