MINDFULNESS IN MEDICINE AND HEALTHCARE:
A Personal Introduction

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Abstract

Mindfulness meditation is a cognitive-behavioral intervention which shows benefits in a wide range of conditions. It is effective for stress reduction and lifestyle modification which are central to the treatment of many chronic diseases. Mindful practice enhances job satisfaction and counters burnout in medical professionals. The effects of mindfulness meditation are mediated through attentional networks and brain areas associated with stress processes, emotional regulation, learning, memory, and executive control. Mindful practice is relevant for both personal and professional challenges which many physicians face on a daily basis.

I clearly remember the bright summer day, climbing a cliff at the old quarry near my boyhood home, feeling for little nooks and ledges to carry me safely upward. Along the way I paused to catch my breath and admire below the view of the Arkansas river flowing away to the horizon and above me a hawk gliding on the wind. Out of nowhere a tiny ladybug in shiny orange and black landed on my outstretched arm, paused, and then flew off. Rested, I started back up, feeling the world at my fingertips.

In contrast to this vivid experience, I can remember arriving at the hospital one morning and realizing that I had been rehashing a recent case that did not go well. I did not recall much about my drive which I had made many times, although it routinely involved both travel at high speeds and grinding stop and go traffic. I assumed I had driven the whole way safely and nothing unusual had happened, but few details of the trip came to mind. I tried to focus as I stepped into the ER and the nurse handed me a chart.

As I recognize now, while both climbing and driving, my attention was guided by aspects of my experience that were in turn threatening, pleasant, or novel, their salience in the moment determined simultaneously at conscious and unconscious levels. (1) While climbing, a balanced sense of vigilance and calm prevailed. In technical terms, working memory and task-positive "attentional" brain networks were fully engaged. (2) In contrast, being on auto-pilot with mind wandering while driving involved the anticorrelated default mode network of the brain (DMN), which interferes with working memory and learning. (3, 4, 5) Mind wandering is a common mode of mental activity, active about 50% of the time as demonstrated in a study of over 2,000 adults sampled in real time. And it is more often than not associated with unhappiness. As the authors of the 2010 Science study conclude:

"A human mind is a wandering mind, and a wandering mind is an unhappy mind. The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost." (6)

Such vast differences in the quality and potential consequences of normal wakeful states, either attentive or mind-wandering, raise an important question. How is

one to be aware in the moment whether one is paying attention to what one is doing or on auto-pilot with the mind wandering? Given the mind's tendency to wander, awareness and regulation of the attention is indeed crucial to anyone processing complex information and making vital, potentially life-altering decisions, whether one is climbing a steep cliff or driving to work. But how is one to know? In the words of William James,

"The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will. No one is compos sui if he have it not. An education which should improve this faculty would be the education par excellence. But it is easier to define this ideal than to give practical directions for bringing it about."(7)

Moving along a few decades in my story, I had been practicing emergency medicine and raising a family for some years. Multi-tasking had become routine. I felt preoccupied with diverse concerns and frequently under pressure, and had also developed some significant health problems. Although following my doctors' orders, there was little improvement in my condition. I suspected that stress itself might be an underlying factor and that the ways I have been accustomed to coping with life's challenges were no longer helping much. About this time one of my physicians suggested that I look into a course in stress reduction based on the practice of mindfulness, which had been developed at the Univeristy of Massachusetts Medical School. I had practiced meditation for periods of time in the past since learning it from a classmate in medical school, and I decided to give the program a try.

In the course I became more aware of the role of stress in my health, as well as the influence of a negative bias in my thinking. This well-recognized asymmetry in the way we use negative versus positive information to make sense of our world has been documented to be active from infancy. (8, 9) How influential this bias is, and how it is reflected in one's thinking and behavior, can make a profound difference in one's stress load and related physical and mental health. (10, 11) As I began noticing how active this bias was in my own thinking, I saw a tendency toward being critical and worried. Although written 500 years ago, Montainge's words described how my own thoughts were inclined: "My life has been filled with terrible misfortune; most of which never happened."

Mindfulness meditation is a prescription for relieving stress that can be traced back to the Buddha. It has been practiced widely in the East for millennia, and has been most highly developed in the Buddhist tradition. In 1979, Jon Kabat-Zinn, a molecular biologist interested in the mind-body connection to stress-related disease, removed the religious elements from the practice and developed a course on mindfulness as an approach to reducing pain and stress. (12) Physicians at the University of Massachusetts Medical Center began sending patients with a variety of stressful chronic diseases to the UMass Stress Reduction Clinic. In 1982, Kabat-Zinn published the first paper on mindfulness as a clinical intervention, showing significant benefits for patients with chronic pain. (13)

In this 8-week course * in the practice of mindfulness, I became more familiar with the nature of stress and what determines it, especially how highly individual it is. It brought home the meaning of Hans Selye's statement that "it is not the stress that kills us, it is our reaction to it". The course emphasized techniques designed to enhance awareness of stress and interrupt the stress reaction cycle. Meditation was taught as a way of settleing the mind and training the attention, including active monitoring and recogition of mind-wandering. In these practices I saw a way to handle the frequent worry and negative thinking that often ran in a discursive loop, especially when the mind was on auto-pilot. As I became more familiar with the technique of paying attention to my attention and attitude, I began noticing that I had more choices in stressful situations, with better options for responding rather than reacting more or less out of habit.

As I started approaching situations with a new perspective, I sensed a shift toward being more accepting and less critical. I also noticed a fresh approach to coping with situations I would have found frustrating or disappointing in the past, and being more inclined to be proactive about taking responsibility for my own outlook and well-being. Although stressful situations continued to be a regular part of life, practice and growing skill in reframing perceptions were showing me that stress was not what happened to me, but what happened in me, a product of attitudes and choices I was becoming more adept at recognizing.

The central practice of mindfulness for stress reduction is meditation, which is key for developing certain skills of awareness which can then be used in everyday situations, particularly stressful ones. Meditation itself is a formal exercise of attention-training aimed at strengthening one's core psychological capacities, including self-

regulation of thoughts and feelings, along with body awareness, especially of stress-related sensations. Mindfulness as a distinctive expression of awareness involves three components: 1) training the attention; 2) engaging a certain attitude- one that is open, curious and friendly, i.e. "non-judgmental"; and 3) being purposeful, i.e. having some recognizable intention, including why one is meditating in the first place. (14)

Mindfulness is an inherent trait (termed "dispositional mindfulness") which all people have in varying capacities, (15) which is modifiable, and which is associated with various markers of health and healthy behaviors. (16, 17, 18) The formal practice through which one cultivates this trait is mindfulness meditation, a technique of focused and relaxed attention to present-moment experience with an attitude of acceptance. Meditation is often done sitting quietly while focusing on the breath. Other mindful practices include moving meditation such as yoga and chi gong. Of various types of such practices, mindfulness meditation (in the form of MBSR and similar interventions based on it) has received the most attention in modern healthcare and neuroscience research. The number of articles on mindfulness in peer-reviewed journals has grown exponentially over the past four decades, marked by increasing methodological rigor as this field of study matures. (19, 20)

Individual intentions for practicing mindfulness vary, but as a clinical intervention, the primary goal is to obtain relief from stressful physical and mental symptoms. The methods of mindfulness involve training the attention in meditation for active awareness while reducing reactivity to negative stimuli. Mindfulness meditation and yoga (practiced as a mindfulness exercise) induce a set of intergrated physiologic changes termed the relaxation response, a hypothalamic-mediated reaction which results in decreased sympathetic nervous stress system activity, decreased heart rate, lower metabolism, and decreased respiratory rate. (21, 22, 23)

Stress-induced processes can be adaptive in the short term ("allostasis") but can lead to damange when stress is excessive ("allostatic load"). Consequently, allostasis and allostatic load jointly affect vulnerability to brain-dependent and stress-related mental and physical health conditions. These include impaired immunity, atherosclerosis, bone demineralization and metabolic syndrome. (24) In the brain, stress-induced plasticity, causing atrophy of nerve cells, is most prominent in the prefrontal cortex, hippocampus and other areas associated with fear-related memories and self-regulatory behaviors. (25, 26)

The brain is the central processor as well as target of stress signals and stress-related hormones. It determines what one will experience as stressful and how one will cope with stressful experiences. At the same time the brain changes both functionally and structurally as complex neural circuits coordinate behavioral and physiological stress response systems to meet the demands imposed by particular stressors. This dynamic activity involves bidirectional signaling between the brain and body.

As a target of stress, the brain undergoes functional and structural remodeling in response to stress which can lead to damage when stress is excessive. Critically, the prefrontal cortex, which is the most evolved brain region and supports our highest-order cognitive and executive functions, is also the brain region most sensitive to the detrimental effects of stress. Acute uncontrollable stress can cause a rapid and profound loss of prefrontal cognitive abilities, and more prolonged stress exposure leads to changes in prefrontal structure. (27, 28)

The cumulative damage of chronic stress (29) is described succinctly in a 2016 article in the journal Metabolism: "Stress and its related comorbid diseases are responsible for a large proportion of disability worldwide. Although the term 'stress' is used in a wide variety of contexts, it has consistently been demonstrated that individuals with stress and related disorders experience impaired physical and mental functioning, more work days lost, increased impairment at work, and a high use of health care services." (30)

`As methodolgically rigorous studies accumulate, the intersection of the role of stress in disease and the role of mindfulness as a clinical intervention becomes more clear. Mindfulness as a treatment for chronic pain offers a good example of how this research has developed over time. A current PubMed search of "mindfulness chronic pain" brings up 247 articles, ranging from Kabat-Zinn's 1982 study (13) to one in the current issue of the journal "Pain" describing significant improvments in chronic pain in patients who had taken the MBSR course (compared to a control group receiving usual care) mediated by factors including decreased catastrophizing, along with improved self-efficacy and acceptance. (31) In a 2016 editorial in JAMA reviewing the efficacy of mindfulness for chroinc pain, the authors comment: "For patients with

chronic painful conditions, options are needed to help them live with less pain and disability now. ... High-quality studies such as the clinical trial by Cherkin et. al. create a compelling argument for ensuring that an evidence-based health care system should provide access to affordable mind-body therapies." (32)

Besides being proven effective as an intervention in major disease entities, mindfulness has a demonstrated role in disease prevention. An analysis of the New England Family Study revealed that participants' mindfulness was found to be associated with factors involved in lowering cardiovascular disease risk, including high physical activity, non-smoking, weight, and diabetes. Reviewing this and other studies, the authors offer a consensus-based model for the clinical mechanisms of mindfulness in disease prevention and management, as supported by epidemiologic and neuroscientific evidence to date. They conclude that mindfulness is associated with and positively influences cardiovascular health through improved self-efficacy and self-regulation, associated with decreased craving, reactivity, and depressive symptomatology, which positively affect behavior regarding smoking, diet, exercise, and medication adherence. (34)

In other studies, mindfulness has been shown to be associated with recognized biopsychological factors involved in disease treatment and prevention which include i.) producing a relaxation response, ii.) decreasing sympathetic nervous system activity at the level of the brain (33), iii.) improving attentional focus (35, 36, 37, 38), iv.) increasing cognitive flexibility (39), v.) decreasing emotional reactivity (40, 41), vi.) improving conflict monitoring and reactive control (42), and vii. facilitating rational decision making. (43)

"Bottom-line" epidemiologic studies demonstrate significant benefits in reduced health care utilization associated with mind-body interventions which emphasize patient participation incorporating mindfulness and meditation. (44, 45) Most recently, Benson and colleagues examined healthcare "billable encounters" of patients (n=4,452) deemed "high utilizers" of medical services, compared to controls (n = 13,149) over 4 years, using an 8 week mind-body intervention combining mindfulness and relaxation training with other techniques to reduce stress and enhance resiliency. Total utilization for the intervention group decreased by 43% ($p < 0.0001$). Clinical encounters decreased by 42% and Emergency Department visits decreased from 3.6 to 1.7/year ($p<0.0001$) . Subgroup analysis (identically matched initial utilization rates of the intervention group compared to high utilizing controls) showed the intervention group significantly reduced utilization relative to the control group by 25% across all clinical categories. The authors concluded that such mind-body interventions are safe, effective and inexpensive relative to the usual cost of care: "the cost savings from reduced emergency room visits alone in the treatment group relative to the control group is on the order of $2360/ patient/year. ...Assuming median values for visits at these treatment sites (including outpatient care, urgent care and emergency department visits, and hospitalizations) gives an expected range of cost savings of $640- $25,500/ patient/year. … These estimates are rough and based on aggregate numbers but give a sense of the scale of the opportunities available." (46)

Any account of the impact of stress and the role of mindfulness would be remiss if it did not include some mention of the epidemic of professional burnout which is at an all-time high among physicians, and which begins in training. More than half of US physicians report symptoms of burnout, including 63% of family physicians, 69% of general surgery residents, and 71% of medical students. (47, 48, 49) In addition to the toll on the individual physician, this stress-induced syndrome of emotional exhaustion, depersonalization, and impaired sense of accomplishment is associated with suboptimal care and major medical errors. (50, 51) The sources of workplace stress for physicians are complex, and proposed solutions are equally complex and challenging given the dynamic and often competing forces shaping today's practice of medicine. (52, 53)

I am no stranger to burnout, but I have noticed that during periods when I have made time for regular meditation, things have gone better in my life: in my work, my relationships, in how I handle stress. My experience resonates with a 2009 report in JAMA which demonstrated that primary care physicians participating in a program focusing on mindful awareness experienced improved personal well-being, including burnout and improved mood, along with positive changes in empathy and psychosocial beliefs, both indicators of a patient-centered orientation to medical care. (54) As leaders in medicine call for changes to reduce demands on physicians, many see promise in the mounting evidence that mindful practice offers a unique approach for coping with the inherent stress of clinical care. (55, 56, 57)

Besides the benefits to well-being, I can concur with the results of these studies which show that being more observant and empathic are inherent to mindful practice. This would sometimes be affirmed in the ER after evaluating a patient and telling them what I thought was causing the headache or chest pain or abdominal pain or whatever it was that had brought them in. It was not unusual to have to say that I could not find anything conclusive in the labs and X-rays and EKG's that would explain their symptoms. After answering their questions the best I could and advising follow-up, I would not infrequently hear a patient thank me for seeing them. In a sense I felt that this confirmed that a crucial part of our encounter had occured- that of truly seeing this patient, and that this sense of being seen and heard was what most connected me as a physician with a human being who had entrusted life and limb to me, who was almost always a perfect stranger to them. I also believe it was this sense of connection which, despite the inevitable missed diagnoses and poor outcomes, played some part in there being no claims of malpractice from any of the thousands of patients I treated in a high-risk setting for over 30 years.

After life in the ER, I attended teacher training at the UMass Center for Mindfulness, and now only see patients in my role as an instructor of the Mindfulness Based Stress Reduction course. My students include many with diseases that have been reported on in studies of mindfulness referenced in this article, including chronic pain, cardiovascular disease, cancer, immune disorders, anxiety, depression, ADHD and PTSD. My experience in this role confirms what patients were told from the beginning in the Stress Reduction Clinic, that "it doesn't matter if you believe in the practice or not, it just matters that you do it". In this sense, mindfulness meditation is like physical therapy: studies show that the benefits flow from the exercise itself, and depend on effort rather than faith. (58, 59)

In 2007 NIH Director Elias A. Zerhouni, MD described the deep challenges facing healthcare: "We are in a revolutionary period of medicine.... As opposed to the doctor-centric, curative model of the past, the future is going to be patient-centric and proactive. It must be based on education and communication.... It requires voluntary, intelligent participation, not passive acceptance. We can provide the information, but you have to do something for yourself." (60) Physicians-in-training are increasingly being introduced to this patient-centered participatory model of care. Mindfulness-related training relflected in wellness programs and/or research can now be found at most US medical schools, and, increasingly, in residency programs. (61, 62)

Although meditation is the traditional core practice of mindfulness, there are many ways of cultivating this dispositional trait that is present in each of us, which is essentially an attitude toward experience. In this sense, anything that helps the mind become more aware of experience with acceptance becomes a mindfulness practice. This might include, for instance, such practices as reflective inquiry, compassion, gratitude, and active listening, as described in the 2009 JAMA article on "Mindful Practice". (54) In healthcare and society at large there is a growing appreciation for what mindfulness offers in response to the stress of modern life, beginning with the challenge we each share of living in a digital world with a stone-age brain. (63)

In an age of rapid change and continual uncertainty, we are often faced with new and at times unpleasant realities, and how we manage these circumstances becomes for each of us a question to some degree at least of how we shall adapt. In these times, the words of Viktor Frankl always seem relevant: "When we are no longer able to change a situation, we are challenged to change ourselves". (63) In my experience, mindful practice is an approach to the challenge which has stood the test of time.***

*MBSR is taught by instructors who have taken training through the Center for Mindfulness at the University of Massachusetts Medical School. The 8 week course meets once a week for 2.5 hours plus one 6 hour session, and involves attention training exercises which include sitting meditation, body scan meditation (focusing on bodily sensations as the attention moves from one body region to the next), and yoga (traditional postures and stretches designed to develop strength, flexibility and balance). MBSR also involves recognition of one's intention for practice as well as cultivating an attitude of acceptance and non-judgment as part of being present to one's experience in the moment. Besidies in-class meditation and discussion, there is daily at-home practice.

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*The NIH defines mindfulness meditation as one of a group of mind-body interventions that are "designed to facilitate the mind's capacity to affect bodily function and symptoms". The focus is on the interaction between the brain, body, and behavior, and is practiced with intention to use the mind to alter physical function and promote overall health and well-being. (49)

***If you would like to try a brief form of meditation, here is the "20 Breaths Meditation"

"20 Breaths" Meditation Instructions

The mindfulness practice described is called "20 breaths." This exercise helps you take a fresh start whenever and wherever you want. It teaches you to step away from the distractions, frustrations, irritations, and preoccupations that stress and exhaust us.

The "20 breaths" exercise is actually 20 separate mindfulness exercises. For 20 breaths you bring all of your attention to each breath just for the duration of that breath. Each practice only lasts about 5 seconds, which is how long a typical breath lasts. At the end of each breath, that period of mindfulness practice is over; you take a fresh start with the next breath. When that next breath begins, give it your full and complete attention. You do that 20 times, with 20 breaths.

Start by seeing what it feels like to pay attention to a single breath. Take an upright, balanced posture, close your eyes if that is comfortable for you, and in a moment, take a single breath, while giving it all of your attention. You can try it right now.

It's not hard, and of course, nothing dramatic happens, you are just noticing your breath, but you are doing something that most people have never tried. You are intentionally bringing all of your attention to what is happening in the present moment. You have started your training in mindfulness.

Try the same thing again, but this time, pay attention to three breaths. When you notice your first breath, see if you are giving it your full attention. Often we notice something without experiencing it fully. It is possible to practice mindfulness with only part of your mind. Obviously, that isn't our goal now. If you find that part of your attention is somewhere else on your first breath, see if you can bring more of your attention to the second breath. And finally, see if you can bring all of your attention, which is completely possible, to your third breath. See what it feels like to experience each breath a little more fully than the one before.

Gradually build up to 20 breaths. Or, if your day is very busy, do several practices of 3, 5 or 10 breaths during the day.

When you do the 20 breaths, each breath is a separate event, and each breath gets separate attention. At the end of the breath, you can let go of any effort. Relax, and the next breath will come. You will need to count the breaths to know when you are finished. So when you breathe in, and breathe out, you count it by saying the number "one" to yourself. After the second out breath, you count "two" and so on. When you get to "10", start counting back to "zero." So, for the first 10 breaths, you count from "1 to 10", and for the second 10 breaths, you count back from "9 to 0."

If you lose count, it's no problem. If you like, you can make your best guess as to where you were, and pick up there. Or, you can just start over as the whole exercise takes only a couple of minutes. As you do this, you might discover that it is harder to pay attention, even for only a few seconds, then you might have thought.

Sometimes, it seems as if every second has its own distraction and that the mind wanders constantly. Don't let it bother you. In fact, this is one of the most important things that this exercise teaches us. You begin to notice when you are distracted, and then step away from that distraction. If we are going to undo stress, distractedness, and tension, first it takes noticing that they are happening in the first place. Try not to give yourself a hard time, or struggle too much. A light touch and a sense of humor will help.

If you practice this everyday, soon you will find that it is possible to bring all of your attention back into the present moment even when you are very stressed and distracted. You won't do it perfectly every time, but with practice you will get better and better. Pretty soon you will be able to use this technique to find stillness and relaxation right in the middle of your busiest and most stressful day.

Adapted from Michael Baime, MD

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