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MINDFULNESS TRAINING FOR HEALTHCARE PROFESSIONAL STUDENTS: A
WAITLIST CONTROLLED PILOT STUDY ON PSYCHOLOGICAL AND WORK-
RELEVANT OUTCOMES

A dissertation submitted in partial fulfillment of the requirements for the Doctorate in
Philosophy of Psychology at Virginia Commonwealth University

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Abstract**MINDFULNESS TRAINING FOR HEALTHCARE PROFESSIONAL STUDENTS: A
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By Sarah Ellen Braun, M.S.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctorate in
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Virginia Commonwealth University, 2019.

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Burnout in healthcare professionals (HCPs) can negatively affect HCPs' health and the overall functioning of the healthcare system. Of great concern is the negative effect of HCP burnout on psychological, cognitive, and work-relevant functioning. Mindfulness-based interventions have been shown to decrease burnout in HCPs and preliminary evidence suggests they may improve work-relevant outcomes. However, the literature is limited by methodological issues and generalizability concerns. The current pragmatic trial investigated feasibility, acceptability, and effectiveness of Mindfulness for Interdisciplinary Healthcare Professionals (MIHP) using a partially randomized, waitlist-controlled, crossover design [intention-to-treat sample: 22 in the mindfulness group (MG), 26 in the control group (CG)] on psychological, cognitive, and interprofessional measures. The present study also included an explanatory aim evaluating mindfulness practice time and practice quality as mediators of change. Within-group changes were assessed with the combined crossover data for mediation and three-month follow-up analyses. Finally, the present study explored the perceived effects of MIHP and how MIHP had its effects using a grounded theory approach. Results found mixed evidence for feasibility and

acceptability. Small to large effects were found for the MG on outcomes of burnout, perceived stress, and mindfulness. These effects were present with groups combined and remained at the follow-up. No effect of MIHP was found on cognitive or interprofessional outcomes. Practice time and quality were not significant mediators of main effects. A grounded theory model is proposed for how MIHP may exert its positive effects within the context of healthcare.

Mindfulness Training for Healthcare Professional Students: A Waitlist Controlled Pilot Study on Psychological and Work-Relevant Outcomes

Burnout, or job-related stress, in healthcare professionals (HCPs) is increasingly reported at unacceptably high rates (Aiken, 2002; Dyrbye & Shanafelt, 2016). HCP burnout and stress have costly and troubling negative consequences for healthcare professional well-being and work-relevant functioning (Garman, Corrigan, & Morris, 2002; Halbesleben & Rathert, 2008; Hall, Johnson, Watt, Tsipa, & O'Connor, 2016; Lu, Dresden, McCloskey, Branzetti, & Gisondi, 2015; Marin et al., 2011; Shanafelt et al., 2010; Shanafelt, Bradley, Wipf, & Back, 2002; Vahey, Aiken, Sloane, Clarke, & Vargas, 2004). In 2014, Bodenheimer and colleagues added improving HCP work life as a fourth aim among improving health of the population, enhancing the patient experience of care, and reduction of the cost of healthcare, making it the Quadruple Aim to improve the healthcare system. HCP psychological and cognitive functioning are now well-recognized factors contributing to the optimal performance of the healthcare system (Bodenheimer & Sinsky, 2014).

HCP Psychological Functioning

High levels of stress and burnout have been documented in nearly all healthcare professions, including nursing (Aiken, 2002), medicine (Dyrbye & Shanafelt, 2016), dentistry (Gorter et al., 2008), mental health (Acker, 2012), and pharmacy (Lahoz & Mason, 1990). Burnout in HCPs has been defined as a state of chronic job-related stress characterized by three domains: 1) emotional exhaustion, 2) depersonalization or detachment from patients, and 3) lack of personal accomplishment (Maslach & Jackson, 1981). Secondary trauma, moral distress, increased time spent charting, managing both patient and institutional demands (e.g., billing expectations), chronic fatigue, and challenging clinical decisions may all be factors leading to

stress and burnout in HCPs. Burnout has been extensively studied and found to significantly relate to poor physical and mental health outcomes including the use of more sick days (Consiglio, Borgogni, Alessandri, & Schaufeli, 2013; Parker & Kulik, 1995), cardiovascular disease (Melamed, Shirom, Toker, Berliner, & Shapira, 2006), depression (Bianchi, Schonfeld, & Laurent, 2015; Toker & Biron, 2012), suicidal ideation (Dyrbye & Shanafelt, 2016; van der Heijden, Dillingh, Bakker, & Prins, 2008), and mortality (Ahola, Väänänen, Koskinen, Kouvonen, & Shirom, 2010).

Studies suggest that burnout may lead to negative coping behaviors, including increased alcohol abuse. Two large population-based studies found that burnout was related to alcohol abuse and dependence in physicians (Oreskovich et al., 2015) and medical students (Jackson, Shanafelt, Hasan, Satele, & Dyrbye, 2016). Though not in HCPs, another study found that burnout in urban transit operators was indirectly related to substance use and mediated by negative coping behaviors; namely, escapist coping predicted more substance use for those who were burned out (Chen & Cunradi, 2008). Therefore, HCPs may benefit from interventions to teach adaptive coping and stress management. Interestingly, a recent study found that personality factors, more than organizational factors, predicted burnout (Bianchi, Mayor, Schonfeld, & Laurent, 2018). This work builds upon a body of research demonstrating an association between personality traits and burnout (Bianchi et al., 2018). Taken together, it stands to reason that interventions targeting healthy coping and stress management in the face of distress may be especially beneficial.

Data also suggest that burnout in HCPs is associated with lower empathy, less altruistic views, and a higher likelihood to engage in unprofessional behaviors, including cheating (Brazeau, Schroeder, Medicine, & 2010; Dyrbye et al., 2010; Paro et al., 2014; Thomas et al.,

2007). Given these troubling sequela on work-relevant outcomes, burnout and psychological dysfunction has the potential to negatively affect professional development in HCP students (Dyrbye & Shanafelt, 2016). Therefore, interventions targeting students may be especially called for to decrease the potential for psychological dysfunction to have long-standing negative effects on work-relevant performance.

Perhaps most troubling is the effect of burnout on patient care. Whether burnout has a direct effect on patient care or by way of decreased functioning, burnout seems to exert a negative effect on HCP performance and patient care. Burnout in HCPs has been associated with lower patient satisfaction (Garman et al., 2002; Halbesleben & Rathert, 2008; Vahey et al., 2004), more perceived medical errors, adverse events, and impairments in job performance (Braun, Auerbach, Rybarczyk, Lee, & Call, 2017; Halbesleben & Rathert, 2008; Hall et al., 2016; Lu et al., 2015; Prins et al., 2009; Shanafelt et al., 2010, 2002; West et al., 2006; West, Tan, Habermann, Sloan, & Shanafelt, 2009). These studies demonstrate the costly effects of burnout on HCP trainee health, patient safety, and healthcare quality.

HCP Cognitive Functioning

Extensive research shows that job-related stress is inversely related to several aspects of cognitive functioning including executive functions (e.g., task switching, updating, and inhibition) attention (e.g., sustained), and memory – all of which are frequently required of HCPs (Deligkaris, Panagopoulou, Montgomery, & Masoura, 2014; Sokka et al., 2016; Van Der Linden et al., 2005). HCP performance on cognitively demanding tasks is especially relevant to the efficiency and safety of the healthcare system. Burnout and related reduction in performance on cognitively demanding tasks may increase HCP errors and prevent adequate learning of healthy

coping mechanisms for high stress situations (Halbesleben & Rathert, 2008; Hall et al., 2016; Shanafelt et al., 2010).

Rationale for Mindfulness

MBIs may be particularly well-suited to address the growing issue of burnout, and its correlates, in HCPs. Mindfulness is practiced by attending to present-moment stimuli, often the breath, guided imagery, a mantra (repeated sound/word), or gentle movements (e.g., yoga, Tai Chi). Practitioners learn to inhibit attention toward future-oriented worries and past-oriented ruminations by redirecting attention to the present moment. Improved ability to pay attention is one of the theoretical understandings of how MBIs reduce stress (Brown, Ryan, & Creswell, 2007). Importantly, a growing literature base demonstrates promise for MBIs to reduce burnout in HCPs (Bond et al., 2014; Burton, Burgess, Dean, Koutsopoulou, & Hugh-Jones, 2016; Danilewitz, Bradwejn, & Koszycki, 2016; Greeson, Toohey, & Pearce, 2015; Krasner et al., 2009; Lamothe et al., 2016; Regehr, Glancy, Pitts, & LeBlanc, 2014; Shapiro, Astin, Bishop, & Cordova, 2005). However, the research on whether MBIs improve psychological functioning, like burnout, is limited by few studies with comparison groups, heterogeneous and poorly described MBIs, few studies with formal investigation of feasibility and acceptability, and few studies with follow-up assessments.

Evidence suggests that MBIs in lay populations improve cognitive functioning in the domains that are frequently taxed by the work of HCPs (e.g., memory, sustained attention, and executive functioning; Brown et al., 2016; Chambers, Lo, Allen, Chuen, & Lo, 2008; Chiesa, Calati, & Serretti, 2011; Jha, Krompinger, & Baime, 2007; Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). By increasing attention and awareness (Brown & Ryan, 2003), MBIs may enhance divided attention, inhibition of automatic responses, and processing speed – domains

measured by the cognitive task in the present study, thereby, improving work-relevant functioning. MBIs may not only protect against the negative health effects of stress, but they may also enhance HCP cognitive functioning in the domains required of HCPs, thereby improving healthcare safety and efficiency.

In fact, one study investigated a MBI for therapists in training using a non-randomized controlled design on cognitive functioning in the domains of sustained attention, inhibitory control, and task switching and found significant between group effects with improvements in the MBI group (Rodriguez Vega et al., 2014). However, in this study, the MBI was mandatory curriculum for training therapists, preventing generalization and confounding participant motivation. Further, to date, no study has investigated an MBI tailored to the stressors of interdisciplinary HCPs on cognitive functioning.

Several studies have found an effect of mindfulness interventions on the Trail Making Test in clinical samples (Cash, Ekouevi, Kilbourn, & Lageman, 2016; Moynihan et al., 2013; Sachse, Keville, & Feigenbaum, 2011; Zylowska et al., 2008). This test is a measure of processing speed, divided attention or task switching, and inhibition of automatic responding, all important domains of executive functioning for HCPs. Other studies failed to find an effect of mindfulness on Trail Making Test performance in clinical samples (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011; Mcmillan, Robertson, Brock, & Chorlton, 2010). A review article found mixed evidence for the effects of MBIs on the construct of task switching, though not all studies used the Trail Making Test (Gallant, 2016). Notably, some studies using the Trail Making Test used raw scores, while others adjusted for age, race, level of education, and gender. This could have bearing on the mixed results. Furthermore, no studies investigated the effects in HCP students, a population for whom processing speed, task switching, inhibition of automatic

responding, and divided attention are increasingly expected. Thus, training to improve these domains of executive attention could be especially relevant to the work of HCP students and contribute to their functioning in the work place.

MBIs may also positively affect socioemotional outcomes (Arch & Landy, 2015; Brown, Goodman, & Inzlicht, 2013; Burgoon, Berger, & Waldron, 2000; Chambers, Gullone, & Allen, 2009; Chiesa et al., 2013; Teper, Segal, & Inzlicht, 2013); therefore, MBIs tailored to HCPs may improve not only individual-level outcomes like HCP psychological and cognitive functioning but also attitudes toward interprofessional collaboration and team-based healthcare – an important factor in the increasingly interdisciplinary healthcare environment (Baker, Amodeo, Krokos, Slonim, & Herrera, 2010; Brock et al., 2013). Thus far, no research has investigated the effects of MBIs for HCPs on interprofessional attitudes.

Investigating Mechanisms

There is ample research supporting the effects of mindfulness on improved psychological and cognitive functioning in a wide range of populations (Chiesa et al., 2011; De Vibe, Bjørndal, Fattah, Dyrdal, Halland, 2017; Gallant, 2016). It remains unclear how mindfulness exerts its positive effects on psychological and cognitive functioning. Theoretical and empirical evidence suggests that MBIs may have their effects by improving mindfulness itself (Brown et al., 2007; Gu, Strauss, Bond, & Cavanagh, 2015). In fact, a recent review by the current author on mindfulness for HCPs proposed a model suggesting that MBIs may exert their effects on psychological and cognitive functioning by improving mindfulness. The paper called for more research in HCPs to measure and test mechanistic questions in order to advance the science (Braun, Kinser, & Rybarczyk, 2018). To truly measure mindfulness as a mechanism by which MBIs have their effects, mediation analyses must be conducted. Importantly, the

conceptualization and definition of mindfulness per se is the topic of debate (Chiesa, 2013). A seminal work by Davidson and Kaszniak (2015) categorizes conceptualizations of mindfulness into three domains: state, trait, and procedure (Davidson & Kaszniak, 2015). First, state mindfulness is the immediate effect of mindfulness practice on the practitioner's state. Second, trait mindfulness is a dispositional quality, shown to improve over time with mindfulness practice (Quaglia, Braun, Freeman, McDaniel, & Brown, 2016). Third, and the focus of the present study, mindfulness can be conceptualized as a procedure, or adherence to the form, or type, of mindfulness practice. However, there are many different forms of mindfulness practice and it is difficult to measure adherence in a novice practitioner. To address these issues, mindfulness as a procedure can be measured as the amount of mindfulness practice or quality of mindfulness practice. For the present study, focus was placed on the investigation of the quality and quantity of formal practices of seated meditation as the mechanism by which mindfulness interventions may have their effects. The theoretically based (Dobkin, 2008) selection of formal seated meditation was done to clarify the inconclusive research on whether quantity of seated meditation practice is a mechanism by which mindfulness interventions exert their effects (Carmody & Baer, 2008; Carmody, Reed, Kristeller, & Merriam, 2008; Davidson et al., 2003; Speca, Carlson, Goodey, & Angen, 2001). Furthermore, given the many elements practiced in most mindfulness-based interventions (MBI; e.g., yoga, walking meditation), clearly defining evidenced-based mechanisms to be tested is necessary to clarify the active ingredients. In the present study, the MBI under study was a multicomponent intervention, however, seated meditation was the only investigated mechanism to reduce heterogeneity of measured mediators and to address the mixed evidence on quantity and quality of seated meditation as potential

mechanisms. To address the multicomponent nature of MIHP, a qualitative grounded theory aim explored participant's perception of how MIHP had its effects, described at more length below.

Mindfulness for Interdisciplinary Healthcare Professionals (MIHP) – A New Intervention

Mindfulness-based stress reduction (MBSR) is one MBI for which there is an extensive research base showing adaptive changes on psychological measures, including stress, depression, and emotion regulation in a variety of clinical and nonclinical populations (Khoury, Sharma, Rush, & Fournier, 2015; Zainal et al., 2013). A strength of the MBSR manual is the adaptability of the intervention to different populations. Adapted from the empirically-based structure of MBSR, Mindfulness for Interdisciplinary Healthcare Professionals (MIHP) has been tailored to address the specific stressors of HCPs and students. The formal mindfulness practice of MIHP includes hatha yoga, supported by evidence to suggest that movement-based mindfulness practices are especially effective in improving outcomes for novice and high-stress populations (Carmody & Baer, 2008; Gard, Noggle, Park, Vago, & Wilson, 2014; Kinser, Goehler, & Taylor, 2012).

A proof-of-concept study of MIHP with three separate cohorts of HCPs and trainees demonstrated clinically meaningful reductions in psychological dysfunction and increases in dispositional mindfulness (Braun, Kinser, Carrico, & Dow, 2019; Kinser, Braun, Deeb, Carrico, & Dow, 2016). Specifically, following MIHP, validated measures of burnout and anxiety showed significant decreases and a measure of dispositional mindfulness showed a significant increase. Furthermore, these effects were maintained at a long-term follow-up assessment (6 months, 1 year, and 2 years for three separate cohorts; Braun et al., 2019). A qualitative analysis of the long-term effects of mindfulness in the context of patient care revealed several themes, including use of top-down attention strategies for improved socioemotional regulation, improved

confidence in sharing mindfulness practices with in-need patients, and enhanced ability to persist during stressful work encounters and maintain effective patient care (Braun et al., 2019). These results are promising for a Phase IIa proof-of-concept study and warrant Phase IIb: Pilot and Feasibility testing (Czajkowski et al., 2015).

While the feasibility and acceptability of MIHP was established in the two previous proof-of-concept studies, two of the three cohorts were taking MIHP as an interprofessional elective course for credit. This limits the generalizability of feasibility and acceptability findings beyond the classroom setting, as attendance at the intervention may not reflect the true feasibility of attendance when course credit is not offered. Nearly all of the current literature on MBIs for HCP students provide course credit for students receiving the intervention (Bond et al., 2014; Danilewitz et al., 2016; Rodriguez Vega et al., 2014; Shapiro, Schwartz, & Bonner, 1998). This greatly confounds participant motivation and prevents generalizability when course credit cannot be offered. Ultimately, research in participants who are receiving course credit for their participation in the intervention under study calls into question motivation, coercion, and lacks ecological validity. Therefore, an investigation of feasibility and acceptability of MIHP outside of the for-credit classroom setting is warranted.

Statement of the Problem

MBIs targeting HCP students may be especially helpful given the troubling research on burnout, its correlates, and its effects. Research in HCP samples provides evidence for the positive effects of MBIs on psychological functioning. Given the link between burnout and compromised work performance, researchers have begun to investigate the effects of MBIs on work-relevant outcomes. However, the current body of research on MBIs for HCPs is limited by few comparison groups, homogenous samples (e.g., mental health professionals only),

heterogeneous and poorly reported intervention characteristics, and a dearth of follow-up assessments. For MIHP specifically, a Phase IIB: Pilot Study, using the ORBIT model for behavioral treatment development (Czajkowski et al., 2015), is warranted based on clinically meaningful data from proof-of-concept studies (Braun et al., 2019; Kinser et al., 2016). To carry out a Phase IIB: Pilot Study, following recommendations for pilot feasibility trials in behavioral health interventions (Freedland, 2013), comparison of MIHP to usual care (waitlist control) is best practice for a pragmatic trial of the effects of MIHP in community settings.

Furthermore, despite the increasing amount of research and commentaries suggesting MBIs for HCPs have an effect on psychological, cognitive, and work-relevant functioning (Burgess, Beach, & Saha, 2016; Dierynck, Leroy, Savage, & Choi, 2017; Drach-zahavy & Saban, 2016; Sibinga & Wu, 2010), potential mechanisms by which MBIs may have their effect have not been studied. Thus, an explanatory aim in the otherwise pragmatic trial is warranted to investigate mindfulness practice time and quality. Given that these mechanisms – mindfulness practice time and quality – would not be present in a control group of any kind, the investigation of mechanisms will be carried out within-person, rather than relative to a comparison group.

Finally, given the methodological weaknesses and the preliminary status of studies investigating work-relevant outcomes and mechanisms of MBIs, a qualitative exploration of both the perceived effects and perceptions of how mindfulness had its effects is warranted.

The proposed study addresses several gaps in the research by investigating an evidenced-based mindfulness intervention, adapted for and preliminary tested with HCPs and students (MIHP; Braun et al., 2019; Kinser et al., 2016), using a partially randomized, between-subjects, parallel waitlist-controlled, crossover design (mindfulness group = MG; waitlist control group = CG) on the following aims.

Aim 1: Determine the feasibility and acceptability of MIHP in HCP students.

Feasibility and acceptability of MIHP were investigated on the following domains: feasibility of recruitment, acceptability of randomization and procedures, acceptability of the intervention, and feasibility of quantitative measures. These categories follow the guidelines for pilot feasibility trials and all metrics were compared to previously established recommendations (Lancaster, Dodd, & Williamson, 2004; Leon, Davis, & Kraemer, 2011; Vranceanu et al., 2019). The measurement of each is described in detail in the Methods section.

Aim 2: Investigate the efficacy of MIHP in improving psychological functioning.

Between-group differences from pre- to post-assessment on psychological measures of burnout (Maslach Burnout Inventory), depressive symptoms (Patient Health Questionnaire), stress (Perceived Stress Scale), and dispositional mindfulness (Five Facet Mindfulness Questionnaire) were investigated. It was hypothesized that participants in the mindfulness group (MG) would have significantly steeper decreases in burnout, depressive symptoms, and stress and increases in dispositional mindfulness relative to the control group (CG).

Aim 3: Investigate the efficacy of MIHP in improving cognitive functioning.

Between-group differences from pre- to post-assessment on measures of processing speed, task switching, and divided attention – domains of executive functioning – were investigated. The cognitive task provided three scores of interest: speed on a task requiring participants to connect numbers (Trail Making Test A, TMT A); speed in switching between numerical and alphabetical dots (Trail Making Test B, TMT B); and a ratio score of TMT B/TMT A which is a measure of divided attention while controlling for processing speed. It was hypothesized that participants in the MG would show significantly higher improvements across all three measures relative to the CG.

Aim 4: Investigate the efficacy of MIHP in improving interprofessional attitudes.

Between-group differences from pre- to post-assessment on a measure of interprofessional attitudes (Fike et al., 2013) were investigated. This aim tested the hypothesis that MIHP would increase positive attitudes toward interprofessional collaboration and team-based healthcare.

Aim 5: Investigate mechanisms by which MIHP has its effects. Using a crossover design, groups were collapsed after the CG completed the intervention, allowing for a larger sample to test the mediation effects. First, group, discipline, year in school, and attendance were entered into the model. Any covariates that had a significant effect on change in an outcome were included in subsequent mediation analyses. When main effects of time were found, an investigation of practice time and practice quality as separate mediators of the change in outcomes was conducted. It was hypothesized that practice time and practice quality would separately account for improvements in outcomes for which main effects were found.

Aim 6: Investigate the long-term effects of MIHP. At the three-month follow-up with crossover design the effects of time on outcomes outlined in Aims 2 and 4 were investigated across the three time points. The cognitive task was not administered at the follow-up, therefore, long-term effects could not be investigated for this outcome.

Aim 7: Explore perceived effects of mindfulness and perceptions of how mindfulness had its effects. A grounded theory exploration of mindfulness' effects on work-relevant functioning (e.g., burnout, stress, working in a healthcare environment, patient care) was conducted (Charmaz, 2014) via qualitative coding of interviews. To better understand how mindfulness may improve HCP functioning and to build upon extant theoretical frameworks of the mechanisms by which MBIs may exert their effects in HCPs, a grounded theory approach was selected. Grounded theory is a qualitative approach that takes concrete data to develop an

explanatory theory of the relationship under study. This was done via stratified-purposeful sampling, or theoretical sampling, of the participants from the upper quartile based on change scores of burnout and perceived stress from pre- to post-assessment.

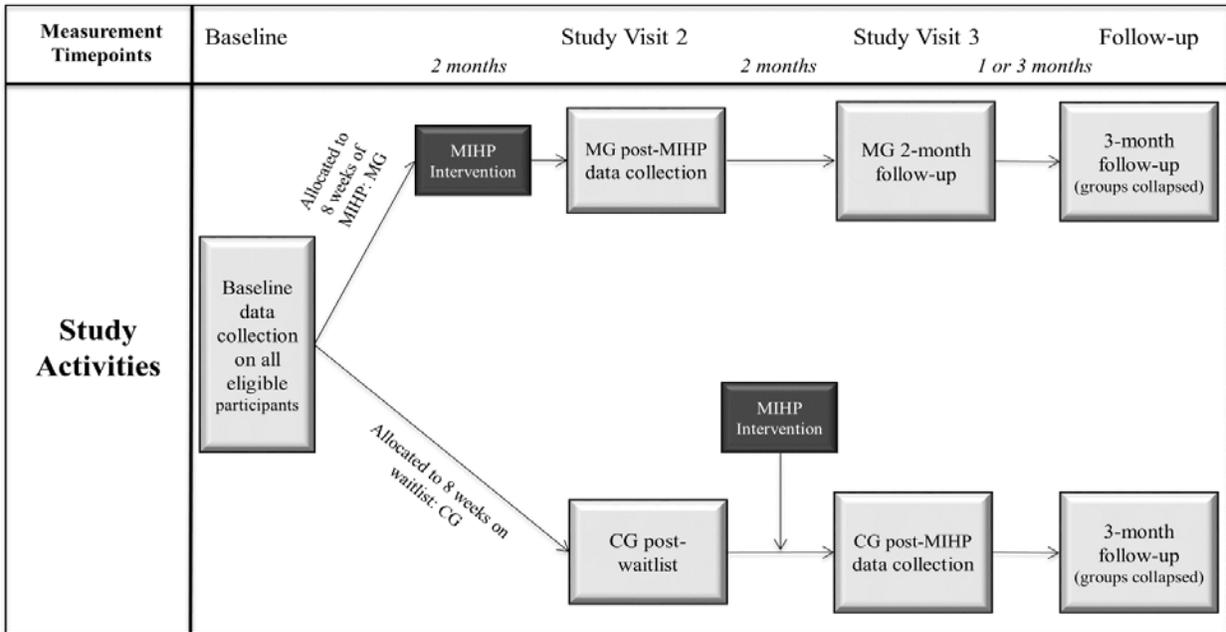
Methods

Overview and Design

To investigate MIHP on psychological, cognitive, and work-relevant outcomes, a partially randomized, waitlist-controlled, crossover design was used. Participants were students in a healthcare professional training program partially randomized to receive the intervention (MG) or waitlist control group (CG). Allocation to groups was done, first, via randomization, then, if the group to which they were randomized did not work with their schedule, they were given preferential group allocation. Given student's demanding class and clinic schedules, in order to attain a sample size of 33 participants per group (see power analysis below) preferential group allocation was offered out of necessity. The MG received an 8-week mindfulness intervention (MIHP), followed by the CG. Participants were recruited in the six weeks prior to the MG receiving MIHP. Eligibility was confirmed via prescreen questionnaires. Informed consent was obtained and participants were allocated to groups at the baseline assessment (BL). Further data collection occurred at Study Visit 2 (after MG's intervention or eight weeks after baseline for the CG), at Study Visit 3 (after CG's intervention or two-month follow-up for MG) and a three-month follow-up (FU) for both groups (see Figure 1). Practice time and quality were collected via electronic monitoring of participants timed usage of guided mindfulness practices during their intervention phase. The crossover design collapsed groups for within group comparisons. The crossover methodology is a tradeoff of reduced internal validity in order to increase

statistical power to investigate mechanisms of change and sustained effects at the follow-up. Figure 1 provides a chart of study activities.

Figure 1. Study Activities



Note. MIHP = Mindfulness for Interdisciplinary Healthcare Professionals; MG=Mindfulness Group; CG=Control Group

Participants

Power analyses based on normative standard deviations for a primary outcome measure (Maslach Burnout Inventory) at a significance level of 0.05, a desired power of 0.80, and a small to medium effect size (Cohen’s $d = 0.40$; based on previous research investigating mindfulness in HCP students that found small to medium effects on burnout Braun, Kinser, Carrico, et al., 2019; Burton et al., 2016; Kinser et al., 2016) indicated that 33 persons per group would be required to detect a significant difference between the MG and CG. Therefore, $N=66$ was the target for enrollment.

Inclusion criteria. Participants were at least 18 years of age, enrolled as a student in one of the following disciplines: School of Nursing, School of Dentistry, School of Pharmacy, School of Medicine, Clinical or Counseling Psychology graduate programs, Social Work graduate program, Allied Health, or undergraduate students with a 80% certainty they would apply to graduate school in a healthcare profession.

Exclusion criteria. Individuals who had engaged in a consistent mindfulness-based activity (such as yoga or meditation) more than once per month for the past six months were excluded.

Recruitment and Informed Consent

Participants were recruited from the departments listed above in the six weeks prior to the start of the intervention. To recruit for this study, emails were sent from the above listed program directors, flyers were posted in the relevant program buildings, and information was listed in electronic newsletters and print newsletters posted in bathroom stalls campus wide. An example recruitment flyer is provided in Appendix A. To maximize recruitment and retention, all materials used for recruitment advertised the study as free mindfulness training with a chance to win \$100 in a lottery, and the option to receive an individualized feedback report on psychological and cognitive functioning after completion of study activities. A total of 12 participants who completed all study phases requested a psychological and cognitive feedback report at the three-month follow-up. An example of the feedback reports given to participants who requested it is provided in Appendix B. To recruit a racially and ethnically representative sample of HCP trainees, email and flyers providing information on the study included images with all genders and racial/ethnic groups represented.

Procedure

Following eligibility confirmation, participants were scheduled for the baseline assessment where informed consent was obtained and they were randomized to either the MG or CG (see Figure 1). A computerized random number generator was used to randomize participants to groups. Preferential group allocation was offered for participants only if their schedules did not allow them to attend the intervention to which they were randomized. First, the MG received MIHP. After Study Visit 2, CG participants received MIHP. Baseline, Study Visit 2, and Study Visit 3 were scheduled one on one for 60 minutes each, during which questionnaires were completed electronically and cognitive tasks were administered. The three-month follow-up was conducted online, in which participants were emailed the link to complete their questionnaires and told to do so within two weeks. See Figure 1 for a flowchart of study activities.

Table 1 provides a breakdown of when specific measures were administered. In summary, psychological outcomes were administered at every assessment (baseline, Study Visit 2, Study Visit 3, and follow-up). Cognitive outcomes were administered at baseline, Study Visit 2, and Study Visit 3. Mechanisms of change (practice time and quality) were assessed during the intervention for both groups using electronic records of participant's timed usage of guided meditations. Participants were provided with a unique link to access online meditations using a university specific URL (Ram Pages) and were instructed to only use this link for out-of-session mindfulness practice throughout the duration of the intervention. This link and all the practices therein remains available to the participants.

At the three-month follow-up a stratified purposeful sampling of intervention participants were invited to participate in a qualitative interview, comprised of participants in the upper

quartile based on the largest reduction in burnout and perceived stress from pre- to post-assessment.

All participants who completed all study activities, defined as no more than three absences from the intervention and completion of all assessments (not including the qualitative interview), were entered to win 1 of 5 \$100 gift cards.

Table 1. Study Measures by Study Visit

Measure/Activity	Construct assessed	Present Sample α	Items/Time	B L	SV 2	SV 3	FUV
Study-Specific Demographics Form	Demographics	--	15	x			
Patient Health Questionnaire – 9-item	Depressive symptoms	0.84	9	x	x	x	x
Maslach Burnout Inventory – Student Survey	Burnout	0.79-0.90	16	x	x	x	x
Perceived Stress Scale	Stress	0.81	14	x	x	x	x
Five Facet Mindfulness Questionnaire	Dispositional mindfulness	0.79-0.90	39	x	x	x	x
Student Perceptions of Interprofessional Clinical Ed.	Interprofessional Attitudes	0.72-0.96	6	x	x	x	x
Practice Time	Amount of time in meditation	--	3-25 min	During MIHP			
Practice Quality	Quality of meditations	--	6	During MIHP			
Trail Making Test A	Processing speed and visual scanning	--	<5min	x	x	x	
Trail Making Test B	Task switching and processing speed	--	<5min	x	x	x	
Qualitative Interview	Perceived effects and mechanisms of MIHP	--	≤45min				x

Note: BL= baseline; SV= Study Visit; FUV= 3-month follow-up visit

Description of Intervention

The intervention was developed by a team of interdisciplinary healthcare professionals and trainees. Using two manualized MBIs: MBSR (Kabat-Zinn, 1982) and an adapted version of

MBSR for physicians (Krasner et al., 2009), qualitative and quantitative pilot data (Braun et al., 2019; Kinser et al., 2016), and a thorough review of mindfulness intervention literature, the MIHP intervention was developed as an eight-week skills-based course for interdisciplinary HCPs. Each week, participants engaged in 45-60 minutes of didactic and discussion on a different topic relevant to the specific stressors of HCP work (e.g., leadership, burnout, patient care, dealing with suffering, handling errors; see Appendix C for weekly themes). Time was also spent discussing homework, home practice, and using mindful communication with patients. Following didactic and discussion, activities based on the weekly themes were introduced to practice mindfulness, including, mindful walking, Tai Chi, journaling, and interpersonal skill building (5-15 minutes). During the first half of each session an informal mindfulness practice was introduced to encourage cultivation of mindfulness during day-to-day activities. Informal practices are distinct from formal practices in that they can be practiced during everyday life and are brief. The final 45-60 minutes was allocated for the formal practice of hatha yoga (35-40 minutes), deep breathing (during movement practice), relaxation (10 minutes), and seated meditation (10-20 minutes). Time spent in practices for each session is provided in Appendix C. Homework was assigned each week to develop a regular mindfulness practice (using the unique link to access practices). Other resources were provided but were not made mandatory, including self-monitoring questionnaires and relevant scientific readings.

MIHP was led by a primary instructor and a co-instructor. The primary instructor was a graduate-level HCP student, thus a peer to the participants, with more than eight years of experience teaching meditation and yoga, more than 200 hours of training in mindfulness meditation, and a certified Yoga Alliance teacher. The co-instructor was a faculty member in the School of Nursing with more than ten years of experience teaching yoga, 30 hours of training in

mindfulness meditation, and a certified Yoga Alliance teacher. The guest speakers ranged in terms of meditation and yoga experience and were all licensed healthcare professionals with personal practices of mindfulness, meditation, Tai Chi, and/or yoga.

Measures

Feasibility and acceptability. Following guidelines for pilot feasibility trials and previously published studies adhering to these recommendations (Lancaster et al., 2004; Leon et al., 2011; Vranceanu et al., 2019), we measured the following domains of feasibility and acceptability using recommended metrics. *Feasibility of recruitment* was assessed by the number of participants who met inclusion criteria and agreed to participate. *Acceptability of randomization and procedures* was determined by measuring those lost to follow-up (at initiation of the intervention, Study Visit 2, Study Visit 3, and the Follow-up) and by calculating the difference in dropout rates (at Study Visit 2 & 3) based on those randomized and those who preferentially allocated. Finally, differences on all outcome measures were calculated for those who dropped out compared to nondropouts to determine acceptability of the randomization and procedures. *Acceptability of the intervention* was determined by calculating retention rates with treatment initiators (attendance at the first session of MIHP) in the denominator and treatment completers at Study Visit 2 (for MG) and Study Visit 3 (for CG) in the numerator. *Acceptability of the intervention* was also determined based on attendance rates for treatment initiators. *Feasibility of quantitative measures* was determined by assessing the internal reliability and the degree of missingness in the questionnaires; such that if there was less than 25% of missing data and if scale reliability (Cronbach's alpha) was higher than 0.70, feasibility was established.

Demographics. A study-specific, 15-item Demographics Form was administered at baseline that included questions about age, gender (coded as male, female, or nonbinary),

discipline, year in program, use of psychotropic medications, relevant psychiatric diagnoses, and other demographic items. Discipline was grouped into three categories for covariate analyses due to small sample size; medical students, nursing students, and all other disciplines. Please refer to Appendix D for a copy of this measure.

Burnout. The Maslach Burnout Inventory – Student Survey (MBI; Maslach et al., 1997) was used to assess student burnout. It is a 16-item questionnaire of burnout symptoms falling on three subscales, Exhaustion, Cynicism, and Professional Efficacy (reverse scored). Respondents rate items on a seven-point scale from “not at all” to “everyday.” This is the gold standard of burnout measurement in HCP student samples and has been widely used, including several translation and validation studies (Faye-Dumanget, Carré, Le Borgne, & Boudoukha, 2017; Gumz, Erices, Brähler, & Zenger, 2013; Ilic, Todorovic, Jovanovic, & Ilic, 2017; Pérez-Mármol & Brown, 2018; Rostami, Abedi, Schaufeli, Ahmadi, & Sadeghi, 2014; Simancas-Pallares, Fortich Mesa, & González Martínez, 2017; Tsubakita & Shimazaki, 2016; Yavuz & Dogan, 2014). Evidence from a recent systematic review demonstrates an effect of MBIs in HCP samples on burnout, many studies using forms of the MBI to measure burnout (Burton et al., 2016). Further, pilot data on MIHP shows significant reductions on two subscales (Emotional Exhaustion and Depersonalization) of the MBI Human Services Survey in Medical Personnel (Kinser et al., 2016); these reductions were maintained at long-term follow-up (Braun et al., 2019). Scores on the Cynicism subscale should be interpreted as follows: low 0-5; moderate 6-10; high 11 or over. Scores on the Exhaustion subscale should be interpreted as follows: low 0-10; moderate 11-15; high 16 and over. Please refer to Appendix D for a copy of this measure.

Depressive symptoms. The Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) was used to measure depressive symptoms. Its nine items ask respondents to

rate symptoms of depression over the last two weeks in frequency on a four-point scale ranging from “not at all” to “nearly everyday.” It is well-validated and widely used (Moriarty, Gilbody, McMillan, & Manea, 2015). Depression is a more general mental health outcome, but has been correlated with burnout in previous research (Toker & Biron, 2012). Research shows a positive effect of MBIs on depression in HCP and non-HCP samples (Kuyken et al., 2016; Lamothe et al., 2016). Pilot data on MIHP demonstrated mean decreases on the PHQ-9 that were maintained at a long-term follow-up, however, these reductions were not significant (Braun et al., 2019; Kinser et al., 2016). Scores on the PHQ-9 can be interpreted as follows: minimal 0-4; mild 5-9; moderate 10-14; moderately severe 15-19; severe 20-27. Please refer to Appendix D for a copy of this measure.

Perceived stress. The Perceived Stress Scale (PSS-14; Cohen & Williamson, 1988; Roberti, Harrington, & Storch, 2006) is a 14-item survey with a five-point scale ranging from “never” to “very often” assessing symptoms of stress over the last month. Similar to depression and burnout, MBIs have been shown to have an effect on stress in HCPs (Lamothe et al., 2016). A pilot study of MIHP showed significant reductions in perceived stress from pre- to post-intervention (Kinser et al., 2016). Please refer to Appendix D for a copy of this measure.

Dispositional mindfulness. The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2008) is a 39-item survey with a six-point scale ranging from “Never, or very rarely true” to “Very often or always true” assessing one’s tendency to be mindful in daily living. The scale is comprised of five facets, or subscales: Observe, Describe, Acting with Awareness, Nonjudging of Inner Experience, and Nonreactivity to Inner Experience. MBI research in HCP samples has been shown to have an effect on two facets from the FFMQ: Observe and Nonreact (Krasner et al., 2009). Further, pilot data on MIHP showed significant improvements on several facets of the

FFMQ with maintenance of these gains at a long-term follow-up (Braun et al., 2019).

Importantly, a recent meta-analysis of MBI research showed that changes in the five subscales of the FFMQ following a MBI ranged from a small to medium effect size, suggesting that MBIs have an effect on dispositional mindfulness as measured by the FFMQ (Quaglia et al., 2016).

Please refer to Appendix D for a copy of this measure.

Cognitive functioning. A neuropsychological task, the Trail Making Test was used to assess cognitive functioning (Lezak, Howieson, Bigler, & Tranel, 2012). First, Trail Making Test A (TMT A) – a measure of processing speed during visual scanning – is administered in which participants are asked to connect numbered bubbles in sequential order. Then, Trail Making Test B (TMT B) – a measure of task switching, processing speed, and inhibition of automatic responding – is administered, in which participants are asked to connect numbered and lettered bubbles in sequential order, this time switching between numbers and letters. The ratio of TMT B/TMT A is a measure of pure divided attention with processing speed and visual scanning held constant. Raw scores on the TMT A and B are the amount of seconds until the task is completed. When participants make errors the administrator corrects them and this is reflected in longer completion times. Raw scores are converted to normed scores, accounting for participant age, race, level of education, and gender using previously published normative data (Heaton, Miller, Taylor, & Grant, 2004). There are three variables of interest: speed on TMT A, speed on TMT B, and the ratio score of TMT B/TMT A. The Trail Making Test is one of the most often used neuropsychological tests, is available for free, and provides preliminary evidence of the participant's executive functioning (Reitan & Wolfson, 1985; Tombaugh, 2004). Please refer to Appendix D for a copy of this measure.

Interprofessional attitudes. The Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education (SPICE) instrument was slightly modified for the purposes of the proposed project and used to measure interprofessional attitudes in a mixed sample of interdisciplinary HCP students. SPICE is 10-item questionnaire asking respondents to rate each item on a five-point Likert scale ranging from “Strongly Agree” to “Strongly Disagree”. SPICE contains three subscales, Interprofessional Teamwork and Team-based Practice, Roles/Responsibilities for Collaborative Practice, and Patient Outcomes from Collaborative Practice. SPICE was developed and validated in a sample of medical and pharmacy students (Fike et al., 2013). For the present study, item 9: “Physicians and pharmacist should collaborate in teams” was amended to say “Healthcare professionals should collaborate in teams.” Item 8: “Clinical rotations are the ideal place within their respective curricula for medical and pharmacy students to interact” was removed from the questionnaire for the present study as it was specific to interdisciplinary collaboration on clinical rotations, making the amended version of SPICE for the present study a nine-item questionnaire. Finally, the subscale Roles/Responsibilities for Collaborative Practice demonstrated poor internal reliability ($\alpha = 0.54$) in the present sample and was therefore not included in analyses. Please refer to Appendix D for a copy of this measure.

Attendance. Attendance in the eight sessions of MIHP was recorded for all participants. This was used as a potential covariate in mixed-model analyses at the crossover design. It was also used to determine engagement in the feasibility and acceptability analyses.

Practice time and practice quality. During MIHP, participants were given access to a study-specific website with a catalogue of mindfulness meditation practices provided in audio format. Each mindfulness practice was introduced during MIHP sessions. Participants were given a unique website link specific to each individual. Practice time was logged for each

participant when the audio file finished and the practice quality survey (described below) was completed. This allowed for tracking of practice time (specific to each audio recording) and type of mindfulness practice. Participants were specifically instructed to only use this website and their unique link to practice mindfulness and to not use other applications or guided meditations. This was clearly discussed in the informed consent procedures as well as during MIHP sessions. Participants were given their unique link on the first day of MIHP for their group. After completing a mindfulness practice recording, a validated six-question practice quality survey appeared asking participants to rate the quality of their mindfulness practice (Del Re, Flückiger, Goldberg, & Hoyt, 2013; Goldberg, Del Re, Hoyt, & Davis, 2014). Please refer to Appendix D for a copy of this measure. Participants were told at the end of MIHP that they could continue to use their unique link to access the mindfulness practice recordings indefinitely.

Qualitative interview. Using a semi-structured interview, a grounded theory exploration (as described by Charmaz, 2014) on the effects of mindfulness in HCP students was employed via stratified-purposeful sampling with the intention to interview participants from the upper quartile based on change scores of perceived stress and burnout from baseline to post-MIHP. The purposeful stratified sampling was done to explore perceptions of effects from those that reported reductions in stress and burnout, as these reductions drive quantitative research interpretations and were therefore the source of inquiry. This represents theoretical sampling (per grounded theory; Charmaz, 2014) in that these participants have experienced the positive stress reductions following mindfulness training and can meaningfully contribute to a theory on how mindfulness has its effects. The topic explored was: What are the perceptions of MIHP's effects and how does it have those effects? A secondary interest was, how has mindfulness been integrated into the life of a HCP student? Said another way, how are the participants of MIHP

experiencing and expressing mindfulness in their daily and work lives? Open-ended questions, informed by the topics of exploration, were used to develop a better understanding of MIHP's effects. Two research assistants were responsible for interviewing participants and were trained by the student investigator on study aims, interviewing skills, and qualitative methodology. Interviews were audio recorded for later transcription. Per grounded theory, field notes were kept during interviews and during coding. Field notes are the in vivo observations and reactions from research personnel that contain valuable data in grounded theory studies (Charmaz, 2014). The two research assistants along with the student investigator were responsible for all phases of coding (described in detail in Data Analysis section). Field notes were also coded in the final analysis of the grounded theory framework. Please refer to Appendix D for the semi-structured interview questions.

Data Preparation and Analysis

Aim 1. Descriptive statistics were used to assess feasibility and acceptability.

Aims 2-4. All data were entered into a secure, electronic database. To examine the effects of MIHP relative a waitlist control on quantitative outcomes (i.e., questionnaires and the cognitive task) from baseline to Study Visit 2, a restricted maximum likelihood (REML) mixed modeling approach was used (Goldstein, Bryk, & Raudenbush, 2006; Raudenbush & Bryk, 2002; Stangl, Kreft, & Leeuw, 2006). In an effort to estimate statistical effects accurately, maximize internal validity, and minimize potential bias from data imputation methods, the REML mixed modeling approach was conducted as the principal analysis. This approach nests lower levels of data (repeated measures) within higher levels (group). It also uses cases even when there is missing data, allowing for the analysis of the full intention-to-treat sample (ITT). The Mixed Model procedure in SPSS version 25 was used for these analyses. Per mixed

modeling guidelines (Goldstein et al., 2006), Level 2 categorical variables (group) were scaled to include zero. Time and group were considered fixed effects and the intercept and slope for each individual was treated as a random effect. Two covariance structures were considered, unstructured and compound symmetry. In short, compound symmetry assumes the variance at each time point and their correlation are equal, whereas unstructured makes no assumption. First order autoregressive was not investigated as a potential covariance structure for Aims 2-4 because when there are only two time points, first order regressive treats the data similarly to compound symmetry. Comparison between covariance structures using chi-square tests of -2 restricted log likelihood revealed compound symmetry as the superior covariance structure in all analyses. The interclass correlations were computed for preliminary models, revealing significant ($p < 0.001$) within person (Level 1) and between person (Level 2) variation, providing justification for the subsequent investigation of group by time interactions.

Repeated measures analyses of variance (ANOVA) were also conducted to model the between- and within-subjects effects. This was done to reiterate the results from the REML method. All statistical assumptions were verified. These analyses were considered secondary to the REML mixed models and are presented in Appendix D, Table 4. For the repeated measures ANOVAs, treatment initiators from the MG ($n=18$) and only CG participants who completed Study Visit 2 ($n=19$) were included. For the treatment initiators in the MG that dropped out and therefore no Study Visit 2 data obtained, a last observation carried forward approach was used. This represents a conservative estimate of effects.

Aims 5. To examine the effects of MIHP for both the MG and CG using crossover design at Study Visit 3, a REML mixed model approach was used to test for differences across the two time points for all measures while controlling for relevant covariates. For Aim 5, the treatment

completers sample was used as this is the sample under study in mechanistic investigations (Gu et al., 2015). Similar to data preparation for Aims 2-4, categorical variables were scaled to include zero and continuous variables were centered around zero. Time, group, discipline (medicine, nursing, and other), level of education, and attendance were entered as covariates in the model. Subject slope and intercept were treated as random effects. Time, group, education, attendance, and discipline were entered as fixed effects. Group by time was the only interaction effect modeled. Again, covariance structures were compared using chi-square tests of the -2 restricted log likelihood and compound symmetry was the superior covariance structure for all outcomes. Subsequent mediation analyses were performed when there was a significant effect of time in these REML adjusted mixed models. When covariates were significant they were retained in the subsequent mediation analyses.

Next, the effect of practice time and practice quality were investigated as mediators of main effects found in the above REML mixed models with crossover design from pre- to post-MIHP. Practice time was summed and practice quality was averaged. To test mediation effects, the Baron and Kenny (1986) method was followed using hierarchical linear regression analyses. First, all statistical assumptions were verified. Practice quantity was nonnormal and transformed using a square root transformation. Second, pre-MIHP outcomes (IV) were investigated as a predictor of post-MIHP outcomes (DV), adjusting for any significant covariates from the previous REML models. Third, pre-MIHP outcomes were investigated as a predictor of the mediator (practice time and practice quality investigated separately). If these were both significant, then a fourth regression entered the mediator and pre-MIHP outcome into the model simultaneously as predictors of post-MIHP outcomes. If the mediator remained significant in the

model with pre-MIHP outcomes ($p < 0.05$), then a Sobel test was conducted to test for full or partial mediation effects.

Aim 6. To investigate the effects of MIHP across time and at the three-month follow-up on psychological and interprofessional outcomes, REML mixed models were conducted. This allowed estimation of effects using the full ITT. Primary interest was in the effect of time (pre-MIHP, post-MIHP, and the three-month follow-up). Relevant covariates adjusted for included group, discipline, level of education, and attendance. When time was significant, post hoc pairwise comparisons of estimated marginal means were conducted on mean differences between all time points. Post hoc pairwise comparisons were also performed if there was an effect of discipline. Group by time interaction was also modeled and when significant, post hoc *t* tests were conducted, using a Bonferroni correction for multiple comparisons. Data preparation followed the same guidelines as described in Aims 2-4 and Aim 5. Categorical variables were scaled to include zero and continuous variables were centered around zero. Time, group, level of education, attendance, and discipline were entered as fixed effects. Subject intercept and slope were treated as random effects. Group by time was the only interaction effect modeled. Covariance structures were compared using chi-square tests of the -2 restricted log likelihood model fit indices. This time, first order autoregressive was also considered. Again, compound symmetry was the superior covariance structure for all outcomes.

Aim 7. A grounded theory qualitative approach was used for analysis of the data and subsequent development of an explanation for relationships between key concepts. Transcribed interviews and interviewer field notes were subjected to open coding using line-by-line sections by the two interviewers and the student investigator (Charmaz, 2014). Line-by-line coding was selected to act as a corrective for imposing bias on the data and to preserve the richness of the

full data (Charmaz, 2014). Open coding procedures provided meaning and displayed action, per grounded theory (Charmaz, 2014). Initial coding was completed early in the process, shortly after each interview, to guide more focused coding and to keep the experience close in mind for the interviewers (Charmaz, 2014).

After an initial line-by-line coding, initial themes and codes were shared and discussed between coders. Field notes were recorded from all coders during the coding process and subjected to coding during subsequent focused coding sessions. Following line-by-line coding, focused codes were identified. To develop focused codes, interview transcriptions, initial line-by-line codes, and field notes were subjected to interpretation and coded. Focused coding is the process of conceptualizing, interpreting, and finding implicit meaning in the descriptions and initial explanations made in line-by-line coding and field notes (Charmaz, 2014). Focused coding moves the results out of total immersion in description of the data and into thematic analysis. These interpretations, though more distant from the data than line-by-line codes, are devised from the raw data and only when the data indicate. Often, focused codes give meaning to something implicit in the data and provide a deeper explanation, raising the level of analysis while remaining connected to the data. Once open coding (line-by-line) was complete, the three coders met to discuss focused coding, compared their results, and agreed on focused codes as a group. Then, the focused codes were compared once again with the raw data and refined. During this last step, the student investigator actively looked for disconfirming evidence to contribute to the trustworthiness of the resulting themes (Creswell, 2009). Focused coding provided the basis for the analysis and subsequent theoretical framework (Charmaz, 2014).

To derive a theory and framework, results from line-by-line and focused coding were considered within the context of previous literature (Braun et al., 2018; Braun et al., 2019;

Kinser et al., 2016). The student investigator and research assistants individually developed rough sketches of a framework based on the results of all line-be-line codes and all focused coding. Then, together, the three research personnel met to compare these findings. It was immediately apparent that common themes and stages were present across each coder's framework. When discrepancies or differences appeared, the raw data was consulted and quotes were used to build a case for themes. During this process, the coders searched for disconfirming evidence to ensure rigor and encourage critical thinking. Finally, a cohesive framework was collaboratively developed with consideration of previous research and raw data.

To ensure rigor and trustworthiness, member checking was conducted throughout each interview to increase credibility of in vivo interpretations (Lincoln & Guba, 1985). Member checking is the process of confirming developing codes and themes with the interviewee. In the present study, member checking took place in the form of active reflection by the interviewers. This was a developing process, such that member checks could be informed by previous coding sessions; this reflected the emergent process of grounded theory and contributed to the trustworthiness of findings (Charmaz, 2014). Each coder also kept field notes during their coding process. These were considered during meetings to identify codes and themes.

To reduce the inherent power differential between interviewee and interviewer – that the interviewer is inherently the leader (Lincoln & Cannella, 2009), interviewers began each interview reminding participants of the voluntary nature of their participation, and throughout the interview used conversational tone, rapport building, and professional self-disclosure (Dickson-Swift, James, Kippen, & Liamputtong, 2007). The interviewers and coders also practiced reflexivity – to be aware of their own biases, self-monitor their biases and expectations prior to and during interviews (Creswell, 2009).

An important ethical consideration for this project was maintaining confidentiality for participants. This was explicitly stated in the verbal consent and several strategies employed to maintain confidentiality of all participants, including telling participants they did not need to reveal any information (e.g., their name) that they did not wish to share throughout the interview. Interviews were transcribed without any confidential information. All participants provided informed consent and the study was approved by the ethical review board prior to participant recruitment.

Results

A total of 48 participants were enrolled and allocated to groups at baseline. After Study Visit 2 and before MIHP began for the CG, nine additional participants were recruited and enrolled into the CG for a larger crossover sample size. Therefore, a total of 57 participants were enrolled in the study; demographic information for the full sample is provided in Tables 2 and 3. Please see Figure 2 for a complete CONSORT diagram.

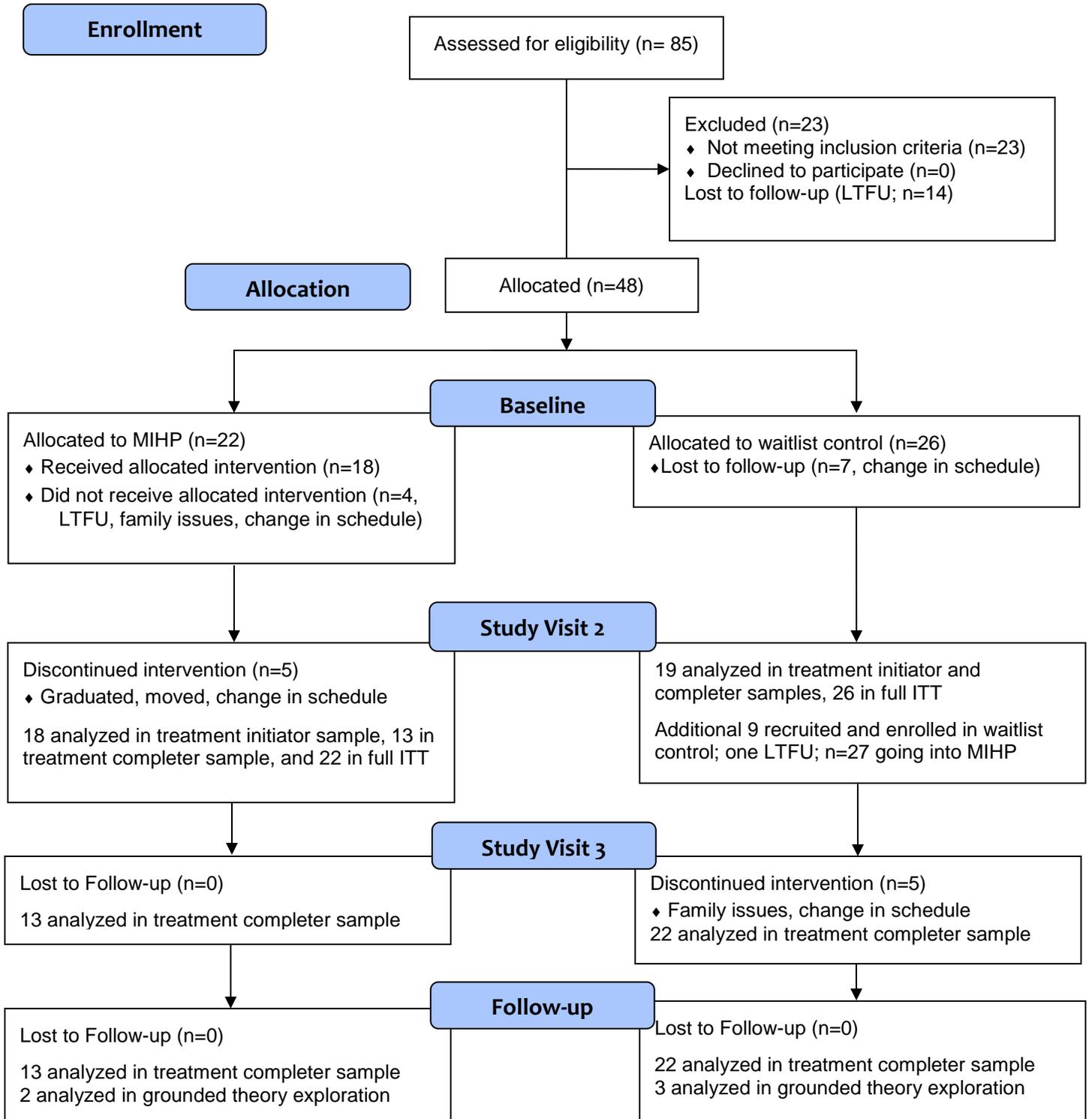
Table 2. Demographic Information

		N (%) / M (SD)			N (%)
Age	26.77 (7.03) range 18-40		Discipline		
Race/Ethnicity			Nursing	18 (31.6)	
	Black	7 (12.3)	Medicine	14 (24.6)	
	White	30 (52.6)	Dentistry	5 (8.8)	
	Hispanic	4 (7.0)	Pharmacy	4 (7.0)	
	Asian	12 (21.1)	Psychology	6 (10.5)	
	Other	3 (5.3)	Social Work	2 (3.5)	
Gender			Allied Health	8 (14.0)	
	Female	52 (89.4)			
	Male	5 (10.6)			

Table 3. Extended Demographic Information

		N (%)			N (%)
Psychiatric Diagnosis			Current Health		
No	37 (64.9)		Poor	0 (0.0)	
Yes	19 (33.3)		Fair	5 (8.8)	
	<i>If yes, current</i>	14 (24.6)	Not sure	2 (3.5)	
	<i>If yes, past</i>	5 (8.8)	Good	41 (71.9)	
Psychotropic Medication			Excellent	8 (14.0)	
	Stimulant	5 (8.8)	Marital Status		
	SSRI	2 (3.5)	Single	44 (77.2)	
	SNRI	1 (1.8)	Living w/partner	5 (8.8)	
	More than one	5 (8.8)	Married	5 (8.8)	
	Other	2 (3.5)	Divorced/Separated	1 (1.8)	
	None	42 (73.7)	Widowed	1 (1.8)	
Alcohol Consumption			Children		
	Not at all	19 (33.3)	Yes	5 (8.8)	
	Couple drinks per week	34 (59.6)	No	52 (91.2)	
	1-2 drinks most days	4 (7.0)	Year in School		
	More than 2 drinks most days	0 (0.0)	Undergrad (prehealth, nursing)	20 (31.6)	
			1 st year of grad	21 (36.8)	
			2 nd year of grad	6 (10.5)	
			3 rd year of grad	4 (7.0)	
			4 th year and up	6 (10.5)	

Figure 2. CONSORT Flow Diagram



Aim 1. Feasibility and Acceptability Measures

Feasibility of recruitment. A total of 94 HCP students (85 at Baseline and an additional 9 at Study Visit 2) expressed interest in the study and completed pre-screen measures to determine eligibility. Of those, a total of 62 met inclusion criteria at Baseline; another 9 individuals met inclusion criteria at Study Visit 2. Of those 71 HCP students that met inclusion criteria (i.e., 62 plus 9), 14 were not enrolled and lost to follow-up, which represents an 80% recruitment rate.

Interest for MIHP was also monitored; 94 participants indicated interest in the program over the course of six weeks. Table 4 provides a breakdown of how participants heard about the study via recruitment efforts.

Table 4. Success of Recruitment Methods

Method of Recruitment	<i>N</i> (%)
Email from Faculty	9 (15.8)
Electronic/digital flyer on MCV campus	5 (8.8)
Paper flyer on MCV campus (includes Stall Seat Journal)	19 (33.3)
Paper flyer on Monroe Park Campus (includes Stall Seat Journal)	7 (12.3)
In the classroom	10 (17.5)
Friend or colleague	2 (3.5)
VCU Telegram	4 (7.0)
Other	1 (1.8)

Acceptability of randomization and procedures. For acceptability of randomization and procedures for the MG, we assessed number of enrollments and retention rates. Twenty-two participants were enrolled and 18 attended the initial session for an 18% (4/22) dropout rate between allocation and intervention. For retention from allocation through the intervention

period 13/22 completed Study Visit 2, for 59% retention rate. At Study Visit 3, 13/22 were retained, for 59% retention. At the Follow-up, 13/22 were retained for 59% retention.

For the CG, that later received MIHP, the same calculations were conducted. Of the 26 enrolled, 19 completed Study Visit 2 for a 73% retention rate over the waitlist period. Nine additional participants were added at Study Visit 2 to the CG, therefore of the 35 total enrolled (26 + 9), 8 dropped out in the time between enrollment and intervention, for a 23% dropout rate. Of the total 35 enrolled in CG, 22 completed Study Visit 3 for a 63% retention rate over the intervention period. At the Follow-up 22/35 were retained for 63% retention.

With groups combined, this represents a 21% dropout rate between enrollment and intervention start; a 67% retention rate at Study Visit 2; a 61% retention rate at Study Visit 3; and 61% retention at Follow-up.

Next, differences in dropout rates were determined between those randomized and those who preferentially allocated. For these analyses only those enrolled at Baseline were included (n=48; those 9 additional participants enrolled at Study Visit 2 were allocated to CG by necessity, therefore excluded since there was no group allocation). A total of 30 participants were randomized for 63% randomization and the remaining 18 (37%) were preferentially allocated. Of the 12 that dropped out between allocation and MG intervention, 83% were randomized. Ten additional participants dropped out during their intervention phase (treatment initiator sample, five lost from each group). Within that group, 70% were randomized and 30% were preferentially allocated. A chi-square test was conducted to investigate the difference in dropout rates based on randomization or preferential allocation; those who were randomized were significantly more likely to dropout ($\chi^2 = 5.42, p = 0.02$).

Acceptability of the intervention. For the MG, out of the 22 participants that were allocated to the group, 18 came to the first intervention session. Of those 18, 13 participants completed Study Visit 2, for a 72% retention rate. Of those 13, 10 participants attended more than half of the intervention (five or more sessions), indicating 77% engagement. Further, of the 13 completers, three participants did not miss a single intervention session (23%) and seven participants missed \leq two sessions (54%). All 13 treatment completers participated in Study Visit 3 (two months after MIHP) and Follow-up (three months after MIHP)

For the CG, a total of 27 participants attended the first session of MIHP. At Study Visit 3, the CG retained 22 participants for an 82% retention rate. Of those 22, 15 participants attended more than half of the intervention, for 68% engagement. Two participants (9%) did not miss a single intervention session and 13 participants missed \leq two sessions (59%). All 22 treatment completers participated in the Follow-up (three months after MIHP)

With groups combined, MIHP demonstrated a 78% retention rate and 71% engagement (defined as attending more than half the intervention sessions). Further, 57% of participants from both groups missed two or fewer sessions of MIHP. For those participants that dropped out and provided a reason (i.e., those not lost to follow-up), the most cited reasons for doing so were unexpected changes in their schedule, becoming too busy, and family or personal issues.

Feasibility of quantitative measures. There were no questionnaires missing in full. Table 1 shows the internal reliability for all scales, which were all above the 0.70 Cronbach's alpha cutoff for determining feasibility.

Aim 2. Between Group Analyses of Psychological Functioning

With groups combined, burnout subscale Cynicism had a mean of 10.18 (SD=7.15) which is characterized as moderate based on validated categories of burnout in students

(Maslach, Leiter, & Schaufeli, 2009). Burnout subscales Exhaustion and Professional Efficacy were also in the moderate ranges ($M=14.31$, $SD=6.32$ and $M=26.04$, $SD=5.52$, respectively). Depressive symptoms for the full sample were in the mild range ($M=6.61$, $SD=4.66$) based on validated cutoffs of symptom severity (Moriarty et al., 2015). Perceived stress were in the moderate range relative to student norms ($M=26.86$; $SD=6.80$). Using published normative data (Heaton et al., 2004), the sample's mean T-scores on the TMT A were at the low end of average (T-score sample mean= 43.82 , $SD=12.19$, 25th percentile), and TMT B scores were average (T-score sample mean= 46.18 , $SD=10.06$, 34th percentile).

Between group analyses revealed that the groups were not significantly different on any measure at baseline (Supplementary Table 1 in Appendix E). Between group differences were also investigated between dropouts and non-dropouts on all outcomes measures. There were no differences between groups (Supplementary Table 2 in Appendix E). Multilevel modeling using REML was conducted to investigate whether there were differences in outcomes variables from baseline to Study Visit 2, and whether these changes differed based on group (Aims 2-4) using the full ITT sample. Effect size refers to partial eta squared and should be interpreted as such, ≥ 0.02 =small effect, ≥ 0.13 =medium effect, and ≥ 0.26 large effect. Table 5 shows the results from the REML analyses for all outcome measures.

Repeated measures ANOVAs were also conducted using the treatment initiator sample to corroborate the findings from the REML analyses and can be found in the Appendix E Supplementary Table 3. Assumptions of normality, homogeneity of variances, and sphericity were met for all ANOVAs performed in Aims 2-4.

Table 5. Means, Standard Deviations, Effect Sizes, and P-Values from REML Mixed Models

Outcome	MIHP n=22 M (SD)		Waitlist Control n=26 M (SD)		Partial η^2 Time	p-value Time	Partial η^2 Group*Time	p-value Group*Time
	Pre	Post	Pre	Post				
MBISS CY	11.23 (6.73)	7.08 (6.74)	11.08 (7.60)	10.95 (5.80)	0.13	0.028*	0.09	0.066
MBISS EX	14.48 (6.68)	8.46 (7.74)	15.96 (5.41)	14.11 (5.67)	0.27	0.001**	0.12	0.036*
MBISS PE	26.14 (5.92)	26.46 (7.11)	24.89 (5.46)	25.05 (6.14)	<0.01	0.84	<0.01	0.78
PHQ	6.64 (5.02)	4.85 (6.12)	8.00 (4.29)	7.94 (5.32)	0.09	0.10	0.05	0.20
PSS	26.91 (5.93)	21.00 (7.83)	28.69 (7.10)	27.56 (7.75)	0.33	<0.001**	0.27	0.002**
FFMQ AA	24.14 (5.87)	27.54 (4.14)	23.81 (6.07)	22.42 (5.86)	0.05	0.08	0.23	0.001**
FFMQ O	25.64 (4.80)	30.39 (4.31)	24.50 (6.55)	24.79 (5.69)	0.27	0.001**	0.23	0.003**
FFMQ D	28.33 (6.25)	30.08 (5.99)	26.81 (5.40)	26.21 (4.13)	0.02	0.42	0.17	0.02*
FFMQ NR	19.43 (4.33)	24.00 (3.29)	19.32 (4.25)	19.11 (3.60)	0.23	0.003**	0.25	0.002**
FFMQ NJ	23.62 (6.15)	28.85 (6.94)	25.77 (6.65)	27.26 (7.28)	0.34	<0.001**	0.21	0.006**
TMT B/A Ratio	2.24 (0.56)	2.72 (1.05)	2.33 (0.55)	2.35 (0.69)	0.03	0.10	0.01	0.16
TMT A	45.91 (15.13)	54.46 (15.90)	42.31 (10.00)	47.47 (10.39)	0.41	<0.001**	0.02	0.39
TMT B	47.41 (11.75)	49.77 (9.80)	43.50 (7.75)	48.00 (9.13)	0.20	0.008**	0.01	0.65
SPICE Team	22.68 (2.36)	23.08 (2.10)	22.96 (2.07)	23.00 (2.36)	0.01	0.47	0.01	0.59
SPICE Patient	9.23 (1.07)	9.00 (1.16)	9.12 (1.03)	9.07 (1.03)	0.04	0.23	<0.01	0.70

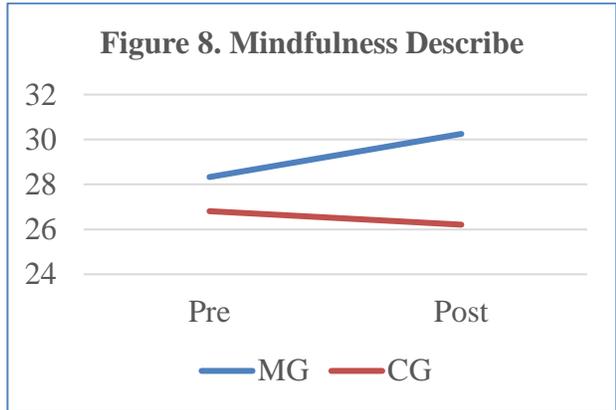
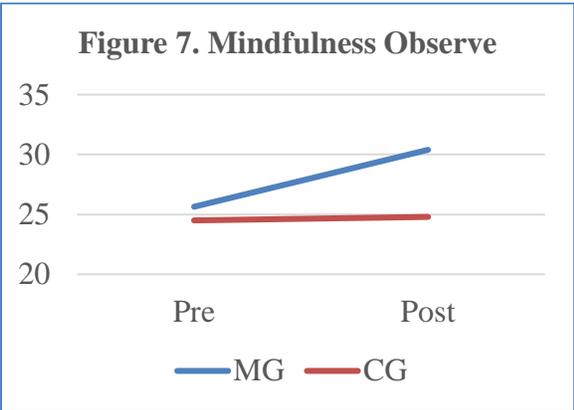
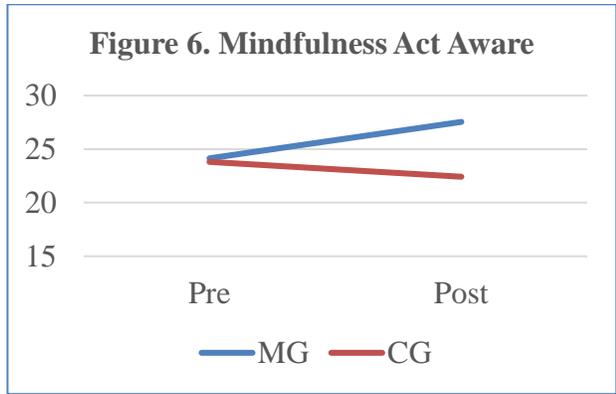
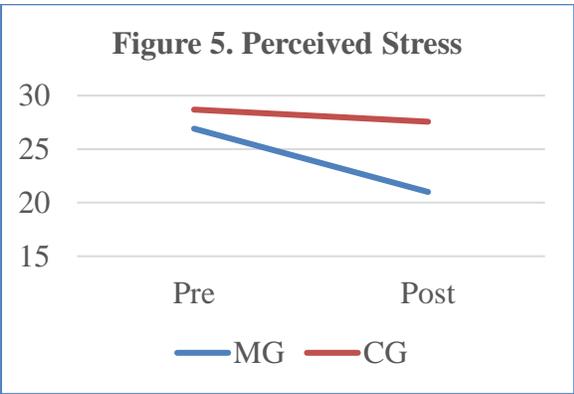
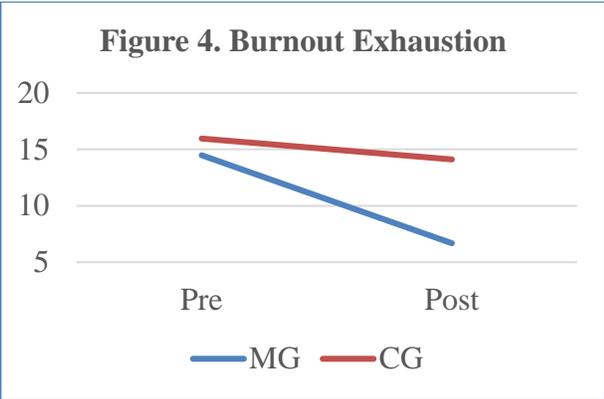
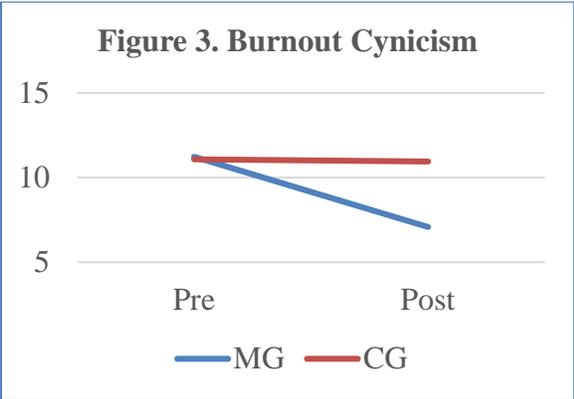
Note: MIHP=Mindfulness for Interdisciplinary Healthcare Professionals; M=Mean; SD=Standard Deviation; MBISS=Maslach Burnout Inventory Student Survey; CY=Cynicism; EX=Exhaustion; PE=Professional Efficacy; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; FFMQ=Five Facet Mindfulness Questionnaire; AA=Acting with Awareness; O=Observe; D=Describe; NR=Nonreactivity to Inner Experience; NJ=Nonjudging of Inner Experience; TMT=Trail Making Test; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. * $p < 0.05$; ** $p < 0.01$.

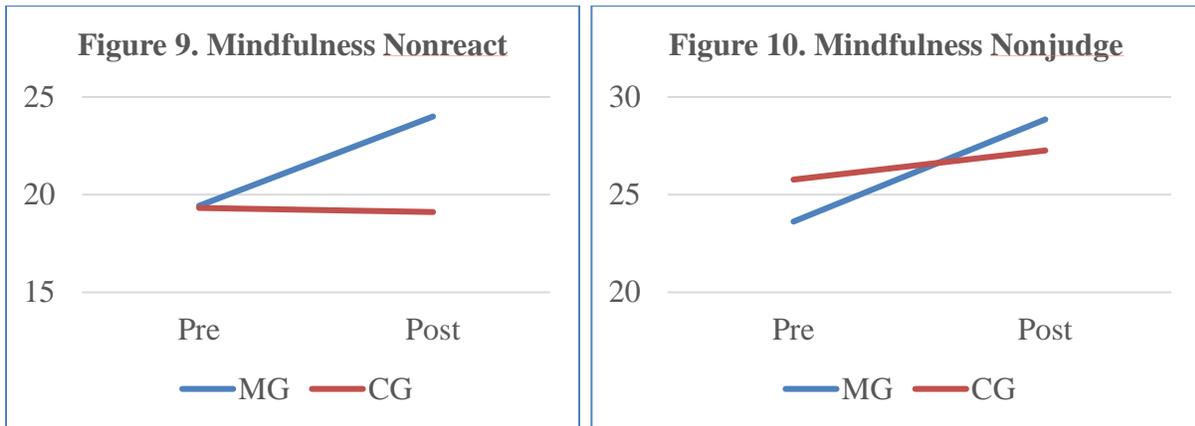
Burnout subscale Cynicism showed a significant effect of time, $F(1, 34.78) = 5.28, p = 0.028$, partial $\eta^2 = 0.13$. These effects were not qualified by a significant group by time interaction, $F(1, 34.78) = 3.60, p = 0.066$ partial $\eta^2 = 0.09$. Though it should be noted that the means trended in the expected direction with both groups in the high range at Baseline and only the MG decreased to moderate at Study Visit 2, effect size was small (see Figure 3). The burnout subscale Exhaustion showed a significant effect of time, $F(1, 33.81) = 12.78, p = 0.001$, partial $\eta^2 = 0.27$. These effects were qualified by a significant group by time interaction and small effect size, $F(1, 33.81) = 4.78, p = 0.036$ partial $\eta^2 = 0.12$ with the MG dropping from moderate to low and the CG remaining in the moderate range (see Figure 4). The burnout subscale Professional Efficacy did not show a significant effect across time [$F(1, 32.43) = 0.04, p = 0.838$, partial $\eta^2 < 0.01$], or group by time interaction [$F(1, 32.43) = 0.08, p = 0.776$, partial $\eta^2 < 0.01$]. Depressive symptoms did not demonstrate a significant effect of time [$F(1, 31.80) = 2.95, p = 0.096$, partial $\eta^2 = 0.09$] or group by time interaction [$F(1, 31.80) = 1.70, p = 0.201$, partial $\eta^2 = 0.05$]. Though it should be noted that means trended in the expected direction with both groups in the mild range at Baseline and only the MG decreasing to the minimal range at Study Visit 2. Perceived stress showed a significant effect of time, $F(1, 32.39) = 15.97, p < 0.001$, partial $\eta^2 = 0.33$. These effects were qualified by a significant group by time interaction and large effect size $F(1,$

32.39) = 11.90, $p = 0.002$, partial $\eta^2 = 0.27$ with the MG showing significantly larger decreases than the CG (see Figure 5).

FFMQ Acting with Awareness did not show a significant effect of time, $F(1, 32.29) = 3.23$, $p = 0.082$, partial $\eta^2 = 0.09$, but there was a significant group by time interaction with large effect $F(1, 32.29) = 12.69$, $p = 0.001$, partial $\eta^2 = 0.28$; such that the MG increased across time and the CG slightly decreased (see Figure 6). FFMQ Observe showed a significant effect of time, $F(1, 33.15) = 12.38$, $p = 0.001$, partial $\eta^2 = 0.27$, and group by time interaction with medium effect, $F(1, 33.15) = 10.15$, $p = 0.003$, partial $\eta^2 = 0.23$, in which the MG increased across time, and the CG remained stable (see Figure 7). FFMQ Describe did not show an effect of time $F(1, 31.46) = 0.68$, $p = 0.415$, partial $\eta^2 = 0.02$, but there was a significant group by time interaction and medium effect, $F(1, 31.46) = 6.34$, $p = 0.017$, partial $\eta^2 = 0.17$, with the MG showing greater increases relative to the CG (see Figure 8). FFMQ Nonreactivity to Inner Experience showed a significant effect of time, $F(1, 35.42) = 10.28$, $p = 0.003$, partial $\eta^2 = 0.23$, and group by time interaction with medium effect $F(1, 35.42) = 11.58$, $p = 0.002$, partial $\eta^2 = 0.25$; in which the MG increased across time, and the CG remained stable (see Figure 9). FFMQ Nonjudging of Inner Experience showed a significant effect of time, $F(1, 32.19) = 16.67$, $p < 0.001$, partial $\eta^2 = 0.34$, and group by time interaction with medium effect, $F(1, 32.19) = 8.73$, $p = 0.006$, partial $\eta^2 = 0.21$, characterized by larger increases in the MG across time than the CG (see Figure 10).

Figures 3-10 Group by time Interactions





Note: Pre=Baseline; Post=Study Visit 2; MG=mindfulness group; CG= waitlist control; Act Aware=Acting with Awareness; Nonreact=Nonreactivity to Inner Experience; Nonjudge=Nonjudgement of Inner Experience

Aim 3. Between Group Analyses of Cognitive Functioning

The TMT B/A ratio did not show an effect of time [$F(1, 41.28) = 2.78, p = 0.103$, partial $\eta^2 = 0.06$] or group by time interaction [$F(1, 41.28) = 2.02, p = 0.163$, partial $\eta^2 = 0.05$]. TMT A demonstrated a significant main effect of time, $F(1, 33.06) = 22.68, p < 0.001$, partial $\eta^2 = 0.41$. However, there was no group by time interaction, $F(1, 33.06) = 0.77, p = 0.386$, partial $\eta^2 = 0.02$. Similarly, TMT B showed a significant main effect of time, $F(1, 32.84) = 7.97, p = 0.008$, partial $\eta^2 = 0.20$, but there was no group by time interaction, $F(1, 32.84) = 0.21, p = 0.649$, partial $\eta^2 = 0.01$.

Aim 4. Between Group Analyses of Interprofessional Attitudes

The Interprofessional Teamwork and Team-based Practice subscale of the interprofessional attitudes questionnaire did not show an effect of time [$F(1, 32.52) = 0.54, p = 0.470$, partial $\eta^2 = 0.01$] or group by time interaction [$F(1, 32.52) = 0.29, p = 0.594$, partial $\eta^2 = 0.01$]. Similarly, the Patient Outcomes from Collaborative Practice subscale of the interprofessional attitudes questionnaire did not show an effect of time [$F(1, 36) = 1.49, p =$

0.231, partial $\eta^2 = 0.04$] or group by time interaction [$F(1, 36) = 0.16, p = 0.696$, partial $\eta^2 < 0.01$].

Aim 5. Crossover Design and Investigation of Mechanisms

Adjusted mixed models with groups collapsed. To determine main effects, equivalence of groups, and relevant covariates, a REML mixed model approach was conducted for each outcome. Table 6 shows the results from REML mixed models on group by time interactions to determine equivalence of groups.

Table 6. REML Models: Equivalence of Groups on Outcomes Pre- to Post-MIHP

Outcome	Initial MIHP n=13		Waitlist MIHP n=22		Partial η^2 Time	p-value Time	Partial η^2 Group*Time	p-value Group*Time
	M (SD)		M (SD)					
	Pre	Post	Pre	Post				
MBISS CY	11.15 (7.84)	7.08 (6.74)	9.59 (6.48)	8.36 (6.88)	0.19	0.006**	0.06	0.12
MBISS EX	15.77 (6.07)	8.46 (7.74)	11.64 (5.07)	10.68 (6.37)	0.30	<0.001* *	0.20	0.007**
MBISS PE	25.83 (4.57)	26.46 (7.11)	26.36 (6.22)	26.14 (5.32)	<0.01	0.84	<0.01	0.80
PHQ	6.54 (4.88)	4.85 (6.12)	5.95 (5.34)	5.55 (4.60)	0.06	0.16	0.03	0.37
PSS	28.25 (4.81)	21.00 (7.83)	26.05 (8.10)	21.40 (7.27)	0.45	0.001**	0.05	0.20
FFMQ AA	23.23 (5.09)	27.54 (4.14)	23.95 (4.78)	26.53 (4.91)	0.31	<0.001* *	0.04	0.18
FFMQ O	25.77 (4.05)	30.38 (4.31)	25.09 (4.66)	29.14 (5.44)	0.58	<0.001* *	<0.01	0.76
FFMQ D	28.08 (6.14)	30.08 (5.99)	27.41 (5.27)	29.41 (5.08)	0.21	0.007**	<0.01	0.93
FFMQ NR	19.75 (3.93)	24.00 (3.29)	20.14 (3.48)	25.77 (4.05)	0.44	0.001**	0.04	0.26
FFMQ NJ	23.58 (5.96)	28.85 (6.94)	27.27 (6.01)	29.14 (5.41)	0.33	<0.001* *	0.09	0.08
TMT B/A Ratio	2.42 (0.57)	2.72 (1.05)	2.11 (0.59)	2.76 (1.84)	0.07	0.10	0.01	0.51

TMT A	46.77 (16.04)	54.46 (15.90)	45.36 (11.22)	51.24 (12.93)	0.33	0.009**	0.01	0.59
TMT B	45.69 (11.27)	49.77 (9.80)	49.59 (9.63)	50.65 (16.87)	0.03	0.32	0.01	0.94
SPICE Team	22.77 (2.32)	23.08 (2.10)	22.27 (3.97)	22.64 (3.51)	0.03	0.32	<0.01	0.52
SPICE Patient	9.31 (1.11)	9.00 (1.16)	8.77 (1.34)	8.95 (1.46)	<0.01	0.78	0.04	0.27

Note: MIHP=Mindfulness for Interdisciplinary Healthcare Professionals; M=Mean; SD=Standard Deviation; MBISS=Maslach Burnout Inventory Student Survey; CY=Cynicism; EX=Exhaustion; PE=Professional Efficacy; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; FFMQ=Five Facet Mindfulness Questionnaire; AA=Acting with Awareness; O=Observe; D=Describe; NR=Nonreactivity to Inner Experience; NJ=Nonjudging of Inner Experience; TMT=Trail Making Test; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. * $p < 0.05$; ** $p < 0.01$.

There was a significant effect of time from pre- to post-MIHP on burnout subscale Cynicism, $b = 4.08$, $SE(b) = 1.41$, $t(38.04) = 2.89$, $p = 0.006$, with scores decreasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on burnout subscale Exhaustion, $b = 7.31$, $SE(b) = 1.75$, $t(33) = 4.17$, $p < 0.001$, with scores decreasing over time. Group by time interaction was also significant, $b = -6.35$, $SE(b) = 2.21$, $t(33) = -2.88$, $p = 0.007$, such that the MG saw a steeper decrease than the CG over time. Discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was no effect of time from pre- to post-MIHP on burnout subscale Professional Efficacy. Group, discipline, attendance, and education level were also nonsignificant. Similarly, there was no effect of time from pre- to post-MIHP on depressive symptoms (PHQ9). Group, discipline, attendance, and education level were also nonsignificant. There was a significant effect of time

from pre- to post-MIHP on perceived stress (PSS), $b = 4.31$, $SE(b) = 1.36$, $t(31.63) = 3.16$, $p = 0.003$, with scores decreasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses.

There was a significant effect of time from pre- to post-MIHP on FFMQ Act Aware, $b = -4.31$, $SE(b) = 1.16$, $t(41.92) = -3.71$, $p = 0.001$, with scores increasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on FFMQ Observe, $b = -4.62$, $SE(b) = 1.03$, $t(32.38) = -4.47$, $p < 0.001$, with scores increasing over time. Attendance was also significant, $b = 0.72$, $SE(b) = 0.34$, $t(22.53) = 2.11$, $p = 0.046$, such that higher attendance was related to greater increases. Group, discipline, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on FFMQ Describe, $b = -2.13$, $SE(b) = 1.15$, $t(32.74) = -1.86$, $p = 0.007$, with scores increasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on FFMQ Nonreact, $b = -4.41$, $SE(b) = 1.15$, $t(32.83) = -3.83$, $p = 0.001$, with scores increasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on FFMQ Nonjudge, $b = -5.27$, $SE(b) = 1.45$, $t(31.93) = -3.65$, $p = 0.001$, with scores increasing over time. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses.

There was no effect of time from pre- to post-MIHP on TMT B/A ratio. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was a significant effect of time from pre- to post-MIHP on TMT A, $b = -5.83$,

$SE(b) = 2.10, t(32.22) = -2.78, p = 0.009$, with scores increasing over time. Discipline was also significant, with the nursing group increasing significantly more than medicine and the ‘Other’ group, $b = 15.74, SE(b) = 4.96, t(28.98) = 3.17, p = 0.004$. Group, attendance, and education level were nonsignificant and dropped from subsequent analyses. There was no effect of time from pre- to post-MIHP on TMT B. Attendance was significant $b = 2.28, SE(b) = 0.93, t(21.91) = 2.45, p = 0.023$, with higher attendance related to greater increases. Group, discipline, attendance, and education level were nonsignificant and dropped from subsequent analyses.

There was no effect of time from pre- to post-MIHP on either subscale of SPICE. Group, discipline, attendance, and education level were also nonsignificant in the analyses of SPICE Team and Patient Care subscales.

In sum, main effects of time were found for burnout subscales Cynicism and Exhaustion, perceived stress, the five subscales of the FFMQ and TMT A. These outcomes were investigated in the following mediation analyses.

Mediation analyses. Practice time and quality were separately investigated as mediators of pre- to post-MIHP on outcomes showing a main effect in above REML mixed models. Table 7 shows means, standard deviations, and ranges for practice time and quality. Table 8 shows the amount of time each different mindfulness audio recording was used throughout the study. Of the 35 treatment completers, 26 practiced meditation using their unique link (74%), 9 never logged any practice time. In addition, five treatment dropouts logged meditation time, for a total of 31 participants with practice time data presented in Table 8. Of the 31 participants that practiced, they practiced on average 265.97 minutes per week ($SD = 89.84$) and 38.00 minutes per day.

Table 7. Practice Time and Quality Descriptives

	Mean (SD)	Median	Min-Max	25 th percentile	75 th percentile
Practice Time	58.84 (88.31)	28.00	0 - 446.50	0	71.00
Practice Quality	61.43 (11.55)	58.07	38.33 - 84.17	53.28	70.61

Note. n=26; Mean for Practice Time and Quality reflects the average during the 8 weeks of MIHP.

Table 8. Use of Different Mindfulness Practices at Home

	Practice	Duration (minutes)	Count
	<i>Intro to Meditation</i>	21	8
	<i>Body Scan</i>	20	10
	<i>Awareness Meditation</i>	15	7
	<i>Loving-Kindness</i>	15	22
	<i>Unguided Meditation</i>	15	6
	<i>Sensation Meditation</i>	11	12
	<i>Unguided Meditation</i>	10	5
	<i>Walking Meditation</i>	8	15
	<i>Breath Counting</i>	8	25
	<i>Labeling Thoughts</i>	8	9
	<i>Simple Breath</i>	7	12
	<i>Meditation on Thoughts</i>	6	9
	<i>Hearing Meditation</i>	6	12
	<i>Mental Noting</i>	5	10
	<i>Unguided Meditation</i>	5	4
	<i>How We Talk To Ourselves in Meditation</i>	4.5	15
	<i>4-Minute Breathing Space</i>	4	25
	<i>Simple Breathing Meditation</i>	3	7
	<i>Unguided Meditation</i>	3	11

Note. n=31; Count reflects the amount of practice during the 8 weeks of MIHP.

First the IV and DV relationship was determined: pre-MIHP Cynicism significantly predicted post-MIHP Cynicism, $b = 0.67$, $SE(b) = 0.12$, $t(33) = 5.50$, $p < 0.001$. However, pre-MIHP Cynicism was not significantly related to practice quantity, $b = -0.10$, $SE(b) = 0.13$, $t(33) = -0.75$, $p = 0.456$. Therefore, the mediation analysis was terminated at this point. Second,

practice quality was investigated as a mediator of pre- to post-MIHP on burnout subscale Cynicism. However, pre-MIHP Cynicism was not significantly related to practice quality, $b = -0.05$, $SE(b) = 0.36$, $t(23) = -0.15$, $p = 0.883$. Therefore the mediation analysis was terminated at this point.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP burnout subscale Exhaustion with group entered as a covariate. First the IV and DV relationship was determined: pre-MIHP Exhaustion significantly predicted post-MIHP Exhaustion, $b = 0.63$, $SE(b) = 0.19$, $t(32) = 3.25$, $p = 0.003$, while controlling for group (per REML adjusted models above). However, pre-MIHP Exhaustion was not significantly related to practice quantity, $b = -0.17$, $SE(b) = 0.16$, $t(32) = -1.04$, $p = 0.308$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on burnout subscale Exhaustion. Pre-MIHP Exhaustion was significantly related to practice quality, $b = -1.33$, $SE(b) = 0.61$, $t(22) = -2.19$, $p = 0.039$. When both pre-MIHP Exhaustion and practice quality were entered into the model as predictors of post-MIHP Exhaustion, both pre-MIHP Exhaustion and practice quality dropped to nonsignificance and the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP perceived stress (PSS). First the IV and DV relationship was determined: pre-MIHP perceived stress significantly predicted post-MIHP perceived stress, $b = 0.66$, $SE(b) = 0.15$, $t(30) = 4.45$, $p < 0.001$. However, pre-MIHP perceived stress was not significantly related to practice quantity, $b = -0.12$, $SE(b) = 0.13$, $t(31) = -0.88$, $p = 0.387$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on perceived stress. Pre-MIHP perceived stress was significantly related to practice quality, $b = -$

0.70, $SE(b) = 0.31$, $t(21) = -2.26$, $p = 0.034$. When both pre-MIHP perceived stress and practice quality were entered into the model as predictors of post-MIHP perceived stress, only pre-MIHP perceived stress remained significant, $b = 0.47$, $SE(b) = 0.18$, $t(20) = 2.64$, $p = 0.016$ and practice quality dropped to nonsignificance; therefore, the mediation analysis was terminated at this point.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP FFMQ Act Aware. First the IV and DV relationship was determined: pre-MIHP FFMQ Act Aware significantly predicted post-MIHP FFMQ Act Aware, $b = 0.49$, $SE(b) = 0.15$, $t(30) = 3.23$, $p = 0.003$. However, pre-MIHP FFMQ Act Aware was not significantly related to practice quantity, $b = 0.14$, $SE(b) = 0.18$, $t(33) = 0.78$, $p = 0.440$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on FFMQ Act Aware. Pre-MIHP FFMQ Act Aware was not significantly related to practice quality, $b = 0.06$, $SE(b) = 0.53$, $t(23) = 0.11$, $p = 0.911$. Therefore, the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP FFMQ Observe. First the IV and DV relationship was determined: pre-MIHP FFMQ Observe significantly predicted post-MIHP FFMQ Observe, $b = 0.79$, $SE(b) = 0.14$, $t(32) = 5.58$, $p < 0.001$, while controlling for attendance (per REML adjusted models above). However, pre-MIHP FFMQ Observe was not significantly related to practice quantity, $b = -0.17$, $SE(b) = 0.20$, $t(33) = -0.83$, $p = 0.413$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on FFMQ Observe. Pre-MIHP FFMQ Observe was not significantly related to practice quality, $b = 0.44$, $SE(b) = 0.50$, $t(23) = 0.89$, $p = 0.383$. Therefore, the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP FFMQ Describe. First the IV and DV relationship was determined: pre-MIHP FFMQ Describe significantly predicted post-MIHP FFMQ Describe, $b = 0.73$, $SE(b) = 0.12$, $t(32) = 6.26$, $p < 0.001$. However, pre-MIHP FFMQ Describe was not significantly related to practice quantity, $b = 0.28$, $SE(b) = 0.16$, $t(32) = 1.78$, $p = 0.084$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on FFMQ Describe. Pre-MIHP FFMQ Describe was not significantly related to practice quality, $b = -0.22$, $SE(b) = 0.45$, $t(22) = -0.48$, $p = 0.634$. Therefore, the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP FFMQ Nonreact. First the IV and DV relationship was determined: pre-MIHP FFMQ Nonreact significantly predicted post-MIHP FFMQ Nonreact, $b = 0.34$, $SE(b) = 0.16$, $t(32) = 2.07$, $p = 0.047$. However, pre-MIHP FFMQ Nonreact was not significantly related to practice quantity, $b = 0.08$, $SE(b) = 0.25$, $t(32) = 0.32$, $p = 0.749$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on FFMQ Nonreact. Pre-MIHP FFMQ Nonreact was not significantly related to practice quality, $b = 0.47$, $SE(b) = 0.73$, $t(22) = 0.65$, $p = 0.521$. Therefore, the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP FFMQ Nonjudge. First the IV and DV relationship was determined: pre-MIHP FFMQ Nonjudge significantly predicted post-MIHP FFMQ Nonjudge, $b = 0.62$, $SE(b) = 0.14$, $t(31) = 4.61$, $p < 0.001$. However, pre-MIHP FFMQ Nonjudge was not significantly related to practice quantity, $b = 0.24$, $SE(b) = 0.14$, $t(32) = 1.72$, $p = 0.096$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on

FFMQ Nonjudge. Pre-MIHP FFMQ Nonjudge was not significantly related to practice quality, $b = 0.31$, $SE(b) = 0.38$, $t(22) = 0.80$, $p = 0.431$. Therefore, the mediation analysis was terminated.

Practice time and quality were separately investigated as mediators of pre- to post-MIHP TMT A. First the IV and DV relationship was determined: pre-MIHP TMT A significantly predicted post-MIHP TMT A, $b = 0.79$, $SE(b) = 0.13$, $t(31) = 6.25$, $p < 0.001$, while controlling for discipline (per REML adjusted models above). However, pre-MIHP TMT A was not significantly related to practice quantity, $b = -0.06$, $SE(b) = 0.07$, $t(33) = -0.93$, $p = 0.359$. Therefore, the mediation analysis was terminated at this point. Second, practice quality was investigated as a mediator of pre- to post-MIHP on FFMQ TMT A. Pre-MIHP TMT A was not significantly related to practice quality, $b = -0.13$, $SE(b) = 0.19$, $t(23) = -0.67$, $p = 0.510$. Therefore, the mediation analysis was terminated.

Aim 6. Three-Month Follow-up

Table 9 displays means, standard deviations, and results from post-hoc comparisons for the full ITT sample at the three time points (pre-MIHP, post-MIHP, and three-month follow-up). REML mixed models were conducted to test the effects of time at the Follow-up. Figures 11 and 12 display changes across time on outcomes.

Table 9. Effects of Time on Outcomes at Follow-up

Outcome	Pre (n=57)	Post (n=35)	Follow-up (n= 35)
MBI Cynicism	10.00 (6.41) ^a	7.89 (6.76) ^b	10.51 (7.15) ^a
MBI Exhaustion	13.35 (5.93) ^a	9.86 (6.89) ^b	10.43 (6.59) ^b
MBI Professional Efficacy	26.27 (5.76) ^a	26.26 (5.97) ^a	23.80 (7.90) ^a
Depressive Symptoms	6.37 (5.03) ^a	5.29 (5.14) ^a	6.71 (4.90) ^a
Perceived Stress	26.13 (6.84) ^a	21.24 (7.38) ^b	24.52 (8.61) ^{a,b}
FFMQ Act Aware	23.80 (5.54) ^a	26.94 (4.57) ^b	27.22 (5.53) ^b

FFMQ Observe	25.14 (5.21) ^a	29.62 (5.01) ^b	28.88 (5.21) ^b
FFMQ Describe	27.76 (5.56) ^a	29.66 (5.36) ^b	29.40 (5.16) ^b
FFMQ Nonreact	19.43 (3.83) ^a	23.31 (3.54) ^b	22.03 (4.09) ^b
FFMQ Nonjudge	25.98 (6.90) ^a	29.03 (5.94) ^b	28.53 (6.41) ^b
SPICE Team	22.50 (3.14) ^a	22.80 (3.04) ^a	22.60 (3.98) ^a
SPICE Patient	9.10 (1.18) ^a	8.97 (1.34) ^a	9.14 (1.24) ^a

Note: MBI=Maslach Burnout Inventory Student Survey; FFMQ=Five Facet Mindfulness Questionnaire; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. Different letters signify significant differences $p < 0.05$.

Burnout subscale Cynicism showed a significant effect of time, $F(2, 70.00) = 5.72, p = 0.005$, partial $\eta^2 = 0.14$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed a significant reduction in pre- to post-MIHP Cynicism (mean difference = 2.64, $SE = 0.89, df = 70.91, p = 0.012$) and significant increases from post-MIHP to the follow-up (mean difference = -2.61, $SE = 0.89, df = 68.19, p = 0.015$). There was no difference between pre-MIHP and the follow-up.

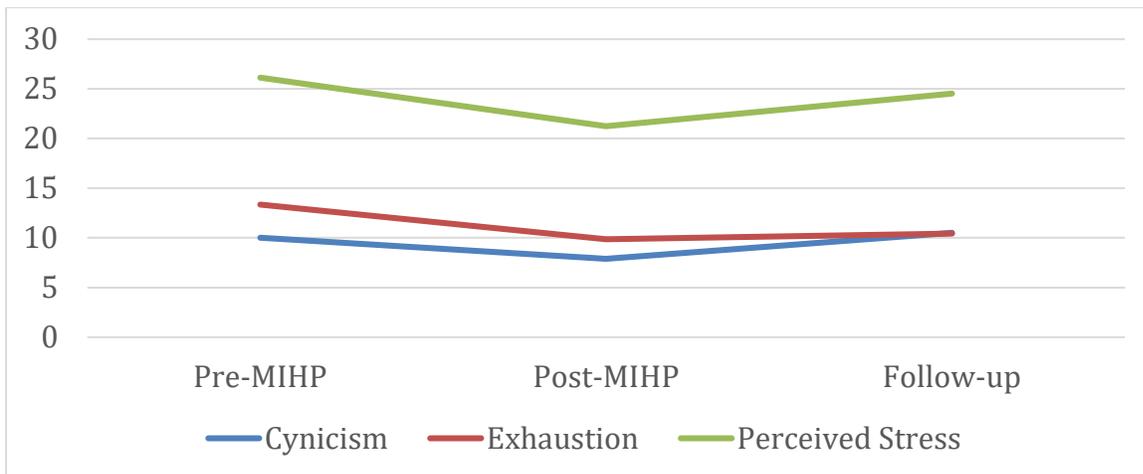
Burnout subscale Exhaustion showed a significant effect of time, $F(2, 67.83) = 9.06, p < 0.001$, partial $\eta^2 = 0.21$. This was characterized by a group by time interaction, $F(2, 69.72) = 4.06, p = 0.022$, partial $\eta^2 = 0.10$. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant decreases in Exhaustion from pre- to post-MIHP (mean difference = 4.01, $SE = 0.99, df = 69.08, p < 0.001$) and from pre-MIHP to the follow-up (mean difference = 3.19, $SE = 0.99, df = 69.08, p = 0.006$). There was no difference between post-MIHP and the follow-up. Post hoc t-tests of group by time

interaction revealed a significant difference between groups at post-MIHP only, with the MG showing lower scores than the CG.

For burnout subscale Professional Efficacy there was no effect of time or group by time interaction. Discipline, education level, and attendance were also nonsignificant. Depressive symptoms also failed to show an effect of time or group by time interaction. All covariates were also nonsignificant.

Perceived stress showed a significant effect of time, $F(2, 67.84) = 9.34, p < 0.001$, partial $\eta^2 = 0.22$. This was characterized by a near-significant group by time interaction, $F(2, 70.01) = 3.02, p = 0.055$, partial $\eta^2 = 0.08$. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed a significant decrease in perceived stress from pre- to post-MIHP (mean difference = 5.54, $SE = 1.28, df = 69.16, p < 0.001$). There were no other difference between time points. Post hoc t-tests of group by time interaction revealed a significant difference between groups at the three-month follow-up only, with the MG showing lower scores than the CG.

Figure 11. Burnout and Stress Across Time



FFMQ Act Aware showed a significant effect of time, $F(2, 70.26) = 6.87, p = 0.002$, partial $\eta^2 = 0.16$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant increases in FFMQ Act Aware from pre- to post-MIHP (mean difference = -3.01, $SE = 1.05, df = 70.76, p = 0.017$) and from pre-MIHP to the follow-up (mean difference = -3.17, $SE = 0.94, df = 71.17, p = 0.004$). There was no difference between post-MIHP and the follow-up.

FFMQ Observe showed a significant effect of time, $F(2, 61.04) = 23.28, p < 0.001$, partial $\eta^2 = 0.43$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant increases in FFMQ Observe from pre- to post-MIHP (mean difference = -4.32, $SE = 0.67, df = 61.83, p < 0.001$) and from pre-MIHP to the follow-up (mean difference = -3.38, $SE = 0.67, df = 61.70, p < 0.001$). There was no difference between post-MIHP and the follow-up.

FFMQ Describe showed a significant effect of time, $F(2, 66.50) = 5.82, p = 0.005$, partial $\eta^2 = 0.15$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant increases in FFMQ Describe from pre- to post-MIHP (mean difference = -2.09, $SE = 0.65, df = 67.30, p = 0.006$) and from pre-MIHP to the follow-up (mean difference = -1.70, $SE = 0.65, df = 67.30, p = 0.033$). There was no difference between post-MIHP and the follow-up.

FFMQ Nonreact showed a significant effect of time, $F(2, 68.31) = 12.31, p < 0.001$, partial $\eta^2 = 0.27$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant increases in FFMQ Nonreact from pre- to post-MIHP (mean difference = -3.56, $SE =$

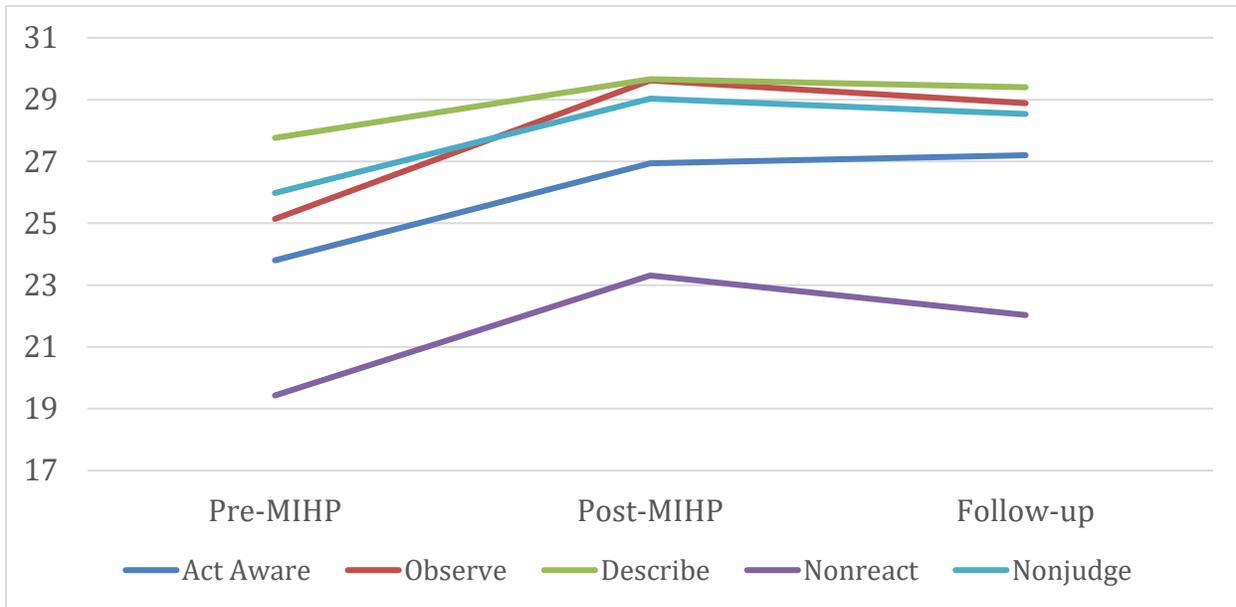
0.73, $df = 70.49$, $p < 0.001$) and from pre-MIHP to the follow-up (mean difference = -2.31, $SE = 0.75$, $df = 72.11$, $p = 0.008$). There was no difference between post-MIHP and the follow-up.

FFMQ Nonjudge showed a significant effect of time, $F(2, 64.00) = 7.45$, $p = 0.001$, partial $\eta^2 = 0.19$. This was not characterized by a group by time interaction. Discipline, education level, and attendance were nonsignificant. Post hoc pairwise comparisons of time points revealed significant increases in FFMQ Nonjudge from pre- to post-MIHP (mean difference = -3.51, $SE = 0.97$, $df = 65.10$, $p = 0.002$) and from pre-MIHP to the follow-up (mean difference = -2.93, $SE = 0.99$, $df = 65.62$, $p = 0.012$). There was no difference between post-MIHP and the follow-up.

For SPICE Team there was no effect of time or group by time interaction. Education level, and attendance were also nonsignificant. However, there was an effect of discipline, $F(2, 44.13) = 4.26$, $p = 0.020$, partial $\eta^2 = 0.16$. Post hoc pairwise comparisons revealed one significant difference between medicine and other disciplines (mean difference = -2.88, $SE = 0.99$, $df = 44.69$, $p = 0.017$), such that students in medical school reported higher SPICE Team attitudes than the category of other disciplines.

For SPICE Patient Care there was no effect of time or group by time interaction. Discipline, education level, and attendance were also nonsignificant.

Figure 12. Facets of Mindfulness Across Time

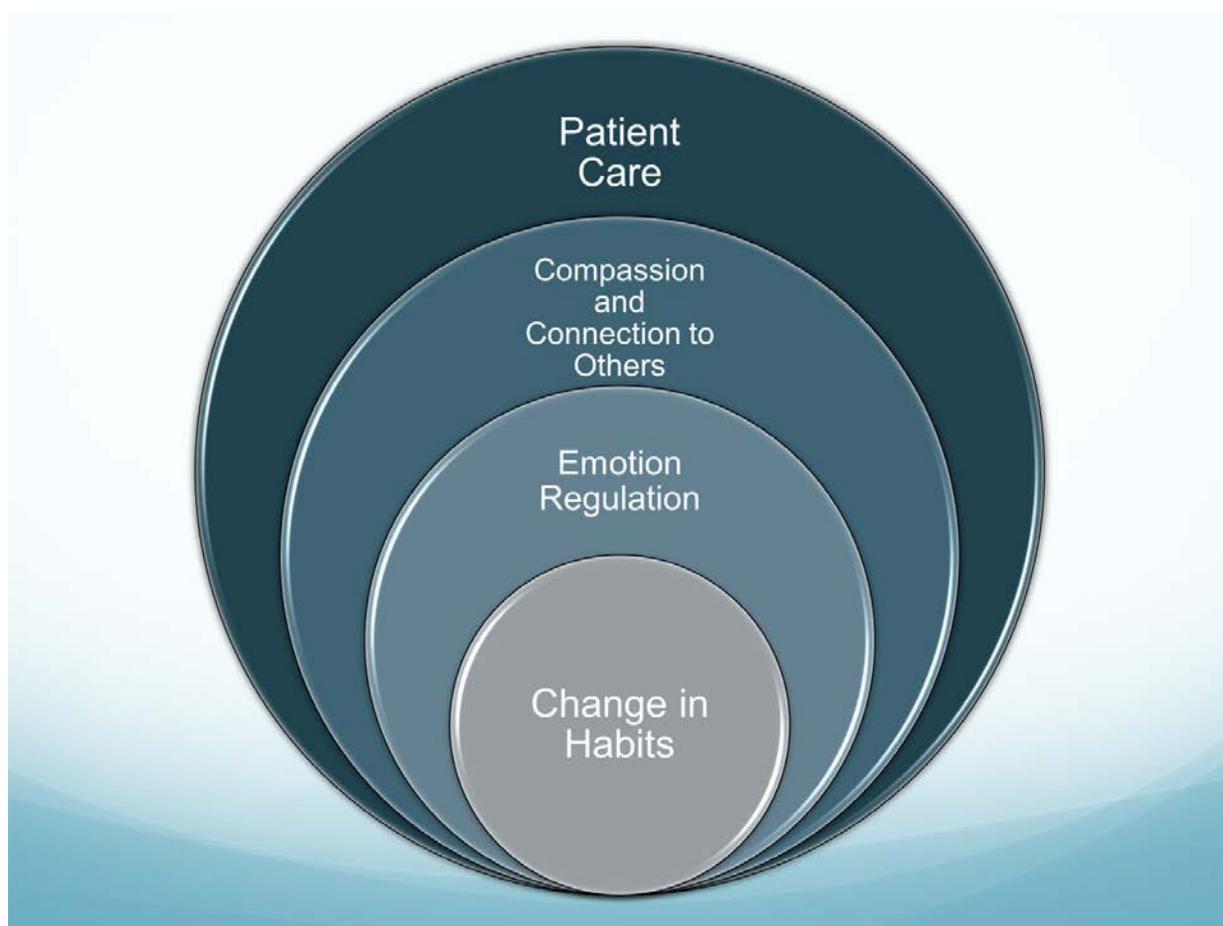


Aim 7. Grounded Theory Exploration

Nine participants were invited to participate in the interview at the three-month follow-up. Five participants agreed to participate and were interviewed for the grounded theory exploration. All invited participants were from the highest quartile in reductions from pre- to post-MIHP on burnout and/or perceived stress. The four participants that were invited but not interviewed were either lost to follow-up (n=2) or were willing to be interviewed at a later date (n=2); these interviews will be integrated into the results here for publication. For the grounded theory approach in the present study, first we explored participants' perceptions of improvements from their experience with MIHP during the interviews. Then, we conducted an analysis focused on the specific effects of MIHP and participants' perceptions of mechanisms of these effects. Themes regarding MIHP's improvement informed the development of the grounded theory on how MIHP had its effects.

Improvements from MIHP. Four main themes about improvements from MIHP arose in the interviews: 1) changing habits, 2) emotion regulation, 3) compassion and connection with others, and 4) patient care. These four categories represent increasingly larger-scale and environmental effects from MIHP that build upon one another such that the effects of MIHP seemed to start with the self and radiate outward, becoming increasingly other-focused and influential beyond the self (Figure 13).

Figure 13. Categories of Improvement Following MIHP



Changing habits was discussed by the participants as beneficial in several ways including increased self-care, increased awareness of self and the effects of stress, and the experience of

positive emotions. For example, integrating informal mindfulness practices was discussed as an important self-care strategy, “I think incorporating more small mindfulness practices into my daily life was the most valuable. And things you can do in the moment that are unstructured to ground and center myself.” Another participant said, “I really enjoyed taking the mindfulness course because it reinforced why self-care is so important, personally for me.” Yet another participant said she learned from MIHP to:

Just be in the moment. Just listen to everything that is happening around you without judging and just take a....so if you are working in a hospital or you are going from class to class to class and you pass a doorway or door entrance you give yourself those small moments.

MIHP was also discussed as a positive shift toward taking care of the self, when so often the focus was on patients,

That even incorporating these things can make a big difference because even me I wasn't practicing this stuff. I knew it's great for my patients but then I just didn't even do it myself. I think I was myself not buying into the power of some of the stuff that I was trying to get my patients to buy into.

Similarly, a participant described a paradigm shift facilitated by MIHP,

It made me aware of the cultural shift that is occurring specifically with western society, I think being proud of being busy is kind of looked at as a good thing, so we talked about that shift [in MIHP], and how we are more aware that it is actually not good to be busy all the time and how it impacts people's health.

Other participants described a shift characterized by an increase in self-awareness as a result of mindfulness practice, “now that I'm practicing mindfulness, that is my break and that's my moment to check my attitude and make sure that I'm aware of how I come across to people.”

Lastly, participants reported more positive emotions as a result of practicing formal mindfulness, “I felt at least twice after leaving some of the sessions, almost like, I guess exhilarated is the

word...not high...but exhilarated... like refreshed, like enlightened, like and....It...it was a good feeling that I don't get to experience that often.”

Participants described emotion regulation benefits following from their mindfulness practice.

So I noticed like, especially in school, when I'm having a hard week or I have a lot going on within a week, I feel like I get irritable around the people that know me and that I love. I get like really short fused and small things, like if I just come home and someone asks me a simple question, I'm like 'I just got home, why are you asking me that?' I notice myself taking more time and realizing that I can't really be mean to people, especially those that love me and help me out.

Mindfulness was especially helpful to manage difficult emotions before facing stressors at work, “I tend to be an anxious person so it's important to me to ground and center myself and I do a lot of mindful breathing before I see an anxious patient who increases my anxiety.” Personal relationships were positively affected by mindfulness too,

And then in my personal relationships, which is something that I am still working on, mindfulness has taught me a little bit more patience and I ready myself before I am going to talk to friends that are really upset. Because normally that would be really draining and I feel like sometimes I'm not really listening when I should be, so it helps me ready myself for potential energy vampires, so to speak.

Another participant discussed better ability to regulate emotions by being present,

Because I find that anxiety is increased when I am constantly thinking ahead, like, not staying in the moment, ya know? When you are mindful you are taking everything as it comes, the way things come right then and there. You are not trying to think 10 steps ahead.

Mindfulness also seemed to improve compassion and connection with others. For example, one participant discussed the value she now sees in patient interactions, “I got to help my patient and I haven't even picked up a stethoscope yet or I haven't even done an exam and I am already, ya know.” Several participants reported explicitly noticing they were better listeners, “In my interactions with patients I am a better listener and I feel like I connect with them more and I can

see the patients' receptiveness to that." Another participant said that mindfulness improved her connection with patients,

At work it's positively influenced me and sort of encouraged me to take that second before I go into a patient's room that I know is going to be a hot mess, or I know that I am going to be there for awhile. Where I just, stop breathe be, and count a couple of breaths and bring myself back to reality, so that I can be with that person and present.

Building on the benefits described above, mindfulness as a form of self-care was a necessary component to providing good patient care,

We can do things as professionals to prevent burnout, and incorporate self-care, which includes mindfulness, to make sure that we don't get burnout, because if we do [get burnt out] I think that really impacts patient care, and can lead to negative health outcomes for our patients.

Several participants connected their improved emotion regulation and compassion with patient care,

I always remember again with using mindfulness to check how I, what I say, and how I say it, and who I say it to. Because when you're saying stuff like, 'oh my gosh, they're back,' that's so negative and it already puts the precursor on how that persons going to be treated and assessed. And that essentially messes with their plan of care.

Another participant said,

It's really hard for you to approach anyone in a way that is kind, and healing, compassionate and caring if you haven't put that into yourself first with like being mindful and like being in the moment and taking 30 seconds to meditate or it becomes more of a challenge.

Grounded theory model for how MIHP improves HCP work. The most commonly reported work-relevant benefit of MIHP was improved compassionate patient care. This was described as developing from the other benefits, as presented in Figure 13. The grounded theory model for how mindfulness improves patient care, building on the theoretical framework of Braun et al., 2018 (see Figure 14) and developed from the data collected for the present study, is presented in Figure 15.

Figure 14. Mechanisms of Mindfulness-based Interventions from Braun et al., 2018

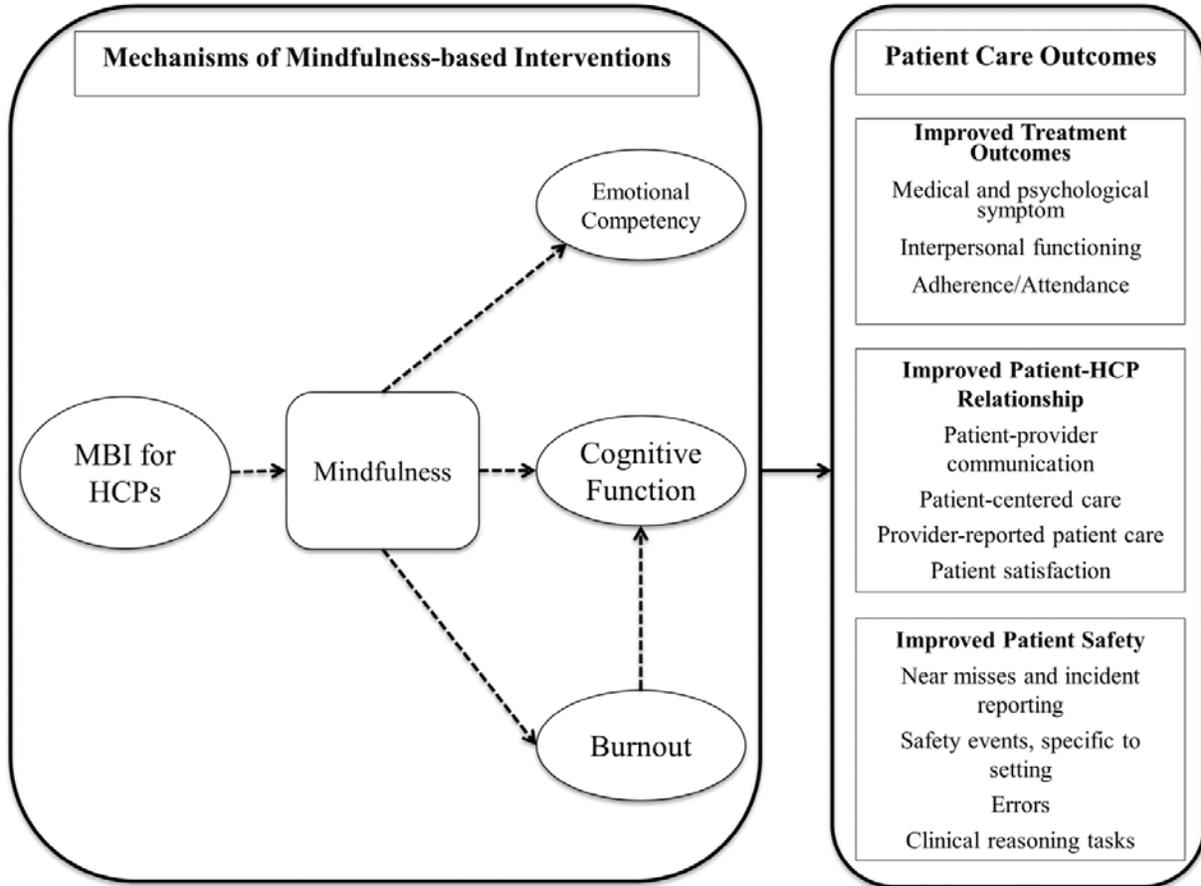


Figure 15. How Mindfulness Improves Patient Care



This grounded framework is not distinct from the improvement categories reported on above, but rather, builds from them. Participants reported that the *integration* of mindfulness practices and principles developed deeper *awareness* and *connection* with self and others, leading to increased *emotional competencies*, including *compassion*. (Terms in italics reflect subthemes of the developing framework.)

Integration was often described as a change in habit, or shifting of priorities to emphasize self-care. One participant said,

Just learning to prioritize it [mindfulness] and understanding that if that's something at the top of your list every day, looking at how your day works itself out versus when you

don't put it at the top of your list every day. Having that understanding that it really impacts how your day goes.

All of the participants discussed integration of informal mindfulness practices as strategies for managing stressful situations.

You can do it [mindfulness] anywhere... and it does not matter if you are at home, work, if you are at school, if you are in the bathroom, if you are just waking up, or just going to bed ...cooking, walking outside, whatever...you can do it whenever or wherever... you can fit almost any mindfulness practice in, while you are on a bus, or waiting or for whatever, it's not difficult and the benefits can be monumental.

Another participant described how she used informal practices at work,

I usually just like sit at my desk before going into a meeting or seeing a patient that I feel like is going to provoke my anxiety, and I just kind of like do - I do mindful breathing quite frequently. Or I sit and chose a mantra and breathe in and out to that mantra repeatedly for a couple minutes.

Another participant described using informal practices as essential to her integration,

Those [informal practices] are really helpful, especially because they're like things that you can do in the moment. You don't really have to have a quiet setting. Especially like with the stop be breathe, often times when I'm getting ready for work or getting ready for school, and I'm having a rough morning, I can sometimes catch myself getting worked up. Like if I'm getting in the car and I feel like rushing or if I'm forgetting something, like take a second to just stop, breathe and be.

Participants reported that the group's accountability was essential for integration,

The goal was to, from one class to the next, try to do at least one recording a day and then maybe document how you felt after it or be ready to share how that impacted your day, just keeping up with it. Again because I felt my experience, completing the task, people were relying on my feedback and that encouraged me to be more diligent, intentional about completing the task of meditating. And then it kind of formed a habit cause it was 8 weeks of that.

Alternatively, one participants reported guilt at not having kept up with the practices, "Yeah, I mean it was just hard to stay on top of it and so sometimes I was just like 'Oh, I shouldn't go' because I didn't do what I was supposed to." Another said that after MIHP, accountability was missing. "So I feel like once it ended, I definitely found myself not practicing mindfulness as

much as I was during the intervention.” Later she said, “So whenever I kind of found myself not practicing the mindfulness as regularly as I was during the intervention I kind of try and get on track. But it was nice throughout the intervention to have that accountability.” This supported the concept of needing integration for subsequent benefits from MIHP, as this participant’s report reflected less awareness of self and less connection with patients. Further, she demonstrated less awareness of the concept of mindfulness, frequently calling it relaxation and referring to progressive muscle relaxation as a mindfulness practice (which it is not, nor was it introduced in MIHP). This participant reported direct benefit from MIHP during the intervention (health benefits), but seemed to discuss these benefits in the past tense, citing the lack of integration as a source of concern for her current unmanaged stress.

Integration led to increased *awareness* and *connection*, bringing the practitioner into the present moment or “back to reality” when it was needed most. The participants reported that by practicing informal mindfulness they felt more “grounded,” “centered,” and “present.” It also built awareness of the mind-body connection and how detrimental stress can be to one’s health and functioning. One participant reported on the belief that being overworked is good for you,

It is made to look as if that is how it is supposed to be. And if you are not doing well, then you just need to figure out how to do better. But it’s like no, you actually need to change what you are doing cause that is why you are not..., its’ not something that is healthy for you to consistently be busy and not have a moment to breathe.

Another participant enrolled in MIHP due to health issues and said, “It was specifically a cardiac related issue with my heartbeat, so deep breathing and mindfulness and meditation is obviously helpful for that.” Awareness fostered connection; discussions on challenging topics developed a sense of belonging, of not being alone in their suffering:

The open platform of the other students and their shared experiences, what they try to do when they’re in a situation that is intense, because they’re in the health field and dealing

with patients that have anxiety. They are in the fast paced environment, so them sharing their own experiences in that open dialogue allowed you to realize that you are not alone in your struggles.

From this increased awareness and connection, participants reported improved *emotional competencies* (see emotion regulation above) and compassionate patient-centered care.

I think I just became really aware of how my own mental health can impact my patient care. And so, I think that's something I've been really mindful and aware of since participating in the intervention.

Participants described increased compassionate patient-centered care as less judgment toward their patients, better listening skills, and improved understanding for patients and work situations.

[The course] has helped me to not see the patient as diabetes or see a TBI or whatever, it's helped me see past their medical diagnosis and what has happened to them and the reason why they are there to get more useful information within my interactions, assessments, and conversations.

Another participant said,

There's going to be difficult moments, because I've definitely seen it. Being able to have a mindfulness course, yet again, this early on in my career, I feel like it has set the tone for what I need to be on the lookout for and how I need to handle certain situations.

Several quotes help to demonstrate this linear relationship wherein mindfulness improves patient care. One participant said, "I think, taking care of myself, I think brings me...is more...brings me more to the present moment when I'm working with others." Another said,

Spending 30 seconds being in the moment, doing some yoga. Even if it is just simple or little...sitting and breathing. That has such an impact on you that it actually ends up being healing to anyone that you deal with during your day. So if you are dealing with patients that is your goal, right?

Another said,

[with mindfulness] dealing with patients, you are kind of able to know what needs to be done. And that can be a little tricky when you have patients coming in and out, you are

also looking ahead because you are keeping up with the schedule and have to remind yourself what time it is and how much time you can devote to this patient. But when all is said and done, if you are able to just be in that moment and you are, at least I find for myself, that the time that I spend in the moment with the patient, I find myself a little more efficient because I am actually a little more focused on what I am doing for the patient rather than focusing on the patient that's ahead.

Another participant connected her ability to manage difficult situations with coworkers to her mindfulness practice,

As the new person sometimes it's really hard to say, you know, 'how about you not say that,' because I am the new person. It's a very fine line and I think with the mindfulness I get to take a step back and really analyze how I'm going to go about a certain situation.

Discussion

The present study investigated MIHP's feasibility and acceptability, effectiveness, mechanisms of action, and sustained effects at a three-month follow-up. Finally, this study explored participants experience with MIHP and used a grounded theory approach to develop a framework by which to understand mindfulness' potential effects on work-relevant functioning in HCP samples. The results of each Aim are discussed below and relevant conclusions drawn.

Aim 1. Feasibility and Acceptability

Results support feasibility of recruitment for a full-scale MIHP trial, with a high rate of enrollment from recruitment efforts. It is important to note, however, that recruitment yielded less than the number of participants stipulated by the power analysis (N=57, power analysis called for 66). Therefore, while there was a relatively low rate of participants lost to follow-up between recruitment and enrollment, there was not enough interest to meet the projected numbers. This was not likely due to a lack of interest by HCP students, but rather the inclusion criteria of no regular meditation practice and schedule availability; had these criteria not been necessary for inclusion, the study could have enrolled another 23 interested participants. Results

also supported the feasibility of quantitative measures as determined by high internal consistency and low rate of missing data.

With respect to the acceptability of randomization and procedures, the present study saw a 39% dropout rate from enrollment to follow-up, with 54% of the dropouts occurring between allocation and treatment initiation. Notably, between-group comparisons of dropouts versus non-dropouts on all outcomes at baseline revealed no differences. Therefore, it is unlikely that dropouts were due to psychological distress (e.g., burnout, depressive symptoms, perceived stress) or greater difficulties with cognitive demands (e.g., Trail Making Test A & B). When comparing retention rates for all those enrolled (ITT) versus those who attended the first session of MIHP (treatment initiators), MIHP did not demonstrate acceptability for the ITT sample (67% retention rate), but for treatment initiators retention rates were comparable (78% retention rate) to other randomized trials of MBIs for HCPs and students (Jain et al., 2007; Schroeder et al., 2018), which demonstrated 78% and 79% retention rates respectively.

It is important to place these dropout and retention rates of our ITT sample in the context of prior research. Two research studies investigating MBIs for HCPs – with varying levels of intervention evidence-base and adaptation, using RCTs and within-group designs – report higher rates of retention and lower dropout rates for their ITT samples than the present study (Jain et al., 2007; Schroeder et al., 2018). While other studies of mindfulness-based interventions for both HCP students and non-HCP samples have reported high dropout rates similar to the ITT sample in this study (e.g., 35% -44%; Chang et al., 2004; Shapiro et al., 2005). Moreover, several studies in HCPs with lower dropout rates provided course credit to their student participants (Bond et al., 2014; Danilewitz et al., 2016; Jain et al., 2007; Shapiro et al., 1998). In one, the intervention was mandatory as part of the students' training (Rodriguez Vega et al., 2014). In another, waitlist

control participants were paid to improve retention in that group only (Barbosa et al., 2013). In others, students and providers were provided with text book vouchers (de Vibe et al., 2013) or continuing education credits (Krasner et al., 2009). It is also important to note that in several of these studies the intervention leader and researcher was a superior to the students, residents, or providers (Krasner et al., 2009; Rodriguez Vega et al., 2014). The present study did not provide any educational or career gains (e.g., course credit, CMEs, or text books vouchers). Furthermore, the primary intervention leader and researcher was a peer to the participants. The present study did attempt to improve retention by offering a raffle for five participants to receive \$100 in the form of a gift card to Amazon, preferential group allocation, and the option to receive a feedback report at study-end. These recruitment efforts were little- to no-cost incentives that distinguish the present study from similar investigations of its kind. Compared to the other studies, this investigation did not have the funding to provide compensation for all participants. One advantage with this approach is the lower likelihood of confounding feasibility, acceptability, and efficacy outcomes with extrinsic motivation provided by study incentives.

Given the lower dropout rates after treatment initiation (i.e.,21), which were comparable or better than other studies in HCPs and students (Barbosa et al., 2013; Bondi, Rodriguez, Gould, Frazer, & Morilak, 2008; Chesak et al., 2015; Danilewitz et al., 2016; Jain et al., 2007; Shapiro et al., 2005), we argue that results support the feasibility of MIHP as an intervention. However, we cannot ignore the troubling results regarding acceptability of randomization and argue that randomization was unacceptable in this study and sample.

Several observations can be made about the feasibility of randomization in future studies. The significant difference between dropouts who were preferentially allocated versus randomized supports the use of preferential allocation in future trials, even with the potential

threats to internal validity that this method entails. Given the demanding and complicated schedules of HCP students, the present study offered preferential group allocation to acquire the necessary sample size. Even with the option to preferentially allocate, 11 interested HCP students did not meet criteria due to scheduling conflicts for both group interventions. These results suggest that randomization may not be feasible for HCP students and an 8-week intervention due to their schedules. Further investigation into the reason for dropouts could also be undertaken. In the present study, agreement with the ethical review board prevented us from contacting a participant more than three times with no response and no effort was made to inquire on dropout reasons if they were not offered voluntarily. Future work could improve upon these methods. Second, future trials could investigate the effects of compensation in various forms on retention, efficacy, and perceptions of intervention to better understand how research procedures to reduce retention may have unintended effects on motivation and thus outcomes. Third, it is important to learn from our mistakes. MIHP and other MBIs for HCPs and students may simply need to provide education or professional incentives to be feasible and acceptable. This is supported by the better retention rates for ITT samples when participants are given course credit or CME credits (Barbosa et al., 2013; Bondi et al., 2008; Chesak et al., 2015; Danilewitz et al., 2016; Jain et al., 2007; Schroeder et al., 2018; Shapiro et al., 2005) and in the retention rates of our previous MIHP studies without a control group when course credit was offered (Braun et al., 2019; Kinser et al., 2016).

Lastly, retention for treatment initiators was higher for the CG crossovers (85%) than the MG (72%). It is important to provide some context for these results; the MG received MIHP beginning mid-semester and into the beginning of summer semester, whereas the CG crossovers received MIHP throughout the summer semester. Given that the sample consisted of students, a

population significantly constrained by their academic calendars, the higher rate of dropout in the MG may be due in part to timing in the academic year. Future iterations of MIHP and mindfulness interventions for HCP students should adhere to the academic calendar, and perhaps provide course credit, to reduce these historical artifacts and potential effects on dropout rates. Notably, there were no dropouts from post-MIHP to the three-month follow-up in either group, suggesting that retention rates are very high once participants have fully completed the treatment protocol.

Aims 2-4. Between Group Differences

Psychological Functioning. A small effect was found for MIHP relative the waitlist control for reductions on two subscales of burnout, namely Cynicism and Exhaustion. Exhaustion saw a statistically significant group by time interaction favoring the MG and the group by time interaction indicated a trend for reduced Cynicism ($p=0.066$). There was no effect found for Professional Efficacy, the third subscale of burnout. Most notable was the large group by time effect found favoring MIHP relative the waitlist control on reduced perceived stress. All subscales of the dispositional mindfulness questionnaire demonstrated a medium group by time effect for MIHP relative the waitlist control. Taken together, it appears that MIHP had the largest effect on stress and dispositional mindfulness. Aspects of burnout, namely Exhaustion, also seem to be affected by MIHP. These results are encouraging and support continued investigation into MIHP for the improvement of psychological functioning in HCP students.

Cognitive Functioning. There was no effect of time or group by time on divided attention (TMT B/A ratio). This was juxtaposed by medium to large effects of time on both processing speed (TMT A) and processing speed with task switching (TMT B). These effects of time on domains of executive attention were not characterized by group by time interactions. In

fact, both groups improved across time. This likely reflects a practice effect. Most of the research on the Trail Making Test A & B has been conducted without the use of an alternate form, but most of this research was in clinical or older adult populations (Cash et al., 2016; Moynihan et al., 2013; Sachse et al., 2011). In this sample of interprofessional students who were presumably high functioning and primed to learn new tasks as students, they may have simply learned how to perform the Trail Making Test more quickly. It is worth noting that the ratio score, or pure measure of divided attention with processing speed and visual scanning held constant, had no evidence of a practice effect. It is possible that the more difficult task – divided attention – was not learned; rather, they simply improved their speed. It appears that MIHP did not improve divided attention. Future investigations of MIHP and mindfulness for HCPs should make use of an alternate form to determine whether MIHP has any specific effects on processing speed and task switching. Furthermore, future work should carefully select measures of executive attention to reduce the potential for practice effects.

Interprofessional Attitudes. There was no effect of time or group by time interactions on the two subscales of interprofessional attitudes measured in this study. Inspection of the means at baseline and Study Visit 2 show very little change. This may be reflective of the face-valid nature of the scale and the desire for respondents to present themselves favorably. It should also be noted that this measure was originally developed to assess team functioning following team-based learning exercises. Given that MIHP is not a team-based learning exercise, this measure may be ill-equipped to capture the more nuanced and subtle changes that group discussions applying mindfulness qualities to the stressors of HCPs may have on interprofessional attitudes.

Aim 5. Crossover Design and Investigation of Mediators

When crossovers (CG) were combined with the initial intervention group (MG) and the effects of MIHP were investigated in the treatment-completer sample, within-group results mirrored those found in the between-group analyses. Specifically, significant and medium to large effects were found for reductions in burnout subscales Cynicism and Exhaustion as well as perceived stress. No changes were found on burnout subscale Professional Efficacy or on depressive symptoms.

One unexpected finding was the reduction in Exhaustion, which differed based on group. The initial MG saw steeper decreases compared to the CG crossovers. It is unclear why the initial MG saw a different rate of change from pre- to post-MIHP relative the CG crossovers. Even though care was taken to standardize all aspects of the intervention it is possible that historical artifacts played a role. The initial MG may have demonstrated steeper reductions in Exhaustion because the assessment at post-MIHP for them fell at the beginning of summer, after finals; whereas, the assessment at post-MIHP for the CG crossovers fell at the middle of the summer semester. Thus, experience of school-related exhaustion may simply have been lower for the MG at post-MIHP given the time of year. However, no other outcomes were different between groups, suggesting a unique effect on Exhaustion.

The five subscales of dispositional mindfulness saw medium and large effects of time. Acting with Awareness, Observing, Describing Experience, Nonreacting to Inner Experience, and Nonjudging of Inner Experience increased from pre- to post-MIHP. Interestingly, increases in Observing were significantly affected by attendance such that higher rates of attendance predicted steeper increases in Observing from pre-to post-MIHP. This suggests that engagement in MIHP may be an explanatory factor for its positive effects on the skill of observing, an aspect

of present moment awareness. Future research should attempt to replicate these findings to corroborate the existence of this effect.

Similar to the between-group analyses, there was no effect found for divided attention or interprofessional attitudes. Processing speed significantly increased over time and these results were qualified by a significant effect of discipline. Interestingly, the nursing group saw larger increases in processing speed than the other disciplines. This finding may reflect that the nursing students were generally younger, not just in age, but also less educated than those in the other disciplines. However, the measure of processing speed was adjusted based on age and level of education so this seems an unlikely interpretation. There may be other reasons for nursing students to see a larger effect of time on processing speed, however, interpretations are cautioned here due to the fact that processing speed did not show a MIHP-specific effect, but rather seemed to increase as a result of practice effects. Therefore, these findings are unlikely to be due in any part to MIHP and therefore interpretations are likely unwarranted. Processing speed with the addition of task switching did not show an effect of time, however, attendance was a significant predictor, suggesting that higher attendance at MIHP predictor larger improvements in processing speed with task switching. It is unclear what aspect of attendance could be driving these effects on mindfulness (reported above) or executive attention. Given the multi-component nature of MIHP, findings regarding attendance could reflect the effect of social support, attention from intervention leaders/members, discussions on work stressors, yoga practice, meditation practice, or their combination. Therefore, little can be inferred regarding attendance until larger-scale trials with active control groups test for potential mechanisms of change. However, some interpretation can be made by considering these results alongside the results from the qualitative exploration in which participants reported gaining a sense of belongingness, sensing a change of

perspective, and learning skills with informal mindfulness practices from the group sessions. These may be important elements of MIHP to investigate in future trials, and at the very least, should be retained in future iterations of MIHP as potentially beneficial intervention elements. For an in-depth discussion of the qualitative exploration, see relevant section below.

Mediation analyses. Before conducting mediation analyses, the prevalence of practice was explored. Nine participants from the treatment completer sample never practiced, which represents 74% (26 out of 35) engagement in home practice. Of the various mindfulness practices provided in audio format, 4-minute breathing space, breath counting, and loving-kindness were the most practiced. For the latter two this was due to two participants who practiced these almost exclusively. The 4-minute breathing space was practiced by the most participants. The prevalence rates of guided meditation use reflects the importance of providing a wide range of practices for participants to choose from.

Practice time and practice quality were not significant mediators of the relationship between pre- to post-MIHP Cynicism, Exhaustion, perceived stress, mindfulness, or performance on a task of processing speed. This may have been related to the fact that methods for recording practice time were significantly limited. Practice time was only recorded when the participant completed the practice quality survey following the recording and many participants reported technical difficulties with this survey. These difficulties were addressed quickly, but it stands to reason that there is an unknown amount of missing practice time data. The same is true for the practice quality data. Therefore the lack of mediation is not necessarily reflective of a lack of true relationship. We discuss these limitations in more depth below, but several things have been learned and can therefore be recommended for future studies. Device and browser had an effect on technical difficulties and this may have been avoided if more extensive piloting had been

done. Reminding participants to practice may also be helpful to increase engagement. This could be done via email or text. During MIHP, participants were encouraged to use these strategies for increasing home practice, but this was not used as an intervention in itself – that is, the interventionist or researcher did not contact study participants in the form of reminders to practice meditation. Finally, at-home yoga practice was not tracked as a possible mediator. This was done to reduce the potential heterogeneity of mechanisms being tested, but given the focus on yoga in MIHP, this could be an avenue for future exploration, though it should be kept separate from the investigation of seated meditation as a mechanism.

It is also possible that neither practice time nor quality were significant mediators of effects for MIHP. This could be due to the multi-component nature of MIHP that includes yoga, group support, and introduction to informal mindfulness (practices integrated into the daily lives of practitioners), which were not measured as potential mediators in the present study. Without measuring all potential mechanisms, it is unclear which components of MIHP could be driving the effects on burnout, stress, and mindfulness. Another potential limitation could be that participants used other sources for meditation practice not tracked in the present study (e.g., non-study specific applications), creating noise in the statistical analyses of mediators. Future research could investigate practice time and quality and include yoga to investigate mindful movement as a potential mediator of effects. Future studies should also employ active control groups to control for social support, time spent discussing health and stress, and other nonspecific components of MIHP (MacCoon et al., 2012) to provide sophisticated investigation of mechanisms. Another recommendation for future research would be to monitor and track informal mindfulness practices. This could be done electronically, using ecological momentary assessment or daily diaries, in which participants report approximate counts for or time spent in

informal practices throughout their day. Some preliminary work has been conducted on the effects of informal mindfulness. One study, in a sample of undergraduate students, found that a mindfulness-based intervention with informal practices but without formal seated mindfulness was less effective in reducing stress and increasing compassion as compared to an intervention with formal seated meditation (Hindman, Glass, Arnkoff, & Maron, 2015). However, in this trial neither the amount of seated practice nor informal practice mediated changes in outcomes. Another study found conflicting results and demonstrated improvements on psychological symptoms for both intervention arms (informal practice only and seated meditation) compared to a waitlist control (Cavanagh et al., 2018). In HCPS, one study found an informal mindfulness exercise to improve state-level stress following difficult patient encounters relative a usual care group in family medicine residents (Edgoose, Regner, & Zakletskaia, 2015). Ultimately, more research on the effects of informal mindfulness is needed with careful classification of informal vs. formal practices and sophisticated monitoring of practice time, type, and quality to build upon these research questions.

Aim 6. Three-Month Follow-up

Results from the follow-up analyses demonstrated some sustained effects of MIHP at three months following the intervention and supported results from previous aims. Specifically, reductions in Exhaustion and perceived stress as well as improvements on all five subscales of mindfulness were maintained at the follow-up. Whereas reductions in Cynicism returned to Baseline levels at the Follow-up. Similar to previous aims, no effects were found for depressive symptoms or interprofessional attitudes.

Three main effects of time were qualified by two significant covariates at the follow-up. Exhaustion was characterized by a difference between the initial MG and CG crossovers at post-

MIHP only, reflecting the difference discussed in Aim 5. Perceived stress was also characterized by a difference between groups, this at the follow-up, suggesting the initial MG showed more sustained effects of MIHP relative to the CG crossovers. Given that Exhaustion seemed to decrease more in the initial MG at post-MIHP and reductions in perceived stress were greater for the initial MG at the follow-up, it is possible that MIHP had a greater effect for these participants than the CG crossovers. This could be due to the smaller class size (n=18) of the initial MG relative the size of the CG crossovers (n=27), making the intervention more impactful for the initial MG. It is also important to note the limited sample size and therefore lack of power in these post-hoc analyses, which prevents strong conclusions from being drawn regarding these treatment group differences. Though no main effects of time were found for interprofessional attitudes, the subscale measuring Team Attitudes was significantly different between disciplines, with the medical students reporting significantly higher Team attitudes than the other category. This is difficult to interpret due to the heterogeneity of disciplines in the other category. Discipline was grouped into three categories due to small sample size in each group and to retain power in analyses.

Aim 7. Grounded Theory Exploration

The present study explored the perceptions of a mindfulness course for HCP students and how mindfulness was thought to improve work-related functioning. A grounded framework was developed to better understand how mindfulness for HCPs may have its effects and to develop a theory which might guide future iterations of MIHP and future investigations. The results of this grounded theory approach revealed that, for participants who had the largest reductions in stress outcomes, mindfulness changed their habits, improved emotion regulation, developed compassion and connection with others, and enhanced patient care. These benefits were

discussed as starting with the self and, as mindfulness became more integrated into their daily lives, began to have larger and more other-focused benefits, including behaviors (dealing with difficult emotions), relationships, and patient care. These findings must be qualified by the limited number of participants interviewed (n=5). A larger sample would benefit this grounded theory model and results could change should more qualifying participants be interviewed and integrated into the current sample.

The grounded theory model revealed that mindfulness had its effects by first, becoming integrated in their lives. This integration was made possible from accountability in the group, learning self-care practices, and using mindfulness informally throughout their day as a strategy to manage difficult situations. This was interesting and not necessarily in line with most of the research to date (Burton et al., 2016; Lamothe et al., 2016) in that mindfulness practice was described as a tool to help manage stressful situations, but not necessarily reduce stress. Nevertheless, the participants were eligible for this aspect of the study from measurable and reported decreases in stress and burnout on quantitative measures; therefore, reductions in stress and burnout were demonstrated, albeit not discussed directly as a mechanism by which mindfulness improved work functioning. Stress reduction may occur in parallel with or downstream of improvements in emotional regulation and patient care rather than prior to, which is in line with other conceptualizations of how mindfulness may benefit HCPs (Epstein & Krasner, 2013).

The second and third steps in the grounded theory model for how mindfulness has its effects on HCP work-relevant functioning, was an experience of awareness and connection that arose from the successful integration. Participants described awareness as a sense of groundedness and centering that followed directly from the practice of informal mindfulness at work. The utility

and flexibility of informal practices were discussed as an important aspect of how mindfulness improves work-relevant functioning. This mirrors results from previous qualitative research on MIHP (Braun et al., 2019; Kinser et al., 2016). By centering and grounding the participants, mindfulness increased awareness of the self, thereby giving pause and enhancing emotional regulation. This aligns with several previous conceptualizations and theoretical understandings of mindfulness (Baer, 2003; Baer, Smith, & Allen, 2004; Creswell & Lindsay, 2014). The group based nature of MIHP was discussed as an important factor in increasing connection. Hearing stories from others with similar struggles developed a sense of belonging and provided unique perspectives for managing work situations. This represents a non-specific factor which may account for treatment gains; future research should test MIHP alongside an active control group designed to control for these group effects (see MacCoon et al., 2012 for a description of an active control) to see what effects, if any, remain specific to mindfulness. MIHP also cultivated awareness of how stress affects the body and the negative implications of pressures to stay busy. Participants gained awareness of what mindfulness is and were able to introduce practices and concepts to their patients. This also mirrors previous research on MIHP (Braun et al., 2019). MIHP also developed connection with the self and their patients, leading into the fourth step in the grounded theory model: developing emotional competencies. MIHP fostered compassion and understanding for their patients. This was discussed as less judgment of their patients, better listening skills, and more patience in moments of difficulty. These findings corroborate findings from a recent review suggesting mindfulness for HCPs may improve empathy (Lamothe et al., 2016), another review on the potential for mindfulness to improve patient care (Braun et al., 2018), as well as several commentaries on the purported benefits of mindfulness to positively

affect patient-centered care and provider biases (Burgess et al., 2016; Dierynck et al., 2017; Drach-zahavy & Saban, 2016).

Taken together the results of this grounded theory framework can be compared to the results from a recent review that proposed a model by which mindfulness may improve patient care (Braun et al., 2018). In the previous model, presented in Figure 14, the effects of mindfulness for HCPs were purported to first enhance mindfulness itself, thereby exerting effects on work-relevant outcomes (Braun et al., 2018). This was supported by our findings here and reflected in the grounded theory framework in the form of integration and awareness – mindfulness must be integrated into one’s life before functioning is affected. Then, in the previous model, mindfulness was proposed to improve several domains of functioning (emotional competencies, cognitive functioning, reduced burnout) and thus affect several aspects of patient care (treatment outcomes, patient relationship, and patient safety; Braun et al., 2018). The results of the grounded theory framework supported aspects of this model, but not the model as a whole. Specifically, we found support for improved emotional competencies which were described as improving the patient-provider relationship including patient-centered care and patient treatment outcomes (indirectly). However, we did not find support for improved cognitive functioning, in the qualitative or quantitative results, nor did participants report perceived improvements on patient safety. This could be a reflection of the student sample that had less clinical experience and perhaps less insight into things affecting patient safety. Overall, the results of the grounded theory framework seem to build upon the model proposed in Braun and colleagues (2018) and flesh out portions of the model, providing more insight into participants’ experience of how mindfulness had its effects on emotion regulation and patient-centered care.

Recommendations for future investigations. Following from the development of a grounded theory on mindfulness for HCPs, several recommendations can be made for future work. First, the ability to tolerate and regulate negative emotion may be an important outcome measure. Participants reported gaining skills to manage stress during difficult patient interactions, which should be explored in future investigations. This could be done in a laboratory setting with mock patient scenarios or in vivo within medical settings in which HCP-functioning or evaluation of care is measured during or immediately following stressful encounters. It may be helpful to measure physiological arousal of HCPs in the face of distressing clinical situations, to determine, along with HCP-reported distress, whether practicing mindfulness reduces stress or whether it reduces the duration of the stress response. This would build on previously published work in non-HCP populations demonstrating mindfulness may exert its health benefits by attenuating physiological arousal in the face of stressors (Brown, Weinstein, & Creswell, 2012; Creswell & Lindsay, 2014). More simply, a measure of coping styles could be investigated as an outcome, however, this measure would need to be specific to dealing with difficult clinical situations or at least relevant to coping within the work of a HCP. Important outcomes for patient care may be patient-centered care, as determined by coding interactions between providers and patients, or self-reported measures of compassionate care. It may be tempting to measure patient satisfaction, however, in the review by Braun et al., 2018, they found no effect of mindfulness for HCPs on patient satisfaction.

Importantly, the results presented here suggest that informal mindfulness practices may have a direct and beneficial effect on HCP work and patient care. Therefore, future studies should investigate the immediate and long-term effects of informal practices. This may be difficult to study as informal practices are hard to quantify since they happen in vivo and are

often brief and, by definition, integrated into the daily lives of practitioners. Ecological momentary assessment may prove beneficial for designing a study to investigate cumulative effects of informal practices – this would consist of randomly paging HCPs to practice informally and then measuring the effects on patient care outcomes relative to a group of HCPs not practicing informal mindfulness. This was preliminarily investigated in a recent study with findings supported by our grounded theory model – Edgoose and colleagues (2015) found that an informal practice at work improved HCP-perceptions of difficult patient encounters (Edgoose et al., 2015). Another method for investigating informal practices may be to follow the example by Edgoose et al., 2015, and measure HCP and patient outcomes prior to and following an encounter in which the HCP practices informal mindfulness immediately before the patient encounter and immediately after the baseline outcome measurement. This would provide information on the state-effects of informal practices as opposed to cumulative, or trait, effects.

The group treatment style of MIHP seemed to be important to participants. The group provided accountability for practice, a sense of belongingness, and differing perspectives, all of which contributed to integration and improved emotional competencies. Future investigations of MIHP and other MBIs for HCPs may test the effects of an intervention delivered online and/or one-on-one compared to an in-person group based intervention to uncover any group-specific effects. It is, however, recommended that MIHP be offered in a group-based setting to emphasize the gains reported by participants from the social component of the intervention.

Grounded theory in the context of quantitative results. In the grounded theory exploration, participants in the upper quartile of stress reduction reported improved awareness of the self, less judgment of the self, and a greater sense of groundedness in the present moment. This was corroborated by significant increases in dispositional mindfulness subscales Acting

with Awareness, Nonjudgment of Inner Experience, and Nonreactivity of Inner Experience. Gains in dispositional mindfulness were also supported by the report of integration of mindfulness qualities and practices into their daily lives.

Enhanced emotional competencies and emotion regulation was a main theme discerned with the grounded theory approach, however these outcomes were not measured quantitatively in the present study. Future studies should investigate the effects of MIHP on measures of emotional competencies using questionnaires of empathy or compassion. A more sophisticated approach could make use of laboratory tasks to test effects of altruistic behaviors.

The present study used quantitative and qualitative methods to investigate the mechanisms by which MIHP had its effects. Practice time and quality were investigated as potential mediators of changes on psychological and cognitive functioning. Results did not support either practice time or quality as significant mediators of the main effects found on measures of burnout, stress, dispositional mindfulness, and a processing speed task. When considered in the context of the grounded theory exploration, these results are supported – participants reported informal mindfulness practices, rather than formal practice quantity or quality, as the most often cited mechanism for MIHPs positive benefits on emotion regulation and work-relevant outcomes. Though participants described informal mindfulness as benefiting them, they did not discuss these benefits as reduced burnout or stress – the outcomes for which quantitative investigations found the largest effects. Perhaps reduced stress was implicit in their report of MIHPs benefits, and their discussion of improved skills for emotion regulation, connection, and dealing with difficult situations implied reduced stress. But they rarely discussed formal mindfulness or the quality of a practice as a driver of their perceived benefits. In addition to informal practices, the sense of belongingness and perspective from the group were also

frequently touted as important factors leading to improvements. Therefore, these results emphasize the need to investigate informal practices and the social/group component of MIHP as potential mechanisms by which it has its effects on burnout, stress, and measures of patient care.

Grounded theory conclusion. Overall, the grounded theory study of how mindfulness has its effects on HCP work-relevant functioning demonstrated the importance for informal practices to manage stress at work, ground the practitioner, and improve patient care. The model emphasized the need for integration of mindfulness into HCPs' daily lives to enhance emotion regulation and patient-centered care. The results provide insight and build upon a previous model of how mindfulness may exert its effects on patient care (Braun et al., 2018). The results of this study encourage investigations in which patient-centered care and HCP-stress response in the face of difficult clinical encounters are measured as outcomes. It also suggests investigations of informal mindfulness as a predictor of patient care are warranted.

Limitations

As with all studies, there were several notable limitations. First, because dropout rates were higher than guidelines suggest, threats to internal validity and reduced generalizability of findings were limitations of the present study. Further, randomization and study procedures were below expectations in terms of feasibility and acceptability, calling into question unintended effects of the research procedure on participants' ability to remain engaged. Furthermore, there may have been pre-existing group differences unaccounted for due to the quasi-randomization procedures. For example, participants unable to participate in the MG due to workload may have demonstrated increases in stress that would have diminished treatment effects had they been able to adhere to their randomization into the MG condition. However, these limitations were qualified by promising feasibility and acceptability once participants engaged in the intervention,

providing support for future larger-scale trials of MIHP. Second, the practice effects found on the measure of cognitive functioning prevented conclusions from being drawn regarding the potential for MIHP to affect cognition. Third, the restricted range on the measure of interprofessional attitudes suggests that this measure may not have been well-suited in the present study for capturing variability in interprofessionalism, much less, potential effects of MIHP. Fourth, it is important to note that effects in the present study were specific to self-report measures and were not found on the objective measures investigated. Therefore, effects of MIHP may be subjective in nature and interpretations regarding objective functioning are not warranted. Fifth, the small sample size reduced power, especially in investigations of relevant covariates and mediators, making interpretation of significant covariates tenuous. Sixth, the method for recording practice time was flawed and had an unknown amount of missing data, and therefore prevented conclusions from being drawn about the potential mediating effect of practice.

As mentioned previously, active-controlled studies are warranted to fully investigate mechanisms, especially given the multi-component nature of MIHP. The present study's findings could be due to several intervention components and are not limited to mindfulness practice specifically. Lastly, the present study could not properly blind participants to group allocation, therefore demand characteristics cannot be ruled out. This limitation is exacerbated by the use of self-report measures, which increase the potential for demand characteristics to confound results given that participants can determine the purpose of the questionnaires used.

Conclusion

The present study built upon previous work (Braun et al., 2019; Kinser et al., 2016) and demonstrated support for the feasibility and acceptability of the intervention, MIHP, in a

pragmatic, peer-led, waitlist controlled trial. However, randomization and study procedures were found to be unacceptable and could be due to lack of participant compensation, lack of school-specific compensation (e.g., course credit), or the time intensive nature of the study procedures. Results provide evidence for the effectiveness of MIHP on reducing domains of school-related burnout and perceived stress, and on improving participants' tendency to be mindful in their daily lives. No support was found for MIHP on cognitive functioning or interprofessional attitudes, however, due to practice effects and restricted range (respectively) these findings seem to be limited by measurement choices. Attendance in the intervention may be an important covariate for improvements in the ability of mindful observing and performance on a measure of executive attention. However, these results should be considered preliminary and, given the heterogeneity of MIHP, it remains unclear what element of attendance may be responsible for these effects. Practice time and quality did not mediate treatment gains and these findings were qualified by methodological limitations and warrant future investigation. At the three-month follow-up, participants demonstrated sustained reductions in one domain of burnout and perceived stress, as well as sustained increases in dispositional mindfulness.

Overall, effectiveness of MIHP was strongest on outcomes of perceived stress and dispositional mindfulness, with some evidence for effects on burnout. The grounded theory approach explored participants with the largest reduction in burnout and perceived stress and found that they reported increased self-awareness, integration of mindfulness skills and principles, and improved emotion regulation from MIHP. These effects were described as having a positive effect on patient care and work functioning. When quantitative results are considered alongside results from the grounded theory framework, the integration and improvement of participants' present moment awareness, nonjudgment, and compassion seemed to improve

stress management at work and in life to enhance patient-centered care. Future studies should continue to investigate MIHP, using preferential group allocation to maximize participation and measure effects on emotional competencies (compassion, empathy) and patient-centered care to build upon this work.

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APPENDIX A
RECRUITMENT FLYER



Are you a healthcare professional student interested in mindfulness training? You may be eligible for a new study and FREE evidence-based mindfulness course

WHAT: 8-week evidence-based mindfulness training for improved burnout and resilience in healthcare professional trainees

WHO: ANY HEALTHCARE PROFESSIONAL STUDENT/TRAINEE AT VCU (e.g., in nursing, medicine, psychology, dentistry, and more)

WHEN: Email for details

WHY: FREE MINDFULNESS, MEDITATION, AND YOGA TRAINING. Entered to win \$100 in compensation, and a personalized report of your cognitive and psychological functioning at study-end.

INTERESTED: CONTACT SARAH BRAUN in the Dept. of Psychology at mindfulhcps@vcu.edu or visit <https://rampages.us/mindfulhcps>

APPENDIX B

PSYCHOLOGICAL AND COGNITIVE FEEDBACK REPORT EXAMPLE

Psychological and Cognitive Functioning Report

Thank you for participating in our mindfulness study! Below you will find some information about many of the outcomes that we measured throughout our study. You were surveyed four times: at baseline (BL), after the mindfulness course (P1), at a two-month follow-up (P2) and at a three-month follow-up (3F). Below you will see a breakdown of your scores at each time point. This report is not meant to be diagnostic, but rather to provide you with general information about your psychological and cognitive functioning. If you have any other questions, please do not hesitate to contact me, Sarah Braun, at braunse2@vcu.edu.

Psychological Functioning:

One of the main outcomes of our study was burnout. Student burnout was assessed on two domains: Cynicism and Exhaustion.

- Cynicism is the tendency to distance yourself from your work and is conceptualized as an unhealthy coping mechanism. An increase in scores suggests an increase in cynicism.
 - From BL to P1 your Cynicism saw a marked decrease from the high to low range.
 - From P1 to P2 your Cynicism did not change.
 - From P2 to 3F your Cynicism increased from low to moderate.
 - Overall, from BL to 3F your reported Cynicism saw a clinically significant decrease following the mindfulness course, but increased thereafter.
- Exhaustion is conceptualized as not having emotional resources to manage your work and school stressors. An increase in scores suggests an increase in exhaustion.
 - From BL to P1 your Exhaustion saw a marked decrease from the high range to the low range.
 - From P1 to P2 your score did not change.
 - From P2 to 3F your score did not change.
 - From BL to 3F, your reported Exhaustion saw a clinically significant decrease that was maintained throughout.

We also measured a number of other psychological outcomes, such as depressive symptoms, perceived stress, and state anxiety. For all these measures, higher scores or increases indicate more reported emotional distress.

- Depressive symptoms
 - Overall, from BL to 3F your depressive symptoms did not change and remained in the minimal range.
- Perceived Stress
 - From BL to P1 your perceived stress levels saw a marked decrease but remained in the moderate range.

- From P1 to P2 your perceived stress levels increased slightly.
- From P2 to 3F your perceived stress levels increased.
- From BL to 3F your perceived stress decreased following the mindfulness course but gradually returned to baseline.
- State Anxiety
 - From BL to P1 you demonstrated a decrease in state anxiety.
 - From P1 to P2 your state anxiety did not change.
 - From P2 to 3F you demonstrated an increase in state anxiety.
 - From BL to 3F your reported state anxiety saw a reduction following the mindfulness course that increased thereafter.

Another main outcome of our study was dispositional mindfulness or the tendency to be mindful in your daily life. For this measure, increases in your score suggest an improvement in your tendency to be mindful.

- From BL to P1 you demonstrated a dramatic increase.
- From P1 to P2 your dispositional mindfulness did not change.
- From P2 to 3F your dispositional mindfulness did not change.
- Overall, your dispositional mindfulness saw an improvement throughout the study that was maintained at the three-month follow-up.

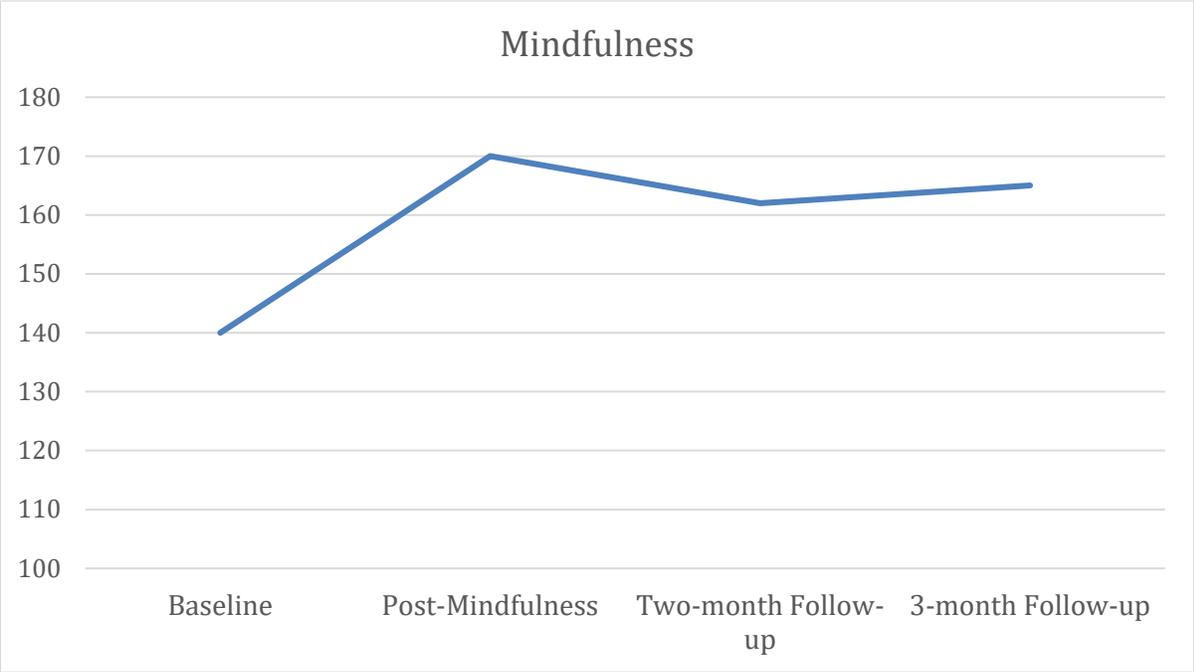
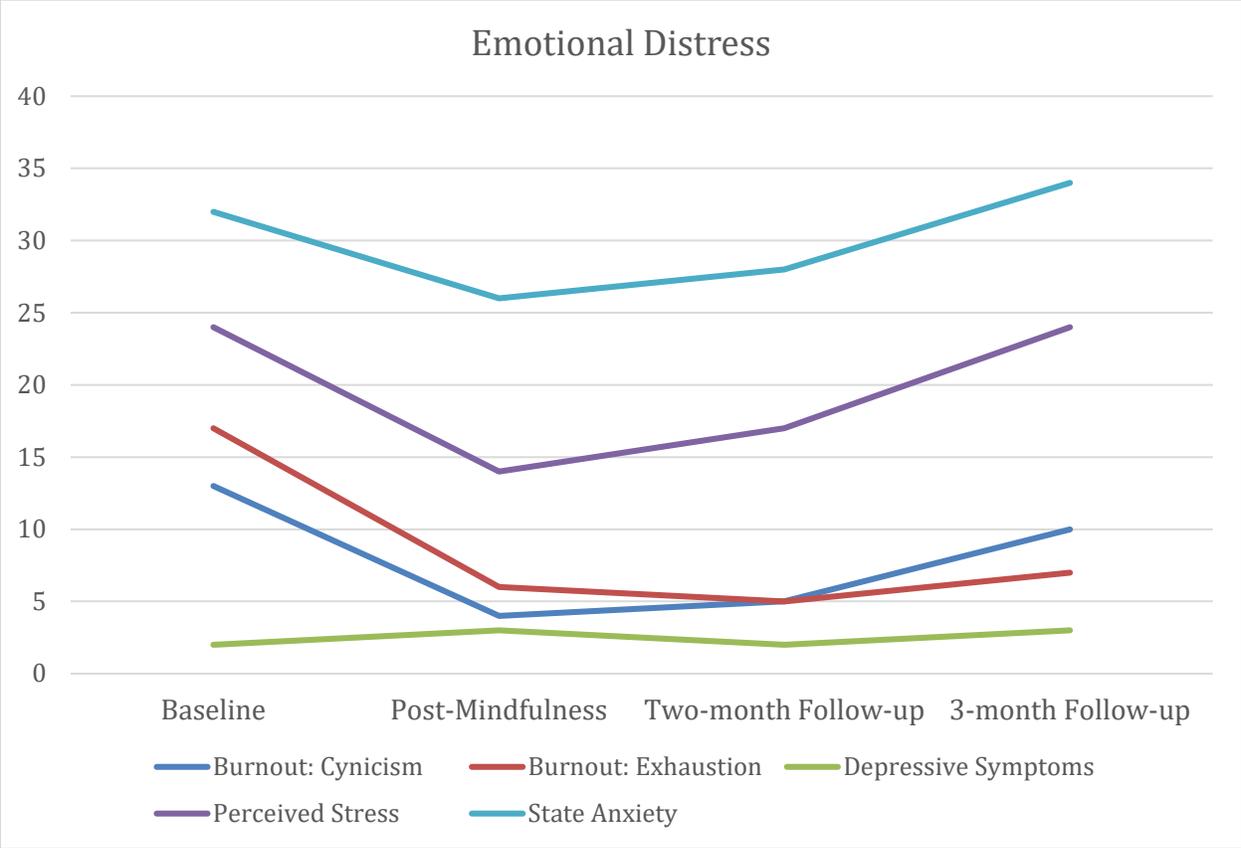
Cognitive Functioning:

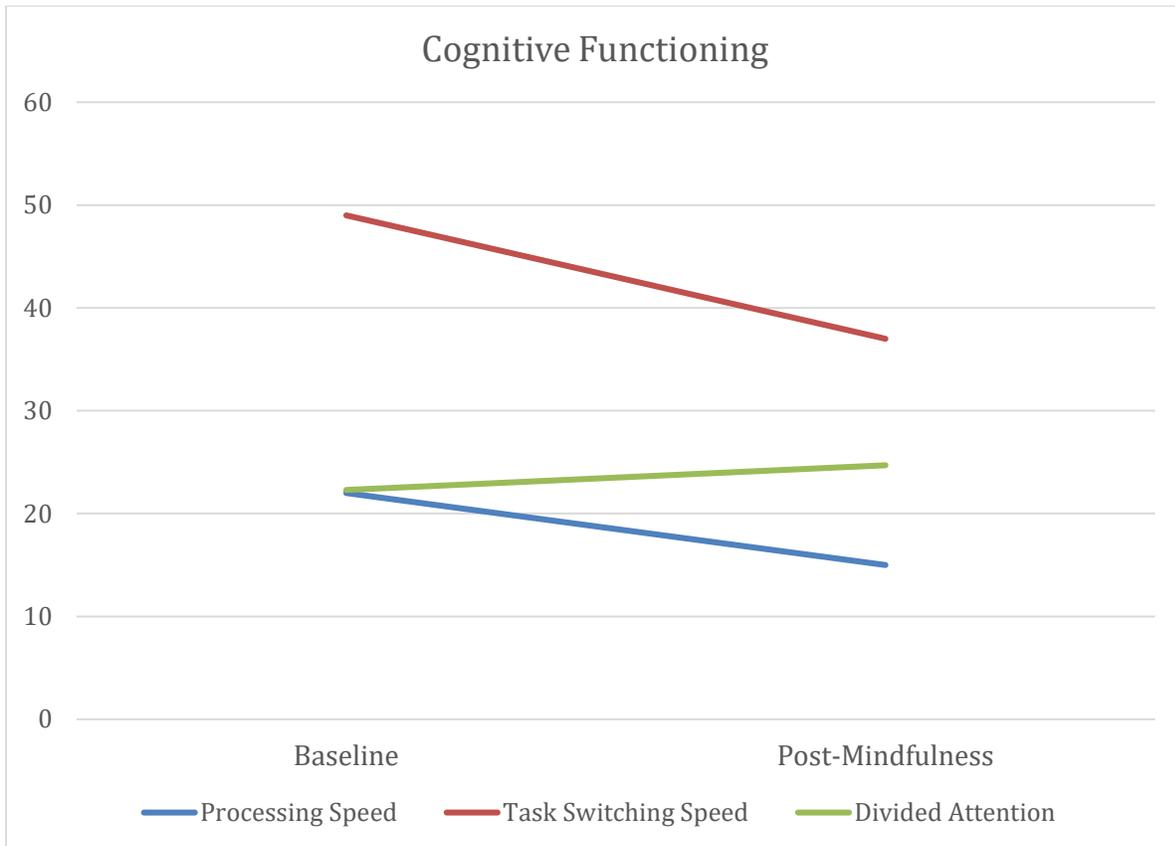
We measured three aspects of cognitive functioning: processing speed, task switching speed, and divided attention. We only measured cognitive functioning at BL, P1, and P2.

- Processing speed:
 - From BL to P1 your performance improved.
 - Overall, your processing speed improved.
- Task switching speed:
 - From BL to P1 your performance improved.
 - Overall, your task switching speed improved.
- Divided attention:
 - From BL to P1 your performance did not change.
 - Overall, your divided attention did not change.

Graphs:

Below are the changes in several outcomes displayed graphically. Note: Lower scores on the cognitive functioning measures indicate better performance, whereas higher scores on the psychological functioning measures indicate more distress. The one exception is mindfulness, which is better when higher!





Summary:

Overall, your psychological functioning and emotional distress improved following the mindfulness course. Anxiety, perceived stress, and one domain of burnout saw increases at the three-month follow-up. Mindfulness improved following the mindfulness course and these improvements were also maintained at the three-month follow-up. Your cognitive functioning also improved, specifically your processing and task switching speed improved – way to go!

Recommendations:

Overall, your reported depressive symptoms, burnout, and perceived stress were lower than average. The mindfulness course seemed to improve your experience of burnout, anxiety, and stress. It may have also improved your cognitive functioning. I hope you continue practicing mindfulness. Your profile demonstrated some loss of gains in psychological functioning at the follow-up; therefore, if you should ever experience emotional distress, the following resources are provided. If you have any other questions, do not hesitate to contact me, Sarah Braun at braunse2@vcu.edu.

Richmond Behavioral Health Authority

- Crisis Line: 804-819-4100
- 107 South Fifth Street, Richmond, VA 23219

University Counseling Services (for students and employees)

- Monroe Park Campus
 - Monday-Friday, 8am-4:30pm
 - University Student Commons, Room 238
 - (804) 828-6200
- MCV Campus
 - Monday-Friday, 8am-4:30pm
 - VMI Building, Room 412
 - (804)828-3964

In case of an after-hours emergency, call VCU Police dispatcher at (804) 828-1234 and ask to speak to a therapist.

Student Health (students only)

- Monroe Park Campus
 - 1300 W. Broad St., Suite 2200
 - (804) 828-8828
- MCV Campus
 - 1000 E. Marshall St., Room 305
 - (804) 828-9220

APPENDIX C

INTERVENTION THEMES

Mindfulness for Interdisciplinary Healthcare Professionals – Session Themes

Introduction to Mindfulness (5 minutes of meditation)	
Mindfulness to Handle Burnout (7 minutes of meditation)	
Applications of Mindfulness in Healthcare (8 minutes of meditation)	
Mindful Teams and Leadership (10 minutes of meditation)	
Interpersonal Mindfulness and Mindful Patient Care (12 minutes of meditation)	
Mindfulness in the Presence of Suffering (15 minutes of meditation)	
Mindfulness and Compassion in the Face of Imperfection (20 minutes of meditation)	
Finding Balance Through Mindful Living (20 minutes of meditation)	

Note: The intervention was developed by a team of interdisciplinary healthcare professionals and students including the author and mentors of the current dissertation. Using two manualized mindfulness-based interventions: MBSR (Kabat-Zinn, 1982) and an adapted version of MBSR for physicians (Krasner et al., 2009), qualitative and quantitative pilot data (Braun et al., 2019; Kinser et al., 2016), and a thorough review of mindfulness intervention literature, the MIHP intervention was developed as an 8-week skills-based course for credit for graduate level interdisciplinary HCP trainees (Kinser et al., 2016). Each week, participants engage in 45-60 minutes of didactic and discussion on a different topic relevant to the specific stressors of HCP work, followed by 60 minutes of formal mindfulness practice.

APPENDIX D
SURVEY INSTRUMENTS
Demographics Form

1. Age:
2. Gender:
 - a. Male
 - b. Female
 - c. Non-binary
3. Race/Ethnicity:
 - a. Black
 - b. White, non-Hispanic
 - c. Hispanic
 - d. Asian/Pacific Islander
 - e. Native American/Eskimo
 - f. Other:
4. Martial Status:
 - a. Single
 - b. Living w/partner
 - c. Married
 - d. Divorced/Separated
 - e. Widowed
 - f. Other:
5. Do you have any children?
 - a. Yes
 - b. No
 - c. If so, how many:
6. What department or school are you pursuing your degree in:
 - a. School of Nursing
 - b. School of Medicine
 - c. School of Dentistry
 - d. School of Pharmacy
 - e. Department of Psychology
 - f. School of Social Work
 - g. Allied Health
 - h. Other
7. What degree are you currently pursuing?
8. In what year of study or training are you currently enrolled (do not include undergraduate study, only graduate and post-graduate years of training)??
9. How would rate your current health?
 - a. Excellent
 - b. Good
 - c. Not sure
 - d. Fair
 - e. Poor

10. Please describe any major life changes that have occurred within the last 6 months (e.g., move to a new city, change in job, change in marital status, death in the family, etc.):
11. Please indicate if you are taking any of the psychotropic medications listed below (you may select more than one).
 - a. Stimulant (e.g., Adderall, Ritalin)
 - b. SSRI (e.g., Zoloft, Paxil)
 - c. SNRI (e.g., Effexor)
 - d. Benzodiazepine (e.g., Ativan, Xanax, Klonopin)
 - e. Other:
 - f. None
12. Do you have a current or history of psychiatric diagnosis (e.g., ADHD, depression)?
 - a. Yes
 - b. No
13. If yes, is it current or past?
 - a. Current
 - b. Past
14. Please describe current or past history of psychiatric diagnoses:
15. How often do you drink alcohol?
 - a. Not at all
 - b. Not every day, but a couple of drinks per week
 - c. 1-2 drinks most every day
 - d. More than 2 drinks per day

Maslach Burnout Inventory – Student Survey

The purpose of the following survey is to assess how university students view their studies and their reactions to academic work.

Instructions: On the following pages are 16 statements of university-related feelings. Please read each statement carefully and decide if you ever feel this way about your academic work. If you have never had this feeling, select the **Never** option. If you have had this feeling, indicate how often you feel it by selecting the phrase that best describes how frequently you feel that way. The phrases describing the frequency are:

- 0 Never
- 1 A few times a year or less
- 2 Once a month or less
- 3 A few times a month
- 4. Once a week
- 5 A few times a week
- 6 Every day

- 1. I feel emotionally drained by my studies. Ex
- 2. I feel used up at the end of the day at the university. Ex
- 3. I feel tired when I get up in the morning and have to face another day at the university. Ex
- 4. Attending classes all day is really a strain for me. Ex
- 5. I can effectively solve the problems that arise in my studies. PA
- 6. I feel burned out from my studies. Ex
- 7. I feel I am making an effective contribution in class. PA
- 8. I've become less interested in my studies since my enrollment. CY
- 9. I have become less enthusiastic about my studies. CY
- 10. In my opinion, I am a good student. PA
- 11. I feel exhilarated when I accomplish something at the university PA
- 12. I have accomplished many worthwhile things in my studies. PA
- 13. I just want to get my work done and not be bothered. CY
- 14. I have become more cynical about whether my university work contributes anything. CY
- 15. I doubt the significance of my studies CY
- 16. While working at the university, I feel confident that I am effective at getting things done. PA

Patient Health Questionnaire – 9 item

Over the last 2 weeks, how often have you been bothered by any of the following problems? <i>(Use "X" to indicate your answer)</i>	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

Perceived Stress Questionnaire

The questions in this scale ask you about your feelings and thoughts *during the last month*. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly.

	Never 0	Almost Never 1	Sometimes 2	Fairly Often 3	Very Often 4
1. In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. In the last month, how often have you felt nervous and “stressed”?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. In the past month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. In the last month, how often have you felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. In the last month, how often have you been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. In the last month, how often have you felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. In the last month, how often have you been angered because of things that happened that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Five Facet Mindfulness Questionnaire

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

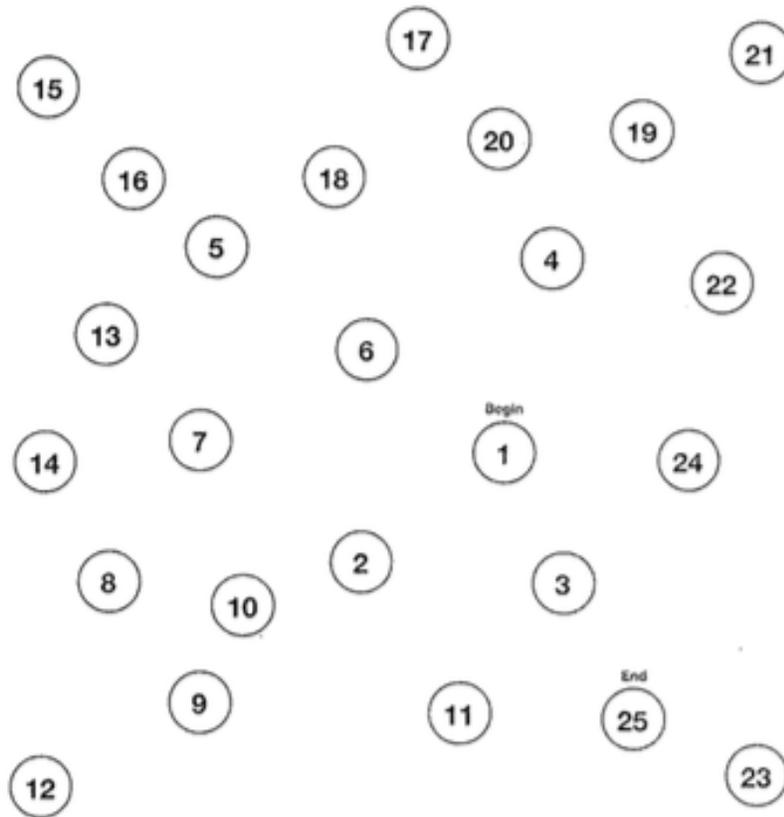
1	2	3	4	5
Never or very rarely true	Rarely true	Sometimes true	Often true	Very often or always true

- _____ 1. When I'm walking, I deliberately notice the sensations of my body moving.
- _____ 2. I'm good at finding words to describe my feelings.
- _____ 3. I criticize myself for having irrational or inappropriate reactions.
- _____ 4. I perceive my feelings and emotions without having to react to them.
- _____ 5. When I do things, my mind wanders off and I'm easily distracted.
- _____ 6. When I take a shower or bath, I stay alert to the sensations of water on my body.
- _____ 7. I can easily put my beliefs, opinions, and expectations into words.
- _____ 8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
- _____ 9. I watch my feelings without getting lost in them.
- _____ 10. I tell myself I shouldn't be feeling the way I'm feeling.
- _____ 11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
- _____ 12. It's hard for me to find the words to describe what I'm thinking.
- _____ 13. I am easily distracted.
- _____ 14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
- _____ 15. I pay attention to sensations, such as the wind in my hair or the sun on my face.
- _____ 16. I have trouble thinking of the right words to express how I feel about things.
- _____ 17. I make judgments about whether my thoughts are good or bad.
- _____ 18. I find it difficult to stay focused on what's happening in the present.
- _____ 19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
- _____ 20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
- _____ 21. In difficult situations, I can pause without immediately reacting.
- _____ 22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.
- _____ 23. It seems I am "running on automatic" without much awareness of what I'm doing.
- _____ 24. When I have distressing thoughts or images, I feel calm soon after.
- _____ 25. I tell myself that I shouldn't be thinking the way I'm thinking.
- _____ 26. I notice the smells and aromas of things.
- _____ 27. Even when I'm feeling terribly upset, I can find a way to put it into words.
- _____ 28. I rush through activities without being really attentive to them.
- _____ 29. When I have distressing thoughts or images I am able just to notice them without reacting.
- _____ 30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
- _____ 31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

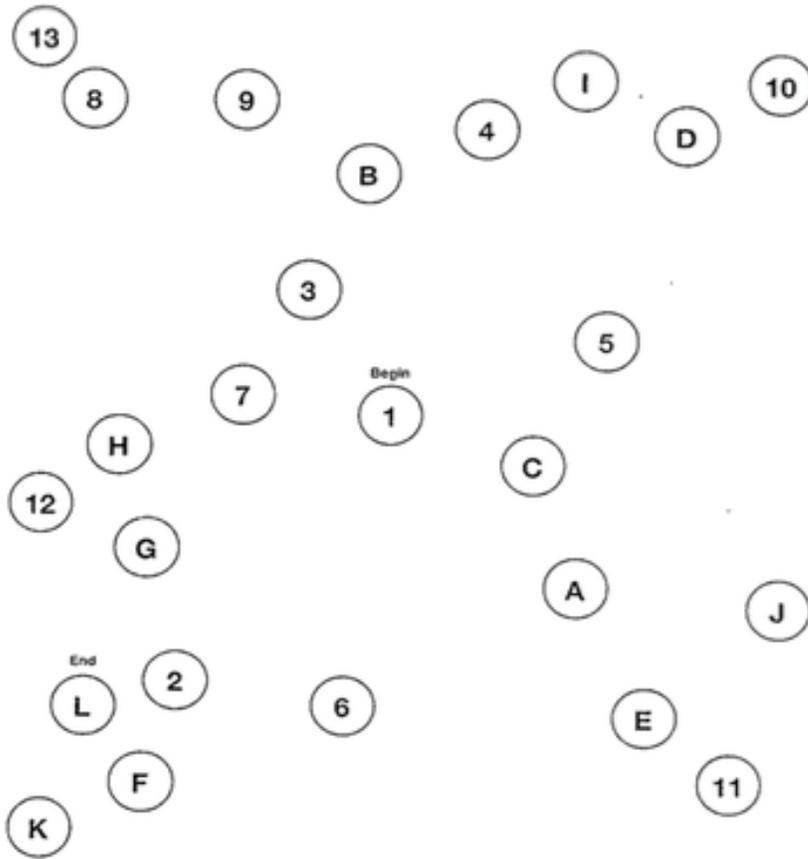
- _____ 32. My natural tendency is to put my experiences into words.
- _____ 33. When I have distressing thoughts or images, I just notice them and let them go.
- _____ 34. I do jobs or tasks automatically without being aware of what I'm doing.
- _____ 35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.
- _____ 36. I pay attention to how my emotions affect my thoughts and behavior.
- _____ 37. I can usually describe how I feel at the moment in considerable detail.
- _____ 38. I find myself doing things without paying attention to them.
- _____ 39. I disapprove of myself when I have irrational ideas.

Trail Making Test A & B

Trial A



Trails B



RGP
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GiiC
geriatric
interprofessional
collaboration



SPICE – Adapted

Please be completely honest as you rate the extent of your agreement with each of the following statements:

- Strongly Disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly Agree
1. Working with students from other disciplines enhances my education
 2. My role within the interdisciplinary team is clearly defined
 3. Health outcomes are improved when patients are treated by a team of professionals from different disciplines
 4. Patient satisfaction is improved when patients are treated by a team of professionals from different disciplines
 5. Participating in educational experiences with another discipline of students enhances my future ability to work on an interdisciplinary team
 6. All health professions students should be educated to establish collaborative relationships with members from other disciplines
 7. I understand the roles of other professionals within the interdisciplinary team
 8. Healthcare professionals should collaborate in teams
 9. During their education, students should be involved in teamwork in order to understand their respective roles

Practice Quality

Revised six-item Practice Quality-Mindfulness (PQ-M)

With respect to the session you just completed, please indicate the approximate percentage of time that your experience reflected each statement below.

1. During practice, I attempted to return to my present-moment experience, whether unpleasant, pleasant, or neutral.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. During practice, I attempted to return to each experience, no matter how unpleasant, with a sense that “It’s OK to experience this”.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. During practice, I attempted to feel each experience as bare sensations in the body (tension in throat, movement in belly, etc).

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. During practice, I was struggling against having certain experiences (e.g., unpleasant thoughts, emotions, and/or bodily sensations).

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. During practice, I was actively avoiding or “pushing away” certain experiences.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. During practice, I was actively trying to fix or change certain experiences, in order to get to a “better place”.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Qualitative Interview Questions

The following are example questions that will guide the development of the semi-structured interview along with mentorship from Dr. Alan Dow and Dr. Marianne Baernholdt regarding patient care issues, and mentorship from Dr. Patricia Kinser and Dr. Rosalie Corona regarding qualitative research.

Project question: **How** does mindfulness improve stress?

PRIMARY AIMS

1. Tell me about your experience with the mindfulness course.
2. How has mindfulness affected you, if at all? [Use their words if possible]
3. *If not already gathered:* What mindfulness skills or practices do you continue to use? In your personal life? In your work/school life?
 - a. *Follow-up question:* How do these practices influence /support you?
4. *If not already gathered:* How has mindfulness influenced your management of work- or school-related stressors, if at all?
 - a. *Follow-up question:* How do you handle stressors in your clinical practice/training environment? What skills are helpful to you when you feel stressed out at work?

SECONDARY AIMS

5. *If not already gathered* What are some of your favorite aspects of training as a healthcare professional?
 - a. *If involved in patient care:* What are some of your favorite aspects of working with patients?
6. *If not already gathered* What are some of the challenges to training as a healthcare professional?

- a. *If involved in patient care:* What are some of the challenges to providing quality patient care?
7. Do you have any recommendations for future iterations of the course, i.e., any things you would change?
8. When in your training do you think this course would be most beneficial?
9. What are some challenges to practicing mindfulness?
10. Would you recommend this course to someone else? Why or why not?

ASK AT THE END

11. You were selected to be in this study because you demonstrated one of the largest improvements on a measure of perceived stress and school-related burnout. How do you interpret those improvements?
12. As you know, this is a research study, so we will be publishing the findings. What would you hope is shared with the world about this course and your experience as a clinician in it?

APPENDIX E

ADDITIONAL GROUP COMPARISONS

Supplementary Table 1. Independent Samples T-Tests Comparing Groups on Outcomes at Baseline

Outcome	MIHP n=13 M (SD)	Waitlist Control n=19 M (SD)	P value
MBISS CY	11.15 (7.84)	11.47 (7.59)	0.94
MBISS EX	15.77 (6.07)	15.42 (5.73)	0.44
MBISS PE	25.83 (4.57)	25.21 (5.40)	0.45
PHQ	6.54 (4.88)	8.22 (4.51)	0.32
PSS	28.25 (4.81)	27.83 (7.49)	0.36
FFMQ AA	23.23 (5.09)	23.74 (6.2)	0.85
FFMQ O	25.77 (4.05)	24.58 (7.09)	0.50
FFMQ D	28.08 (6.14)	27.37 (5.55)	0.37
FFMQ NR	19.75 (3.93)	19.17 (4.74)	0.93
FFMQ NJ	23.58 (5.96)	26.58 (6.82)	0.26
TMT B/A Ratio	2.42 (0.57)	2.29 (0.52)	0.61
TMT A	46.77 (16.04)	42.00 (11.53)	0.35
TMT B	45.69 (11.27)	43.05 (7.34)	0.19
SPICE Team	22.77 (2.31)	22.95 (2.15)	0.66
SPICE Patient	9.31 (1.11)	9.16 (1.07)	0.71

Note: Comparison of the treatment completer sample at Study Visit 2; M=Mean; SD=Standard Deviation; MBISS=Maslach Burnout Inventory Student Survey; CY=Cynicism; EX=Exhaustion; PE=Professional Efficacy; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; FFMQ=Five Facet Mindfulness Questionnaire; AA=Acting with Awareness; O=Observe; D=Describe; NR=Nonreactivity to Inner Experience; NJ=Nonjudging of Inner Experience; TMT=Trail Making Test; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. * p <0.05; ** p<0.01.

Supplementary Table 2. Independent Samples T-Tests Comparing Dropouts to Nondropouts on Outcomes at Baseline

Outcome	Dropouts n=17 M (SD)	Nondropouts n=40 M (SD)	P value
MBISS CY	10.94 (5.88)	9.85 (7.67)	0.60
MBISS EX	15.12 (7.26)	13.95 (5.93)	0.53
MBISS PE	25.47 (6.11)	26.28 (5.30)	0.62
PHQ	7.59 (4.40)	6.20 (4.76)	0.32
PSS	27.94 (5.57)	26.39 (7.29)	0.44
FFMQ AA	24.24 (5.63)	24.28 (5.66)	0.98
FFMQ O	23.77 (5.87)	25.48 (5.64)	0.31
FFMQ D	26.41 (5.34)	28.46 (6.02)	0.23
FFMQ NR	18.38 (4.26)	19.95 (3.98)	0.20
FFMQ NJ	24.12 (6.90)	26.03 (6.46)	0.32
TMT B/A Ratio	2.18 (0.57)	2.27 (0.54)	0.60
TMT A	44.06 (11.04)	43.73 (12.78)	0.93
TMT B	47.59 (10.75)	45.58 (9.83)	0.49
SPICE Team	22.53 (2.07)	22.55 (3.29)	0.98
SPICE Patient	9.00 (1.00)	9.20 (1.22)	0.56

Note: Dropouts = Participants from both groups that dropped out between Pre-MIHP and Post-MIHP; M=Mean; SD=Standard Deviation; MBISS=Maslach Burnout Inventory Student Survey; CY=Cynicism; EX=Exhaustion; PE=Professional Efficacy; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; FFMQ=Five Facet Mindfulness Questionnaire; AA=Acting with Awareness; O=Observe; D=Describe; NR=Nonreactivity to Inner Experience; NJ=Nonjudging of Inner Experience; TMT=Trail Making Test; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. * p <0.05; ** p<0.01.

Supplementary Table 3. ANOVAs for Treatment Initiator Sample

Outcome	MIHP n=18 M (SD)		Waitlist Control n=19 M (SD)		Partial η^2 Time	p-value Time	Partial η^2 Group*Time	p-value Group*Time
	Pre	Post	Pre	Post				
MBISS CY	11.11 (7.37)	8.17 (6.79)	11.47 (7.59)	10.94 (5.80)	0.10	0.058*	0.05	0.18
MBISS EX	14.65 (6.60)	9.06 (7.60)	15.42 (5.73)	14.11 (5.67)	0.23	0.003**	0.10	0.059*
MBISS PE	26.65 (5.17)	26.94 (7.03)	25.21 (5.40)	25.05 (6.14)	0.00	0.92	0.00	0.75
PHQ	5.94 (4.84)	4.72 (5.68)	8.22 (4.51)	7.94 (5.32)	0.06	0.14	0.03	0.35
PSS	26.47 (6.51)	21.24 (8.04)	27.83 (7.49)	27.56 (7.75)	0.22	0.005**	0.18	0.01**
FFMQ AA	24.44 (5.67)	27.56 (4.68)	23.74 (6.20)	22.42 (5.86)	0.05	0.20	0.23	0.003**
FFMQ O	25.78 (3.70)	29.11 (4.44)	24.58 (7.09)	24.79 (5.69)	0.18	0.01**	0.14	0.022**
FFMQ D	27.69 (6.09)	28.53 (5.94)	27.37 (5.55)	26.21 (4.13)	0.00	0.86	0.08	0.10
FFMQ NR	20.06 (3.68)	23.35 (3.46)	19.17 (4.74)	19.11 (3.71)	0.15	0.021**	0.16	0.017**
FFMQ NJ	22.82 (5.67)	26.53 (7.48)	26.58 (6.82)	27.26 (7.28)	0.22	0.004**	0.12	0.038**
TMT B/A Ratio	2.27 (0.58)	2.48 (0.99)	2.29 (0.52)	2.35 (0.69)	0.03	0.29	0.01	0.56
TMT A	46.83 (13.94)	52.39 (14.25)	42.00 (11.53)	47.47 (10.39)	0.35	0.000**	0.00	0.98
TMT B	47.94 (11.18)	50.89 (9.63)	43.05 (7.34)	48.00 (9.13)	0.21	0.004**	0.02	0.44
SPICE Team	22.78 (2.24)	23.00 (2.08)	22.95 (2.15)	23.00 (2.36)	0.01	0.54	0.00	0.71
SPICE Patient	9.17 (1.10)	8.94 (1.11)	9.16 (1.07)	9.00 (1.05)	0.04	0.22	0.00	0.83

Note: MIHP=Mindfulness for Interdisciplinary Healthcare Professionals; M=Mean; SD=Standard Deviation; MBISS=Maslach Burnout Inventory Student Survey; CY=Cynicism; EX=Exhaustion; PE=Professional Efficacy; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; FFMQ=Five Facet Mindfulness Questionnaire; AA=Acting with Awareness;

O=Observe; D=Describe; NR=Nonreactivity to Inner Experience; NJ=Nonjudging of Inner Experience; TMT=Trail Making Test; SPICE= Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education; Team=Interprofessional Teamwork and Team-based Practice; Patient=Patient Outcomes from Collaborative Practice. * p <0.05; ** p<0.01.