

On the Importance of Mental Health in STEM

Cite This: *ACS Polym. Au* 2023, 3, 295–306

Read Online

ACCESS |

Metrics & More

Article Recommendations

ABSTRACT: From homework to exams to proposal deadlines, STEM academia bears many stressors for students, faculty, and administrators. The increasing prevalence of burnout as an occupational phenomenon, along with anxiety, depression, and other mental illnesses in the STEM community is an alarming sign that help is needed. We describe common mental illnesses, identify risk factors, and outline symptoms. We intend to provide guidance on how some people can cope with stressors while also giving advice for those who wish to help their suffering friends, colleagues, or peers. We hope to spark more conversation about this important topic that may affect us all—while also encouraging those who suffer (or have suffered) to share their stories and serve as role models for those who feel they cannot speak.

EDITOR'S NOTE

This Editorial is for informational purposes only and does not constitute medical or health advice. Always seek the advice of qualified professionals or healthcare providers if affected by the issues discussed herein. Please note that this Editorial has received critical input from some researchers in the polymer community but not been peer-reviewed by experts in the field of mental health.



Figure 1.

PREFACE

This contribution discusses self-harm/suicidal ideation and mental illnesses. If you are in crisis, call your local emergency line (USA: 911) immediately. If you are having suicidal thoughts, call the *Suicide and Crisis Lifeline* at 988 (USA) or use its webchat at <https://suicidepreventionlifeline.org/chat> to speak with a trained counselor at any time. While we must acknowledge that many resources provided in this Editorial are focused on readership in the United States, helpline.org¹ provides a comprehensive list of mental health helplines across the globe and sorted by country.

Please seek professional help from a health care provider or local university resources if you, or someone you know, is suffering from mental illness that is disruptive to your/their quality of life (e.g., causing problems at work, at school, at home,

or with friends/family) or if any of the symptoms and signs of mental illness resonate with your lived experiences and/or persist for long periods of time (especially after removal of negative stressors). Professional help can include a combination of therapy and medication, depending on your wants and needs. Our Editorial will not discuss medication and will only discuss a few specific types of therapy; there are many other paths available depending on the individual. ***We are in no way implying that practices to improve mental hygiene will cure mental illness.***

We recognize the collective societal stigma about mental illness and treatment. This stigma has different fangs among those of varied backgrounds (e.g., race/nationality, socioeconomic status, location, age, etc.). Systemic challenges to improving mental health exist for many individuals but also our society as an entirety. Someone who must work multiple minimum wage jobs to make ends meet will struggle to focus on mental hygiene until nationwide societal inequalities have been addressed. As such, we recognize the Sisyphian (absurd) nature of individual action to rectify such systemic problems.

This Editorial serves as an attempt to highlight such issues of equity and inclusion. We aim to introduce vocabulary to describe shared experiences and to foster dialogue. We also wish to highlight the cruel optimism of *individual* solutions that are offered to address deeply rooted societal problems. By highlighting common stressors, we intend to increase awareness of how we—as faculty members, administrators, or students—sometimes unknowingly contribute to poor mental health. Even for those not affected on a personal level, this Editorial will hopefully improve empathy for those who suffer and—ideally—change the way many of us to do things to prioritize people before papers and respect before proposal deadlines.

Published: June 21, 2023



This Editorial is motivated by the personal experiences of the authors. As a community, we would benefit from more open discussions of experiences and struggles to share our stories and normalize a conversation about our mental health. We consulted with mental health experts and collected invaluable feedback from many faculty and students from diverse backgrounds and academic fields. We wish to acknowledge their contributions here and list their names in the Acknowledgments.

■ INTRODUCTION

Imagine this: You excel at chemistry. Even before graduating with your bachelor's, you teach a senior course at your college. You begin publishing as an undergraduate and proceed to earn the most prestigious awards offered by your university during grad school. You defend your dissertation and land a professorship before leaving academia for one of the leading plastics companies on the globe. Your scientific breakthroughs lead to your election to the *National Academy of Sciences*—as the first industrial organic chemist. Unbeknownst to you, the materials you develop will soon be used by nearly everybody in the world—every—single—day. You are recently married and expecting the arrival of your daughter, Jane.

On April 29, you are found dead in your hotel room. Next to a squeezed lemon and potassium cyanide.



Figure 2. Wallace Hume Carothers (April 27, 1896–April 29, 1937). Reprinted with permission from ref 2. Copyright 2017 American Chemical Society.

This is the story of Wallace Hume Carothers (Figure 2).³ The inventor of Nylon and the great mind behind the established theory of step-growth polymerization. Wallace Carothers took his life, having suffered from depression for many years.

“I find myself, even now, accepting incalculable benefits proffered out of sheer magnanimity and good will and failing to make even such trivial return as circumstances permit and human feeling and decency demand, out of obtuseness or fear or selfishness or mere indifference and complete lack of feeling.” – Wallace Carothers

History is full of prominent scientists who suffered from mental illness, including Isaac Newton, Wolfgang Pauli, David Bohm, and Ludwig Boltzmann.⁴ Many more individual stories remain unnoticed. It is vital for our community to promote more open communication and our role models to show vulnerability. Taking the lead and opening up about our struggles is of high

importance, especially in a culture that leans toward blaming the individual for societal problems.

Mental health in our society is declining. According to a 2020 report by the *National Institute of Mental Health* (NIMH),⁵ nearly 53 million U.S. Americans (21% of all adults) suffer from, or experience, some form of mental illness. The reported prevalence of any mental illness, according to this survey, was highest for adults reporting two or more races/ethnicities; it was also higher for female respondents than for male respondents.⁵ The LGBTQ+ community is disproportionately affected: teenagers are six times more likely to experience depression than non-LGBTQ+ identifying teens, and nearly half of all transgender adults report thoughts of suicide.⁶ A growing percentage of adolescents in the United States live with major depression. The prevalence of mental illness is highest (31%) for those younger than 25 years (67% of college students).⁷ Ages 26–49 show the second-largest fraction affected (25%).⁵ Graduate students are “more than six times as likely to experience depression and anxiety as compared to the general population” with 41% of students showing signs of anxiety and 39% moderate to severe depression.⁸ Alarming, suicide was the second leading cause of death among individuals between the ages of 10–14 and 25–34, and one third of those between 15 and 24.⁹ Despite the gravity of these statistics, only 1 in 3 adolescents or young adults with major depressive disorder receive treatment—even in states with the greatest access to mental health services.¹⁰ COVID-19 has exacerbated this crisis by adding additional stressors and increasing social isolation¹¹—again more so for female students, historically excluded groups, or those with disabilities.^{11,12}

Other authors have recognized and described this mental health crisis, specifically focusing on the academic world: students, trainees, and faculty in science, technology, engineering, and mathematics disciplines (STEM).^{8,13} Here, our goal moves beyond highlighting statistics. We intend to outline symptoms and suggest practices that may support good mental health.

■ MENTAL ILLNESSES: RISK FACTORS AND SYMPTOMS

We will first discuss specific mental illnesses that are common in STEM academia:^{8,14} depression and anxiety. We will also discuss burnout, which is technically classified as an occupational phenomenon by the *World Health Organization* (WHO) and not a mental illness.¹⁵ We highlight prevailing symptoms and signs (see Figure 3), contributing risk factors, and stressors. These are not exhaustive lists and may not apply to everyone equally—albeit, as outlined above, underrepresented groups are generally disproportionately affected.

Depression

Depressive episodes are described as feelings of sadness, irritability, or emptiness. Feelings of hopelessness or pessimism often coincide with a loss of pleasure (anhedonia) or interest in activities, for most of the day, nearly every day, for extended periods of time.^{16,17}



Figure 3. Warning signs for any mental illness.

“It is not pleasant to experience decay, to find yourself exposed to the ravages of an almost daily rain, and to know that you are turning into something feeble, that more and more of you will blow off with the first strong wind, making you less and less. Some people accumulate more emotional rust than others. Depression starts out insipid, fogs the days into a dull color, weakens ordinary actions until their clear shapes are obscured by the effort they require, leaves you tired and bored and self-obsessed – but you can get through all that. Not happily, perhaps, but you can get through. No one has ever been able to define the collapse point that marks major depression, but when you get there, there’s not much mistaking it.” – Andrew Solomon, in “The Noonday Demon: An Atlas of Depression”

Poor concentration, feelings of excessive guilt or worthlessness, hopelessness about the future, thoughts about dying or killing oneself (the authors would like to highlight passive suicidal ideation: a fixation on “not existing” rather than killing oneself), disrupted sleep, changes in appetite or weight, disinterest in personal hygiene, and feeling especially tired or low in energy are further symptoms. The outcome is often difficulty in personal, family, social, educational, occupational, and/or other important areas of functioning. Causes and risk factors for depression include trauma, stress, and external life events (vide infra), as well as biological (brain chemistry) and genetic nature.^{16,17}

Anxiety

Anxiety is an umbrella term that is characterized by excessive and difficult-to-control worry about a variety of life situations; “excessive” here indicates disproportionately severe relative to the impact of the situation. Included are social anxiety disorder, phobias, certain obsessive-compulsive disorders (OCD), panic, and generalized anxiety disorders. Many of these have specific triggers or are focused on grouped worries. For example, social anxiety can surface intrusive thoughts of social awkwardness or reliving self-perceived faults in social interactions. Anxiety can manifest both physical and emotional symptoms. Restlessness, shortness of breath, increased heartbeat, sweating, digestive/bowel dysfunction, and headaches or migraines are common examples of the former. Emotional symptoms can include unexplained feelings of distress or dread, fatigue, inability to concentrate, sleep disturbance, and irritability.^{18–22}

“When I feel anxious, it’s almost that I can’t solve the problem or answer the question clear-mindedly because I’m so scattered and worried about getting my answer in on time (...) I can’t think clearly so if I were to click in a question or have an answer, I don’t know if my answer was the correct answer because I’m so worried about getting my points that day that I feel that I don’t know. I’m not always having the clearest mind.”
– Megan, a science student participant in a study on the influence of active learning practices on anxiety²³

Anxiety generally also includes overthinking future events and developing solutions to all possible worst-case outcomes. Difficulty handling uncertainty and indecisiveness are also hallmarks; whether because of a fear of making the wrong decision or fear of making decisions at all. Causes and risk factors include brain chemistry or genetics. Differences in foundational experiences, especially distress or nervousness about new situations during childhood, can also result in persistent heightened responses to perceived threats.

Burnout

Burnout is exhaustion characterized by excessive prolonged emotional, physical, and/or mental stress. Unlike depression and anxiety disorders, burnout is not a mental illness and not a medically diagnosable condition. Rather, burnout has been officially classified as an “occupational phenomenon” in 2019,¹⁵ and is characterized by feelings of exhaustion, cynicism, and reduced efficacy.²⁴ It is a manifestation of prolonged stress because of one’s job or, if one is a student, due to school.

Despite not being considered a mental illness, we include burnout here as it is increasingly recognized, affects many in STEM academia, and manifests symptoms like depression and anxiety. Symptoms include lack of energy, hopelessness, cynicism, a negative outlook on life, resent, and feeling overwhelmed. Physical symptoms can include suppression of the immune system and disproportionately elevated heart rate.^{25–27} *“The imbalance of effort and reward can lead to increased cynicism in students, or a negative attitude toward schoolwork. It can lead to increased emotional exhaustion, such as feeling drained from academics. Finally, it can lead to decreased efficacy as a student, or feeling less competent in one’s ability to complete schoolwork.”*²⁸ Effective treatments for burnout are an active area of research. The current theory involves developing a healthy workplace framework by examining the misaligned or misfit relationship between an individual and their occupational environment.²⁹

■ STRESSORS AND RISK FACTORS FOR WORSENING MENTAL HEALTH

Stress

According to the *American Psychological Association* (APA), stress is the body’s emotional, physical, or behavioral response to environmental change.³⁰ Some amount of stress can actually be beneficial for performance,³¹ yet the accumulation of *too much* stress (e.g., homework deadlines, upcoming exams, and oral presentations) can be harmful, even if associated with a positive event (e.g., graduation, invited talk, and a sports competition). Chronic or acute stressful experiences can also have significant impacts. Dr. Nadine Harris—former Surgeon General of California—outlined the effect of lingering or suppressed trauma on the mind and body in her pediatric research,³² and highlighted the importance of healing long-term effects of adversity: *“Imagine you’re walking in the forest, and you see a bear.*

Immediately your brain sends a bunch of signals (...) 'Release stress hormones! Adrenaline! Cortisol!' So your heart starts to pound, your pupils dilate, your airways open up, and you are ready to either fight the bear or run from the bear." According to Dr. Harris' research, consistent exposure to stress over prolonged times results in a dysregulated stress response. "When you put a kid who had experienced adversity in an MRI machine, you could see measurable changes to the brain structures."³² This "living with the bear" has been connected to significantly increased risk of mental health disorders, but also heart disease and cancer, notably often not noticeable until advanced ages. Fortunately for those who have suffered such trauma, many effects can be reversed through "synaptic plasticity," i.e., sleep, exercise, nutrition, meditation, and healthy relationships. Nevertheless, it is important to note that long-term repression of dormant past trauma (e.g., by diving deep into work, school, or hobbies) is often a mere distraction that provides limited (if any) long-term relief. The high stress environment of STEM and its *publish or perish* culture can trigger and worsen trauma or distract us from realizing that past trauma more significantly impacts our behavior than we notice.

"Dysregulation of the stress response has a profound impact on immune and inflammatory responses because virtually all the components of the immune system are influenced by stress hormones. Chronic exposure to stress hormones can suppress the immune system in some ways and activate it in others, and unfortunately none of it's good. – Nadine Burke Harris in "The Deepest Well"

Postevent Blues

Even positive and joyfully anticipated events can bring negativity. The *post-event-blues*, or *letdown effect*, describe the mental crash that often occurs following major accomplishments or positive life events.^{33–35} Often unexpectedly, physical and emotional fatigue sets in, triggering a questioning of purpose, and possibly even a spiraling into clinical depression. Events that fall into this category are often those generally accepted as positive: a wedding, finishing a marathon, submitting your first scientific manuscript, winning a postdoctoral fellowship, accepting a new faculty position, or retirement. We venture outside of the academic world to highlight two examples: post-Olympics depression. Michael Phelps³⁶ and Simone Biles³⁷—two "greatest of all time" athletes—have begun openly discussing their mental health.³⁸ For students, an important exam, an on-site job interview, or submitting their dissertation can have similar effects as prolonged training and competition as an athlete.

"Hopefully, I can save a life. I can help somebody else because I know that the feelings that I have, I had, what I go through every single day, every single week, every single month. I know I'm not alone and I understand that for me it's OK to not be OK." – Michael Phelps

Loneliness and Lack of Community

Moving to attend college is becoming the norm. In 2020, 4 in 10 U.S. Americans moved away from home to obtain higher education. Nearly a third of all newly admitted students relocated to a different state,³⁹ if not even a different country. While this can be exciting for some, it can be daunting for others. For postdocs, new faculty members, or young professionals, the academic path can often limit chances to put down roots by promoting a lifestyle that requires frequent relocation. Moving is inherently challenging and social isolation and disconnection

from natural environments in cities⁴⁰ are both risk factors for mental health—especially for introverts.⁴¹ Maybe surprisingly, a sense of isolation and acute loneliness was actually correlated to cause similar stress levels as *physical* attacks.⁴² U.S. Surgeon General Dr. Vivek Murthy describes loneliness as a silent pandemic and highlights the systemic causes of loneliness and its increasingly negative implications.⁴³

Additional Stressors

The APA has surveyed graduate students and found that 60% of students report academic pressures, financial debt, or overall anxiety as significant stressors.⁴⁴ Poor work/school–life balance (59%), family issues (45%), and burnout (38%) also make attending college challenging outside of the classroom or lab. As a result of these and many other stressors, students may isolate themselves, give up easily when frustrated, react with strong emotions (e.g., anger, hostility), or adopt new and negative coping mechanisms.⁴⁵

STEM-Specific Culture

Particularly in STEM fields, there can be a culture of *this is supposed to be hard*. It can often be challenging for students and early career academics to recognize inappropriate levels of stress. This can lead to self-doubt about something being "supposed" to be hard and whether the levels of stress and sacrifice are normal, appropriate, and, in fact, necessary. The line between being "challenged" and "suffering" becomes blurred and can prevent those affected from seeking out necessary guidance and help. The "*suffering Olympics*" is another phrase that evokes the unhealthy culture of bragging about lack of sleep and working hours/busy-ness. Not having the time to grab coffee has become a status symbol,^{46,47} despite increasing evidence that lack of work/life balance negatively affects our mental health. The "*Why is this class required?*" question can become daunting and lead to a perceived loss of agency and purpose,⁴⁸ as can the "*why?*"—especially for fundamental researchers. A perceived imbalance between effort and reward also affects our health.⁴⁹ For example, putting hour after hour into scientific articles to receive negative feedback. Destructive peer evaluations appear to always come from "Reviewer 2"—an almost comical trend that has become the subject of many memes throughout the scientific community.⁵⁰ Many feel a need to drop their hobbies to make room for the constant onslaught of homework, exam, or project deadlines, leaving little free for many to enjoy a calming breath of fresh air or walk in nature—despite its proven positive effects on mental health (vide infra). The offered solutions to these systemic issues are often based on cruel optimism: it is relayed to the individual to work harder and study more. Even as graduation approaches, insecurities about the professional future and a daunting and important decision about what comes next is scary, not even mentioning the previously outlined post-event-blues that are looming on the horizon.

MENTAL HYGIENE: HOW CAN YOU TAKE CARE OF YOURSELF?

The systemic deprioritization of mental health is difficult to address by individual action. Such a concept of "bootstrapping" oneself into better mental health places undue agency and blame on those who are suffering, without addressing the underlying social and cultural structures and causes. Nevertheless, there is research to suggest that certain individual actions can support you in managing your mental health. As Austrian psychiatrist and philosopher Dr. Viktor Frankel writes in his best-selling book *Man's Search for Meaning*:

“When you can’t control what happens, challenge yourself to control how you react to what happens. That’s where your power is.” – Viktor Frankl in “*Man’s Search for Meaning*”

If you are suffering, try to be kind to yourself during this time. Try to imagine what you would say to your best friend if they were in your shoes: offer yourself the same grace and compassion. Be kind to yourself and recognize that sometimes activation barriers may feel insurmountable. The activities outlined below (see Figure 4) may improve your mood and your mental hygiene. Do what you can as you can. Other things that may help:



Figure 4. Some recommended practices to improve mental hygiene.

Talk It Out: Consider Therapy

Different types of therapy in the United States are facilitated by mental health professionals (counselors, social workers, psychologists):

- *Psychotherapy*⁵¹—a broad term for treatment techniques to help someone identify and alter troubling thoughts, emotions, and behavior.
- *Cognitive behavioral therapy*^{51,52}—an evidence-based therapy focused on helping someone identify and reprogram inaccurate and harmful automatic thoughts (e.g., low evaluation of one’s abilities). It can also include exposure therapy.
- *Interpersonal therapy*⁵²—an evidence-based therapy that examines the connection between mood and interpersonal functioning and relationships.
- *Dialectical behavioral therapy*⁵³—a form of cognitive behavioral therapy for individuals who experience emotions very intensely.
- *Group therapy*⁵⁴—groups of patients with one (or more) mental health professionals designed to target specific problems by both talking and listening. Groups can also sometimes act as sounding boards and support networks.

There are many challenges to obtaining professional help and/or therapy, including long wait times, expense, and difficulty finding a therapist you “click” with.^{48,49} Such challenges can feel insurmountable when you are already struggling. Consider asking a friend to help you get organized and make phone calls. Many university campuses have counseling services with free sessions for students. Your general practitioner, health insurance provider directories, or the *National Alliance on Mental Illness* (www.nami.org) may be able to provide resources and/or help with initial discussions

and referrals. For readers outside the United States, <https://www.helpguide.org/find-help.htm> provides a comprehensive by-country overview of mental health resources.

Be Present and Aware: Meditation and Mindfulness

There is increasing scientific evidence that mindfulness and certain meditation practices can improve mental and physical health.^{55,56} Mindfulness and meditation practices focus on being present in the moment and your current experiences, rather than allowing errant thoughts to distract your attention. The goal is to experience your thoughts and feelings without passing judgment on them. Apps like *Calm*, *Headspace*, or *Healthy Minds* (free) can provide guided meditations of varying lengths. There are also many free guided meditations on YouTube. Several books are great references to start your practice.⁵⁷ Mindfulness practice does not necessarily require sitting still and breathing deeply. It can be as simple as observing the textures, temperatures, and substances as you wash dishes. When your attention wanders, gently guide it back to experiencing the task at hand. There are many activities that have similar “meditative” benefits: anything that is all-encompassing and requires your entire attention: running, hiking, and various artistic outlets are good examples.

Let Words Move You: Read and Reflect

Reading has many positive effects—reducing stress, building vocabulary and knowledge, and expanding our horizons.⁵⁸ Often overlooked are the benefits on our mental and emotional well-being. Many great philosophical minds have discussed the purpose and meaning of life. Reading how your feelings and problems have troubled others for centuries can provide support and comfort. You are not alone. Reading and educating yourself about the underlying causes for how you feel can also have healing powers.⁵⁹ Reading captures your attention to a different degree than watching a show or movie and allows you to place yourself in someone else’s shoes. Reading fiction has indeed been found to increase empathy,⁶⁰ social skills, and interpersonal understandings.^{61,62} “*Bibliotherapy*” or “*reading therapy*” are structured reading programs run by clinics, libraries, or schools that benefit recovery or support people with mental health challenges.⁶³ Bibliotherapy resources in the United States can be found on the website of the *American Library Association* (ala.org). Generally, consider paperbacks and hardcovers over screen reading³⁰ to improve comprehension and avoid blue light (disturbs sleep cycles) or possible distractions from electronic devices.

Explore: Experience the Outdoors

You do not have to climb Mt. Everest. Only a few minutes of walking per day can boost your mood.⁶⁴ Find nature if you can. Immersing yourself in a green space, an arboretum, or a forest has numerous benefits.^{40,65} It reduces depression, anger, and aggressiveness. It lowers your blood pressure, heart rate, and level of stress hormones faster than urban landscapes can. “*Forest bathing*” or hiking can help you regain the sense of agency and accomplishment that is often missing for those suffering from mental illness. As you escape the bustling city, try to disconnect from your external stressors. Leave your phone at home or turn it to airplane mode, turn off your music, and let your mind wander without distraction. Allow your subconscious to process your challenges and experiences and exhibit healing powers while also improving your creativity.

Take Care of Your Physical Health

Your physical and mental health are inherently connected.⁶⁶ Make it your goal to reinforce habits that are healthy for you

body. This includes physical activity and rest, but also your diet and consumption behavior of legal stimulants. Focus on maximizing the intake of whole foods, reduce fat and refined sugar intake, avoid drinking alcohol, consuming nicotine, or taking drugs (including medications not prescribed for you).^{67–70}

Move: Healthy Body—Healthy Mind

There is a measurable connection between physical activity and emotional health.⁷¹ Physical exercise, in particular engaging team sports that build a sense of community⁷² and resistance training provide considerable benefits. “Lifting gave me a sense of agency. It gave me a sense of control”⁷³—control that often goes awry during challenging mental health episodes.⁷³ Sustained cardiovascular exercise is also correlated to decreased anxiety and reduced *Attention-Deficit/Hyperactivity Disorder* (ADHD) symptoms.⁷⁴ It is important to note however that excessive physical activity (*overtraining syndrome*) can itself lead to sleep disturbances, irritability, emotional imbalance—and even depression and anxiety.⁷⁵ Research estimates an optimal threshold of 2.5–7.5 h of weekly physical activity to maximize mental health benefits without risk of overtraining.⁷¹ Just as physical health and well-being are key components for mental health, so are recovery and sleep.⁷⁵

Sleep: Give Yourself the Rest You Need

The seemingly endless workload for students (and faculty) can be correlated with rising anxiety levels, depression, and increasing sleep disturbances.^{76,77} A vicious cycle ensues. Anxiety is also worsened by lack of sleep, which, in turn, disturbs subsequent nights' sleep. Both quantity—an average of 7 h nightly has proven benefits—and quality of sleep are critical for our well-being.^{67,68,78,79} Some science-backed ideas to improve the quality of your sleep:

- Try to establish a regular bedtime routine. Wake up at the same time every day, even on weekends.⁸⁰
- Consider a warm bath, meditation,⁸¹ yoga routines,⁸² or stretching to help you fall asleep.
- Keep your bedroom cool at temperatures between 60 and 67 °F (15 and 19 °C).⁸³
- Teach your brain that your bed is only for sleep (and sexual activity). Do not allow your mind to associate your bed with anxiously ruminating over tomorrow's tasks or scrolling social media.⁸⁴
- Limit screen/device time in the hour before bed. Blue screen light suppresses melatonin production⁸⁵ and interferes with your circadian rhythms.⁸⁶ Even if you use blue-light filters, an upsetting e-mail, deadline reminder, or social media post can heighten your awareness and keep you awake.
- Limit alcohol consumption near bedtime. The proverbial nightcap may make you feel like it is easier to fall asleep, but alcohol causes sleep to be light and of poor quality.⁸⁷

Feel the Rhythm: Play or Listen to Music

Both listening to and making music have been established to influence mental health.⁸⁸ As humans, we are capable of both interpreting music to detect emotions, but we are also wired to be emotionally affected by it.^{89,90} As such, upbeat and happy music can elicit happiness, while sad music may trigger melancholy.^{91,92} It is important to note that this is highly individual and can have contrasting effects. Some studies indeed show a worsening of mood for listeners of sad music,^{93–95} but melancholic genres can also help reflect and offer comfort for

others.^{96,97} Making music is generally considered to enhance both personal well-being and social connectedness.⁸⁸ Playing an instrument or beginning music lessons can provide valuable and welcome distractions from problems.^{98,99} If you suffer from performance anxiety, refraining from audiences and keeping music-making, singing, or song-writing as an individual or small-group hobby is a viable option.^{100–102}

Connect with Friends and Colleagues

Social interactions and norms have changed rapidly. Through advances in, and accessibility of, technology, social interactions are no longer restricted by time and place. Rather than communicating primarily with those in local geographical spaces, social media and social networking sites now provide modern town squares with sometimes unclear norms of social behavior.¹⁰³ Digital platforms can allow us to stay connected to existing friends and colleagues or to meet new ones. However, smartphones and internet access have also been correlated to increases in loneliness,^{104,105} in part, because of the lower quality of digital communication compared to in-person interactions. In addition, smart phones and digital media may heighten fear of missing out (or being excluded), can distract during in-person interactions, or can be used to ignore people by looking at one's phone (phubbing).^{106,107} While there are undoubtedly advantages of social media for our mental well-being¹⁰⁸ (e.g., through support networks), there are many correlated negative impacts: declining well-being,¹¹⁰ worsening sleep and lower self-esteem,¹¹¹ increasing depression,^{112–115} anxiety,^{111,113,116} and suicide rates.¹¹⁷ The research on both negative and positive effects of smart phone use on psychological well-being and mental health is ongoing.^{118–120}

Mental hygiene involves being aware of these trends and critically considering social media use. If you spend 20 min a day only using social media, starting at the age of 16 and until you turn 65, you will have spent *more than an entire year of your life looking at your phone*. This is a shocking underestimate, as recent consumer data¹¹⁵ exceeds this example (63 and 49 min for women and men, respectively)¹²¹ Much of this time you will have spent on scrolling through emotionally triggering and addictive videos,¹²² #livingmybestlife hashtags, or your someone who broke your heart living their new life.

“Ironically, this fixation on the positive—on what's better, what's superior—only serves to remind us over and over again of what we are not, of what we lack, of what we should have been but failed to be. After all, no truly happy person feels the need to stand in front of a mirror and recite that she's happy. She just is.” – Mark Manson

For social media posts, but also more generally, it is also important to realize the differences between *internal* and *external* motivation.¹²³ If you are internally motivated, you do things because they give you joy. You explore your surroundings, bring your camera, and pursue art for your own creative fulfillment. The externally motivated photographer, in contrast, may focus on positive feedback from the number of likes on a posted photograph, eventually leading to the possibility of a disappointing disconnect between what you think is a good photo and what your followers like.

Improve your mental health by focusing on high quality personal interactions to mitigate social isolation and loneliness:¹²⁴ online ties can supplement face-to-face connection, and online communication can reinforce offline friendships. Rather than mindlessly scrolling through content, consider ways

to connect with people in real life. Join a club, try group exercise, pick up a pottery class!

■ HOW CAN I HELP SOMEONE WHO IS SUFFERING?

We outlined several warning signs of those who may be struggling: lack of concern regarding personal hygiene, changes in weight or appetite, irritability, energy levels, sleeping patterns, or alcohol consumption.¹²⁵ Mood changes, anxiety, and aggressive behavior are also noticeable—as are comments made in passing or in jest about death or dying. In social circles, detachment from people and activities can also be a warning sign. What can you do to help your friend, colleague, or student in distress (see Figure 5)?^{17,30,126} Offer help and gently ask if there is anything of concern: “I notice you seem stressed (or worried or distracted) lately. Is there something I can help you work through?”³⁰



Figure 5. Suggestions on how to help a friend/colleague/student suffering from mental health disorders.

Before You Try to Help, Take a Minute

One crucial consideration is the difference between intention and impact: you may say something that you intend to be supportive but that may have negative (and potentially serious) impacts. Such unsupportive (in terms of impact) social interactions have been linked to depression and overall psychological distress in response to a stressor.¹²⁷ Upsetting responses include:¹²⁷ distancing (changing the subject), bumbling (seeming uncomfortable or afraid to say the wrong thing), minimizing (“it could be worse,” “look on the bright side,” “get over it”), and blaming (“I told you so”).

Believe the words and experiences that someone conveys to you. Now is not the time to play devil’s advocate, a theoretical mental exercise for you, but a painful dismissal of lived experiences. Do **not** say things like “Snap out of it” or “You just need to be better at dealing with it.” Avoid making judgements or expressing displeasure, and do not gossip about their behavior. Speak in private and treat your conversations as confidential. Be understanding and share vulnerability. Harness your empathy: “That sounds really tough.” Focus on listening and not on telling them how they *should* feel.

Helping a friend or a colleague means listening and engaging supportively. Rather than giving medical advice or acting like a counselor,¹²⁸ validate your friend’s feelings and encourage them to share and talk.¹²⁹ In other words, be an active-empathic listener!¹³⁰

Engage and Support

“I’m here.” Offer support, understanding, patience, and encouragement. Rather than offering blanket support (“How can I help you?”), offer specific actionable suggestions (“Let’s wash your dishes together”). Combat the hopelessness that depression radiates and show empathy: “This isn’t an ending. You can get through this.” Help them seek out professional help if they

are open to it. Try to reignite their spark for their favorite activities—but understand (and respect) that even the easiest activities may feel impossible.

“Being heard is so close to being loved that for the average person, they are almost indistinguishable.” – David Augsburger.

Ask and Listen

Check in regularly. Rather than: “let me know what I can do to help,” reach out. Listen with empathy and without judgment if they feel ready to share. Otherwise, be present with them—even in silence. Show that you are there to support them and they are not alone: “There’s nothing you can say to me that will send me away from you.” Throughout everything you do, be mindful of the power of your own words.

Take Care of Yourself

It is great to reach out and help, but even if someone is willing to seek treatment or make changes to their behavior. Be patient and do not forget your own mental health and emotional energy.¹³¹

A Comment on Self-Harm and Those in Acute Crisis

Understanding how to behave with an individual in acute crisis is challenging to navigate. We refer you to a pamphlet from the *National Alliance on Mental Illness*.¹²³ However, we also encourage you to ask for help from your colleagues or from local resources that are available to you. Many U.S. universities now have a **Red Folder** (based on the *Red Folder Initiative* from the University of California) to provide guidance on how to recognize and effectively respond to others in distress.¹³² Comparable resources exist at institutions across the globe, and we encourage you to learn about and leverage resources available at your workplace.

Research has demonstrated that there is no correlation between increased suicide rates and at-risk individuals being asked about thoughts of killing themselves.¹³³ As psychologist Karen Young outlines: “There’s a misconception that discussing suicide might plant the idea, but it just doesn’t work like this. If someone is contemplating suicide, the idea will already be there. If they aren’t, talking about it won’t put the idea into their mind. Suicide isn’t caused by asking the question. Never has been.”¹²⁵ Many faculty and staff at universities are mandatory reporters. If someone shares their intention to kill themselves, you must report this to emergency services. We recommend being direct about this during your conversations if the student seems poised to reveal something.

■ CONCLUSION

The concept of “cruel optimism” refers to simple upbeat *individual* solutions that are offered to us address problems deeply rooted in our society. It is considered *your* responsibility to exercise and offset decreasing food quality and huge portion sizes that are being offered¹³⁴—only to strive for an unrealistic body image that is portrayed to you by social media influencers.^{135,136} It is *your* responsibility to turn off your phone—despite the entire monetary concept of major media outlets being to capture your attention. It is called *cruel* optimism because the problem should not be there—yet it is commonly considered *your* individual responsibility to address it—and it is considered as easy as it is being suggested.

“Our society today, through the wonders of consumer culture and hey-look-my-life-is-cooler-than-yours social media, has bred a whole generation of people who believe that having (...) negative experiences—anxiety, fear, guilt, etc.—is totally not ok.” – Mark Manson

Academia is full of cruel optimism. The “publish or perish” culture and the common assumption that getting a higher degree “should be hard” are two of many factors that can lead to students (and faculty) experiencing mental health disorders or refer to taking medication to enhance performance and manage stress.

As a community, we need to find ways to remove mental health stigma from the individual, have open discussions about systematic errors that promote health issues, and begin taking responsibility as a collective. There is a reason that mental health issues and attention deficit disorders are most prominent in capitalistic cultures that promote excessive working hours, idealize unrealistic body images, and distract us from meaningful activities through benign activities. It is not *your* job to fix yourself—it is *our* job, as a collective, to improve the system. Those of us who are mentors and authority figures can help by modeling good mental hygiene practices.

We—as a society—need to regain our own agency and values. We need to not sit next to each other mindlessly scrolling through Instagram, but *actually* connect with our peers and friends through meaningful conversation. We need to make sure students, postdocs, and young faculty are heard and supported by their mentors. We need to appeal Reviewer 2’s comments if they make no sense—and as editors ensure we actively engage with authors and rebuttals. We need to question if our curriculum and our means of delivery make sense—not just push our students because “We had to do it too.”

And we need to embrace, understand, and support those who experience mental health issues. We cannot stress this strongly enough: seeking help is not a sign of weakness. You have value and worth beyond your productivity.

“And once the storm is over you won’t remember how you made it through, how you managed to survive. You won’t even be sure, in fact, whether the storm is re-ally over. But one thing is certain. When you come out of the storm you won’t be the same person who walked in. That’s what this storm’s all about.” – Haruki Murakami

RESOURCES TO FIND HELP

Many of the resources outlined are available in the United States. An exhaustive by-country list for these resources is beyond the scope of this Editorial, but similar programs exist in many countries. We would like to refer the international community to <https://www.helpguide.org/find-help.htm> as a first, important step to find guidance.

- If you are in immediate crisis or think you may have an emergency, call your doctor or 911 immediately.
- If you are having suicidal thoughts, **call the Suicide and Crisis Lifeline at 988**. The 988 Suicide & Crisis Lifeline is a national network of local crisis centers that provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 h a day, 7 days a week in the United States.
- Because text can feel more secure, there is also a **webchat** (988lifeline.org/chat/) and a **crisis text line** (Text HOME to 741741) to speak with a skilled, trained counselor at any time.

- The website of the *American Psychological Association* (APA) offers valuable resources if you are in distress under [apa.org/topics/crisis-hotlines](https://www.apa.org/topics/crisis-hotlines) as well as abilities to connect to professional help from a psychologist or counselor (sorted by state).
- Health insurance provider directories provide lists of mental health professionals. Your general practitioner or family doctor may also be able to help with initial discussions and providing referrals. The *National Alliance on Mental Illness* (NAMI) has links to other resources at www.nami.org.
- Many university campuses have counseling services with a specified number of free sessions for students that we encourage you to learn about. In recent years, the **Red Folder Initiative** has gained momentum as a concrete, highly visible, and helpful resource for universities to provide guidance to students and faculty members in identifying and dealing with distress.
- Finally, for further reading and information, we would like to refer you to resources from the *Center for Disease Control and Prevention* (CDC),¹³⁷ the *World Health Organization* (WHO),¹³⁸ and the *National Institute of Mental Health* (NIMH).¹⁷

Christian W. Pester  orcid.org/0000-0001-7624-4165

Gina Noh  orcid.org/0000-0003-4717-5767

Andi Fu

AUTHOR INFORMATION

Complete contact information is available at:
<https://pubs.acs.org/10.1021/acspolymersau.2c00062>

Author Contributions

§Christian W. Pester and Gina Noh contributed equally to this paper. Credit: Andi Fu validation (supporting).

Notes

Views expressed in this editorial are those of the authors and not necessarily the views of the ACS.
The authors declare no competing financial interest.

ACKNOWLEDGMENTS

We express our sincere gratitude for invaluable feedback about this topic and article from many STEM scientists from various backgrounds and at various stages in their career. In alphabetical order: Stephanie Butler Velegol, Nicholas Cross, Sarah Freeburne, Jan Genzer, Enrique Gomez, Zachary Hudson, Whitney Loo, Patricia Pereira, Themis Matsoukas, Scott Milner, Chinedum Osuji, Cole Thomas, Bryan Vogt, and Wanying Xie.

REFERENCES

- (1) Directory of International Mental Health Helplines. *Help-Guide.org*. <https://www.helpguide.org/articles/therapy-medication/directory-of-international-mental-health-helplines.htm> (accessed 2022-12-11).
- (2) Strom, E. T. Wallace Carothers and Polymer Chemistry: A Partnership Ended Too Soon. *ACS Symp. Ser.* **2017**, 1262, 121–163.
- (3) The tragic story of Wallace Hume Carothers. *Financial Times*. <https://www.ft.com/content/2eae82b2-b9fa-11dd-8c07-0000779fd18c> (accessed 2022-08-31).
- (4) My invisible battle. *Physics World*. <https://physicsworld.com/a/my-invisible-battle/> (accessed 2022-12-11).
- (5) Mental Illness. NIMH. <https://www.nimh.nih.gov/health/statistics/mental-illness> (accessed 2022-08-29).

- (6) Recommended citation: James, S. E.; Herman, J. L.; Rankin, S.; Keisling, M.; Mottet, L.; Anafi, M. *About the National Center for Transgender Equality*, 2016.
- (7) Hanson, M. College Enrollment and Student Demographic Statistics. *Education Data Initiative*. <https://educationdata.org/college-enrollment-statistics> (accessed 2022-08-29).
- (8) Evans, T. M.; Bira, L.; Gastelum, J. B.; Weiss, L. T.; Vanderford, N. L. Evidence for a Mental Health Crisis in Graduate Education. *Nature Biotechnology* **2018**, *36* (3), 282–284.
- (9) Suicide. NIMH. <https://www.nimh.nih.gov/health/statistics/suicide> (accessed 2023-01-21).
- (10) The State of Mental Health in America. *Mental Health America*. <https://www.mhanational.org/issues/state-mental-health-america> (accessed 2022-09-17).
- (11) COVID-19 and Mental Health: A Growing Crisis. *Mental Health America*. <https://mhanational.org/research-reports/covid-19-and-mental-health-growing-crisis> (accessed 2022-09-01).
- (12) Sifri, R. J.; McLoughlin, E. A.; Fors, B. P.; Salehi, S. Differential Impact of the COVID-19 Pandemic on Female Graduate Students and Postdocs in the Chemical Sciences. *J. Chem. Educ.* **2022**, *99* (10), 3461–3470.
- (13) Forrester, N. Mental Health of Graduate Students Sorely Overlooked. *Nature* **2021**, *595* (7865), 135–137.
- (14) Guthrie, S.; Lichten, C. A.; van Belle, J.; Ball, S.; Knack, A.; Hofman, J. *Understanding Mental Health in the Research Environment: A Rapid Evidence Assessment*. RAND Corporation 2017; pp 1–94.
- (15) Burn-out an “occupational phenomenon”: International Classification of Diseases. *World Health Organization*. <https://www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases> (accessed 2022-09-16).
- (16) Depressive disorder (depression). *World Health Organization*, 2022. <https://www.who.int/news-room/fact-sheets/detail/depression>.
- (17) *Depression (NIH Publication No. 21-MH-8079)*; National Institute of Mental Health: Bethesda, MD, 2022. <https://www.nimh.nih.gov/health/publications/depression>.
- (18) Generalized Anxiety Disorder: When Worry Gets Out of Control. NIMH. <https://www.nimh.nih.gov/health/publications/generalized-anxiety-disorder-gad> (accessed 2022-09-16).
- (19) Spitzer, R. L.; Kroenke, K.; Williams, J. B. W.; Löwe, B. A Brief Measure for Assessing Generalized Anxiety Disorder: The GAD-7. *Arch Intern Med.* **2006**, *166* (10), 1092–1097.
- (20) NIMH Expert Dr. Krystal Lewis Discusses Managing Stress & Anxiety. NIMH. <https://www.nimh.nih.gov/news/media/2021/nimh-expert-dr-krystal-lewis-discusses-managing-stress-anxiety> (accessed 2022-09-16).
- (21) Grupe, D. W.; Nitschke, J. B. Uncertainty and Anticipation in Anxiety: An Integrated Neurobiological and Psychological Perspective. *Nat. Rev. Neurosci* **2013**, *14* (7), 488.
- (22) Penninx, B. W.; Pine, D. S.; Holmes, E. A.; Reif, A. Anxiety Disorders. *Lancet* **2021**, *397* (10277), 914–927.
- (23) Cooper, K. M.; Downing, V. R.; Brownell, S. E. The Influence of Active Learning Practices on Student Anxiety in Large-Enrollment College Science Classrooms. *Int. J. STEM Educ* **2018**, *5* (1), 1–18.
- (24) How to Measure Burnout Accurately and Ethically. *Harvard Business Review*. <https://hbr.org/2021/03/how-to-measure-burnout-accurately-and-ethically> (accessed 2022-10-23).
- (25) Madigan, D. J.; Curran, T. Does Burnout Affect Academic Achievement? A Meta-Analysis of over 100,000 Students. *Educ Psychol Rev.* **2021**, *33* (2), 387–405.
- (26) Lian, P.; Sun, Y.; Ji, Z.; Li, H.; Peng, J. Moving Away from Exhaustion: How Core Self-Evaluations Influence Academic Burnout. *PLoS One* **2014**, *9* (1), No. e87152.
- (27) Burnout. *Mental Health UK*. <https://mentalhealth-uk.org/burnout/> (accessed 2022-09-16).
- (28) Jensen, L. E.; Deemer, E. D. Identity, Campus Climate, and Burnout Among Undergraduate Women in STEM Fields. *Career Dev Q* **2019**, *67* (2), 96–109.
- (29) Maslach, C. Finding Solutions to the Problem of Burnout. *Consult Psychol J.* **2017**, *69* (2), 143–152.
- (30) *Students Experiencing Stress*; American Psychological Association, 2022. <https://www.apa.org/ed/schools/primer/stress-health-primer.pdf>.
- (31) Jamieson, J. P.; Black, A. E.; Pelaiá, L. E.; Graveling, H.; Gordils, J.; Reis, H. T. Reappraising Stress Arousal Improves Affective, Neuroendocrine, and Academic Performance Outcomes in Community College Classrooms. *J. Exp Psychol Gen* **2022**, *151* (1), 197–212.
- (32) Burke Harris, N. *The Deepest Well: Healing the Long-Term Effects of Childhood Adversity*; Mariner Books, 2021.
- (33) Crash landing: Coping with post-event blues. *UW Health*. <https://www.uwhealth.org/news/crash-landing-coping-with-post-event-blues> (accessed 2022-09-16).
- (34) After the Celebration: What Do You Do With Post-Event Blues? *Psychology Today*. <https://www.psychologytoday.com/us/blog/the-couch/202111/after-the-celebration-what-do-you-do-post-event-blues> (accessed 2022-09-16).
- (35) How to Deal with Post-Event Depression. *aSweatLife*. <https://asweatlife.com/2018/06/how-to-deal-with-the-post-event-blues-according-to-an-expert/> (accessed 2022-09-16).
- (36) Michael Phelps opens up about mental health. <https://olympics.com/en/news/michael-phelps-don-t-be-afraid-to-dream-as-big-as-you-possibly-can> (accessed 2022-08-29).
- (37) Simone Biles on her new role: mental health advocate. <https://olympics.com/en/news/simone-biles-exclusive-mental-health-advice-future> (accessed 2022-09-22).
- (38) Russell, E. Olympic athletes face mental health challenges after the Games. *NPR*. <https://www.npr.org/2022/02/20/1081945134/a-deep-depression-after-the-olympics-the-challenges-facing-athletes-at-home> (accessed 2022-08-29).
- (39) Kupriyanov, V. 2021 Study: Which Colleges & Universities Do Freshmen Travel Farthest For? *Hire A Helper*. <https://blog.hireahelper.com/2021-study-which-colleges-and-universities-pull-the-most-out-of-state-students/> (accessed 2022-08-29).
- (40) Pearson, D. G.; Craig, T. The Great Outdoors? Exploring the Mental Health Benefits of Natural Environments. *Front Psychol* **2014**, *5*, 1178.
- (41) Castile, E. 4 Ways Moving To A New Place Affects Your Mental Health, According To Science. *Bustle*. <https://www.bustle.com/articles/176615-4-ways-moving-to-a-new-place-affects-your-mental-health-according-to-science> (accessed 2022-08-29).
- (42) Cacioppo, J. T.; Patrick, W. *Loneliness: Human Nature and the Need for Social Connection*; W W Norton & Co., 2008.
- (43) Murthy, V. H. *Together: The Healing Power of Human Connection in a Sometimes Lonely World*, 1st ed.; Harper Wave, 2020.
- (44) El-Ghoroury, N. H.; Galper, D. I.; Sawaqdeh, A.; Bufka, L. F. Stress, Coping, and Barriers to Wellness among Psychology Graduate Students. *Train Educ Prof Psychol* **2012**, *6* (2), 122–134.
- (45) *Students Experiencing Stress*. American Psychological Association. <https://www.apa.org/ed/schools/primer/stress> (accessed 2022-08-29).
- (46) Pesce, N. L. average worker checks their email before they even get out of bed in the morning. *MarketWatch*. <https://www.marketwatch.com/story/the-average-worker-checks-their-email-before-they-even-get-out-of-bed-in-the-morning-2019-02-06> (accessed 2022-08-29).
- (47) Pinsker, J. ‘Ugh, I’m So Busy’: A Status Symbol for Our Time. *The Atlantic*. <https://www.theatlantic.com/business/archive/2017/03/busyness-status-symbol/518178/> (accessed 2022-08-29).
- (48) Hanson, C. M. Why Do I Have to Take This Class?: A Lesson in Making the Required Course Relevant. *College Teaching* **2002**, *50* (1), 21.
- (49) Marmot, M. *The Status Syndrome: How Social Standing Affects Our Health and Longevity*; Owl Books, 2004.
- (50) Watling, C.; Ginsburg, S.; Lingard, L. Don’t Be Reviewer 2! Reflections on Writing Effective Peer Review Comments. *Perspectives on Medical Education* **2022**, *10* (5), 299–303.

- (51) Psychotherapies. NIMH. <https://www.nimh.nih.gov/health/topics/psychotherapies> (accessed 2022-09-22).
- (52) Markowitz, J. C.; Weissman, M. M. Interpersonal Psychotherapy: Principles and Applications. *World Psychiatry* **2004**, *3* (3), 136.
- (53) Dialectical Behavior Therapy (DBT): What It Is & Purpose. Cleveland Clinic. <https://my.clevelandclinic.org/health/treatments/22838-dialectical-behavior-therapy-dbt> (accessed 2022-09-22).
- (54) Psychotherapy: Understanding group therapy. American Psychological Association. <https://www.apa.org/topics/psychotherapy/group-therapy> (accessed 2022-10-23).
- (55) Breedvelt, J. J. F.; Amanvermez, Y.; Harrer, M.; Karyotaki, E.; Gilbody, S.; Bockting, C. L. H.; Cuijpers, P.; Ebert, D. D. The Effects of Meditation, Yoga, and Mindfulness on Depression, Anxiety, and Stress in Tertiary Education Students: A Meta-Analysis. *Front Psychiatry* **2019**, *10* (APR), 1.
- (56) Meditation and Mindfulness: What You Need To Know. NCCIH. <https://www.nccih.nih.gov/health/meditation-and-mindfulness-what-you-need-to-know> (accessed 2022-09-22).
- (57) Siegel, R. D. *The Mindfulness Solution: Everyday Practices for Everyday Problems*; The Guilford Press, 2010.
- (58) Can Reading Books Improve Your Mental Health? *Psychology Today*. <https://www.psychologytoday.com/us/blog/talking-about-men/201905/can-reading-books-improve-your-mental-health> (accessed 2022-09-01).
- (59) Koenig, H. G. Research on Religion, Spirituality, and Mental Health: A Review. *Canadian Journal of Psychiatry* **2009**, *54* (5), 283–291.
- (60) Novel Finding: Reading Literary Fiction Improves Empathy. *Scientific American*. <https://www.scientificamerican.com/article/novel-finding-reading-literary-fiction-improves-empathy/> (accessed 2022-09-01).
- (61) Mar, R. A.; Oatley, K. The Function of Fiction Is the Abstraction and Simulation of Social Experience. *Perspect Psychol Sci*. **2008**, *3* (3), 173–192.
- (62) Kidd, D. C.; Castano, E. Reading Literary Fiction Improves Theory of Mind. *Science (1979)* **2013**, *342* (6156), 377–380.
- (63) Fanner, D.; Urquhart, C. Bibliotherapy for Mental Health Service Users Part 1: A Systematic Review. *Health Info Libr J*. **2008**, *25* (4), 237–252.
- (64) Edwards, M. K.; Loprinzi, P. D. Experimental Effects of Brief, Single Bouts of Walking and Meditation on Mood Profile in Young Adults. *Health Promot Perspect* **2018**, *8* (3), 171.
- (65) The healing effects of forests. *ScienceDaily*. <https://www.sciencedaily.com/releases/2010/07/100723161221.htm> (accessed 2022-08-29).
- (66) Ohrnberger, J.; Fichera, E.; Sutton, M. The Relationship between Physical and Mental Health: A Mediation Analysis. *Soc. Sci. Med.* **2017**, *195*, 42–49.
- (67) Knüppel, A.; Shipley, M. J.; Llewellyn, C. H.; Brunner, E. J. Sugar Intake from Sweet Food and Beverages, Common Mental Disorder and Depression: Prospective Findings from the Whitehall II Study. *Scientific Reports* **2017**, *7*:1 **2017**, *7* (1), 1–10.
- (68) Molteni, R.; Barnard, R. J.; Ying, Z.; Roberts, C. K.; Gómez-Pinilla, F. A High-Fat, Refined Sugar Diet Reduces Hippocampal Brain-Derived Neurotrophic Factor, Neuronal Plasticity, and Learning. *Neuroscience* **2002**, *112* (4), 803–814.
- (69) Francis, H. M.; Stevenson, R. J.; Chambers, J. R.; Gupta, D.; Newey, B.; Lim, C. K. A Brief Diet Intervention Can Reduce Symptoms of Depression in Young Adults – A Randomised Controlled Trial. *PLoS One* **2019**, *14* (10), No. e0222768.
- (70) Bremner, J. D.; Moazzami, K.; Wittbrodt, M. T.; Nye, J. A.; Lima, B. B.; Gillespie, C. F.; Rapaport, M. H.; Pearce, B. D.; Shah, A. J.; Vaccarino, V. Diet, Stress and Mental Health. *Nutrients* **2020**, *12* (8), 2428.
- (71) Kim, Y. S.; Park, Y. S.; Allegrante, J. P.; Marks, R.; Ok, H.; Ok Cho, K.; Garber, C. E. Relationship between Physical Activity and General Mental Health. *Prev Med. (Baltim)* **2012**, *55* (5), 458–463.
- (72) Pluhar, E.; McCracken, C.; Griffith, K. L.; Christino, M. A.; Sugimoto, D.; Meehan, W. P. Team Sport Athletes May Be Less Likely To Suffer Anxiety or Depression than Individual Sport Athletes. *J. Sports Sci. Med.* **2019**, *18* (3), 490.
- (73) Friedman, D. How Weight Lifting Can Help Heal Trauma. *The New York Times*. <https://www.nytimes.com/2022/07/07/well/move/weight-lifting-ptsd-trauma.html> (accessed 2022-08-29).
- (74) Mehren, A.; Reichert, M.; Coghill, D.; Müller, H. H. O.; Braun, N.; Philippen, A. Physical Exercise in Attention Deficit Hyperactivity Disorder – Evidence and Implications for the Treatment of Borderline Personality Disorder. *Borderline Personal Disord Emot Dysregul* **2020**, *7* (1), 1.
- (75) Johnson, M. B.; Thiese, S. M. A Review of Overtraining Syndrome—Recognizing the Signs and Symptoms. *J. Athl Train* **1992**, *27* (4), 352.
- (76) Harrington, J. M. Health Effects of Shift Work and Extended Hours of Work. *Occup Environ. Med.* **2001**, *58* (1), 68–72.
- (77) Afonso, P.; Fonseca, M.; Pires, J. F. Impact of Working Hours on Sleep and Mental Health. *Occup Med. (Chic Ill)* **2017**, *67* (5), 377–382.
- (78) Pilcher, J. J.; Ginter, D. R.; Sadowsky, B. Sleep Quality versus Sleep Quantity: Relationships between Sleep and Measures of Health, Well-Being and Sleepiness in College Students. *J. Psychosom Res.* **1997**, *42* (6), 583–596.
- (79) Milojevic, H. M.; Lukowski, A. F. Sleep and Mental Health in Undergraduate Students with Generally Healthy Sleep Habits. *PLoS One* **2016**, *11* (6), No. e0156372.
- (80) Scott, A. J.; Webb, T. L.; Rowse, G. Does Improving Sleep Lead to Better Mental Health? A Protocol for a Meta-Analytic Review of Randomised Controlled Trials. *BMJ. Open* **2017**, *7* (9), e016873.
- (81) Can Meditation Treat Insomnia? *Sleep Foundation*. <https://www.sleepfoundation.org/insomnia/treatment/meditation> (accessed 2022-08-31).
- (82) Bankar, M. A.; Chaudhari, S. K.; Chaudhari, K. D. Impact of Long Term Yoga Practice on Sleep Quality and Quality of Life in the Elderly. *J. Ayurveda Integr Med.* **2013**, *4* (1), 28–32.
- (83) Best Temperature for Sleep. Cleveland Clinic. <https://health.clevelandclinic.org/what-is-the-ideal-sleeping-temperature-for-my-bedroom/> (accessed 2022-08-31).
- (84) Scott, H.; Woods, H. C. Understanding Links Between Social Media Use, Sleep and Mental Health: Recent Progress and Current Challenges. *Current Sleep Medicine Reports* **2019**, *5*:3 **2019**, *5* (3), 141–149.
- (85) Lockley, S. W.; Brainard, G. C.; Czeisler, C. A. High Sensitivity of the Human Circadian Melatonin Rhythm to Resetting by Short Wavelength Light. *J. Clin Endocrinol Metab* **2003**, *88* (9), 4502–4505.
- (86) Burgess, H. J.; Molina, T. A. Home Lighting before Usual Bedtime Impacts Circadian Timing: A Field Study. *Photochem. Photobiol.* **2014**, *90* (3), 723–726.
- (87) Park, S. Y.; Oh, M. K.; Lee, B. S.; Kim, H. G.; Lee, W. J.; Lee, J. H.; Lim, J. T.; Kim, J. Y. The Effects of Alcohol on Quality of Sleep. *Korean J. Fam Med.* **2015**, *36* (6), 294.
- (88) McFerran, K. S.; Garrido, S.; Saarikallio, S. A Critical Interpretive Synthesis of the Literature Linking Music and Adolescent Mental Health. *Youth Society* **2016**, *48* (4), 521–538.
- (89) Hevner, K. Experimental Studies of the Elements of Expression in Music. *Am. J. Psychol* **1936**, *48* (2), 246.
- (90) Gabriellson, A. Emotions in Strong Experiences with Music. In *Music and emotion: Theory and research*; Juslin, P. N., Sloboda, J. A., Eds.; Oxford University Press, 2001; pp 431–449.
- (91) Schubert, E. Enjoying Sad Music: Paradox or Parallel Processes? *Front Hum Neurosci* **2016**, *10*, 312.
- (92) Vuoskoski, J. K.; Thompson, W. F.; McIlwain, D.; Eerola, T. Who Enjoys Listening to Sad Music and Why? *Music Percept* **2012**, *29* (3), 311–317.
- (93) Garrido, S.; Schubert, E. Moody Melodies: Do They Cheer Us up? A Study of the Effect of Sad Music on Mood. *Psychol Music* **2015**, *43* (2), 244–261.
- (94) Ter Bogt, T.; Canale, N.; Lenzi, M.; Vieno, A.; van den Eijnden, R. Sad Music Depresses Sad Adolescents: A Listener's Profile. *Psychol Music* **2021**, *49* (2), 257–272.

- (95) McFerran, K. S.; Garrido, S.; O'Grady, L.; Grocke, D.; Sawyer, S. M. Examining the Relationship between Self-Reported Mood Management and Music Preferences of Australian Teenagers. *Nord J. Music Ther* **2015**, *24* (3), 187–203.
- (96) Ter Bogt, T. F. M.; Vieno, A.; Doornwaard, S. M.; Pastore, M.; Van Den Eijnden, R. J. J. M. You're Not Alone": Music as a Source of Consolation among Adolescents and Young Adults. *Psychol Music* **2017**, *45* (2), 155–171.
- (97) Van Den Tol, A. J. M.; Edwards, J. Exploring a Rationale for Choosing to Listen to Sad Music When Feeling Sad. *Psychol Music* **2013**, *41* (4), 440–465.
- (98) North, A. C.; Hargreaves, D. J.; O'Neill, S. A. The Importance of Music to Adolescents. *British Journal of Educational Psychology* **2000**, *70* (2), 255–272.
- (99) Campbell, P. S.; Connell, C.; Beegle, A. Adolescents' Expressed Meanings of Music in and out of School. *Journal of Research in Music Education* **2007**, *55* (3), 220–236.
- (100) Kim, S.; Kverno, K.; Lee, E. M.; Park, J. H.; Lee, H. H.; Kim, H. L. Development of a Music Group Psychotherapy Intervention for the Primary Prevention of Adjustment Difficulties in Korean Adolescent Girls. *J. Child Adolesc Psychiatr Nurs* **2006**, *19* (3), 103–111.
- (101) Parker, E. C. Exploring Student Experiences of Belonging within an Urban High School Choral Ensemble: An Action Research Study. *Music Educ. Res.* **2010**, *12* (4), 339–352.
- (102) Kokotsaki, D.; Hallam, S. The Perceived Benefits of Participative Music Making for Non-Music University Students: A Comparison with Music Students. *Music Education Research* **2011**, *13* (2), 149–172.
- (103) Online and offline relationships | Educating 21st Century Children: Emotional Well-being in the Digital Age. *OECD iLibrary*. <https://www.oecd-ilibrary.org/sites/11f6c5b4-en/index.html?itemId=/content/component/11f6c5b4-en> (accessed 2022-10-23).
- (104) Twenge, J. M.; Haidt, J.; Blake, A. B.; McAllister, C.; Lemon, H.; Le Roy, A. Worldwide Increases in Adolescent Loneliness. *J. Adolesc* **2021**, *93* (1), 257–269.
- (105) Hardy, B. W.; Castonguay, J. The Moderating Role of Age in the Relationship between Social Media Use and Mental Well-Being: An Analysis of the 2016 General Social Survey. *Comput. Human Behav* **2018**, *85*, 282–290.
- (106) Sherman, L. E.; Michikyan, M.; Greenfield, P. M. The Effects of Text, Audio, Video, and in-Person Communication on Bonding between Friends. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* **2013**, *7* (2), 3.
- (107) Twenge, J. M.; Haidt, J.; Blake, A. B.; McAllister, C.; Lemon, H.; Le Roy, A. Worldwide Increases in Adolescent Loneliness. *J. Adolesc* **2021**, *93* (1), 257–269.
- (108) Best, P.; Manktelow, R.; Taylor, B. Online Communication, Social Media and Adolescent Wellbeing: A Systematic Narrative Review. *Child Youth Serv Rev.* **2014**, *41*, 27–36.
- (109) Orben, A.; Przybylski, A. K. The Association between Adolescent Well-Being and Digital Technology Use. *Nature Human Behaviour* **2019**, *3* (2), 173–182.
- (110) Kross, E.; Verduyn, P.; Demiralp, E.; Park, J.; Lee, D. S.; Lin, N.; Shablack, H.; Jonides, J.; Ybarra, O. Facebook Use Predicts Declines in Subjective Well-Being in Young Adults. *PLoS One* **2013**, *8* (8), No. e69841.
- (111) Woods, H. C.; Scott, H. Sleepy teens: Social Media Use in Adolescence Is Associated with Poor Sleep Quality, Anxiety, Depression and Low Self-Esteem. *J. Adolesc* **2016**, *51*, 41–49.
- (112) Lin, L. Y.; Sidani, J. E.; Shensa, A.; Radovic, A.; Miller, E.; Colditz, J. B.; Hoffman, B. L.; Giles, L. M.; Primack, B. A. Association between Social Media Use and Depression among U.S. Young Adults. *Depress Anxiety* **2016**, *33* (4), 323.
- (113) Primack, B. A.; Shensa, A.; Escobar-Viera, C. G.; Barrett, E. L.; Sidani, J. E.; Colditz, J. B.; James, A. E. Use of Multiple Social Media Platforms and Symptoms of Depression and Anxiety: A Nationally-Representative Study among U.S. Young Adults. *Comput. Human Behav* **2017**, *69*, 1–9.
- (114) Davila, J.; Hershenberg, R.; Feinstein, B. A.; Gorman, K.; Bhatia, V.; Starr, L. R. Frequency and Quality of Social Networking among Young Adults: Associations with Depressive Symptoms, Rumination, and Corumination. *Psychol Pop Media Cult* **2012**, *1* (2), 72–86.
- (115) Feinstein, B. A.; Hershenberg, R.; Bhatia, V.; Latack, J. A.; Meuwly, N.; Davila, J. Negative Social Comparison on Facebook and Depressive Symptoms: Rumination as a Mechanism. *Psychol Pop Media Cult* **2013**, *2* (3), 161–170.
- (116) Vannucci, A.; Flannery, K. M.; Ohannessian, C. M. C. Social Media Use and Anxiety in Emerging Adults. *J. Affect Disord* **2017**, *207*, 163–166.
- (117) Twenge, J. M.; Joiner, T. E.; Rogers, M. L.; Martin, G. N. Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U.S. Adolescents After 2010 and Links to Increased New Media Screen Time. *Clinical Psychological Science* **2018**, *6* (1), 3–17.
- (118) Valkenburg, P. M.; Peter, J. Online Communication and Adolescent Well-Being: Testing the Stimulation versus the Displacement Hypothesis. *Journal of Computer-Mediated Communication* **2007**, *12* (4), 1169–1182.
- (119) Ochs, C.; Sauer, J. Disturbing Aspects of Smartphone Usage: A Qualitative Analysis. *Behaviour Information Technology* **2022**, *1*, 1.
- (120) Morgan, P. L.; Wang, Y.; Woods, A. D. Risk and Protective Factors for Frequent Electronic Device Use of Online Technologies. *Child Dev* **2021**, *92* (2), 704–714.
- (121) Global time spent on social apps by gender 2021. *Statista*. <https://www.statista.com/statistics/1272876/worldwide-social-apps-time-spent-daily-gender/> (accessed 2022-09-01).
- (122) Saiphoo, A. N.; Vahedi, Z. A Meta-Analytic Review of the Relationship between Social Media Use and Body Image Disturbance. *Comput. Human Behav* **2019**, *101*, 259–275.
- (123) One type of motivation may be key to success. *Science*; AAAS. <https://www.science.org/content/article/one-type-motivation-may-be-key-success> (accessed 2022-10-23).
- (124) Smale, B.; Wilson, J.; Akubueze, N. Exploring the Determinants and Mitigating Factors of Loneliness among Older Adults. *Wellbeing, Space and Society* **2022**, *3*, 100089.
- (125) Young, K. Question That Could Save a Life. *Hey Sigmund*. <https://www.heysigmund.com/the-question-that-could-save-a-life-depressed/> (accessed 2022-08-29).
- (126) Young, K. What to Say (and Not to Say) to Someone Who's Depressed. *Hey Sigmund*. <https://www.heysigmund.com/what-to-say-to-someone-who-is-depressed/> (accessed 2022-08-29).
- (127) Ingram, K. M.; Betz, N. E.; Mindes, E. J.; Schmitt, M. M.; Smith, N. G. Unsupportive Responses from Others Concerning a Stressful Life Event: Development of The Unsupportive Social Interactions Inventory. *J. Soc. Clin Psychol* **2001**, *20* (2), 173–207.
- (128) Helping a Friend You're Worried About. *Here to Help*. <https://www.heretohelp.bc.ca/infosheet/helping-a-friend-youre-worried-about> (accessed 2022-11-10).
- (129) Jones, S. M.; Wirtz, J. G. How Does the Comforting Process Work? An Empirical Test of an Appraisal-Based Model of Comforting. *Hum Commun. Res.* **2006**, *32* (3), 217–243.
- (130) Bodie, G. D. The Active-Empathic Listening Scale (AELS): Conceptualization and Evidence of Validity Within the Interpersonal Domain. *Communication Quarterly* **2011**, *59* (3), 277–295.
- (131) How to Support Someone With Depression. *Cleveland Clinic*. <https://health.clevelandclinic.org/6-dos-and-donts-for-supporting-someone-who-has-depression/> (accessed 2022-10-23).
- (132) Red Folder Initiative. *Student Mental Health Partnership*. <https://www.ucop.edu/student-mental-health-resources/training-and-programs/faculty-and-staff-outreach/red-folder-initiative.html> (accessed 2022-10-23).
- (133) Mathias, C. W.; Michael Furr, R.; Sheftall, A. H.; Hill-Kapturczak, N.; Crum, P.; Dougherty, D. M. What's the Harm in Asking about Suicidal Ideation? *Suicide Life Threat Behav* **2012**, *42* (3), 341–351.
- (134) Livingstone, M. B. E.; Pourshahidi, L. K. Portion Size and Obesity. *Advances in Nutrition* **2014**, *5* (6), 829–834.

- (135) Saiphoo, A. N.; Vahedi, Z. A Meta-Analytic Review of the Relationship between Social Media Use and Body Image Disturbance. *Computers in Human Behavior* **2019**, *101*, 259–275.
- (136) Fardouly, J.; Vartanian, L. R. Social Media and Body Image Concerns: Current Research and Future Directions. *Curr. Opin Psychol* **2016**, *9*, 1–5.
- (137) Mental Health. *Center for Disease Control and Prevention (CDC)*, 2022.
- (138) Depression. *World Health Organization (WHO)*, 2022.