



The Indirect Effect of Parental Intolerance of Uncertainty on Perinatal Mental Health via Mindfulness During COVID-19

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Abstract

Objectives The COVID-19 pandemic is associated with mental health difficulties, especially during pregnancy and early postpartum. Intolerance of uncertainty (IU) and reduced capacity for mindfulness—a protective factor for child-bearers—may be particularly relevant factors driving mental health problems given the unpredictable nature of the pandemic. The current study aims to shed light on modifiable paths to perinatal psychological distress by testing whether there is an indirect effect of IU on psychological symptoms through a perceived reduction in mindfulness during the pandemic.

Methods Pregnant individuals (67%, $n = 133$) and new mothers within 6 months postpartum (33%, $n = 66$) participated in a cross-sectional online survey assessing IU, current and retrospective pre-pandemic mindfulness (FFMQ), and psychological symptoms (anxiety, depression, somatization; BSI). Perceived change in mindfulness was captured by including retrospective mindfulness as a covariate in the PROCESS macro used for analyses.

Results Tests of the direct association between mindfulness, IU, and psychological symptoms showed significant effects of IU ($b = 0.46$, $SE = 0.064$; $p < .001$) and perceived decrease in mindfulness during the pandemic ($b = -0.72$, $SE = 0.08$, $p < .001$) on psychological symptoms ($R^2 = .21-.34$; $F[2, 197] = 51.13-52.81$, $p < .001$). The indirect effect of IU on symptoms via perceived decrease in mindfulness during the pandemic ($b = 0.13$, $SE = 0.043$, 95%CI [.060, .226]) was significant ($R^2 = .41$, $F[3, 195] = 45.08$, $p < .001$).

Conclusions Results suggest that mothers who are less able to tolerate uncertainty experience more psychological symptoms, in part due to perceived reduction in mindfulness during the pandemic. Future research should examine whether IU is a screening risk marker and target for mindfulness-based interventions to improve maternal well-being and family outcomes.

Keywords COVID-19 · Mindfulness · Intolerance of uncertainty · Psychological symptoms · Mediation · Perinatal

Pregnancy and early postpartum are life-changing periods that can bring joy and excitement but also increased uncertainty (Sorenson, 1990), stress, and vulnerability to emotional problems (Fairbrother et al., 2015; Miller et al., 2006). Child-bearers' mental ill-health in the pre- and postpartum period negatively impacts their experience of early motherhood (Beck, 1999), increases the risk for long-term mental health issues (Letourneau et al., 2010), and can negatively impact interpersonal relationships, including with intimate partners/coparents (O'Hara, 1995). Children's trajectories of social-emotional development are profoundly shaped by

their parents' psychological distress (i.e., depression, anxiety) across gestation and infancy (e.g., Madigan et al., 2018; Mughal et al., 2019), further underlining the importance of identifying child-bearers at risk for perinatal distress and ways to ameliorate it. The COVID-19 pandemic has brought on and/or exacerbated mental health difficulties for many (Cullen et al., 2020; Tull et al., 2020), especially for pregnant individuals and parents in early postpartum (American Psychological Association, 2020; Ceulemans et al., 2020; Chen et al., 2021; Lebel et al., 2020; López-Morales et al., 2021), with depression rates up to 40% from 15% pre-pandemic and anxiety rates increased to 72% from 29% pre-pandemic in a perinatal sample (Davenport et al., 2020). Given that psychological symptoms, that is, depression, anxiety, and associated physical symptoms, in the pre- and postpartum period, are common (Fairbrother et al., 2015; Meltzer-Brody et al., 2018) and associated with adverse maternal and infant

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outcomes (Brand & Brennan, 2009; Howard et al., 2014; Kingston et al., 2012; O'Connor et al., 2002), the psychological impact of COVID-19 on child-bearers requires attention (Ceulemans et al., 2020; Chen et al., 2021). There is a need to illuminate processes that can support parents giving birth in these conditions to ensure their well-being and the future well-being of the next generation.

Recent work suggests that the effects of COVID-19 concerns on psychological symptoms in the general population may be mediated by reduced mindfulness (Belen, 2021). Maternal mindfulness—nonjudgmental and purposeful attention to present-moment experience (Kabat-Zinn, 2003)—has been shown to protect against perinatal anxiety and depression (Hicks et al., 2018), to increase parental relationship satisfaction (Gambrel & Piercy, 2015), and to cultivate sensitive, responsive caregiving in new mothers (Baumrind, 1989; Duncan et al., 2009; Shaddix, 2014; Siegel & Hartzell, 2003). Parents who are able to be aware, accepting, and responsive to their baby's needs either through an inherent capacity for or a cultivated practice of mindfulness will foster higher-quality parent–child relationships and be better able to avoid automatic patterns of maladaptive parenting behavior (Duncan et al., 2009; Fernandes et al., 2021), thus promoting secure attachment relationships (Siegel & Hartzell, 2003). In turn, infants of more mindful mothers show benefits in social-emotional development (Braeken et al., 2017; Van den Heuvel, Donkers, et al., 2015; Van den Heuvel, Johannes, et al., 2015), neurocognitive functioning (Van den Heuvel, Donkers, et al., 2015; Van den Heuvel, Johannes, et al., 2015), and neuroendocrine stress regulation (Laurent et al., 2017). Given these cascading effects on family well-being, it is critical to determine which child-bearers are likely to have limited capacity to be present in the face of challenges.

COVID-19 is a paragon of uncertainty that presents expectant/new parents with a multitude of stressors with an unknown end point (e.g., COVID-19 exposure, financial and material hardship, concerns regarding prenatal/postpartum care, relationship strain, and social isolation (Center for Translational Neuroscience, 2020; Ellington et al., 2020; Lebel et al., 2020), while limiting available coping strategies such as social and mental health support. The changes and uncertainties due to the pandemic are putative causes for increased perinatal psychological symptoms for those previously not at risk and even greater increased risk for child-bearers already struggling with psychological symptoms, including depression and anxiety (Brooks et al., 2020; Chen et al., 2021). These challenging conditions have resulted in what has been characterized as a mental health crisis with an uncertain end, especially for pregnant people and those who have recently given birth (Grose, 2020).

To address this crisis, a key research priority is examining psychological factors that may influence levels of distress to

inform mechanistically driven interventions (Holmes et al., 2020). One such factor is intolerance of uncertainty (IU), defined as fear of the unknown (Carleton, 2012), which is associated with negative reactions to uncertain situations (Dugas et al., 2001). IU is strongly implicated in the etiology of generalized anxiety disorder (GAD; Dugas et al., 1998), but more recently has been included in transdiagnostic models as a central risk and maintenance factor across mental health concerns and an important transdiagnostic intervention target (Boswell et al., 2013; Carleton, 2016; Einstein, 2014; McEvoy & Mahoney, 2012) in COVID-19 (Freeston et al., 2020).

IU has been shown to predict mental health difficulties (e.g., Paulus et al., 2015; Yook et al., 2010), and there is evidence that this relationship is partially mediated via contemporaneous dispositional mindfulness in a female student sample (Nekić & Mamić, 2019). Specifically in COVID-19, IU has similarly shown indirect effects on distress through avoidant, maladaptive coping (e.g., self-distraction; Rettie & Daniels, 2020). During the perinatal period, IU may be a particularly salient familial risk factor as evidence suggests that high IU in pregnancy is associated with pregnancy-related anxiety (Treleaven, 2020), predicts increased psychological symptoms postpartum (Furtado et al., 2019), and is implicated in parent–infant transmission of mental illness as a cognitive bias learned nonverbally through social referencing (Aktar et al., 2017).

While the relationship between IU and mental health concerns is well established, the mechanisms underlying this association warrant further study; elucidating these potentially modifiable mechanisms can inform which preventive intervention strategies are well suited to employ in a pandemic (Schimmenti et al., 2020). IU is highly associated with worry and rumination, which function as mediators in IU's relationships with symptoms of anxiety and depression, respectively (Yook et al., 2010). Other research suggests that rumination acts as both a moderator and mediator between IU and depression and anxiety symptoms (Liao & Wei, 2011). Meta-analyses suggest that repetitive negative thinking (worry and rumination) may be a shared mechanism underlying the relationship between IU and anxiety and depression (Gentes & Ruscio, 2011; McEvoy et al., 2019).

IU is further associated with a failure to employ effective emotion regulation strategies, negative thoughts and emotions about problems, and a perceived inability to cope effectively with aversive responses to uncertainty (Buhr & Dugas, 2002; Ouellet et al., 2019). Models of IU suggest that one's ability to endure distress resulting from ambiguous situations will likely impact responding, including the use of adaptive (e.g., acceptance; Schimmenti et al., 2020) or maladaptive (e.g., avoidance or denial; Zacher & Rudolph, 2021) coping strategies in an uncertain situation (Einstein, 2014). In undergraduate samples, IU has been shown to relate to both lower mindfulness and higher psychological symptoms, in particular anxiety

symptoms such as worry (Kraemer et al., 2016; Papenfuss et al., 2021). This suggests that the ability to tolerate perceived uncertainty may work through the open and nonjudgmental stance of mindfulness to interrupt the repetitive negative thought and maladaptive coping strategies that maintain psychological distress (Deyo et al., 2009; Lotan et al., 2013; Papenfuss et al., 2021; Yook et al., 2010). Thus, IU may play a key role in parents' risk for diminished mindfulness and resultant mental health difficulties in the uniquely uncertain context of the current pandemic.

Identification of factors involved in the development and maintenance of psychological symptoms, including anxiety and mood symptoms, can guide the use of screening measures for early risk detection and selection of interventions well suited to target such factors. As suggested by previous research, IU may serve as a key indicator of risk for distress (Carleton, 2016; McEvoy & Mahoney, 2012)—at least in part by reducing the capacity for mindful presence in the face of uncertain stressors (Kraemer et al., 2016)—that can be screened for and ameliorated through appropriate preventive interventions (Einstein, 2014; Furtado et al., 2019). Further study of these risk paths may inform the development and use of “mechanistically informed and driven” interventions that are needed to address psychological distress due to the pandemic (Holmes et al., 2020).

Guided by the needs identified above, the current investigation aims to identify (1) how IU and perceived change in mindfulness during the pandemic relate to perinatal mothers' psychological symptoms and (2) whether there is an indirect effect of IU on maternal psychological symptoms transmitted through perceived reductions in mindfulness. We hypothesize that both high IU and perceived decrease in mindfulness during COVID-19 will be associated with elevated symptoms and that there will be a significant indirect effect of IU on maternal psychological symptoms through a perceived decrease in mindfulness. Testing these paths in a cross-sectional study is not a true test of mediated or causal effects; thus, in the current study, the term “indirect effect” is used as a statistical term referring to the test of the AB path. The current study will test whether there is a pattern of associations that is consistent with the proposed theoretical model, building toward more definitive tests that will help clarify the conditions most likely to negatively impact mothers and potentially harm the development of children born in the pandemic and target opportunities to intervene before harms to mother, child, and family well-being accumulate.

Method

Participants

Participants were 199 English-speaking pregnant people (66.8%, $n = 133$) or new mothers who had given birth in the past 6 months (33.2%, $n = 66$). Participants' ages ranged from 20.6 to

47.5 ($M = 33.3$, $SD = 4.4$). For almost half of participants (48.7%, $n = 97$), this was their first pregnancy, and 49% ($n = 96$) of participants had no other children living in their household, 35.2% had one other child ($n = 69$), and 15.8% had two or more ($n = 31$). Ninety-seven percent of pregnancies were singletons ($n = 193$; twins: 3%, $n = 6$). This sample was 85.4% White ($n = 170$), 7% Hispanic or Latino ($n = 14$), 2.5% Asian ($n = 5$), 2% Black/African American ($n = 4$), and 1% Native American/Alaskan ($n = 2$). The majority of participants were socioeconomically advantaged (median income \$100,000–\$120,000; 87.9% with a college degree [$n = 175$]) and married or partnered (96%, $n = 191$).

Procedure

The measures of interest in the current study were drawn from the Early Parenthood in COVID-19 (EPiC) online study (Laurent et al., 2021), which includes multiple measures of the perinatal experience and was based on the COVID-19 and Perinatal Experiences (COPE) Survey (VanTieghem et al., 2020). Participants were recruited for the EPiC study via social media targeted to residents of Illinois and email to participants of larger ongoing studies of pregnant individuals and new mothers in Illinois to participate in an online survey administered through REDCap (Research Electronic Data Capture; Harris et al., 2009). All participants gave informed consent before participating in the EPiC study. For every 50 participants, a random lottery selected a participant to receive a \$100 gift certificate. Data collection began in May 2020, with results below reflecting responses through September 14, 2020. All procedures were approved by the University of Illinois Institutional Review Board. Participants were eligible for this study if they were currently pregnant or had given birth within the last six months. Participants with incomplete data on the measures of interest were excluded from the current analysis.

Measures

The EPiC online questionnaire included a larger set of items assessing participants' demographic background and the impact of the COVID-19 outbreak on the feelings and experiences of pregnant individuals and new mothers. Scales relevant to the constructs of interest for the current study are described below (see Table 1 for descriptive statistics).

Intolerance of Uncertainty

The Intolerance of Uncertainty Scale (IUS-12; Carleton et al., 2007) is a 12-item self-report measure examining beliefs about the acceptability of uncertainty or

Table 1 Means, standard deviations, and correlations with confidence intervals of study variables

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. IU	33.15	8.60	–		
2. BSI total	28.28	10.60	.45** [.33, .56]	–	
3. Pre-COVID FFMQ	3.40	0.41	–.40** [–.51, –.28]	–.26** [–.39, –.13]	–
4. COVID FFMQ	3.22	0.47	–.45** [–.55, –.33]	–.56** [–.65, –.46]	.69** [.61, .75]

Note. BSI, Brief Symptom Inventory; FFMQ, Five Facet Mindfulness Questionnaire; IU, Intolerance of Uncertainty Scale. *M* and *SD* are used to represent unstandardized mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation

*Indicates $p < .05$

**Indicates $p < .01$

unpredictability (e.g., “Unforeseen events upset me greatly”). Items were rated a scale from 1 (“Not at all characteristic of me”) to 5 (“Entirely characteristic of me”) and were summed to obtain a total score with higher scores indicating greater IU ($\alpha = 0.91$).

Mindfulness

The Five Facet Mindfulness Questionnaire-Short Form (FFMQ-SF; Bohlmeijer et al., 2011) is a 24-item measure assessing five dimensions of mindfulness: observing, describing, acting with awareness, nonjudgment, and non-reactivity. An example item is, “When I have distressing thoughts or images, I just notice them and let them go.” Participants rated each item twice—“before the COVID-19 pandemic” and “during the COVID-19 pandemic”—to obtain their perceptions of both their pre-pandemic and current pandemic mindfulness; similar to previous studies of perinatal samples that assessed pre-pandemic and current self-report scores during COVID-19 (Davenport et al., 2020). Items are rated on a scale from 1 (“Never or very rarely true”) to 5 (“Very often or always true”) and were averaged to obtain a total retrospective pre-pandemic mindfulness score and a total current pandemic mindfulness score. Higher scores indicate greater self-assessed mindfulness during the specified time period ($\alpha = 0.79$ – 0.84).

Psychological Symptoms

The 18-item version of the Brief Symptom Inventory (BSI-18; Zabora et al., 2001) assesses psychological symptoms, that is, depression (“Feeling blue”), anxiety (“Feeling tense or keyed up”), and somatization (“Nausea or upset stomach”). Due to the online format of this study, the item assessing suicide (i.e., “Thoughts of ending your life”) was removed. The items were scored on a Likert scale of 0 (“Not at all”) to 4 (“Extremely”). Responses were summed

to create a total score used in analyses where high scores indicate greater symptoms ($\alpha = 0.92$).

Data Analyses

The SPSS PROCESS macro (model 4; Hayes, 2009) was used to test both direct associations between standardized scores of mindfulness, IU, and psychological symptoms and the proposed indirect effect of IU on total BSI scores via a perceived change in FFMQ mindfulness during the pandemic. To capture perceived change in mindfulness during COVID-19, pandemic FFMQ scores were analyzed controlling for pre-pandemic scores; this residualized change score is drawn from previous methods for studying changes in mindfulness (Brown & Ryan, 2003; Kumar et al., 2008). Ten thousand bootstrap samples were used to arrive at the 95% confidence interval for parameter estimates.

Results

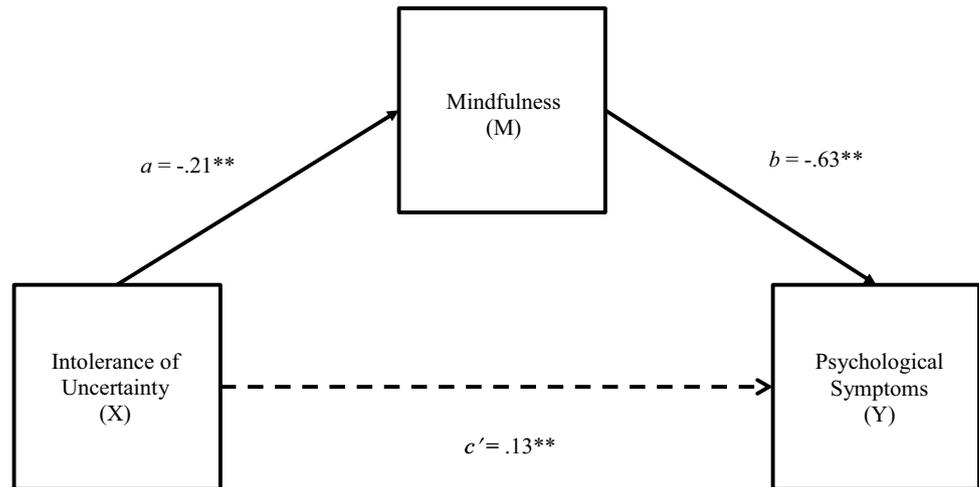
Direct Associations

The total effect of IU ($b = 0.46$, $SE = 0.064$; $p < 0.001$) on psychological symptoms was significant (model $R^2 = 0.21$; $F[1, 201] = 52.81$, $p < 0.001$). The total effect of decreased mindfulness during the pandemic ($b = -0.72$, $SE = 0.08$; $p < 0.001$) on psychological symptoms was significant when controlling for pre-pandemic mindfulness (model $R^2 = 0.34$; $F[2, 197] = 51.13$, $p < 0.001$).

Indirect Effects

The full model revealed a significant, though smaller, direct effect IU ($b = 0.29$, $SE = 0.063$; 95% CI [0.16, 0.41]) on symptoms along with a significant indirect effect via perceived decrease in mindfulness during the pandemic ($b = 0.13$, $SE = 0.043$; 95% CI [0.060, 0.226]). This overall model explained a sizable proportion of the variance in symptoms ($R^2 = 0.41$; $F[3, 195] = 45.08$, $p < 0.001$), see Fig. 1 for full model effects. A post hoc power analysis

Fig. 1 Full model results. Pre-COVID mindfulness was included as a covariate but is not represented here. * indicates $p < .05$. ** indicates $p < .01$



conducted using MedPower (Kenny, 2017) based on the sample size of 199, effects for each path, and an alpha of 0.05 indicated adequate power (0.847) to detect indirect effects.

To further probe which facets of mindfulness drove these indirect effects, mediation analyses were conducted on each of the FFMQ subscales. The indirect effect of IU on symptoms was significant through three subscales: acting with awareness ($b = 0.07$, $SE = 0.030$; 95% CI [0.023, 0.141]), nonreactivity ($b = 0.07$, $SE = 0.036$; 95% CI [0.01, 0.15]), and describing ($b = 0.07$, $SE = 0.032$; 95% CI [0.01 to 0.14]) (model R^2 's = 0.30–0.38; $F[3, 195] = 27.15$ – 39.52 , $p < 0.001$).

Further post hoc analyses were conducted with BSI depression and anxiety as separate outcomes to probe specificity to symptom domain. With depression as an outcome, a significant direct effect of IU ($b = 0.28$, $SE = 0.064$; 95% CI [0.15, 0.40]) on depression symptoms was found in addition to a significant indirect effect via decreased pandemic FFMQ ratings ($b = 0.13$, $SE = 0.04$; 95% CI [0.061, 0.220]; $R^2 = 0.38$; $F[3, 195] = 39.98$, $p < 0.001$). When anxiety was entered as an outcome, mediation analyses similarly showed a significant direct effect of IU ($b = 0.30$, $SE = 0.063$; 95% CI [0.17, 0.42]) on anxiety symptoms and a significant indirect effect via decreased pandemic FFMQ ratings ($b = 0.12$, $SE = 0.04$; 95% CI [0.053, 0.211]; $R^2 = 0.39$; $F[3, 195] = 40.89$, $p < 0.001$).

Discussion

The current study aimed to shed light on paths to psychological symptoms in parents who bear and begin rearing a child in the challenging environment of the COVID-19 pandemic. As hypothesized, high IU and a perceived reduction

in mindfulness during the pandemic were associated with elevated psychological symptoms. There was also, in line with our second hypothesis, a significant indirect effect of IU on maternal psychological symptoms through a perceived decrease in mindfulness qualities—in particular, nonreactivity, acting with awareness, and describing facets of dispositional mindfulness. The indirect effects of these facets driving the overall effect were similar in magnitude and small according to effect size conventions (Cohen, 1992). At least in this study, the indirect effect of IU on symptoms through a perceived reduction in mindfulness was strongest and most apparent when considering all elements of mindfulness working together as opposed to individual facets. In line with indications from previous research outside a pandemic and/or perinatal context (Nekić & Mamić, 2019), these results suggest mothers who are less able to tolerate uncertainty experience more psychological symptoms, in part due to a sense of diminished mindfulness during the pandemic.

These results extend previous work implicating both IU and low mindfulness in elevated psychological symptoms (Brown et al., 2015; Yook et al., 2010) and processes known to maintain anxiety and depression (Deyo et al., 2009; Lotan et al., 2013; Yook et al., 2010) while offering a useful frame for conceptualizing how these may be perpetuated (or interrupted) in the current pandemic. These findings, specifically the post hoc analyses including the depression and anxiety symptom subscales of the BSI, echo previous research showing concurrent mindful attention partially mediated the predictive relationship between IU and depression and anxiety symptoms in a sample of female students in Croatia (Nekić & Mamić, 2019). The current study extends these findings to expectant/new mothers in a particularly uncertain global context, suggesting that mothers who are able to tolerate uncertainty may have more access to mindfulness as an emotion regulation strategy in the face of unpredictable

and potentially overwhelming circumstances, helping them to view negative emotional reactions from a decentered, accepting, and nonreactive perspective. As a result, they may perceive these aversive emotional states as less threatening and more bearable, interrupting the cycle of worry, rumination, and prolonged negative affect that maintain both anxiety and depression symptoms.

These findings are in line with previous research in perinatal populations, which shows that IU predicts poor mental health in mother and child (Aktar et al., 2017; Furtado et al., 2019), whereas mindfulness can promote well-being (e.g., Duncan et al., 2009; Hicks et al., 2018). The current results help to understand how IU functions as an instrumental risk factor in the development and maintenance of psychological symptoms; IU may make it more difficult to engage in adaptive coping/emotion regulation strategies such as mindfulness, thereby increasing sensitivity to stress and likelihood of distress in a climate of uncertainty. Our findings point to particular aspects of mindfulness that may be key to maintaining parental well-being in such a climate, underlining the importance of maintaining the ability to be present with experience as it unfolds without becoming lost in emotional reactivity. This is consistent with previous findings that nonreactivity and openness to experience can buffer stress-related distress (see Hamill et al., 2015; Lindsay, Chin, et al., 2018; Lindsay, Young, et al., 2018; O'Bryan et al., 2018). By promoting openness and flexible responding to changing conditions, mindfulness could help parents foster the supportive environment they and their baby need to maintain healthy stress sensitivity and regulation (Laurent, 2014) and satisfying familial relationships (Barnes et al., 2007; Duncan et al., 2009) in the face of uncontrollable shifts in resources and threats. The current findings thus highlight risk factors that warrant additional research to examine their utility to guide screening for early risk detection and selection of interventions well suited to target such factors in an effort to prevent elevated psychological symptoms in expectant and new mothers amid the mental health crisis for new parents (i.e., COVID-19; Grose, 2020).

Our findings identify IU as a precipitating risk factor for psychological distress in expectant and new mothers (Grose, 2020), a risk factor that has been implicated in the intergenerational transmission of mental illness (Aktar et al., 2017). This research can inform future investigations of IU as a guide in screening for early risk detection and as a proposed modifiable risk factor that may be targeted by psychological interventions during the current pandemic and during future global stress events (Rettie & Daniels, 2020). When misperceptions about absent information cannot be corrected (e.g., as knowledge about the nature and impacts of this novel coronavirus is being generated), future research is warranted to further investigate whether this risk factor may best be addressed through interventions that increase an individual's

ability to cope with and tolerate aversive responses caused by uncertainty.

Mindfulness-based interventions may be uniquely poised to address IU as a cost- and time-effective strategy to decrease parents' mental health risk during uncertain global stress events such as the COVID-19 pandemic (Chen et al., 2021). In addition to mindfulness-based interventions' promotion of healthy coping strategies, mindfulness may directly target IU through an emphasis on nonattachment and letting go of the need for certainty. Mindfulness-based interventions have further been shown to impact processes by which IU leads to distress—that is, by decreasing worry and rumination (Deyo et al., 2009; Ma & Teasdale, 2004), increasing distress tolerance (Lotan et al., 2013), and fostering acceptance and nonreactivity in the face of negative situations and emotions (Lindsay, Chin, et al., 2018; Lindsay, Young, et al., 2018). Furthermore, due to COVID, utilization of telehealth has increased and there are greater options for mindfulness-based interventions to be accessed remotely through online programs in addition to pre-existing apps (e.g., Calm, Headspace, Insight Timer; Huberty et al., 2019). These electronic options increase accessibility both generally during a pandemic and specifically for new parents who may have difficulty attending an in-person class, and meta-analytic evidence supports the effectiveness of online mindfulness-based interventions for mental health (Spijkerman et al., 2016).

This study represents part of a broader effort to inform the selection of “mechanistically informed and driven” risk factors and interventions to address psychological needs during the pandemic (Holmes et al., 2020); this need is especially great in perinatal populations given both heightened vulnerability to mental health concerns and the known negative impact of poor perinatal mental health on maternal, infant, and family well-being over time. During this pandemic, or in future times of great uncertainty, future research should examine the utility of screening child-bearers and new mothers for elevated IU and providing access to interventions, such as mindfulness training, that have been demonstrated to improve tolerance of uncertainty and foster effective coping strategies to improve mothers' and their family's well-being.

Limitations and Future Research

There are several limitations to this research. First, data were collected at one timepoint via an online, self-report survey, which required retrospective report of pre-pandemic mindfulness. These limitations restricted our ability to infer causal relationships, measure change over time, and draw conclusions that could inform clinical use on the basis of the current findings. Longitudinal studies with a randomized intervention component are needed to better understand how IU and mindfulness impact psychological symptoms over time, especially during global stress events.

Second, our sample was relatively privileged and homogenous in race, socioeconomic status, and education. They were predominantly White, upper to upper-middle class, and college educated, which may reflect biases in our recruitment strategies and who had access and time to complete an uncompensated survey in a pandemic. It is possible that the current sample represented higher IU and/or stronger effects of IU because their socioeconomic status had shielded them from uncertainty related to financial or resource insecurity prior to the pandemic. It will be important to test the currently detected paths in more diverse samples that include parents with pre-existing vulnerabilities such as economic hardship and experiences of racism and marginalization who are at greater risk of psychological distress during COVID-19 (Prime et al., 2020) to determine if the same risk paths and attendant screening/intervention recommendations apply. For now, our findings provide insight into processes that can exacerbate or alleviate distress in a group expected to be protected against the worst harms of the pandemic, and underline the fact that the multiple stressors posed by COVID-19 exert widespread effects on the population.

Third, the survey began 2 months after the rise of COVID-19 in the United States and the beginning of quarantine and social distancing guidelines. It is possible that at the beginning of the pandemic, researchers might have observed different intensities of COVID-related fears, IU, perceived mindfulness shifts, and psychological symptoms or resilience. However, our findings provide evidence for the *ongoing* negative impact of COVID-19 in the United States. The negative effects of this pandemic were not just due to initial shock and upheaval; COVID-19 continues to adversely impact expectant and new mothers, and this study provides a window into the cumulative impact of an evolving constellation of stressors (with a still uncertain end) on mothers' well-being.

Lastly, measures in the current study utilized the same method of data collection; thus, common method bias is a limitation of the current study as a source of potential measurement error. Constructs were measured by participants' responses to self-report questionnaires at the same time, which could in part elicit stronger observed associations between variables due to common method variance (e.g., common rater effects, common scale formats, measurement context formats, social desirability, or priming effects) rather than the sheer correlation of the constructs (Podsakoff et al., 2003). Future research may control for common method bias by introducing a time lag between measurement of the variables of interest, counterbalancing item order, or by obtaining multiple measures of the variables via different methods (e.g., self-reported psychological symptoms, collateral report of psychological symptoms, and/or clinical interview; Campbell & Fiske, 1959; Podsakoff et al., 2003).

The current study provides support for IU and perceived diminishing mindfulness in paths to psychological well-being among parents during the COVID-19 pandemic. Our results suggest mothers who are less able to tolerate uncertainty experience more psychological symptoms, in part due to perceived reduction in mindfulness during the pandemic. This finding points to IU as a modifiable risk factor for parental distress in the face of the pandemic and mindfulness as a mechanism that could be targeted to improve family outcomes. These results support the use of IU in screening for risk and mindfulness-based interventions to address IU and psychological distress in expectant mothers, especially during pandemics or similar events.

Author Contributions M.D.S. created research questions, conducted analyses, wrote the majority of article text, and coordinated efforts of co-authors. K.H. created the online questionnaire, assisted in analyses, and contributed to manuscript preparation. H.K.L. supervised the current study, provided intellectual inputs, and assisted in project development, analyses, and manuscript preparation. All authors read and approved the manuscript.

Data availability Once data collection for the larger EPiC study is complete, the data for the current study will be available at the Open Science Framework (<https://osf.io/5khws/>), expected release: Fall 2021.

Declarations

Ethics Approval and Consent to Participate All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All procedures were approved by the University of Illinois Institutional Review Board and informed consent was obtained from all participants prior to study participation.

Conflict of Interest The authors declare no competing interests.

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