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Study Protocol and Statistical Analysis Plan

Study Title: Mindfulness in Motion Targeted to Sustaining the Mental and Physical Resilience of First Responders and Health System Employees

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Attached is the IRB approved study protocol and statistical analysis plan.

Sincerely,

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Mindfulness in Motion Targeted to Sustaining the Mental and Physical Resilience of First Responders and Health System Employees

OBJECTIVES

High levels of chronic and recurrent workplace stressors can profoundly impact the physical, mental, and emotional health and well-being of the health care providers (HCPs) and frontline first responders (FRs).¹⁻¹² Burnout, which is characterized by feelings of emotional exhaustion, depersonalization, compassion fatigue and a low sense of personal accomplishment, continue to escalate as the COVID pandemic and recent incidents of racial and social injustices persist.¹³⁻¹⁸ Significant downstream consequences of chronic stress include compromised quality and safety of patient care delivery, and a high potential for detrimental short- and long-term physical and mental health consequences.

As correlates to their environmental stressors and high potential for burnout, HCPs and FRs also experience high rates of suicide. Studies indicate that physician suicide have risen exponentially; with women physicians 130 times more likely to attempt suicide than other females in the population, and male physicians 40% more likely than other males.¹⁹ In a survey of 13,000 police officers, 19% reported severe levels of emotional exhaustion, one of the facets of burnout.²⁰ Last year, more Police Officers died due to suicide than died in the line of duty.²¹ Likewise, in a recent survey of firefighters and paramedics at 9 emergency medical service agencies, over 48% of respondents were identified as having compassion fatigue and nearly half reported they had considered suicide.¹⁸ The COVID-19 pandemic and recent incidents of racial injustice and political unrest have further compounded concerns about HCPs' and FRs' mental and physical health.^{22,23} These alarming statistics reflect the urgent and growing need to address and mitigate chronic stress for HCPs and FRs.

Another common organizational concern among HCPs and FRs is the high prevalence of both acute and chronic neck/back pain. As mounting evidence indicates, mental health and physical health are inextricably linked, with mental health conditions serving as a risk factor for pain and pain serving as a risk factor for mental health conditions.^{24,25} The overlapping and co-morbid presence of both physical pain and mental health challenges is particularly relevant in work settings where there is a high exposure to trauma such as in healthcare and first responder contexts.²⁶⁻²⁸ Given the overlap between physical and mental health in high stress work environments, preventative and rehabilitation strategies that directly target the mind-body connections that are specific to the needs of first responder workplace environments and contexts are paramount.^{28,29} Pragmatic, proactive interventions are an important next step to promote resilience and minimize the effects of the high mental and physical stress demands of those serving in a first responder role.^{30,31}

The long-term goal of this project is to improve and sustain the health and wellness of both HCPs and FRs to help mitigate and prevent the downstream consequences of chronic stress. Specifically, we seek to expand and adapt a widely successful, evidence-based program developed by PI Dr. Maryanna Klatt and her team to incorporate additional physical health components (an area of expertise of Co-PI Dr. Catherine Quatman-Yates) with stakeholder-driven enhancements to help target the unique needs of FRs in addition to HCPs. To date, over 500 healthcare members have completed Mindfulness in Motion (MIM), with participants reporting significantly reduced stress and burnout and increased resilience and work engagement upon completion.³² Enhancing MIM in this way will enable the program to more comprehensively address the mind-body connections associated with sustained mental and physical health and resilience among HCPs and FRs. This study will address the following four Specific Aims:

Aim 1: Engage in a stakeholder-focused interview process to refine the Mindfulness in Motion (MIM) program to include a targeted track of the MIM program (MIM-FR) that addresses the needs of community FRs. MIM was designed as a workplace intervention that leverages a variety of mindfulness and other resilience-building techniques by preventing an increase in inflammatory biomarkers³³ and building cognitive and physical relaxation strategies.³⁴ Interventions within the MIM program align with a growing body of research demonstrating that mindfulness and physical activity can bolster stress resilience by preventing an

increase in inflammatory biomarkers.³³ MIM is currently delivered in a group format (originally in-person, now virtually via web-based videos), and includes didactic instruction, community-building group discussion, mindfulness, and gentle yoga. As the first responder work environment represents an untested and unique context for MIM delivery, we plan to adapt the MIM program to target the specific needs of FRs. To complete this aim, we will conduct interviews with ~10 firefighter/paramedics and ~10 police force members from various agencies across the state of Ohio. Our recruitment efforts will be supported by community partner (Melinda Gabriel) and The Ohio State University's College of Medicine community outreach leader (Jackiethia Butsch). We have also pro-actively identified some first responder agencies who have expressed interest and a willingness to support our recruitment efforts (see letters of support).

Aim 2: Integrate interview findings for FRs (Aim 1) with prior findings from MIM delivery with HCPs to expand MIM content and delivery to include more targeted physical health interventions and embed them within a mobile app to support delivery and sustainment of MIM results for HCPs and FRs. Prior HCPs who have participated in MIM have repeatedly expressed interest in the creation of an MIM app and suggestions for the integration of more physical health interventions to improve accessibility, effectiveness, and sustainability of MIM. Input from FR participants (Aim 1) combined with our prior HCP data will be used to enhance the existing MIM interventions to support the specific physical stressors experienced by FRs and HCPs. New experiential videos will be created to incorporate physical health interventions and an app to support the delivery of all prior and new MIM content will be developed.

Aim 3: Deliver the enhanced Mindfulness in Motion (MIM-HCP) program to both HCPs and community first responders (MIM-FR) via a mobile app and evaluate the immediate and sustained effects of the intervention on symptoms of burnout, stress, resilience, work engagement, and physical function for both HCPs and FRs. Ongoing evaluation and feedback on the created videos and mobile app (Aim 2) for MIM will be used to refine MIM to provide optimal physical, mental, and emotional health benefits. Pre/post- pilot data on burnout, stress, resilience, work engagement, and physical function will be collected, as well at 6 months post MIM and FR-MIM, to assess sustainability of results. Sixty HCPs and sixty FRs will participate in this pilot study.

Aim 4: Pilot data from both HCPs and FRs (Aim 3) will be shared with HCP and FR leaders as part of interviews gathering their input regarding barriers and facilitators to scaling and large- scale statewide dissemination of MIM for both HCPs and FRs. Data sharing interviews with healthcare and first responder agency leaders will enable the participation of important stakeholders to share their expertise, perspectives, and help strategize effective ways to scale and disseminate MIM programming across Ohio and nationally.

Upon successful completion of the proposed Aims, we will have a video-based, facilitator-delivered model for MIM embedded into a mobile app, which will facilitate larger-scale knowledge translation from research to practice (r2p) for MIM-HCP and MIM-FR participants. The enhanced MIM programming delivered via a mobile device-flexible app for MIM will support FRs' ability to leverage the content and exercises while out in the "field" as well as HCPs on the job. Measures of burnout, perceived stress, work engagement, resilience, and prevalence of musculoskeletal discomfort will show efficacy and sustainability levels. Additionally, there will be a cohort of FRs who can be further trained as MIM facilitators to enable widespread scaling and dissemination of MIM-FR within this population, shown to be an important outcome for participation and adherence.^{35,36} Peer facilitators are already effectively used with our HCPs at OSUMC, and our intention is to be able to deliver a parallel facilitator-delivered MIM-FR upon completion of the project.

A. BACKGROUND

Prevalence and Negative effects of Stress in the Workplace

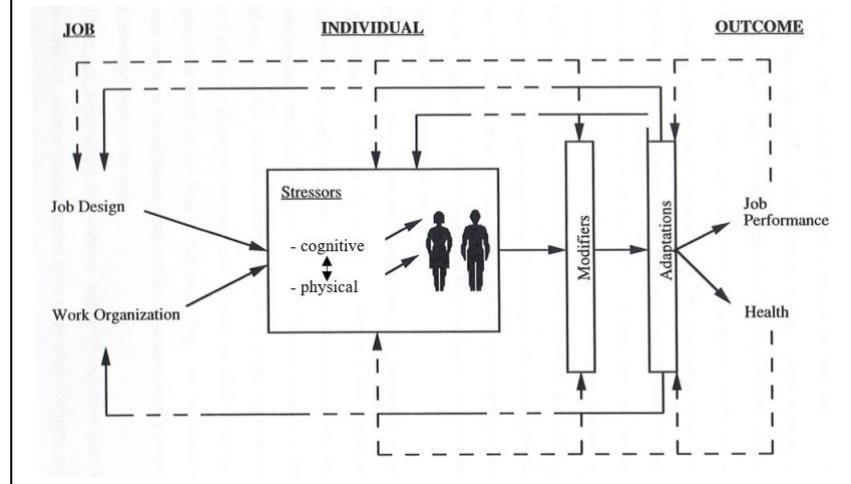
High prevalence of chronic stress contributing to mental and physical health challenges among health care providers (HCPs) and first responders (FRs; e.g., police officers, firefighters, and paramedics) are a large source of concern for their respective professional agencies.¹⁸ COVID has been an unrelenting challenge for all- but especially for FRs, inside the hospital and in the community. The resulting additional stress of the pandemic on our HCPs and FRs in Ohio and worldwide has highlighted the importance of keeping them functional and healthy. Employers with staff who work in high-stress environments are placed under severe financial burden, as the estimated annual indirect and direct costs associated with chronic stress is approximately **\$300 billion dollars**.⁴⁴ Exposure to chronic stress within the workforce increases risk to various negative health outcomes including **burnout**, suicide, suppressed immunity, obesity, substance abuse, and heart disease.⁴⁵ Chronic stress directly inhibits productivity⁴⁶ while also increasing the chance for **musculoskeletal strains** and **on-the-job injuries**, which places **FRs** and **HCPs** at an exceptionally high risk. Significant stress levels undermine health by increasing inflammation in the body, and although the mechanism is not yet fully understood, there is accumulating evidence that chronic inflammation (perhaps even chronic mild inflammation) plays a critical role in the pathophysiology of stress-related chronic illness.⁴⁷ Specifically, stress affects the regulation of various allostatic systems with activation of the sympathetic-adrenal-medullary pathway and the hypothalamic-pituitary-adrenal axis. The release of the various neurotransmitters and hormones involved in these systems, including pro- inflammatory molecules, can change the function of the peripheral and central nervous systems leading to various symptoms like irritability, nervousness, feeling overwhelmed, having difficulty concentrating or remembering, changes in appetite, sleep, heart rate, and blood pressure.

Moreover, chronic stress is a known contributor to burnout, which is characterized by feelings of emotional exhaustion, depersonalization, compassion fatigue, and a low sense of personal accomplishment.¹³⁻¹⁷ With the mounting evidence of the significant health threats that burnout can pose, the World Health Organization now recognizes it as an official medical diagnosis.⁴⁸ The ICD-11 defines burnout as a syndrome resulting from chronic workplace stress that has not been successfully managed. It is characterized by three dimensions: 1) feeling of energy depletion or exhaustion, 2) increased mental distance from one's job or feelings of negativism or cynicism related to one's job, and 3) reduced professional efficacy.⁴⁸ Burnout also increases the risk of other medical conditions such as cardiovascular diseases, depression, suicide, drug abuse disorders and is a known predictor of many physical health disorders (e.g., hypercholesterolemia, Type 2 diabetes, coronary heart disease, musculoskeletal pain, fatigue, headaches, gastrointestinal and respiratory problems).

Additionally, burnout can contribute to the development and/or exacerbation of psychological disorders (insomnia, depression, emotional dysregulation).⁴⁹ High-stress professions where workers, on an almost daily basis, experience demanding situations requiring high level of personal engagement, are at substantial risk for burnout. One in three physicians' experiences burnout, and an estimated 300-400 physicians commit suicide each year.^{50,51} Additionally, an estimated 19% of police experience some form of emotional exhaustion and 13% have extreme scores of depersonalizations.²⁰ In the United States during 2019, police suicide increased by approximately 24% with an estimated 228 police officers committing suicide.⁵² Unfortunately, these numbers are suspect to underreporting, and the number of recent studies on burnout and suicide in these professions has increased exponentially during the past few years.⁵³⁻⁵⁵

The combination of chronic stress, burnout, and stress-related illnesses and injuries can ultimately lead to staffing shortages and worker retention challenges, which are of particular concern for HCPs and FRs as we continue to face the ongoing challenges of the COVID pandemic and racial and political injustices and challenges. When high stress and trauma are a natural part of the work environment, it is often difficult to control and can affect the individual's health and his/her ability to function successfully in the jobs (Figure 1).

Figure 1. Influence of stress on job performance and health within sociotechnical work systems



Employees experiencing stress are on sick leave more often than those who report lower amounts of stress.⁵⁶ Moreover, **stress affects more than psychological health** as it is widely associated with other factors that contribute to an increased risk of **physical health challenges**.

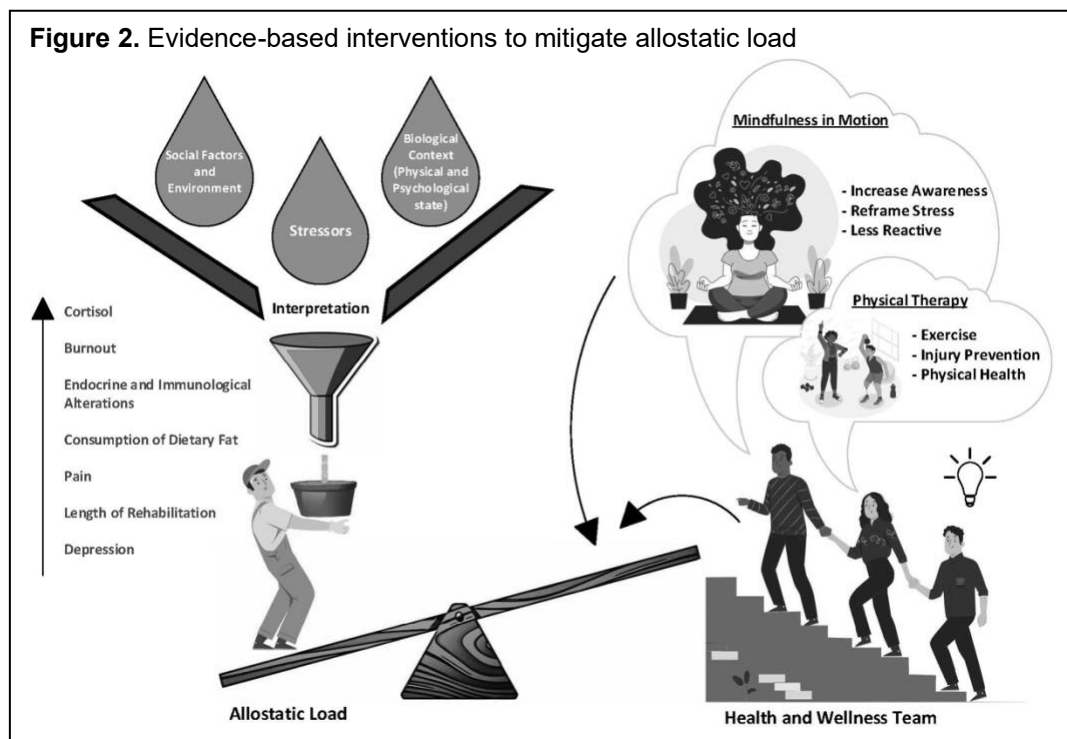
Of note, FRs and HCPs are already at risk of physical health challenges because they often face unique physical demands throughout their workday. Some of these demands, including lifting, handling heavy loads (patients and equipment), and working in awkward environments have been associated with work-related disability and activity limitations.²⁶ Musculoskeletal injuries incurred on the job are typically self-perceived as a result of high manual handling demands, repetitive movements, poor handling techniques, and insufficient training.²⁶ Previous literature has shown these strenuous physical demands are cited as a top reason for leaving the profession.⁵⁷ Prevention programs can prevent claims and keep employees working at pre-injury capacity.⁵⁸ When injury cannot be prevented, guiding the perceptions of disability to a nonthreatening experience can improve the social well-being of the patient. Interpretation of disability is a critical time-period for intervention. This is because being a contributing member in the workforce has positive and protective effects against frustration, anger, and worthlessness.⁵⁹

According to the US Bureau of Labor Statistics, the 2018 incidence rate statistics for police officers with regards to lost time work-related injury are much higher than statistics for local government workers, overall (448.6 per 10,000 FTE v. 163.9); both of which are higher than the overall rate for private industry (89.7 per 10,000 FTE).⁶⁰ The incidence rate of musculoskeletal disorders (83.7 per 10,000 FTE) is twice that of the average rate for local governments.⁶⁰ Incidence rates of sprain/strain types of injuries (157.3 per 10,000 FTE) and soreness/pain (100.3 per 10,000 FTE) are 2.6x higher.⁶⁰ The median number of lost workdays for an injury/illness (42 days) is 4x higher for dispatchers than the median for local governments overall.⁶⁰ The incidence rate associated with exposure to repetitive motion/micromotion is 7x higher for dispatchers than for local government overall.⁶⁰ Related to that is the incidence rate of carpal tunnel syndrome, which is 23.8x higher in dispatchers compared with local government overall.⁶⁰

If physical stress is ignored, it increases the burden of the person's allostatic load, defined as the biological burden exacted on the body through daily adaptation to physical and emotional stress.⁶¹ Allostatic loads sustained over time are associated with burnout and endocrine and immunological alterations.⁶² Additionally, pain,^{63,64} depression,⁶⁵ increased cortisol levels,⁶⁶ higher consumption of dietary fat,⁶⁷ and increased length of rehabilitation⁶⁸ are all associated with increased levels of stress.

Current Evidence-Based Solutions to Chronic Workplace Stress, Burnout, and Physical Health Evidence-based research from members of our team and others has shown that mindfulness-based interventions can be effective in reducing negative stress-related health outcomes within health systems and first responder environments and help mitigate burnout risks.^{39,69-74} Other studies have shown that FRs and HCPs experience significant reduction in musculoskeletal symptoms, levels of anxiety, depression, and pain catastrophizing with increased self-compassion and quality of life perceptions,⁶⁹ after mindfulness interventions. Although mindfulness-based interventions vary in length of time and method of delivery, all focus on helping to grow one's ability to be fully present and aware in the present moment in time. In doing so, a person can start to develop an enhanced ability to prevent the physiological and cognitive reactivity and overwhelm that can be triggered by stressful situations. Mindfulness-based interventions can be embedded within a variety of other activities (e.g., meditation, yoga, exercising) to help train the brain and body to maintain a sense of calm even in times of highly stress. With mindfulness training, individuals often report lower sense of isolation, loneliness, and increased social interactions, which can improve mental health which can help provide a balancing effect to a high allostatic load (Figure 2).^{70,71} Moreover, individuals who have been trained in mindfulness have reported a decrease in burnout, on duty accidents, time off work, and increased productivity while on the job.^{75,76}

From a physical health resilience standpoint, ergonomics principles and knowledge are recognized as critical when designing work systems that can mitigate injuries. However, design alternatives are often not practical and affordable. This creates a need for going beyond ergonomics when addressing work injury prevention. Physical therapists are well-positioned and qualified clinical experts to address musculoskeletal dysfunction and can often play a key role in preventing work related musculoskeletal dysfunction, establishing injury prevention programs, and rehabilitating employees back to work.^{58,77,78} Physical therapists can guide the interpretation of physical sensations through immediate induction of the patient into a rehabilitative mindset. Advice on body mechanics, joint protection, wellness, and a home exercise program are all factors that have been associated with decreased workers compensation claims cost and duration of rehabilitation (Figure 2).⁷⁷



Barriers to Implementing Evidence-Based Mindfulness and Physical Health Promotion Solutions One of the greatest barriers to the short- and long-term success in workplace settings is how to embed programming within work settings to meet the specific needs, timing, and delivery modes that support workers' ability to access effective programming. A barrier to the current utilization of mindfulness-based interventions within the workplace though is the paucity of trained facilitators in mindfulness.³⁵ Similar barriers are present in terms of the physical health and ergonomic interventions in first responder/hospital-based HCPs in health systems and in first responders out in the community. Additionally, there is limited integration of physical therapists and other movement and injury specialists within HCP and FR environments. Integrating these components within

mindfulness-based programming model offers an opportunity to systematically educate and provide physical health interventions for HCPs and FRs. Additional studies that can specifically support implementation and tailoring to unique needs and contexts of HCPs and FRs are of high value and impact to support the integration and sustainability of evidence-based mental and physical health resilience and stress mitigation within their high-risk workday environments.

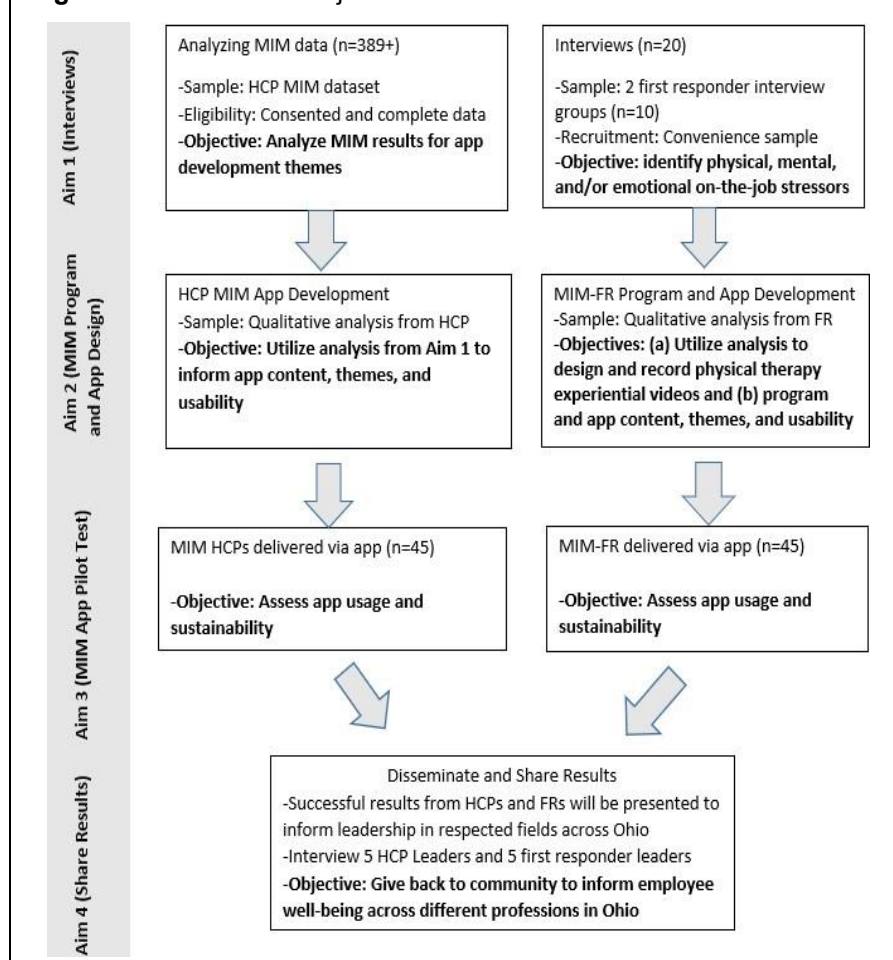
STUDY DESIGN

Rationale

How the Proposed Project will Improve Knowledge, Available Services, and Health of HCPs and FRs

With the proposed project, we aim to improve the knowledge and health of HCPs and FRs in Ohio by expanding the well-established, evidenced-based program developed by PI Dr. Maryanna Klatt called Mindfulness- in-Motion (MIM) to increase the workplace accessibility of the content, incorporate more musculoskeletal/physical health components, and help tailor elements of MIM to meet the specific needs of FRs (Figure 3). Upon successful completion of the proposed Aims, we will have a video-based, facilitator-delivered model for MIM embedded into a mobile app, which will facilitate larger-scale knowledge translation from research to practice (r2p) for MIM HCP and FR participants. The enhanced MIM programming delivered via a mobile device-flexible app for MIM will support FRs' ability to leverage the content and exercises while out in the "field." Efficacy of the intervention and its sustainability will be measured by levels of burnout, perceived stress, work engagement, resilience, and prevalence of musculoskeletal discomfort. Additionally, there will be a cohort of FRs who can be further trained as MIM facilitators to enable widespread scaling and dissemination of MIM-FR.

Figure 3. Overview of Project

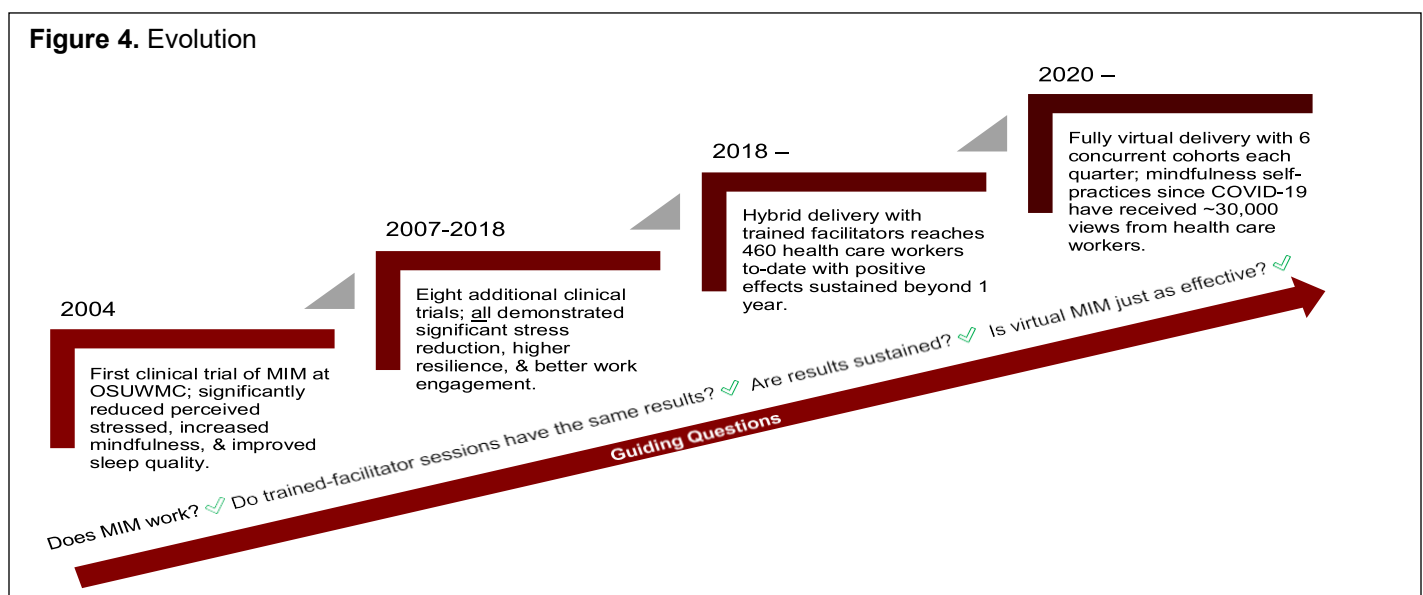


Mindfulness in Motion (MIM)

MIM Overview: MIM is an eight-week evidence-based program specifically designed as a workplace intervention to help participants learn practical burnout/stress reduction and resiliency building techniques. Delivered in a group format (originally in-person, now virtually), MIM includes didactic instruction, community-building group discussion, mindfulness, and gentle yoga. Each MIM session focuses on a specific theme. Participants are also highly encouraged to engage in 10-20 minutes of individual self-practice at least 5 times per week to further reinforce and integrate MIM practices into their work and personal lives. MIM staff currently run three sessions (winter, spring, fall) each year with 4-6 cohorts of approximately 15 participants per cohort per session. No summer sessions are offered due to the frequency of staff and participant vacation interruptions.

MIM Effectiveness: Led by Project Director and Co-PI Dr. Klatt, MIM has been expanded and adapted over the years to meet the growing needs of OSU's faculty, staff, and learners for nearly two decades. Established in 2004, MIM was first implemented as a small randomized-controlled trial with 48 OSU employees.⁷⁹ Guided by the question of "is MIM effective?" the program was then tested in a variety of additional studies with OSU faculty, staff, residents, and patients.^{32,34,37,72-74,80,81} All of these trials showed significant results for stress and burnout reduction with improved resilience.

MIM Evolution: Based on its proven success, MIM was then incorporated as a core program for OSUWMC's Gabbe Health and Wellness Initiative for faculty and staff in 2017. In order to facilitate delivery of this intervention to more of the HCPs, Dr. Klatt adapted the MIM delivery model by: 1) training additional HCP members to serve as facilitators and 2) hybridizing MIM to include recorded videos, live discussions, and activities.⁸² These adaptations were rigorously studied and achieved similar results as the prior trials.⁸³ Since then, over 460 health care professionals at OSUWMC have completed MIM, with many reporting both personal and professional benefits in the short- and long- term. Moreover, evidence indicates that improvements in burnout, stress and resilience obtained by MIM can be sustained beyond a year after program end (Figure 4 and Table 1).^{32,81}



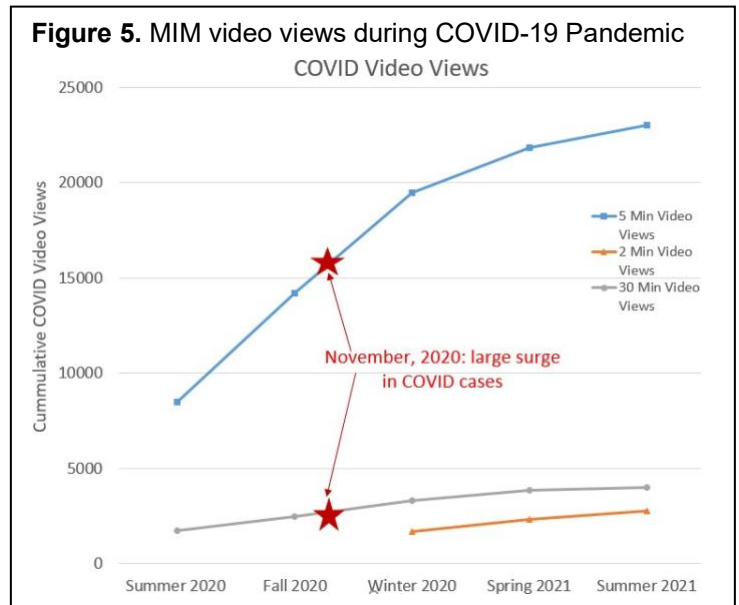
Year(s)	Working Population	Improved outcomes of interest (*p<.05)
2004	The Ohio State University Faculty & Staff (n= 48)	Perceived Stress*, mindfulness*, sleep quality*, and cortisol ⁶⁵
2007-2009 (NIH R21)	The Ohio State University Faculty & Staff (n= 180)	Biomarkers of inflammation for BMI < 35 (p=.08), C-reactive protein when BMI <30* ^{48, 66}
2010-2011	Danish Bank Employees (n= 72)*	Work Engagement*, perceptions of well-being & stress at work* ¹²
2010-2011 (STAR Funded)	The Ohio State University Surgical Intensive Care Unit Personnel (n= 32)	Stress*, salivary α-amylase levels*, work engagement, and correlated changes in mindfulness* ⁴⁷
2012 (STAR Funded)	The Ohio State University Neonatal Intensive Care Unit Personnel (n= 34)	Resiliency*, stress reduction, salivary α-amylase levels, work engagement ¹¹

2016 (Patient Safety Funded)	Ross Heart Hospital Safety Study (n=34)	Self-compassion*, resiliency*, work engagement*, perceived stress*, correlated changes in patient safety ⁶⁷
2017	OSU resident physicians and other house staff (n=23)	Burnout*, resiliency*, vigor towards work* ¹³
2017-2021 (Shared Services)	OSUWMC Health System Interprofessional Employees (n=389)	Burnout*, perceived stress*, work engagement*, and resiliency* ³¹

*Conducted outside of OSU in Denmark, delivered in the second largest bank in Scandinavia, where employee stress is notably higher than other Danish workplaces¹². A trained facilitator (trained by Dr. Klatt) delivered the MIM protocol in person but translated all content to Danish before delivery. This was an important adaptation to delivery success, just as this proposed research will create a population of FRs, who can be trained as future MIM-FR facilitators. Creating a cohort of potential FR facilitators to work with other FRS from within their own culture of dissemination is considered a key innovation of this proposal.

MIM is both Preventative and Reactive (COVID- 19 Response)

Further evidence of MIM's adaptability and usefulness emerged during the pandemic when MIM delivery became fully virtual (Figure 5). Presently, there are six concurrent MIM cohorts offered three times per year with approximately two new facilitators trained each session to support greater capacity for continued spread of MIM. Additionally, Dr. Klatt developed new, COVID-19 relevant 30-minute weekly MIM booster sessions that attracted more than 80 live Zoom participants and over 2,500 views of the recordings. Dr. Klatt also developed 2-, 5-, and 10-minute guided mindfulness practices that were distributed via multiple media and print methods and accessed via weblink or QR code over 29,700 times.³⁴



Although analyses only confirm the effectiveness of MIM on its participants, trends within the data have shown its ability to create a mindful medical center as well.³⁴ Indication of this increasing mindfulness culture at The Ohio State University Wexner Medical Center (OSUWMC) may be seen in the baseline resiliency scores. Prior to the onset of the pandemic, over 460 HCPs at OSUWMC had completed this organizationally sponsored program, perhaps prompting a halo effect for others. With so many OSUWMC HCPs exposed to formal mindfulness programming, they have reported being more mindful with their patients, colleagues, and supervisors, eliciting a culture change at the medical center.^{32,34} Hence, MIM programming could be a protective function of MIM in times of increased stress and demands of the healthcare professional, such as during our current pandemic.

We compared outcome measures of a synchronous virtual delivery of MIM, necessitated by COVID- 19, to traditional in-person delivery of MIM. No significant differences were found in results between Pre-COVID and COVID cohorts. This indicates support for MIM being an intervention that is preventative and reactive; for the COVID cohorts, MIM is a reactive response to increased HCP stress, while for the Pre-COVID cohorts, MIM can be a preventative response to the daily demands of being a HCP. Various past participants expressed gratitude that they had experienced MIM prior to COVID as the felt it ameliorated their stress response. One physician summed this up well: *"This shift of separating the emotions from my identity allowed me to better handle these emotions, but also enabled me to feel multiple things at once: I am feeling grateful that COVID numbers are decreasing in our ICU but I am also feeling frustrated and disappointed in people minimizing COVID or denying my experience. And that's okay."*

Impact

Impact of Proposed Project: MIM is an effective intervention shown that significantly reduces healthcare

professional burnout and stress, while increasing resilience and work engagement. It can be delivered in 3 modes (creator-led, facilitator-led, and fully virtual with creator or facilitator) without differences in outcomes. Additionally, results can be sustained beyond a year post intervention. Our team is well poised to scale MIM within and beyond OSUWMC to facilitate true culture change for the healthcare professional and beyond.⁸² The proposed research project will have a significant impact by providing HCP and FR employees with a sustainable and innovative video-based app aimed to help manage mental and physical stress while on the job. Given findings from other research and our own data (see above) this study could have a significant impact on productivity, workplace accidents/injuries, sick time, and workplace satisfaction within both medical centers and first responder contexts. In law enforcement specifically, research has shown that mindfulness programming is effective in producing health and wellness outcomes, but that additional intervention is necessary to sustain the positive impact of the initial intervention.⁴¹

In the short term, HCP employees from OSUWMC will benefit from implementation of the MIM intervention and sustainability video-based app, while long term benefits include the ability to scale and disseminate this programming to increase resilience and decrease burnout beyond the piloted groups to other employees of high stress FR departments and health systems in Ohio, and nationally. Such an impact would be substantial, as health behavior literature shows that initial change is possible, yet sustaining the change is difficult.⁸⁴⁻⁸⁶ Given the partnership between OSUWMC and various partnering personnel and agencies, the researchers are fully committed to ensure that all participants can directly benefit from participating in the program, findings will be presented at employee in-services, and all research key personnel from sites involved in the research collaboration will be involved in the dissemination of program results.

Community Partners: To ensure MIM-FR is a model that can meet FRs and FR agency leaders' needs, we have collected letters of support from several agencies who are interested and willing to support our recruitment needs for the interviews and pilot testing for FRs (Aims 1, 3, 4). We are committed to ongoing communication with our community partners for the proposal and will share the findings, incorporate their feedback into our implementation for the pilot tests, and integrate the thoughts and perspectives for planning spread and implementation on a wider scale in the future.

Innovation

This project aims to provide HCP and FR employees with strategies to effectively manage and mitigate mental and physical stressors while on the job. The majority of stress reduction research within FRs and health systems has focused on police officers, physicians and nurses. Emerging research has documented the importance of including front line provider support personnel, as both healthcare and FRs involve team efforts to provide the highest level of service⁵⁸⁻⁶⁰. A healthy culture of any healthcare organization or FR agencies impacts each employed individual- both on a personal level and organizational level- with costs associated. We seek to address some of these issues.

The proposed research project is grounded within Urie Bronfenbrenner's Socio-Ecological Model (SEM) which illustrates the multilevel influences on behavior (Figure 6)⁵¹. The SEM has been extensively researched⁵²⁻⁵⁴ and is an effective way to structure multilevel interventions to help aide in the long-term adoption and sustainability of programming^{55, 56}. Justification for using the model in this proposed work is supported through qualitative analysis from previous OSUWMC MIM program participants (Table 2) with the opportunity to draw parallels to the benefit of tailoring MIM for FRs. The project will also produce a novel video-based app which will be accessed through employee smartphones, in effort to sustain the benefits of the MIM program.⁸⁷⁻⁸⁹ The video-based app provides employees easy access to regularly practice a variety of mindfulness, breathing, physical exercises targeted to FRs and HCPs, and other stress- reduction practices before, during, and after on-the- job stressors. Without an app, it is difficult for HCPs and FRs to form sustainable habits.

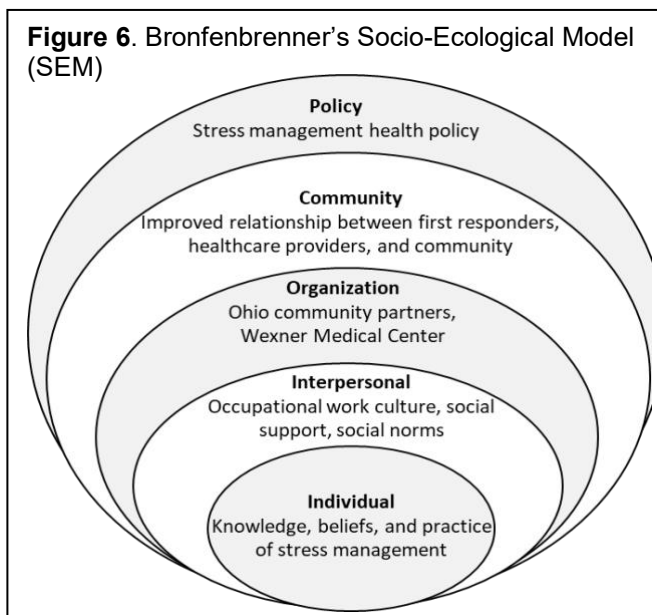


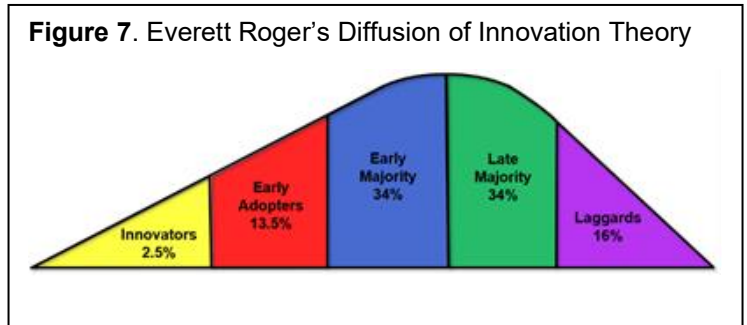
Table 2: Application of Bronfenbrenner's Socio-Ecological Model (SEM) for sustaining MIM results within OSUWMC and employees.

SEM Level	HCP OSUWMC Mindfulness in Motion Qualitative Results	Application to FR
Policy	<i>"Improved my work/home life balance by leaving work-related emotions at work. The organization can create a more mindful work environment by allowing schedule holds to be placed for mindfulness/meditation/movement"</i> <i>"The way we approach mindfulness in your class is simple, applied, and immediately impactful."</i>	Create resiliency programming space for FRs to learn the beneficial coping skills that can be immediately utilized
Community	<i>"I think there needs to be more emotional intelligence training for leaders who have roles where their interpersonal capabilities and effectiveness is working with others"</i> <i>"Connecting to my colleagues in this group allowed me to realize that we have similar concerns and goals, which in turn lead to my understanding that part of all of our lives and lines of work are spent learning how to manage stress. Actually, more precisely I think it's about changing attitudes towards stressors, which are inevitable"</i>	Improve law enforcement employee leadership presence within FRs and the larger community
Organizational	<i>"This has helped tremendously with patient care in maintaining my sense of calm and overall presence and awareness of my patient's needs when I walk into their room. This has also provided me with more insight into my own team and their overall perceptions and needs throughout our workday. If everyone in our organization would simply acknowledge their feelings, whatever they may be, it could cultivate a culture of respect, patience, and awareness to all of those we come in contact with on a daily basis"</i>	Ability to serve effectively by becoming aware of other's stress
Interpersonal	<i>"It has helped me to remain calm in stressful situations, which is often at work. It has also helped me to slow down or focus more when having a conversation with someone."</i>	Communication skills under stress are augmented in dealing with the public
Individual	<i>"Taking time to breathe and think about what I am feeling, why I am feeling that way, and what it means, helps me to gain perspective. This is beneficial to my well-being and to everyone I interact with."</i>	Self-awareness benefits FR employees' responses

Therefore, the provision of the application is a critical step in establishing an occupational health environment which prioritizes and supports regular participation in stress-reduction behaviors throughout the workday. The materials provided in the video-based app will be guided by the information collected in the OSUWMC and FR interviews (Aim 1), so that the app and videos can be tailored to the appropriate occupations (Aim 2). The researchers are following best practice as the

novel training tool will be grounded in extensive formative research and collaboration with the target populations, to ensure relevance and usability.

To help ensure the successful adoption of the innovation, following the grant tenure the researcher's plan is to utilize the train-the-trainer method to train facilitators from within the local work environment and culture. This methodology has been shown to improve mindfulness-based attention programs within the military, when compared to programs that were led by external instructors.³⁵ By incorporating prior MIM participants within the delivery of the MIM program, and the app videos, the researchers hope to increase the acceptance and support of the program within the target populations. Justification for this methodology is found in Everett Roger's Diffusion of Innovation Theory (Figure 7).⁸⁹ DIF is a prominent marketing theory that postulates how innovations spread through a population based on individual characteristics. Thus, it is crucial for the program to leverage trained FRs and healthcare professionals (innovators) to lead MIM courses (early adopters). This is in effort to successfully disseminate the program to other employees (early/late majority), within the video-based app. Therefore, the piloted groups of MIM-FR will serve as our primary champions, (hopefully will elect to become MIM-FR trained facilitators) and early adopters of the program, which will help spread the utilization and acceptance, and the larger dissemination of the MIM program (late majority/laggards) to their organization.



Approach

Aim 1: Engage in a stakeholder-focused interview process to refine the MIM program to include a targeted track of the MIM program (MIM-FR) that addresses the needs of community FRs.

Approach Overview. Interviews will be conducted to identify context-specific stress points for community first responders. Information collected during the interviews will aid in the development of MIM materials and educational videos embedded in the mindfulness app for Aim 2.

Participants. 20 first responder personnel across Ohio will be recruited to participate in an interview (~45-60 minutes in length). Interview participants will consist of police officers (n=10) and firefighters/ paramedics (n=10). Participants will be recruited and consented by the research coordinator and community outreach coordinator.

Procedures. Both sets of interview groups will follow the same research protocol while allowing for discussion of physical, mental, and/or emotional on-the-job stressors that are specific to their individual environments. Interview groups will be conducted over Microsoft Teams and recorded for transcription of audio once completed. Each interview will start with a brief 5-10-minute guided mindfulness meditation in effort to relax participants so that they can more effectively reflect on occupational stressors without posing any risk to their mental or emotional health. The next 10-15 minutes will be designated for discussion of physical, mental, and emotional on-the-job stressors specific to their role as a first responder. All questions will remain open-ended to reduce leading questions and biased answers. Examples of questions include, "What does occupational stress mean to you?" "What would be helpful for stress reduction while on the job?" "Please describe a scenario where you felt overwhelmed during your job?" "What types of movements or stretches would help relieve any chronic work-related pain?" The next 10-15 minutes will be more specific to mindfulness practice and future app development. Examples include, "What are your thoughts regarding the incorporation of mindfulness practice into your daily work life?" "What are your thoughts regarding the use of a stress-reduction app during work?" "What are some barriers to using a stress-reduction app during your workday?" "What information would be important to include in the app?" "Who should be present in the videos you will be able to watch via the app?". Sample 3-5-minute videos from previous Mindfulness in Motion research will also be reviewed for feedback from participants. Finally, the last 10-15 minutes will be used to provide flexibility for any questions that have not been addressed and to follow up on important discussion points.

Data Analysis. Interview content will be transcribed and coded for thematic analysis. Transcription of interview analyses will be conducted by the Research Coordinator, Jacqueline Caputo and PhD student Gabriel Alain under the direct supervision from Dr. Klatt and Dr. Quatman-Yates. Potential coding structures will be discussed as a team and will follow the interview guide to help aide in thematic analysis. The first five interviews will be coded and analyzed as a team to help increase the reliability and validity of coding across team members. After analysis of the first five interviews, the student team will code and analyze the remaining three interviews. Each interview will be coded by two independent coders, and interrater reliability will be analyzed by the percent agreement between the two reviewers. After all interviews are coded, the research team will meet to discuss overarching themes within the dataset and adjust any coding structures, if necessary, to ensure thematic saturation within our dataset.

Validation. Drs. Klatt and Quatman-Yates will lead all interviews, which will be recorded after approval and consent of all participants. At the end of each interview, Drs. Klatt and Quatman-Yates will review all previously discussed app development materials to ensure appropriateness and agreement across participants. By showing previously created Mindfulness in Motion 3-5-minute videos, participants receive an accurate depiction of the app while providing constructive feedback regarding personnel, content, and delivery.

Aim 2: Integrate interview findings for FRs (Aim 1) with prior findings from MIM delivery with HCPS to expand MIM content and delivery to include more targeted physical health interventions and embed them within a mobile app to support delivery and sustainment of MIM results for HCPs and FRs.

Approach Overview. The MIM program has been successful in reducing stress and burnout and increasing resilience within OSUWMC employees, cancer survivors and college students by using the train-the-facilitator model and tailored educational presentations and videos. A similar approach to adapting MIM to be targeted for FRs as was done for other MIM adaptations. The analyzed data from interviews with FRs (Aim1) will provide the content needed to sculpt the intervention for FRs.

Previous analyzed qualitative data from HCPs regarding what needs to be included on a mobile app and specific areas of physical chronic pain associated with being a HCP will inform the videos created for inclusion on the HCP section of the mobile app. The request for mobile app delivery of MIM-HCP daily practice came from the participants themselves (See appendix).

Procedures: Utilizing data from AIM 1, and previous data from HCPs, new experiential videos will be sculpted for the inclusion of both MIM-HCPs and for MIM-FRs to incorporate more physical health musculoskeletal content. Table 3 provides a potential hybrid of topics based on prior HCP feedback and expert suggestions. The plan will be updated in accordance with FR interview results.

For the video creations, the project PI and team have worked extensively with bartha.com, a video production company in Columbus Ohio that is an approved OSU vendor. Bartha combines expertise in video production and post-production, delivering excellent videos for MIM program delivery. Working with Bartha.com over 4 years has proven to be successful collaboration, so we would enthusiastically engage them to deliver our video needs. For App development, we are working with Switchbox, Inc., on a currently funded study to develop a mobile app to assist those patients with sickle cell disease in dealing with chronic pain associated with their disease. We have discussed this project (creation of a mobile app for both HCPs and FRs) with the CEO of Switchbox ,Inc, Joel Stephens. He thinks his team would be an excellent fit for this project also (See Deliverables Section for more details). This will allow the mobile app development to begin July 2022 and be completed by December 2022 with an initial prototype to be built and readily available by the MIM session beginning January 2023 for both HCPs and FRs.

Validation: Samples new videos will be previewed by a select number from each population to ensure appropriateness of content and length.

Table 3: MIM Theme Descriptions and Physical Topics

Theme and Description	Physical Topic
Week 1 Theme: Willingness towards daily practice <i>Committing to a daily practice is not easy, but the benefits are worth it! This guided meditation helps bring a focused attention to simple yogic movements, followed by a mindful meditation in which you see yourself in your daily healthcare work environment. Reflection prompt: What physical or cognitive habits did you catch yourself doing during last week?</i>	Week 1: Posture and Alignment <i>What is the role of posture & alignment in exercise? All movement starts at the trunk. A properly aligned spine in a neutral posture sets the foundation for: moving safely, moving effectively, and optimizing health.</i>
Week 2 Theme: Cultivating mindful sleep <i>Sleep meditation to facilitate faster transition into sleep. Reflection prompt: What thoughts or worries keep you up at night? What thought, if you could put it out of your mind, would allow you to sleep better?</i>	Week 2 Theme: Advanced Core & Postural Stability <i>Why is movement important? It plays a role in everyday activities. It plays a role in health and fitness. It plays a role in work, leisure, and recreational activity. Movement is how we exercise and train our body to be stronger, quicker, durable, and resilient.</i>
Week 3 Theme: Supported by our breath <i>Bring awareness back to your body through body scans. Reflection prompt: What commonalities/differences do you see in your self-image versus how other people see you? What image of self allows you to breathe easier?</i>	Week 3 Theme: Balance & Dynamic Stability <i>What determines your balance? Maintaining balance is an effort of combining sensory information from three systems: your eyes (visual system), muscles, tendons and joints (proprioceptive system), balance organs in the inner ear (vestibular system). The brain stem then makes sense of all this sensory information in combination with other parts of the brain and its past experiences. The brain can then determine which information to listen to most based on your current situation.</i>
Week 4 Theme: Mindful eating and yoga practice <i>Learning to be mindful about your cravings and information on the relationship between yoga and your immune system. Reflection prompt: Describe the most relaxed and satisfying meal you can remember. What factors made it so enjoyable?</i>	Week 4 Theme: Hip, Hinge, Squat, Lunge <i>The squat, lunge and hip hinge are basic functional movements that are essential for many activities of daily living. With each of these movements there are varying degrees of difficulty to increase or decrease the challenge. Throughout this module we will focus on proper technique, offering modifications for every fitness level. We will also explore how these movements correlate to everyday activities and how you can build an exercise routine around these 3 basic movements.</i>
Week 5 Theme: Movement through balance <i>Being able to move in response to the people and situations around us, while staying rooted within our own sense of balance is an irreplaceable tool. Reflection prompt: Are there any factors you can identify that were present during the times in your life when you felt balanced?</i>	Week 5: Pushing & Pulling <i>What is push-pull? Push-pull is a style of training that structures workouts based on your movement patterns. With this training style, we can prioritize function while maintaining the ideal balance in our programming. This helps us focus our training on movements that offset the repetitious movements of our day, while also avoiding overtraining that may lead to asymmetric and dysfunction.</i>
Week 6 Theme: Centering through sensation <i>Healthcare is demanding and often mentally and physically taxing. Learn how to acknowledge your “sore spots” and then to let them go. Reflection prompt: What do you notice about the commonalities between the experiences you judge as “pleasant”? What about the experiences you judge as “unpleasant”?</i>	Week 6: Movement (in Life), Stretching, Mobility <i>What is your core? Your core is the set of muscles around your trunk that help <u>stabilize</u> your mid-section when you are stationary, to maintain good posture, and during movement, to protect your back and improve the efficiency of your movements. The “core” is often associated with your abdominal muscles, but there is more to it than that. The core also includes your diaphragm, your main muscle of breathing, your pelvic floor muscles, the muscles that help keep you continent, and some deep muscles in your back.</i>
Week 7 Theme: Clarity and release <i>Working through mindfulness and trust for successful leadership. Reflection prompt: Is the “thing/person/situation” that is making you unhappy unchangeable? If so, how might you be able to change your reaction to it or experience of that “thing/person/situation”?</i>	Week 7: Exercise to increase resiliency <i>What are the benefits of Exercise? The American College of Sports Medicine recommends a comprehensive program of exercise including cardiorespiratory, resistance, flexibility, and neuromotor exercise (covered in another module) for adults of all ages. Reducing sedentary pursuits and increasing physical activity can improve physical and mental health and fitness in most people. It is important to create a comprehensive program by considering individual preferences and enjoyment because exercise is beneficial only if a person engages in it.</i>
Week 8 Theme: Strength of the mountain <i>Cultivate the tools to acknowledge our various emotions (represented by certain weather conditions), without letting emotions move or rule us. Reflection prompt: Describe a time at work that you felt grounded and empowered.</i>	Week 8: Putting it all Together <i>You now have a good understanding of the benefits of exercise and movement not only for your physical health, but also your mental and emotional health. We have discussed concepts and practiced exercise techniques that will serve as the foundation for continuing your journey after you have</i>

Aim 3: Deliver the enhanced Mindfulness in Motion (MIM-HCP) program to both HCPs and community first responders (MIM-FR) via a mobile app and evaluate the immediate and sustained effects of the intervention on symptoms of burnout, stress, resilience, work engagement, and physical function for both HCPs and FRs.

Approach Overview: The qualitative analysis 1 will inform the content of the app (Aim 2) for MIM-HCP and MIM-FR. This aim focuses on administering MIM to the respective groups using the mobile application. Pilot cohorts of FRs and HCPs of MIM in the winter, spring, and fall will be conducted throughout 2023 and pre/post measures will be collected directly before the program, after the eight weeks, and 6 months post-intervention. Validated scales on burnout, work engagement, perceived stress, resilience, and musculoskeletal health (MIM-FR specific) will be collected and analyzed to measure effectiveness of the program.

Participants: We anticipate recruiting 60 FRs across Ohio and 60 HCPs for this aim. The respective groups will have approximately 15-20 members per winter, spring, and fall cohort for a total of 60 participants in each track. We determined 60 participants was appropriate because our previous analysis has displayed 15-20 members per cohort is optimal for having a quality discussion and completing the weekly content within the hour and would allow for 3 MIM cycles given the scope and timeline to complete recruitment, MIM delivery, and analysis, including sustainability of results.

Procedures: A diverse group of first responders will be recruited for the pilot study with the help of our community partners across Ohio. We aim to have a mix of different professions of first responders from various locations around Ohio. The community partners will ensure MIM is completed during work hours, and MIM trained facilitators will present the mindfulness didactic education and gentle yoga experiential videos and facilitate the discussion, in synchronous, online delivery.

The effectiveness of the app on employee well-being will be assessed through a pre-test post-test design to detect changes within the following measures: Perceived Stress Scale, MBI, Connor Davidson Resilience Scale, Work and Well-Being Survey, and the Modified Nordic Questionnaire. Participants will also have the option to complete a Program Feedback Survey which will be used to evaluate possible barriers to attending weekly sessions. Surveys will be distributed through the secure OSU MIM website and stored on a secure network through The Ohio State University. Participants in the research groups will download the app from the app store and verify their MIM login information via confidential login code and will be routed to their group within the app- either health system personnel or first responder before starting. Prior to the start of the program participants will be reminded to fill out the pre-test survey to establish a baseline. To avoid fraudulent participants who are not a firefighter / EMS, a Validation Survey will be sent out to participants so we can verify our program is reaching the correct audience. Information collected will verify a first responder's certification number, effective date, the issued location, full name, and their certification card upload. The additional resources on the app are sorted by weekly theme and will supplement the content taught in the group sessions and correspond to the eight-week program. At the completion of the program, participants will fill out the post-test surveys and evaluations that will be reviewed by the research team. The app will have 3-5 minute videos to enhance sustainability of the program that participants are able to access at any time. Six months after the program is over, a push notification will be sent to app users to fill out the same surveys as before. The team can determine and analyze the sustainability of app supported MIM and utilize feedback to enhance the app for future users.

Data Analysis: The video-based app delivery effectiveness will be assessed through a pre-test post- test design that has previously been the assessment plan of the MIM program for the HCP version of MIM, with the addition of the Modified Nordic Questionnaire. Surveys will be distributed through the secure OSU MIM website or app and stored on a secure network through The Ohio State University. In addition, the results of the video-based app delivery of MIM (MIM-HCP and MIM-FR) will be compared to the existing data on MIM to detect any significant differences in outcomes or sustainability of outcomes. All MIM-FR and MIM-HCP groups will receive a sustainability survey 6 months after they started their initial MIM intervention.

Validation: The app will provide process evaluation measures of app-usage, number of videos played, which videos helped most with stress reduction, and duration of interaction with the app which will provide quality assurance that the app was being utilized.

Aim 4: Pilot data from both HCPs and FRs (Aim 3) will be shared with HCP and FR leaders as part of interviews gathering their input regarding barriers and facilitators to scaling and large-scale statewide dissemination of MIM for both HCPs and FRs.

Approach Overview. Once the results of MIM-HCP and MIM-FR are collected and analyzed, it is crucial to share and interview leaders of the organizations so they can successfully disseminate the program to their respective professions and provide their own feedback on the findings. It is also important to look at a specific subset of HCPs – oncology nursing staff. They may face different workplace stressors than general HCPs, and gaining insight into their satisfaction with the MIM program help improve the program for future HCPs.

Participants. We aim to recruit five leaders within the health care system and five leaders across the first responder community in Ohio. The successful results from the pilot MIM app study will be shared with HCP and FR leadership in an interview format. We also intend to specifically recruit 10-15 nursing staff who work with cancer patients.

Procedures. The findings of the study will be analyzed by the research team using statistical analysis and qualitative analysis from the feedback of program and app evaluation. These results will inform the presentation shared with leadership in the healthcare and first responder field. The presentations will be specific to the respective professions and data will be analyzed with the different mental and physical stressors in mind. The presentations and interviews will be conducted by Dr. Klatt and Dr. Quatman-Yates and will follow an interview guide for each participant. The PIs or other study team members will conduct the interviews with oncology nursing staff. The focus on these interviews will be to discover how satisfied they are with the program and learn ways to improve it for nursing staff caring for cancer patients.

Data Analysis. Qualitative data from the interviews with leadership will be analyzed. The research coordinator will transcribe the interviews and conduct a qualitative analysis looking for themes and ideas to refine the existing program for HCPS and FRs. Analysis will be completed using qualitative software.

Validation. Data sharing interviews with healthcare and first responder agency leaders will enable the participation of important stakeholders to share their expertise, perspectives, and help strategize effective ways to scale and disseminate MIM programming across Ohio and nationally. Drs. Klatt and Quatman-Yates will lead all interviews, which will be recorded after approval and consent of all participants. Consistent themes across specific populations will be noted and synthesized to be used in scaling and dissemination strategies to increase likelihood of success.

Research impact will be determined by 1) the number of app video downloads 2) pre/post self- reported stress levels of participants after watching each video 3) changes in pre-app/post-app- survey scores (Perceived Stress Scale, Maslach Burnout Inventory (MBI), Connor Davidson Resilience Scale, and the Utrecht Work and Well-Being Survey (UWES) scores, in addition to the Modified Nordic Questionnaire, 4) the number of state and national presentations, 5) study citations in Science Citation Index and Google Scholar, and 6) number of other health systems/law enforcement agencies interested in pursuing future MIM implementation, sending facilitators through the train-the- trainer program, and use of sustainability app that is to be developed in this proposed research.

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