

Identifying Modifiable Factors Associated with Psychological Health in Women  
Experiencing Infertility

by

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Dissertation submitted in partial fulfillment of  
the requirements for the degree of Doctor  
of Philosophy in the Department of  
Psychology & Neuroscience in the Graduate School  
of Duke University

2022

ABSTRACT

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## Abstract

Infertility affects approximately 12.5% of U.S. women and is often accompanied by psychological distress. The following study aimed to assess the relationship of modifiable psychological factors on depression and anxiety symptoms and posttraumatic growth in women experiencing infertility. Women (n=457) in the U.S. completed an online survey containing demographic and clinical information as well as standardized self-report measures of mindfulness (FFMQ-24), self-compassion (SCS-SF), positive affect (mDES), intolerance of uncertainty (IUS-SF), relationship satisfaction (CSI-4), experiential avoidance (AAQ-II), depression (PROMIS Depression 8b), anxiety (PROMIS Anxiety 8a) and posttraumatic growth (PTGI). Efforts were made to recruit Black and Latina women who are less likely to seek medical treatment for infertility and are often underrepresented in infertility research. The final sample included women who identified as Non-LatinX White (65%), Non-LatinX Black (13%), LatinX (16%), Asian (2%) and Other (4%). Clinical and demographics characteristics (age, duration trying to conceive, history of miscarriage, and childlessness) did not significantly predict depression or anxiety. Positive affect and experiential avoidance predicted depression and anxiety, self-compassion predicted depression, and intolerance of uncertainty predicted anxiety. There were also indirect effects of mindfulness on anxiety and depression via these variables. Counter to expectations, posttraumatic growth was associated with higher intolerance of uncertainty and experiential avoidance. This suggests that, measured cross-sectionally, perceiving growth may act as a palliative strategy to reduce distress for women currently experiencing infertility. This cross-sectional study provides preliminary

evidence that interventions targeting experiential avoidance and positive affect may help to address depressive and anxiety symptoms in women experiencing infertility. In addition, offering skills to promote mindfulness may have beneficial downstream effects on other key coping variables. These effects should be evaluated in further clinical research.

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# 1. Introduction

## 1.1 *Infertility and its Impact*

The desire to become a parent is a central life goal for many young adults (Gerson et al., 1991). Though most people who try to become pregnant are eventually successful, the experience of trying to conceive can be quite stressful. Approximately 12.5% of women in the United States experience infertility, which is defined as the inability to conceive after 12 months of regular, unprotected intercourse (Kelley et al., 2019). Infertility is recognized as a disease by the World Health Organization, and the U.S. Centers for Disease Control highlights the diagnosis and treatment of infertility as a national public health priority (Macaluso et al., 2010).

The experience of infertility takes a physical, financial, and emotional toll on patients. Among women presenting at fertility centers, 56.5% report clinically elevated symptoms of depression and 75.9% report clinically elevated symptoms of anxiety (Pasch et al., 2016). Psychological burden is a primary reason patients opt to discontinue treatment, even when the likelihood of conception with continued treatment cycles remains high (Gameiro et al., 2012). Women's depression and anxiety increase after unsuccessful fertility treatment, and often show no recovery at 6-month follow-up (Verhaak et al., 2005). One in ten women continue to experience mental health challenges years after treatment, regardless of whether fertility treatment resulted in the birth of a child (Gameiro et al., 2016). Given the prevalence of heightened distress in this population, research exploring how best to support individuals' mental well-being in the context of infertility is warranted.

## ***1.2 Interventions Addressing Psychological Health in the Context of Infertility***

Despite the high prevalence of distress, most fertility patients do not receive and/or are not referred for mental health services (Pasch et al., 2016). However, women express strong interest in receiving psychological support (Schuette et al., 2022). Of note, women express greater interest in behavioral as opposed to pharmacological interventions (Schuette et al., 2022). This may in part be due to beliefs about harmful effects of psychotropic medication on fertility outcomes. Certain studies report no negative impacts of SSRI use on oocyte retrieval or pregnancy rates (Worly & Gur, 2015), while others suggest that SSRI use is associated with higher risk for pregnancy complications, including increasing risk of miscarriage (Domar et al., 2013). Given these conflicting findings and women's preferences, there is a need for empirically supported behavioral interventions to address and support psychological health in this population.

A number of existing interventions have sought to address psychological health among individuals experiencing infertility (Frederiksen et al., 2015). The most commonly utilized intervention tools include relaxation/stress management, breathing exercises, psychoeducation, and expression of thoughts/feelings (Hinkle & Dodd, 2021). However, studies to date have lacked the methodological quality necessary to draw meaningful conclusions regarding their efficacy at reducing negative psychological symptoms (Verkuijlen et al., 2016). Study limitations include lack of randomized design, lack of control groups, and significant heterogeneity in terms of participant characteristics and outcome measures used. Furthermore, few studies include mediation analyses to

determine what mechanisms of psychological interventions are responsible for their beneficial effects. The move towards process-based psychotherapy emphasizes the importance of identifying core mediators and moderators of change, in order to develop effective transdiagnostic interventions (Hofmann & Hayes, 2019). Determining which factors are most strongly associated with psychological health in the context of infertility is a critical step in developing an impactful intervention.

### ***1.3 Variable Selection Criteria***

A number of clinical and demographic characteristics have an impact on psychological health in infertility patients. For instance, older age, longer duration trying to conceive, history of miscarriage, and involuntary childlessness (versus when a person already has one or more children at home and is trying to conceive again), have been associated with increased risk for psychological symptoms, albeit inconsistently (Hoyle et al., 2020; Ogawa et al., 2011; Patel et al., 2016; Raque-Bogdan & Hoffman, 2015; Schwerdtfeger & Shreffler, 2009). Unfortunately, while important, these factors are outside an individual's control and cannot be ethically manipulated for research purposes. Individual psychological factors can also have risk and protective effects in regards to psychological adjustment. While certain psychological factors are considered trait-like, many have demonstrated the capacity to be altered via behavioral intervention. These types of factors are of primary interest in this study, which aims to inform the development of a future psychological intervention for those experiencing infertility. I chose to examine variables that have demonstrated an association with psychological

health in the context of infertility in prior empirical work. I further considered variables across domains identified in the Research Domain Criteria (RDoC) framework. RDoC was developed by the National Institute of Mental Health as a framework for investigating mental disorders that integrates multiple levels of information to understand human functioning (NIH, 2022). In order to capture a range of possible influences on psychological health, I specifically selected factors that relate to the positive and negative valence systems and social processes domains, which are critical to stress and coping.

## **1.4 Factors to Consider as Potential Intervention Targets**

### **1.4.1 Negative Valence Systems**

Experiential avoidance and intolerance of uncertainty relate to the RDoC negative valence systems domain, which is responsible for responses to aversive situations such as fear, anxiety, or loss.

*Experiential avoidance*, or psychological inflexibility, involves one's unwillingness to hold space for aversive internal experiences (e.g. emotions, thoughts and bodily sensations), and the extent to which this intolerance prevents one from engaging in values-consistent action (Hayes et al., 2006). Experiential avoidance can be viewed as a coping mechanism that may result in decreased distress in the short-term and increased distress in the long-term. Longitudinal research has demonstrated that self-reported experiential avoidance predicts the development of depressive and anxiety disorders (Spinhoven et al., 2014) and has adverse effects on daily well-being (Machell et al., 2015). Previous work has shown that experiential avoidance is associated with increased

depressive symptoms among infertility patients (Pinto-Gouveia et al., 2012), and that infertility patients report higher experiential avoidance than fertile couples (Cunha et al., 2016).

*Intolerance of uncertainty* is the dispositional inability to tolerate aversive reactions triggered by a perceived lack of sufficient information (Carleton, 2016). Individuals with high intolerance of uncertainty find uncertain events distressing and undesirable and may engage in maladaptive coping behaviors to control or avoid uncertainty (Carleton et al., 2012). While intolerance of uncertainty was previously conceptualized as a vulnerability factor for worry, it is now understood to be a distinct construct and a transdiagnostic factor underlying a range of emotional disorders (Shihata et al., 2016). Tolerating uncertainty is particularly relevant to the context of infertility because women go through repeated periods of waiting for treatment and waiting for test results. In a retrospective study, women who reported higher intolerance of uncertainty also reported higher distress and rumination during the period of trying to conceive (Sweeny et al., 2015).

#### *1.4.2 Positive Valence Systems*

*Positive affect* relates to the RDoC positive valence systems domain, responsible for responses to positive motivational situations in contexts such as reward seeking. It involves the experience of pleasurable emotions, such as happiness, joy, excitement, enthusiasm, calm and contentment. Individuals continue to experience positive affect even in the context of chronic stress (Folkman & Moskowitz, 2000). Further, the ability

to experience positive emotions amidst stressful circumstances is associated with psychological health and adaptive coping in individuals facing difficult medical stressors (Folkman & Moskowitz, 2007). Experiencing positive emotions may provide a time out from distress, enabling an individual to sustain adaptive coping behaviors, and may help one recover from stress more quickly (Folkman, 1997; Fredrickson, 2001). Experiencing lower positive affect in the context of daily stressors prospectively predicts increased risk for depression and anxiety (Rackoff & Newman, 2020). Few studies have examined positive affect in women experiencing infertility. However, one study found that positive affect mediated the relationship between resilience and posttraumatic growth among women experiencing infertility in China (Kong et al., 2018).

#### *1.4.3 Social Processes*

Self-compassion and relationship satisfaction relate to the social-processes RDoC domain, representing relationship with self and relationship with others, respectively.

*Self-compassion* is broadly operationalized in the literature according to Kristin Neff's definition, which is based on a Buddhist perspective of compassion for others (Neff, 2003). It includes multiple components such as kindness towards oneself, mindful awareness, and recognition of common humanity. Together, the components of self-compassion inform how one responds to perceived personal inadequacies and difficult life circumstances (Neff & Tóth-Király, 2020). Previous studies have demonstrated that self-compassion helps buffer against anxiety (Neff et al., 2007). In infertility populations, self-compassion has been associated with greater well-being (Raque-Bogdan & Hoffman,

2015) and lower depressive symptom severity (Hoyle et al., 2020). One study found that infertile women report higher self-coldness than fertile women, suggesting it may be an important target for intervention (Cunha et al., 2016).

*Relationship satisfaction* broadly refers to a person's overall evaluation of his or her relationship. Undergoing the struggles of infertility together has the potential to bring couples closer and to strengthen the relationship, but may also reduce relationship satisfaction over time (Repokari et al., 2007). Couples facing infertility treatment options were most likely to rank maintaining a close and satisfying relationship with their partner as a top priority, even above the goal to have a child (Duthie et al., 2017). Maintaining a supportive and communicative relationship may be especially important for managing mental health during infertility. Prior research supports a relationship between infertility-related distress and marital satisfaction (Gana & Jakubowska, 2016). A meta-analysis of partner factors associated with depression and anxiety during the perinatal period suggests a stronger link between relationship satisfaction and depression than anxiety, though far fewer studies assessed anxiety than depression (Pilkington et al., 2015).

In addition to being associated with psychological health in the context of infertility, each of the variables described above is modifiable with behavioral interventions (Bolier et al., 2013; Khaddouma et al., 2017; Lappalainen et al., 2015; McEvoy & Erceg-Hurn, 2016; Wilson et al., 2019). Identifying one variable that influences all of these factors could provide a unifying target for intervention.

## **1.5 The Role of Mindfulness**

*Mindfulness* is a way of paying attention to one's experience of the present moment with a nonjudgmental and accepting attitude (Kabat-Zinn, 1982). Interventions that promote mindfulness have been widely used to treat anxiety and depression, and there is evidence that they may also increase posttraumatic growth (Goldberg et al., 2018; Shiyko et al., 2017). One study demonstrated that, among infertility patients with recurrent pregnancy loss, mindfulness buffered against the effects of depression and anxiety on fertility-related quality of life and perceived stress (G. Li et al., 2020). Studies examining mindfulness-based interventions with infertility patients report increases in self-reported mindfulness alongside improvements in psychological health outcomes (Galhardo et al., 2019; J. Li et al., 2016).

The mechanisms of mindfulness training continue to be an important area of investigation. Mindfulness training directly impacts trait-like mindfulness measures as well as other positive and negative emotional characteristics and social processes, including the variables listed above. Mindfulness may increase positively valenced reward processes. It has been proposed that the broadened attentional state cultivated by mindfulness practice enhances positive emotion (Garland et al., 2010). Indeed, multiple types of meditation practice lead to significant gains in positive emotions (Fredrickson et al., 2017). Mindfulness may further reduce negatively valenced emotional processes of anxiety and avoidance by encouraging a curious and non-judgmental attitude towards aversive internal experiences. Women experiencing infertility who participated in a mindfulness-based intervention demonstrated long-term decreases in experiential

avoidance (Galhardo et al., 2019). The ability to attend to the present moment, cultivated in mindfulness practice, may further reduce uncertainty intolerance, which is future oriented. Participating in a mindfulness-based intervention has been shown to decrease uncertainty intolerance during medical waiting periods (Victorson et al., 2017), and individuals high in uncertainty intolerance appear to benefit most from mindfulness practice (Sweeny & Howell, 2017). Finally, mindfulness addresses interpersonal and intrapersonal social processes. As noted earlier, mindfulness is defined by processes of non-judgment and acceptance towards oneself and others. It is one of the key elements of self-compassion, which mindfulness meditation exercises have been shown to promote (Boellinghaus et al., 2014). A growing literature demonstrates the link between trait mindfulness and relationship satisfaction (McGill et al., 2016). Increases in dispositional mindfulness domains after participating in a mindfulness-based intervention have been linked to increases in relationship satisfaction among individuals and their partners who did not participate in the intervention (Khaddouma et al., 2017).

In sum, the ability to be mindful may contribute positively to psychological outcomes in infertility via multiple direct and indirect pathways.

### ***1.6 Assessing Positive Psychological Outcomes: Infertility and Posttraumatic Growth***

The majority of research examining predictors of psychological health in infertility has focused on risk factors for negative outcomes such as anxiety, stress, and depression (Rockliff et al., 2014). Understanding psychological health goes beyond the mitigation of negative symptoms and thus the absence of positive outcomes is a notable

gap. One example of a positive psychological outcome is posttraumatic growth.

Posttraumatic growth is defined as positive change that one may experience as a result of the struggle with a major life crisis (Tedeschi & Calhoun, 2004a). Some examples of posttraumatic growth include a feeling of increased connection to others, greater sense of personal strength, or the realization of new opportunities (Calhoun & Tedeschi, 1998).

Individuals affected by major health diagnoses such as cancer and HIV report posttraumatic growth in these domains (Collins et al., 1990; Schwartzberg, 1994).

Though fewer studies have examined posttraumatic growth in women who have experienced infertility, preliminary evidence suggests that they report moderate levels of posttraumatic growth (Kong et al., 2018; Paul et al., 2010). Examining factors associated with posttraumatic growth will further our understanding of how growth develops and who is most likely to experience it.

### ***1.7 Study Purpose***

The first aim of this study is to examine the effects of self-compassion, mindfulness, intolerance of uncertainty, positive affect, relationship satisfaction and experiential avoidance on depression, anxiety and posttraumatic growth among women experiencing infertility. These findings will highlight potential protective and risk factors for psychological health in women experiencing infertility and identify potential targets for intervention. While previous research has shown that these variables are individually associated with psychological health in the context of infertility, no study to date has examined their effects in a single model. In doing so, this study will help to detect

possible shared variance between these variables and clarify which are most impactful on psychological health. I hypothesize that greater positive affect, mindfulness, self-compassion, relationship satisfaction and lower experiential avoidance and intolerance of uncertainty will predict lower depression, lower anxiety, and greater posttraumatic growth. The second aim of this study will be to evaluate indirect effects of mindfulness on target outcomes via the other predictor variables. I hypothesize that mindfulness will benefit psychological health via its positive associations with self-compassion, positive affect and relationship satisfaction, and inverse associations with experiential avoidance and intolerance of uncertainty. This analysis will shed light on potential mechanisms of mindfulness training for women experiencing infertility and will help determine whether mindfulness has unique benefits aside from these other core process variables. This study builds on previous research by focusing on predictors that are modifiable via behavioral intervention and by evaluating both positive (i.e. posttraumatic growth) and negative (i.e. anxiety & depression) aspects of psychological health.

## **2. Methods**

I recruited a cross-sectional sample of women experiencing infertility in the United States to complete an online survey assessing the aforementioned psychological predictor variables, symptoms of depression and anxiety, and posttraumatic growth.

### ***2.1 Inclusion/Exclusion Criteria***

Participants were eligible for the study if they 1) identified that their sex assigned at birth was female (and thus were able to conceive), 2) identified as experiencing infertility, 3) lived in the United States, and 4) were at least 18 years old at time of consent.

### ***2.2 Recruitment and Procedure***

Review and approval for this study and all procedures was obtained from the Duke Health IRB (Pro 00106598). Participants were recruited via 1) electronic medical record at Duke University Medical Center, 2) provider outreach, 3) online through listservs and social media outlets relevant to women experiencing infertility, 4) ResearchMatch, and 5) Qualtrics research panels. I reviewed patient lists at Duke Fertility Center and sent an email with the study link to potentially eligible patients. A provider affiliated with the study shared the link with Mental Health Professional Group (MHPG) of the American Society for Reproductive Medicine (ASRM) for providers to share with interested patients. Study personnel shared the study link in relevant social media outlets including Twitter, Instagram, and Reddit after obtaining moderator permission where

indicated. ResearchMatch is a national health volunteer registry that was created by several academic institutions and supported by the U.S. National Institutes of Health as part of the Clinical Translational Science Award (CTSA) program. ResearchMatch has a large population of volunteers who have consented to be contacted by researchers about health studies for which they may be eligible. I identified potential ResearchMatch participants using preliminary inclusion criteria and invited them to participate via email. Qualtrics research panels offer an online recruitment tool for obtaining a nationally representative sample through an approach focused on quota-based sampling. I worked with a Qualtrics representative to identify eligible participants to complete the online survey.

I conducted purposeful recruitment to reach a racially and ethnically diverse sample. Despite experiencing relatively higher rates of infertility, Black and Latina women are less likely to receive medical treatment for infertility than white and Asian women and are consistently underrepresented in infertility research (Greil et al., 2011). Inclusion criteria for the first 75 participants recruited via Qualtrics Panels was limited to Black and Latina women to ensure representation from these groups. A portion of recruitment emails sent via ResearchMatch were also sent to women who identified as Black or Latina in their ResearchMatch profile. Finally, the study link was shared in social media groups specifically for women of color experiencing infertility.

## **2.3 Compensation**

Every 1 in 10 participants was randomly selected to receive a \$25.00 Amazon gift card for her time. Participants recruited via Qualtrics Panels were paid according to the rules and regulations stipulated by Qualtrics Panels at the beginning of the survey.

## **2.4 Measures**

### *2.4.1 Outcome Variables*

*Anxiety and depression.* Anxiety and depression were assessed using the PROMIS Short Form v1.0 Anxiety 8a and PROMIS Short Form Depression 8b (Pilkonis et al., 2011). The PROMIS anxiety form contains items designed to capture the respondent's emotional distress caused by hyperarousal, fear, stress and related somatic symptoms. Items are designed to capture trait rather than state anxiety. The PROMIS depression form contains items to assess depressive mood and emotional distress. Participants are asked to rate each item on a 5-point Likert scale (1 Never – 5 Always) with higher scores indicating higher anxiety and depression. Average scores were calculated as follows: [(raw sum x number of items on the short form) / number of items that were actually answered].

*Posttraumatic growth.* Posttraumatic growth was assessed using the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Calhoun, 1996). The PTGI is a 21-item measure used to assess five factors related to posttraumatic growth, defined as positive psychological change in the wake of struggling with highly challenging life circumstances (Tedeschi & Calhoun, 2004a). Items are scored on a 6-point scale (0 No

Change – 5 A Great Deal of Change). All responses are summed for a total PTGI score. Prior studies suggest that women experiencing infertility report moderate posttraumatic growth (Kong et al., 2018; Paul et al., 2010). Average scores among completed items were used instead of summed scores for analysis to better account for missing data.

#### 2.4.2 Predictor Variables

*Experiential avoidance.* Experiential avoidance was assessed using the Acceptance and Action Questionnaire 2 (AAQ-II) (Bond et al., 2011). The AAQ-II includes 7 items scored on a 7-point scale (1 Never True – 7 Always True) for possible total scores between 7-49, with lower scores indicating greater experiential avoidance. In standard administration, responses are summed for a total score. Scores between 24-28 are typically associated with elevated depression and anxiety symptoms (Bond et al., 2011).

*Intolerance of uncertainty.* Intolerance of uncertainty was assessed using the short form Intolerance of Uncertainty Scale (IUS-SF) (Carleton et al., 2007). The IUS-SF includes 12 items scored on a 5-point scale (1 Not at All Characteristic of Me – 5 Entirely Characteristic of Me), with higher scores indicating higher uncertainty intolerance. Responses are summed for a total score.

*Self-compassion.* Self-compassion was assessed using the short form Neff Self-Compassion Scale (SCS-SF) (Raes et al., 2011). The SCS-SF assesses how people act towards themselves during difficult times, with aspects of self-kindness and self-coldness. The SCS-SF consists of 12 items scored on a 5-point scale (1 Almost Never – 5

Almost Always), with items summed to create a composite self-compassion score. Higher scores reflect greater self-compassion.

*Relationship satisfaction.* Relationship satisfaction was assessed using the 4-item version of the Couples Satisfaction Index (CSI-4) (Funk & Rogge, 2007). Items are summed to yield an overall assessment of relationship satisfaction, and higher scores indicate greater relationship satisfaction. The CSI-4 has shown high measurement precision and strong convergent validity with other measures of relationship satisfaction in previous samples (Funk & Rogge, 2007). Scores below 13.5 suggest notable relationship dissatisfaction.

*Positive affect.* Positive affect was assessed using the modified Differential Emotions Scale (mDES), based on Fredrickson's Broaden-And-Build Theory of Positive Emotions (Fredrickson, 2013). The mDES includes 10 items to assess the experience of discrete emotions. The mDES was created to be a more encompassing measure of positive emotions than the PANAS, which exclusively targets high activation positive affective states (Watson et al., 1999). Items include high-activation pleasant states (e.g. joy, amusement) as well as low-activation pleasant states such as contentment and serenity. Items are rated on a 5-point scale from (0 Never – 4 Most of the Time) to indicate the extent to which positive emotions have been experienced over a particular time frame. A composite score is calculated after summing all responses to create a composite positive emotion score; higher scores indicate greater positive emotion.

*Mindfulness.* Mindfulness was assessed using the Five Factor Mindfulness Questionnaire Short Form (FFMQ-SF) (Bohlmeijer et al., 2011). The FFMQ-SF is a 24-

item instrument which assesses factors comprising the tendency to be mindful in daily life. The five factors assessed are: observing internal experience, describing internal experience, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. Items are rated on a 5-point Likert scale (1 Never or Very Rarely True – 5 Very Often or Always True) with higher scores indicating more mindfulness. In this study a composite mindfulness score was calculated using all but the observe subscale. Omitting the observe subscale has been demonstrated to improve reliability when assessing samples without significant meditation experience (Baer et al., 2006).

Averaged, as opposed to summed, scores were calculated for all self-report variables for the purposes of study analyses to better account for missing data. See Appendix A for the demographics survey administered to participants and Appendix B for a list of access links to standardized self-report measures.

### **2.4.3 Covariates**

Clinical and demographic variables may impact women's stress while trying to conceive. Consequently, the following variables were entered as covariates:

*Duration of Infertility.* Participants were asked how long they had been trying to have a child (answered in months). Longer duration of infertility is associated with greater stress (Patel et al., 2016)

*Age.* Participants recorded their age (in years). Older age is associated with greater stress (Ogawa et al., 2011).

*Children.* Participants were asked if they currently had living children (Yes/No). Women who do not have living children report greater fertility-related distress and depressive symptoms than women who have one or more children and are experiencing infertility while trying to conceive again (Hoyle et al., 2020; Raque-Bogdan & Hoffman, 2015).

*History of Pregnancy Loss.* Participants were asked whether they had experienced pregnancy loss (Yes/No). The experience of pregnancy loss has been associated with depression and fertility-related distress among infertile women (Schwerdtfeger & Shreffler, 2009).

## **2.5 Analysis**

### *2.5.1 Data Screening Criteria*

A number of strategies exist to prevent fraudulent survey responses when conducting online research, each with unique costs and benefits (Teitcher et al., 2015). I undertook a number of steps to protect the integrity of the data. The survey in Qualtrics was set up to identify participants using a VPN and participants whose IP addresses indicated they were not in the U.S. These individuals were immediately directed to the end of the survey. The survey also began with a CAPTCHA button to identify and prevent robot responses. Further, information about compensation for study participation was removed from recruitment materials to reduce motivation to complete the survey multiple times. Data were closely inspected to protect quality and reliability. Responses (n=334) that met one or more of the following criteria were excluded from analysis and

not eligible for subject payment: 1) Illogical or incoherent free text responses that did not address the question, that were not written in comprehensible English, or that contained text directly copied and pasted from the internet or the question itself; 2) Careless or inconsistent multiple-choice responses, such as answers to multiple choice questions that clearly contradicted each other; 3) Duplicate free text responses that indicated a subject completed the survey multiple times in a row and copy/pasted their answers from one survey to the next; 4) Duplicate IP addresses, indicating duplicate responses from a single individual; 5) Response time < 10 minutes, less than ½ the predicted survey length, indicating participants did not read and answer all questions earnestly, 6) Straight-lining, selecting the same response choice on all items of three or more measures, indicating the participant rushed through their responses and may not have fully read the questions, and 7) Participant completed fewer than 80% of items on three or more measures, posing concerns for data reliability.

### *2.5.2 Data Cleaning*

The final sample included 457 participants. Data were examined for multivariate outliers using Mahalanobis distance; no multivariate outliers were identified. Descriptive analysis indicated univariate normality, showing no evidence of heightened skewness and kurtosis. Indices of multivariate normality were mixed: Mardia indicated normality, Henze-Zirkler and Royston did not. Maximum likelihood with robust standard errors was used in estimation to correct for issues related to non-normality. As previously noted,

averaged (as opposed to summed) scores were used for analysis to better account for missing data.

### *2.5.3 Path Analysis*

I used path analysis, a special case of structural equation modeling, to assess multiple mediators and dependent variables simultaneously (G. W. Cheung & Lau, 2008). It has been suggested that samples of 200-400 are appropriate for valid estimation with most models (Hoyle, 2011). I was interested in parameter estimates as opposed to overall model fit and therefore examined a saturated model ( $df=0$ ). I therefore did not conduct a test of omnibus fit.

### *2.5.4 Sensitivity Analysis*

Twenty-four participants reported that they were single and therefore were not asked to complete the CSI-4. I ran the model with and without these participants, and all model parameter confidence intervals were overlapping. There were no differences in the direction or significance of coefficients. Consequently, I included all participants in the model presented here.

### 3. Results

The average age of women in the sample was 32.43 years old (SD: 5.43, range: 19-56). A majority (69%) of participants had earned a bachelor's degree or higher. The mode household income was \$100,000-\$149,000. Approximately three-quarters of the women reported having no children. Most participants reported they had been trying to conceive for 1-3 years (49%). A majority (94%) were insured, and 88% reported they had seen a doctor for infertility. Approximately half the sample reported that they had experienced a miscarriage. Approximately one third reported they were currently seeing a psychotherapist. Table 1 provides a breakdown of demographic information.

Participants reported moderately elevated anxiety ( $T = 62.5$ ) and mildly elevated depression ( $T = 59.7$ ). Participants reported elevated experiential avoidance and intolerance of uncertainty and moderate posttraumatic growth, similar to previous samples of women experiencing infertility (Galhardo, Cunha, & Pinto-Gouveia, 2013; Paul et al., 2010; Sweeny et al., 2015). Participants reported self-compassion scores similar to previous infertility samples (Hoyle et al., 2020), and positive affect approximately one standard deviation below that of a previous study of postpartum women (Wouk, 2019). Previous studies have not reported FFMQ-24 scores in women experiencing infertility. Women in this sample reported FFMQ-24 scores similar to those found in other chronic health populations and adults with elevated depression and anxiety (Bohlmeijer et al., 2011; Compen et al., 2018; Pots et al., 2016). Further, the individual item-average on the FFMQ-24 in this study (2.99) was similar to that of a study of women experiencing infertility who completed the Chinese version of the FFMQ-39

(3.02) (J. Li et al., 2016). See Table 2 for means, standard deviations, and reliability information. Zero-order correlation coefficients for all variables included in the predictive models are shown in Table 3.

**Table 1: Demographics**

	N	%
<b>Race/Ethnicity</b>		
White	297	64.99
Black or African American	58	12.69
Hispanic, Latino, or Spanish origin	73	15.97
Asian	10	2.19
Other/Multiple	19	4.16
<b>Relationship Status</b>		
Single	24	5.25
In a committed relationship, not married or in a domestic partnership	65	14.22
Married or in a domestic partnership	368	80.53
Missing	0	0.00
<b>Relationship Duration</b>		
< 1 year	21	4.60
1 - 3 years	86	18.82
> 3 years	324	70.90
Single	24	5.25
Missing	2	0.00
<b>Partner Gender</b>		
Man	404	88.40
Woman	20	4.38
Non-binary	1	0.22
Transgender	4	0.88
None of the above	3	0.66
Missing	25	5.47
<b>Education</b>		
Some high school, no diploma	9	1.97
High school diploma or GED	24	5.25
Some college, no degree	69	15.10
Associates degree	41	8.97
Bachelor's degree	135	29.54
Master's degree	115	25.16
Doctorate/professional degree	64	14.00
Missing	0	0.00
<b>Employment</b>		
Employed full time	341	74.62

Employed part time	48	10.50
Unemployed looking for work	17	3.72
Retired	1	0.22
Temporarily or permanently disabled	4	0.88
Keeping house	25	5.47
Student	15	3.28
Other	6	1.31
Missing	0	0.00
<hr/>		
Income		
<hr/>		
< \$25,000	28	6.13
\$25,000-\$49,000	58	12.69
\$50,000-\$74,999	58	12.69
\$75,000-\$99,999	71	15.54
\$100,000-\$149,999	100	21.88
\$150,000-\$199,999	72	15.75
\$200,000-\$249,999	29	6.35
> \$250,000	41	8.97
Missing	0	0.00
<hr/>		
Insured		
<hr/>		
Yes	429	93.87
No	28	6.13
Missing	0	0.00
<hr/>		
Duration Trying to Conceive		
<hr/>		
< 1 year	41	8.97
1 year	67	14.66
1-2 years	131	28.67
2-3 years	93	20.35
3-4 years	45	9.85
4-5 years	31	6.78
> 5 years	48	10.50
Missing	1	0.22
<hr/>		
Children		
<hr/>		
No	343	75.05
Yes	113	24.73
Missing	1	0.22
<hr/>		
Miscarriage		
<hr/>		
No	239	52.30

Yes	216	47.26
Missing	2	0.44
<hr/>		
Have sought evaluation for fertility problems by a doctor		
Yes	401	87.75
No	54	11.82
Missing	2	0.44
<hr/>		
Taken Clomid or other oral medication		
Currently taking Clomid or another medication	170	37.20
Taken Clomid or another medication previously	67	14.66
No	219	47.92
Missing	1	0.22
<hr/>		
IUI (intrauterine insemination)		
Never done IUI	252	55.14
Currently planning or undergoing IUI	73	15.97
Have completed IUI in the past	131	28.67
Missing	1	0.22
<hr/>		
IVF (in vitro fertilization)		
Never done IVF	239	52.30
Currently planning or undergoing IVF	146	31.95
Have completed IVF in the past	71	15.54
Missing	1	0.22
<hr/>		
Therapy		
Never seen a therapist	118	25.82
Seen a therapist in the past	200	43.76
Currently seeing a therapist	139	30.42
Missing	0	0.00
<hr/>		
Meditation		
Never meditated	92	20.13
Meditated a small number of times but never consistently	230	50.33
Meditated consistently (e.g. several times a week) in the past, not now	85	18.60
Meditate consistently (e.g. several times a week) now	50	10.94
Missing	0	0.00

**Table 2: Means and Reliability**

	M (SD)	$\alpha$ [95% CI]	Possible Range	Observed Range
AAQ-II	27.63 (8.62)	0.90 [0.88, 0.91]	7 - 49	7 - 49
IUS-SF	37.97 (9.54)	0.90 [0.88, 0.91]	12 - 60	15 - 60
SCS-SF	33.17 (6.60)	0.81 [0.79, 0.84]	12 - 60	17 - 60
CSI-4	15.30 (4.49)	0.92 [0.91, 0.93]	0 - 21	0 - 21
mDES	20.27 (7.70)	0.90 [0.88, 0.91]	0 - 40	0 - 40
FFMQ-24	71.87 (10.27)	0.80 [0.77, 0.83]	24 - 120	42 - 116
PROMISAnx	24.26 (6.95)	0.91 [0.9, 0.92]	8 - 40	8 - 40
PROMISDep	22.17 (7.87)	0.93 [0.92, 0.94]	8 - 40	8 - 40
PTGI	46.92 (23.46)	0.94 [0.94, 0.95]	0 - 105	0 - 105

Note: Weighted summed scores were calculated by taking the mean total score for each item and multiplying by the number of items per scale.

Key: mDES = modified differential emotions scale, FFMQ-24 = 24-item Five Factor Mindfulness Questionnaire, AAQ-II = acceptance and action questionnaire 2, CSI-4 = 4-item couples satisfaction index, SCS-SF = self-compassion scale, short form, IUS-SF = intolerance of uncertainty scale, short form, Dep = Depression, Anx = Anxiety, PTGI = Posttraumatic Growth Inventor

**Table 3: Bivariate Correlations**

Variable	1	2	3	4	5	6	7	8
1. mDES								
2. FFMQ-24	.33**							
	[.25, .41]							
3. AAQ-II	-.28**	-.60**						
	[-.36, -.20]	[-.66, -.54]						
4. CSI-4	.21**	.12*	-.20**					
	[.11, .29]	[.02, .21]	[-.29, -.11]					
5. SCS-SF	.47**	.55**	-.45**	0.03				
	[.39, .54]	[.49, .61]	[-.52, -.37]	[-.07, .12]				
6. IUS-SF	-.13**	-.49**	.59**	-0.03	-.42**			
	[-.22, -.04]	[-.55, -.41]	[.53, .65]	[-.13, .06]	[-.50, -.35]			
7. PromisDep	-.48**	-.46**	.63**	-.22**	-.47**	.38**		
	[-.55, -.41]	[-.53, -.39]	[.57, .68]	[-.30, -.12]	[-.54, -.40]	[.30, .45]		
8. PromisAnx	-.42**	-.49**	.61**	-.16**	-.44**	.44**	.70**	
	[-.49, -.34]	[-.56, -.42]	[.55, .67]	[-.25, -.06]	[-.51, -.36]	[.37, .51]	[.65, .75]	
9. PTGI	.27**	0.03	.14**	0	.26**	.15**	0.00	0.02
	[.19, .36]	[-.07, .12]	[.05, .23]	[-.10, .09]	[.18, .35]	[.06, .24]	[-.10, .09]	[-.07, .11]

Key: mDES = modified differential emotions scale, FFMQ-24 = 24-item Five Factor Mindfulness Questionnaire, AAQ-II = acceptance and action questionnaire 2, CSI-4 = 4-item couples satisfaction index, SCS-SF = self-compassion scale, short form, IUS-SF = intolerance of uncertainty scale, short form, Dep = Depression, Anx = Anxiety, PTGI = Posttraumatic Growth Inventory. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). \* indicates  $p < .05$ . \*\* indicates  $p < .01$ .

Results of the models for anxiety, depression, and posttraumatic growth are displayed separately below in Figures 1-3 respectively. Mindfulness significantly predicted higher self-compassion ( $\beta = 0.56, p = < .001$ ), positive affect ( $\beta = 0.34, p = < .001$ ), relationship satisfaction ( $\beta = 0.12, p = .017$ ), and lower intolerance of uncertainty ( $\beta = -0.48, p < .001$ ) and experiential avoidance ( $\beta = -0.58, p = < .001$ ). Standardized regression coefficients for the full model are reported in Table 4. Indices of model fit are not available because the model was run fully saturated.

### **3.1 Model Predicting Anxiety**

There were significant effects of positive affect ( $\beta = -0.24, p = < .001$ ), intolerance of uncertainty ( $\beta = 0.10, p = .020$ ), and experiential avoidance ( $\beta = 0.41, p < .001$ ) on anxiety. There were significant indirect effects on mindfulness on anxiety via positive affect ( $\beta = -0.08, p < .001$ ), intolerance of uncertainty ( $\beta = -0.05, p = .028$ ), and experiential avoidance ( $\beta = -0.24, p < .001$ ). The effects of self-compassion and relationship satisfaction were insignificant ( $p$ 's  $> .345$ ). Additionally, none of the covariates significantly predicted anxiety. The model accounted for 46.7% of the variance in anxiety.

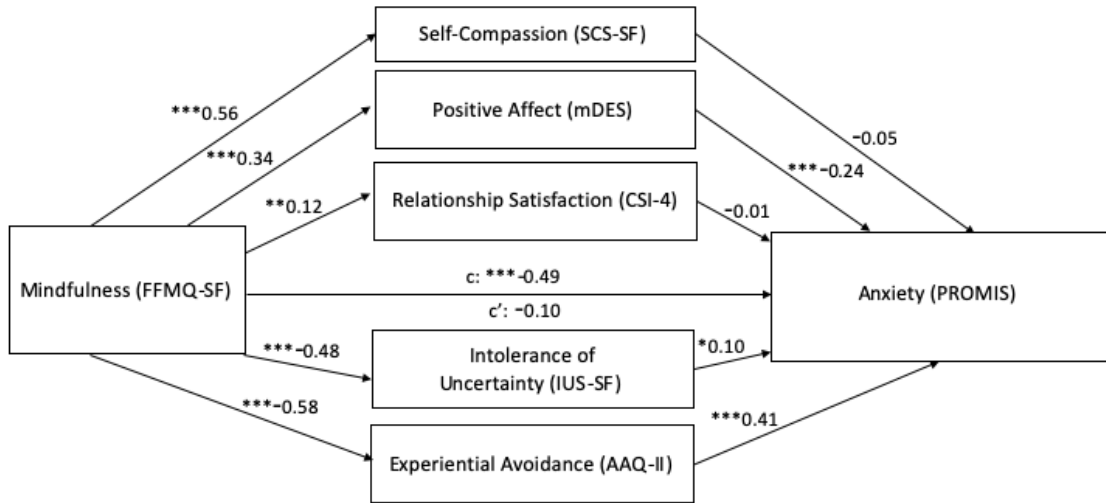
### **3.2 Model Predicting Depression**

There were significant effects of positive affect ( $\beta = -0.27, p < .001$ ), self-compassion ( $\beta = -0.13, p = .004$ ), and experiential avoidance ( $\beta = 0.48, p < .001$ ) on depression. There were significant indirect effects of mindfulness on depression via self-compassion ( $\beta = -0.07, p = .005$ ) positive affect ( $\beta = -0.09, p < .001$ ) and experiential

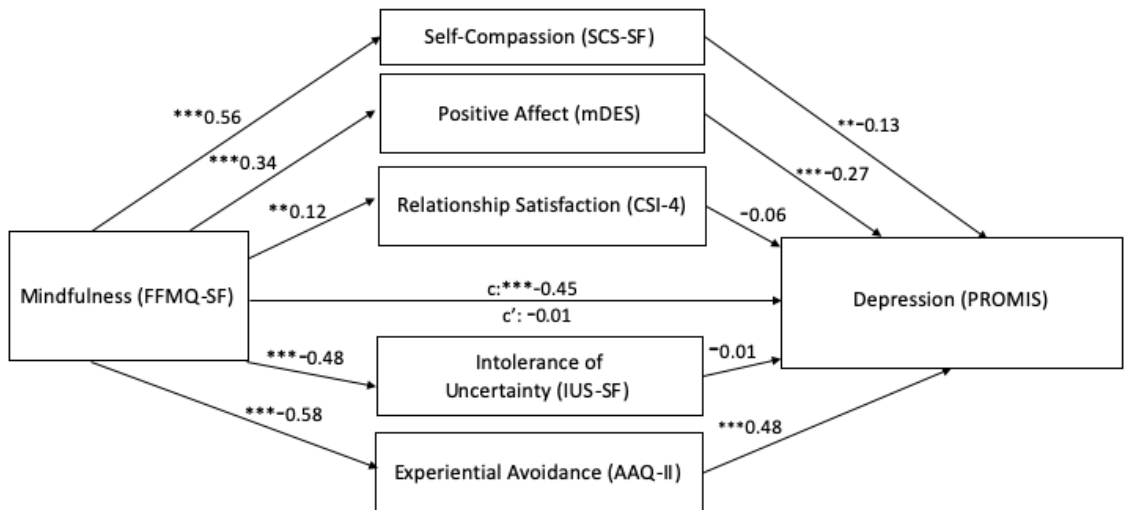
avoidance ( $\beta = -0.28, p < .001$ ). The effects of intolerance of uncertainty and relationship satisfaction were insignificant ( $p$ 's  $> .095$ ). Additionally, none of the covariates predicted depression. The model accounted for 51.3% of the variance in depression.

### **3.3 Model Predicting Posttraumatic Growth**

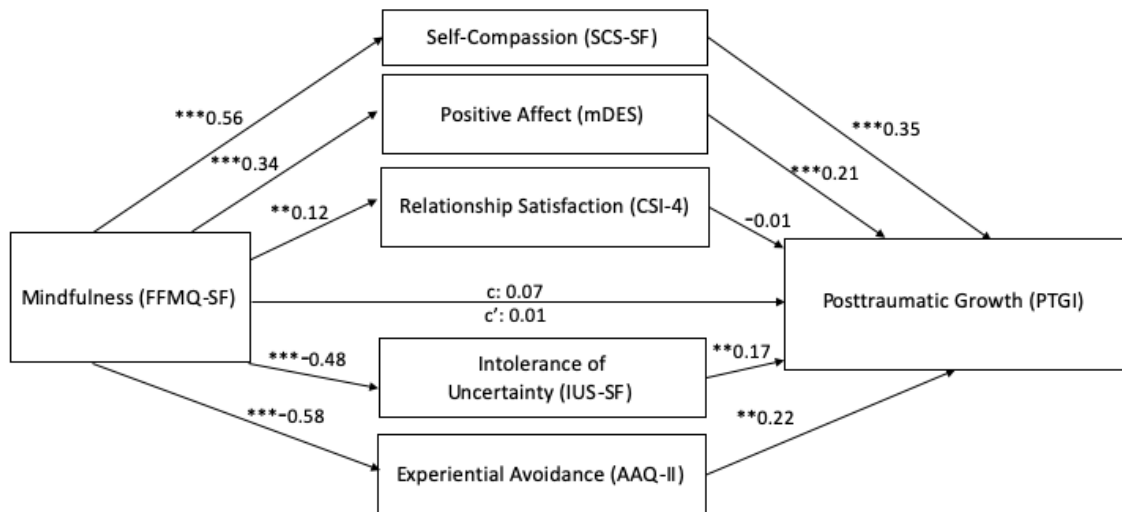
There were significant effects of self-compassion ( $\beta = 0.35, p < .001$ ), positive affect ( $\beta = 0.21, p < .001$ ), intolerance of uncertainty ( $\beta = 0.17, p = .002$ ) and experiential avoidance ( $\beta = 0.22, p = .001$ ) on posttraumatic growth. Mindfulness and relationship satisfaction did not significantly predict posttraumatic growth ( $p$ 's  $> .787$ ). There were significant indirect effects of mindfulness on posttraumatic growth via self-compassion ( $\beta = 0.20, p < .001$ ), positive affect ( $\beta = 0.07, p = .001$ ), intolerance of uncertainty ( $\beta = -0.08, p = .002$ ), and experiential avoidance ( $\beta = -0.13, p = .001$ ). Older age predicted lower posttraumatic growth ( $\beta = -0.19, p < .001$ ) while longer duration trying to conceive significantly predicted higher posttraumatic growth ( $\beta = 0.16, p < .001$ ). The effects of miscarriage and childlessness were insignificant ( $p$ 's  $> .127$ ). The model accounted for 25.8% of the variance in posttraumatic growth.



**Figure 1: Model for Anxiety**



**Figure 2: Model for Depression**



**Figure 3: Model for Posttraumatic Growth**

Figure note: All residual covariances were freely estimated, thus the model is fully saturated. Effects of covariates (age, miscarriage, children, years trying to conceive) on manifest variables were included in the model but are not shown to reduce complexity of the figures. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

**Table 4: Standardized Regression Coefficients for SEM model**

	<i>b</i>	ci lower	ci upper	se	p-value	$\beta$
<b>Anxiety</b>						
<i>Direct</i>	-0.18	-0.37	<.01	0.09	0.052	-0.10
<i>Total</i>	-0.91	-1.07	-0.76	0.08	<.001	-0.49
<i>Indirect</i>						
Total	-0.72	-0.88	-0.59	0.08	<.001	-0.39
SCS-SF	-0.05	-0.15	0.05	0.05	0.355	-0.03
mDES	-0.15	-0.23	-0.09	0.04	<.001	-0.08
CSI-4	<.01	-0.02	0.02	0.01	0.909	-0.001
IUS-SF	-0.09	-0.18	-0.01	0.04	0.028	-0.05
AAQ-II	-0.43	-0.56	-0.30	0.06	<.001	-0.24
<b>Depression</b>						
<i>Direct</i>	-0.02	-0.22	0.14	0.09	0.829	-0.01
<i>Total</i>	-0.94	-1.07	-0.76	0.08	<.001	-0.45
<i>Indirect</i>						
Total	-0.92	-1.06	-0.76	0.08	<.001	-0.44
SCS-SF	-0.15	-0.25	-0.04	0.05	0.005	-0.07
mDES	-0.19	-0.30	-0.12	0.04	<.001	-0.09
CSI-4	-0.02	-0.05	<0.01	0.01	0.206	-0.01
IUS-SF	0.01	-0.09	0.10	0.05	0.894	0.00
AAQ-II	-0.58	-0.74	-0.44	0.07	<.001	-0.28
<b>PTGI</b>						
<i>Direct</i>	0.03	-0.24	0.31	0.14	0.855	0.01
<i>Total</i>	0.17	-0.06	0.39	0.12	0.145	0.07
<i>Indirect</i>						
Total	0.14	-0.08	0.35	0.11	0.187	0.06
SCS-SF	0.46	0.32	0.64	0.08	<.001	0.20
mDES	0.17	0.08	0.27	0.05	0.001	0.07
CSI-4	<.01	-0.03	0.02	0.01	0.796	<.01
IUS-SF	-0.19	-0.33	-0.08	0.06	0.002	-0.08
AAQ-II	-0.30	-0.47	-0.12	0.09	0.001	-0.13

Key: SCS-SF = self-compassion scale, short form, mDES = modified differential emotions scale, CSI-4 = 4-item couples satisfaction index, IUS-SF = intolerance of uncertainty scale, short form, AAQ-II = acceptance and action questionnaire 2

Finally, in order to assess preferences towards various intervention targets, participants were asked to rate their interest in a psychological intervention targeting each of the examined variables [positive affect, tolerating uncertainty, mindfulness, self-compassion, relationship functioning, and acceptance of difficult emotions (lay term for experiential avoidance)] on a scale of 0-10, with higher scores indicating greater interest. The averaged ratings fell between 6.65 (mindfulness) and 7.89 (tolerating uncertainty).

## **4. Discussion**

### ***4.1 Sample Characteristics***

This study explored the relationships between modifiable psychological variables and symptoms of depression, anxiety and posttraumatic growth in a sample of women currently experiencing infertility. Consistent with previous literature (Pasch et al., 2016), women in this sample reported mildly elevated depressive symptoms and moderately elevated symptoms of anxiety, highlighting the stressful nature of infertility. The majority of women in this sample were non-Latina, white, married, college educated, and insured, which is representative of the population of women most likely to receive medical treatment for infertility in the United States (Chandra et al., 2014). However, we conducted purposeful recruitment of women of color and this sample is more racially diverse than previous online studies of women experiencing infertility (Hoyle et al., 2020; Sweeny et al., 2015). Previous studies have reported that a fraction (65%) of women who report experiencing infertility (defined as trying to conceive for >1 year without success) pursue medical evaluation (Farland et al., 2016), and Black and Latina women are less likely to pursue treatment than white and Asian women (Greil et al., 2011). Consequently, participants were intentionally recruited from sources other than a fertility clinic (e.g. social media) in an effort to reach women who may not be pursuing medical treatment for infertility. Surprisingly, a majority of this sample reported that they had sought evaluation or treatment for fertility problems by a doctor. Women were not asked to specify what kind of doctor this was; thus, it is possible that participants included obstetricians and primary

care providers, not necessarily fertility specialists. A smaller portion of this sample reported that they had undergone IUI (28.67%) or IVF (15.54%). It is possible that women who are more likely to pursue medical treatment are also more likely to be engaged in online platforms for infertility support.

#### ***4.2 Predictors of Depression and Anxiety***

Of all variables in the model, experiential avoidance was most strongly associated with anxiety and depression. Experiential avoidance involves unwillingness to stay in contact with aversive private experiences (e.g. thoughts and emotions), as well as taking action to alter these experiences. Previous studies support a predictive relationship between experiential avoidance and depression and anxiety (Galhardo, Cunha, Pinto-Gouveia, et al., 2013; Spinhoven et al., 2014). Used as a coping strategy, experiential avoidance may exacerbate the negative emotional aspects of infertility. For example, women may avoid otherwise rewarding situations such as seeing family and friends who have young children because they elicit painful emotions. Thus, experiential avoidance may be used to reduce suffering in the short-term but lead women to experience less contact with positive reinforcers, thereby enhancing negative affect in the long-term.

Women who reported fewer experiences of daily positive emotions reported greater depression and anxiety symptoms. This finding supports the body of literature demonstrating an inverse relationship between positive affect and psychopathology (Etter et al., 2013). Women experiencing infertility may try to numb positive emotions, such as hope, out of fear of future disappointment. Previous work has pointed to the paucity of

positive emotional measures related to psychological adjustment in infertility populations (Rockliff et al., 2014). Positive emotions have been theorized to promote self-regulation and enhance the ability to cope with stress (Fredrickson, 2001; Garland et al., 2010). In addition to predicting fewer negative psychological symptoms, there is evidence that positive affect is protective against adverse physical health issues and related to certain health behaviors such as medication adherence (Bassett et al., 2019; Steptoe et al., 2009). This is an important consideration in the context of infertility, given the relationship between physical health and fertility and the complex and burdensome medication regimens for fertility treatment (Zeinab et al., 2015).

Self-compassion significantly predicted lower depression but not anxiety. This is consistent with previous literature demonstrating a relationship between self-compassion and depression in women experiencing infertility (Hoyle et al., 2020). Women experiencing infertility report feelings of shame and a sense that they have failed at an essential role of being a woman (Whiteford & Gonzalez, 1995). These feelings of shame and self-judgment may be attenuated by higher levels of self-compassion, including the ability to treat oneself with kindness. The experience of infertility can also be very isolating (Epstein et al., 2002). An important part of self-compassion involves having a sense of common humanity, acknowledging that all human beings are connected in their experiences of suffering. An increased sense of connection may be another pathway by which self-compassion can have a protective effect against depressive symptoms during infertility. Indeed, past research has found that self-compassion fully mediated the effect of

internal shame on infertility-related stress in women (Galhardo, Cunha, Pinto-Gouveia, et al., 2013).

Finally, women with greater intolerance of uncertainty reported higher anxiety. Previous research has highlighted intolerance of uncertainty as a transdiagnostic dispositional risk factor for the development and maintenance of anxiety (Carleton, 2014). Difficulty tolerating uncertainty is especially relevant in the context of medical waiting periods. The experience of infertility is characterized by uncertainty and repeated waiting periods. Examples include the initial period of trying to conceive and not knowing how long this process might take, waiting for an infertility diagnosis that may remain unexplained, and repeated treatment cycles which each involve a two-week wait for pregnancy test results. Consequently, individuals who find uncertainty very upsetting are most likely to suffer through the infertility process. Notably, participants in this study were most interested in an intervention to promote tolerance of uncertainty when compared to the other variables examined in this study. This is an important takeaway for researchers and clinicians looking to engage women in psychological support.

#### ***4.3 Non-significant Predictors of Depression and Anxiety***

Relationship satisfaction did not predict anxiety or depression in this study, despite marital dissatisfaction being associated with anxiety and mood disorders in the general population (Whisman, 1999), and prior research linking distress to reduced marital functioning in infertile couples (Andrews et al., 1992). Scores for relationship satisfaction in this sample were left-skewed; a majority of participants reported good relationship satisfaction. This may have contributed to a ceiling effect, clouding a possible relationship

between low relationship satisfaction and depressive and anxiety symptoms. High relationship satisfaction can serve as a buffer against emotional strain amidst ongoing stressors (Røsand et al., 2012). It is notable that despite reporting high relationship satisfaction, depression and anxiety scores in this sample were clinically elevated. This speaks to the significant impact of infertility on women's mental health.

Demographic and clinical variables also were not predictive of depression and anxiety. The fact that demographic and clinical characteristics were not significant predictors after accounting for psychological factors is uplifting in that it indicates that modifiable variables are more important in determining distress than fixed factors (e.g. age, duration of infertility, history of miscarriage and childlessness). This underscores the importance of a psychological intervention for promoting mental health in the context of infertility.

#### ***4.4 Predictors of Posttraumatic Growth***

The majority of psychological intervention research and studies examining risk and protective factors in infertility focuses on negative psychological symptoms. Beyond depression and anxiety symptoms, I was interested in examining whether women experiencing infertility report posttraumatic growth, and potential related factors.

Participants in this sample reported similar levels of posttraumatic growth ( $M = 46.92$ ,  $SD = 23.46$ ) to a previous sample of U.S. women experiencing infertility ( $M = 51.79$ ,  $SD = 23.4$ ) (Paul et al., 2010). These scores are in the lower range (40-83) of those reported by individuals following a wide variety of stressful events (Tedeschi & Calhoun, 2004b). Of

note, one study of Chinese women experiencing infertility reported higher posttraumatic growth scores ( $M = 64.81$ ,  $SD = 16.20$ ) (Kong et al., 2018), suggesting cultural factors may play a role in how women cope with infertility and their perceptions of posttraumatic growth.

Self-compassion and positive affect predicted greater posttraumatic growth. Previous literature has suggested that self-compassion is associated with adaptive cognitive processes, which predict higher posttraumatic growth (Wong & Yeung, 2017), while positive affect builds resilience, personal relationships, and thought-action repertoires. Mindfulness was not significantly related to posttraumatic growth, and counter to my expectations, higher experiential avoidance and intolerance of uncertainty predicted higher (as opposed to lower) posttraumatic growth. Given their associations with negative psychological symptoms, these relationships were surprising. One explanation for this finding is that individuals who have difficulty tolerating negative emotions (i.e. are experientially avoidant and intolerant of uncertainty) may be more likely to search for positive sources of meaning as a form of dealing with the distress of trauma. It has been suggested that posttraumatic growth has two components, one that is constructive or representative of “actual” growth and one that is illusory (Maercker & Zoellner, 2004). The illusory component includes perceptions of posttraumatic growth that are distorted positive illusions intended to balance emotional distress.

Distinguishing between actual and illusory growth can be a challenge. Collecting qualitative data wherein individuals are able to expand on their perceptions of growth and provide specific examples may help to elucidate if positive changes have occurred.

Another method is to prospectively collect data relating to domains of posttraumatic growth and assess for changing in these domains before and after individuals' experience a trauma. Frazier et al. conducted such a study where undergraduates completed measures of domains related to posttraumatic growth (e.g. relationship quality, perceptions of meaning, life satisfaction, and gratitude) and assessed change scores for participants who reported a traumatic event between time one and time two (Frazier et al., 2009). They found that PTGI scores were unrelated to pre to post changes in these domains, suggesting that individuals' perceptions of growth do not always line up with actual change.

It is important to note that perceiving growth, whether real or not, is not necessarily maladaptive. Zoellner & Maercker suggest that illusory growth may be maladaptive to the extent that it is paired with denial and/or active avoidance of thinking about the trauma. However, if it is paired with mindful thinking about the trauma and does not prevent one from engaging in other active forms of coping, it may be a palliative coping strategy with no harmful effects. Future work may attempt to distinguish between maladaptive and adaptive illusory growth by examining its association with measures of cognitive avoidance.

It has further been proposed that the constructive side of posttraumatic growth takes time to develop, and thus may be more likely to appear in longitudinal studies (Zoellner & Maercker, 2006). In this cross-sectional study, women were asked to report on posttraumatic growth while in the midst of infertility, contributing to the likelihood that posttraumatic growth in this sample is capturing a palliative form of coping with an active stressor. Further longitudinal research may explore if women are more likely to report

constructive posttraumatic growth sometime after the period of actively trying to conceive. It should be noted that there is no evidence that posttraumatic growth is necessary for recovery from trauma. Consequently, clinicians can support patients by remaining open to the possibility of growth, rather than setting it as an expectation.

#### ***4.5 Implications for Psychological Interventions***

The findings from this study are based on cross-sectional data. The following interpretations are made with this context in mind.

Mindfulness was significantly associated with all other predictor variables in the model: positive affect, intolerance of uncertainty, experiential avoidance, relationship satisfaction and self-compassion. As described in the introduction section, past research has demonstrated that mindfulness-based interventions lead to improvements in these variables. Each of these variables, except relationship satisfaction, significantly predicted depression and anxiety. Consequently, interventions that enhance mindfulness may be an effective means of addressing depression and anxiety in women experiencing infertility via their salubrious influence on several other variables. A number of studies have implemented mindfulness-based interventions with infertility patients, reporting reductions in psychological distress (Domar et al., 2011; Galhardo, Cunha, & Pinto-Gouveia, 2013; J. Li et al., 2016; Psaros et al., 2015). However, these studies suffer from methodological limitations (Verkuijlen et al., 2016), including the absence of mediational analyses to determine if changes in mindfulness were responsible for changes in psychological health outcomes. Indeed, some studies of mindfulness-based interventions do not actually assess changes in mindfulness (Domar et al., 2011; Psaros et al., 2015). Further research

examining mediation effects would help to establish causal relationships between predictor variables and psychological symptoms.

The unique effects of mindfulness on anxiety and depression were not significant after accounting for other variables in the model. Experiential avoidance and positive affect demonstrated the strongest relationships with depression and anxiety. This suggests interventions that target positive affect and experiential avoidance, with or without the use of mindfulness, may be well suited for addressing depression and anxiety in the context of infertility. Acceptance and Commitment Therapy (ACT), which incorporates mindfulness among other coping skills, is explicitly designed to target experiential avoidance. An Iranian study demonstrated positive effects of ACT informed counseling on psychological health and quality of life in infertile couples (Hosseinpanahi et al., 2020). There have been no randomized controlled trials of ACT for women with infertility in the United States, though a single case report supports its use (Peterson & Eifert, 2011).

A number of psychological interventions explicitly target positive affect. Positive Affect Treatment (PAT) is a cognitive and behavioral treatment designed to target deficits in reward sensitivity (Craske et al., 2016). PAT entails 15-weekly session building skills such as savoring positive events, practicing gratitude, and pleasurable activity scheduling. It has been shown to improve positive affect and reduce symptoms of depression, anxiety and stress in psychiatric outpatients (Craske et al., 2019). Moskowitz et al. developed an intervention to promote positive affect specifically among individuals facing health stressors (Moskowitz et al., 2012). It has been successfully implemented in patients with HIV, breast cancer, and caregivers (E. O. Cheung et al., 2017; Moskowitz et al., 2012,

2019). This intervention may be especially well-suited to meet the needs of infertility patients because of its adaptability; it has been conducted with lay facilitators and in an online, self-guided format (Moskowitz et al., 2019).

In conclusion, the findings from this study highlight factors associated with psychological distress in the context of infertility. Further research is needed to establish whether intervening on these factors leads to clinically meaningful change in depression and anxiety symptoms.

#### **4.6 Limitations**

A primary limitation of this study is that data were collected cross-sectionally. I am therefore unable to draw causal conclusions regarding the relationships between predictor and outcome variables. However, the nature of the variables measured points to a temporal relationship because predictor variables are trait-like, dispositional characteristics, while outcome variables are symptom-based, state-like measures. Existing studies have demonstrated that interventions which impact mindfulness, self-compassion, positive affect, intolerance of uncertainty, and experiential avoidance also lead to reductions in depression and anxiety (Craske et al., 2019; Dugas et al., 2003; Frostadottir & Dorjee, 2019; Hayes et al., 2006). However, few have conducted mediation analyses, which would help to establish causal relationships between predictors and outcomes.

This study also relied on self-report measures. Critiques of self-report measures point out individuals' limited insight into their own psychological processes and variable construct validity (Nisbett & Wilson, 1977). A discussion of the use of self-report

measures in psychology notes that the construct validity of self-report measures is often superior to behavioral measures (Gerald & George, 2010). They add that in theoretical studies such as this one, the predictive power of measures is of greater consideration than their construct validity. In other words, whether participants' reports of their psychological traits are entirely accurate or not, they lead to meaningful predictions of symptoms of psychopathology.

This sample was recruited online. Online data collection is subject to invalid respondents (Teitcher et al., 2015). I employed a number of data cleaning procedures to protect the validity and reliability of this data. An advantage of online data collection is that it facilitates the ability to recruit a relatively large sample and to reach women across the country and across the spectrum of infertility. I purposefully chose not to solely recruit participants from fertility clinics, with the aim of including infertile participants who may not choose to pursue medical treatment, in order to achieve a sample that would be more generalizable to the broader population of women experiencing infertility.

Finally, I could have studied a number of other psychological factors. I selected factors across a range of influences on psychological health (negative valance systems, positive valance systems, and social processes), based on their theoretical and empirical relevance to the experience of distress in infertility and their ability to be modified with existing empirically-supported interventions.

#### ***4.7 Conclusions and Future Directions***

The results of this cross-sectional study suggest that modifiable psychological

characteristics are important factors in predicting depressive and anxious symptoms in women experiencing infertility. Next steps in this line of research are to implement an intervention to examine whether these variables mediate improvements in depression and anxiety. Findings from this study also support an inverse relationship between perceived posttraumatic growth and measures of experiential avoidance when measured cross-sectionally. Further work may explore longitudinal assessments of posttraumatic growth, particularly in women who are no longer actively trying to conceive.

# Appendix A

## *Demographics and Screening Questions*

### **Section 1. Screening**

1. What is your age (in years)? \_\_\_\_ (If <18 or > 60, skip to the end of survey)
2. Are you currently experiencing infertility?  
2 = Yes  
1 = No (If selected, skip to end of survey)
3. Are you or your partner seeking to become pregnant?  
1 = Me  
2 = My partner (If selected, skip to end of survey)  
3 = Neither me nor my partner is actively seeking to become pregnant
4. What country do you currently live in?  
Drop down selection (If United States is not selected, skip to end of survey)
5. What was your biological sex assigned at birth?  
1 = Male  
2 = Female  
3 = Intersex  
4 = None of these  
5 = Prefer not to answer  
(If 'male' selected, skip to end of survey)

### **Section 2. Demographics**

**(Optional)** Please enter your email address. Your email will be used to send you the brief follow-up survey in approximately 6 months. Please note, if you do not provide an email address, you will not be able to receive payment for this study.

1. Where did you find the link to this study?  
1 = Facebook  
2 = Instagram  
3 = Reddit  
4 = MyChart Email  
5 = From a provider  
6 = From a friend  
7 = Other (please specify)
2. What terms best express how you describe your gender identity?

- 1 = Man
- 2 = Woman
- 3 = Non-binary
- 4 = Transgender
- 5 = None of these describe me, and I'd like to consider additional options
- 6 = Prefer not to answer

Branching logic: If 'non-binary', 'transgender,' or 'none of these describe me and I'd like to consider additional options' selected:

2b. Are any of these a closer description to your gender identity?

- 1 = Trans man/Transgender Man/FTM
- 2 = Trans woman/Transgender Woman/MTF
- 3 = Genderqueer
- 4 = Genderfluid
- 5 = Gender variant
- 6 = Questioning or unsure of your gender identity
- 7 = None of these describe me, and I want to specify \_\_\_\_\_

3. Are you of Hispanic, Latino, or Spanish origin?

- 1 = No
- 2 = Yes, Mexican, Mexican Am., Chicano
- 3 = Yes, Puerto Rican
- 4 = Yes, Cuban
- 5 = Yes, another Hispanic, Latino, or Spanish origin (for example, Salvadoran, Dominican, Colombian, Guatemalan, Spaniard, Ecuadorian, etc.)

4. How would you describe yourself in terms of race? Please select all that apply.

- 1 = White
- 2 = Black or African American
- 3 = American Indian or Alaska Native
- 4 = Asian
- 5 = Native Hawaiian or Pacific Islander
- 6 = Other (please fill in)
  - i. Other text response

5. What is your relationship status?

- 1 = single
- 2 = in a committed relationship, not married or in a domestic partnership
- 3 = married or in a domestic partnership
- 4 = Other (please describe): \_\_\_\_\_

**Branching Logic: Items 6 and 7 will not be asked if participant answers 1 = single to question number 5.**

6. How long have you been married/in a committed relationship with your partner?

1 = < 1 year

2 = 1-3 years

3 = > 3 years

7. What terms best express how you describe your partner's gender identity?

1 = Man

2 = Woman

3 = Non-binary

4 = Transgender

5 = None of these describe my partner, and I'd like to consider additional options

6 = Prefer not to answer

Branching logic: If 'non-binary', 'transgender,' or 'none of these describe my partner and I'd like to consider additional options' selected:

7b. Are any of these a closer description to your partner's gender identity?

1 = Trans man/Transgender Man/FTM

2 = Trans woman/Transgender Woman/MTF

3 = Genderqueer

4 = Genderfluid

5 = Gender variant

6 = Questioning or unsure of your gender identity

7 = None of these describe my partner, and I want to specify \_\_\_\_\_

8. What is the highest level of education you have completed?

1 = Some high school, no diploma

2 = High school diploma or GED

3 = Some college, no degree

4 = Associates degree (2-year degree)

5 = Bachelor's degree (e.g., BA, BS)

6 = Master's degree (e.g., MA, MS, MEd)

7 = Doctorate/professional degree (e.g., PhD, JD, MBA, MD, PharmD, EdD, etc.)

9. What is your current employment status?

1 = employed full time

2 = employed part time

3 = looking for work, unemployed

4 = retired

5 = temporarily or permanently disabled

6 = keeping house

7 = student

8 = other, please specify \_\_\_\_\_

10. What was your household income before taxes in the last year?

- 1 = Less than \$25,000
- 2 = \$25,000-\$49,999
- 3 = \$50,000-\$74,999
- 4 = \$75,000-\$99,999
- 5 = \$100,000-\$149,999
- 6 = \$150,000-\$199,999
- 7 = \$200,000-\$249,999
- 8 = \$250,000 or more

11. Think of this ladder as representing where people stand in the United States. At the top of the ladder are the people who are the best off - those who have the most money, the most education, and the most respected jobs. At the bottom of the ladder are the people who are the worst off - who have the least money, least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom. Where would you place yourself on this ladder?

- 10 = 10 – TOP
- 9 = 9
- 8 = 8
- 7 = 7
- 6 = 6
- 5 = 5
- 4 = 4
- 3 = 3
- 2 = 2
- 1 = 1 – BOTTOM



12. Do you currently have health insurance?

- 2 = No
- 1 = Yes

13. Health insurance plans vary greatly in the degree to which they cover infertility treatments. In your own words, please describe the degree to which your health insurance covers infertility treatments. (free response)

### Section 3. Fertility Experience

1. How long have you been trying to conceive?

- 1 = < 1 year
- 2 = 1 year
- 3 = 1-2 years

- 4 = 2-3 years
- 5 = 3-4 years
- 6 = 4-5 years
- 7 = > 5 years

2. Which of the following options have you considered? Please select all that apply.
  - 1 = childfree living
  - 2 = foster parenting
  - 3 = adoption
  - 4 = assisted reproduction using your eggs and your partner's sperm
  - 5 = assisted reproduction using donor eggs
  - 6 = assisted reproduction using donor sperm
  - 7 = Other (please describe) \_\_\_\_\_
  
3. Is there a fertility clinic in your area?
  - 2 = Yes
  - 1 = No
  - 3 = Unsure
  
4. If applicable, are the fertility clinics in your area open and providing services?
  - 1 = No
  - 2 = Yes
  - 3 = Not applicable, there are not fertility clinics in my area
  
5. Have you currently put family planning on hold due to COVID-19 or another reason (please specify)?
  - 2 = Yes
  - 1 = No
  
6. Do you currently have any living children?
  - 2 = Yes
  - 1 = No
  
7. Have you sought evaluation or treatment for fertility problems by a doctor?
  - 2 = Yes
  - 1 = No
  
8. Have you or your partner been diagnosed with a fertility problem? Please select all that apply.
  - 1 = You
  - 2 = Your partner
  - 3 = You and your partner
  - 4 = Neither of you

9. Please list you and/or your partner's diagnosis \_\_\_\_\_
10. Have you tried Clomid (or another medication taken by mouth)?  
1 = No  
2 = Yes, I am currently taking Clomid (or another medication)  
3 = Yes, I have taken Clomid (or another medication) in the past
11. Are you currently taking any medication as part of an IVF or IUI cycle?  
2 = Yes  
1 = No
12. Have you tried artificial insemination (IUI)?  
1 = No  
2 = Yes, I am currently planning or undergoing an IUI cycle  
3 = Yes, I have tried IUI in the past
13. Have you tried In vitro fertilization (IVF)?  
1 = No  
2 = Yes, I am currently planning or undergoing an IVF cycle  
3 = Yes, I have tried IUI in the past
14. Have you (or your partner) tried any other fertility treatments? 2 = Yes, 1 = No  
If yes, please  
specify \_\_\_\_\_
15. Have you ever experienced a miscarriage?  
2 = Yes  
1 = No
16. In your own words, please describe what has been the most stressful aspect of the experience of infertility for you? (free response)
17. What have done to cope with the experience of infertility? (free response)
18. We are hoping to design programs to help people cope with the stresses of infertility. On a scale of 0-10 (0 being not at all interested and 10 extremely interested), how interested would you be in learning skills to help you:  
Build positive emotions  
Manage uncertainty  
Be more mindful  
Have self-compassion  
Improve your relationship with your partner

Tolerate difficult emotions

19. Please select the option that best describes your experience with meditation:
- 1 = I have never meditated
  - 2 = I have meditated a small handful of times, but never consistently
  - 3 = I have meditated consistently (e.g. several times a week) in the past, but I do not currently meditate consistently
  - 3 = I currently meditate consistently (e.g. several times a week)
20. Please select the option that best describes your experience with psychotherapy:
- 1 = I have never seen a therapist
  - 2 = I have seen a therapist in the past
  - 3 = I am currently seeing a therapist

**Attention Check Question**

21. I completed these questions honestly and to the best of my ability. True / False

## Appendix B

Acceptance and Action Questionnaire (AAQ-II)

<https://stevenchayes.com/wp-content/uploads/2019/08/The-Acceptance-and-Action-Questionnaire.pdf>

Intolerance of Uncertainty Scale Short Form (IUS-SF)

[https://www.midss.org/content/intolerance-uncertainty-scale-short-form-ius-12/#:~:text=The%20IUS%2D12%20is%20a,\(Carleton%2C%20in%20press\)](https://www.midss.org/content/intolerance-uncertainty-scale-short-form-ius-12/#:~:text=The%20IUS%2D12%20is%20a,(Carleton%2C%20in%20press))

Self-Compassion Scale Short Form (SCS-SF)

<https://self-compassion.org/wp-content/uploads/2015/02/ShortSCS.pdf>

Couples Satisfaction index (CSI-4)

[https://www.researchgate.net/publication/299432417\\_The\\_Couples\\_Satisfaction\\_Index\\_CSI-4](https://www.researchgate.net/publication/299432417_The_Couples_Satisfaction_Index_CSI-4)

Modified differential emotions scale (mDES)

[https://sites.temple.edu/rtassessment/files/2018/10/Table\\_mDES\\_A.pdf](https://sites.temple.edu/rtassessment/files/2018/10/Table_mDES_A.pdf)

Five Factor Mindfulness Questionnaire Short Form (FFMQ-24)

Not publicly available online. See Bohlmeijer, E., P. M. ten Klooster, et al. (2011).

"Psychometric properties of the five facet mindfulness questionnaire in depressed adults and development of a short form." *Assessment* 18(3): 308-320.

PROMIS Short Form v1.0 Anxiety 8a

[https://www.healthmeasures.net/index.php?option=com\\_instruments&view=measure&id=147&Itemid=992](https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=147&Itemid=992)

PROMIS Short Form Depression 8b

[https://www.healthmeasures.net/index.php?option=com\\_instruments&view=measure&id=157&Itemid=992](https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=157&Itemid=992)

Posttraumatic Growth Inventory (PTGI)

<https://positivepsychology.com/post-traumatic-growth/>

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## **Biography**

Stephanie Schuette is a 5<sup>th</sup> year student in the clinical psychology doctoral program at Duke University under the mentorship of Dr. Moria Smoski. Stephanie received a bachelor's degree in psychology from Northwestern University in 2013 and a master's degree in clinical psychology from Duke University in 2020. She will be attending Rush University for predoctoral clinical internship beginning in July 2022 specializing in health psychology. Stephanie's research and clinical interests are in women's health and the development and implementation of mindfulness-based interventions. She has co-authored 17 peer-reviewed publications and book chapters related to these topics. In her time at Duke, Stephanie received a Lafitte Award for dissertation research, three Summer Research Fellowships, Vertical Integration Program funding and three travel awards to attend professional conferences.