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Sustainable Humanistic Medicine in a World of Climate Change and Digital Transformation

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Building Sustainable and Climate Change-Resilient Healthcare Systems

Climate Change and Health Consequences

Climate change and its associated increase in greenhouse gas emissions are significantly influencing individual and societal health [1]. The greenhouse effect is a natural process that warms

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our planet's surface. When solar radiation reaches the Earth's atmosphere, some is reflected back into space by clouds, ice, snow, sand, and other reflective surfaces, and some is absorbed by land, oceans, and atmosphere [2]. As oceans, lands, and atmosphere heat up, they release heat, which is radiated back toward space [2]. Some of this heat is trapped by greenhouse gases in the atmosphere, keeping our planet warm enough to sustain life. However, increasing greenhouse gases such as carbon dioxide, nitrous oxide, methane, ozone, and others, through increased trapping of heat, are gradually making the planet warmer [2]. Natural causes that contribute to greenhouse effect include changes in solar energy, volcanic activity, and natural changes in greenhouse gas concentrations [2]. However, recent climate changes cannot be explained by natural causes alone [2]. Scientists have determined that human activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years [2, 3]. Carbon dioxide is the main contributor to human-induced climate change [2, 3]. For example, in the United States and Canada, the largest source of greenhouse gas emissions from human activities is the burning of fossil fuels (coal, oil, and natural gas) for electricity, heat, and transportation [2, 3].

Did You Know?

Global warming is a global average increase in combined air and sea surface temperatures over a 30-year period [1]. In 2017, human-induced global warming reached approximately 1 °C above preindustrial levels (period 1850–1900) [1].

In 2018, the United Nations Intergovernmental Panel on Climate Change (IPCC) released its landmark report, which illustrates the irreversible effects of 1 °C rise in average global temperature that has occurred since the industrial revolution

[1]. These concerns were subsequently echoed by the 2018 Fourth National Climate Assessment from the US government that calls for action to mitigate climate change effects and increase scaled adaptation efforts to avoid substantial damages to the economy, environment, and human health over the coming decades [4]. The 2018 Lancet Countdown on health and climate change is another important report which tracked multiple global indicators including adaptation, planning, and resilience for health [5]. A strategic message of this report is that health potentially holds the key to humanizing climate change conversations, thus spurring more rapid and effective global behavioral changes [5].

Climate change poses many detriments to the health of the planet and its inhabitants. For example, extreme weather events such as floods, wildfires, and heat waves are expected to increase over the next century, with potentially catastrophic risks to human and societal health [5]. As further illustrated in the next skill-building exercise, extended heat waves can be associated with increased heat-related diseases and mortality, particularly in vulnerable populations, such as the older adults and those with pre-existing health conditions [5]. Extended heat will also increase the demand for cooling, thereby increasing household electricity costs [5]. Warmer temperatures will allow the spread of pests and disease vectors into new regions [5]. Therefore, global climate change can bring about a myriad of human health consequences, and a careful and discriminating planning effort for future humanitarian disaster response is necessary.

Global experts expect climate change to greatly compromise public health infrastructure, either directly (i.e., through weather extremes disrupting essential services) or indirectly (i.e., through the overwhelm of subsisting services), with resultant increase in the burden of disease [5] (See Fig. 3.1). Experts urge continued investment in and strengthening of our adaptive capacity in response to the consequences of global climate change, prioritizing preparedness for multi-hazard public health emergencies [5].

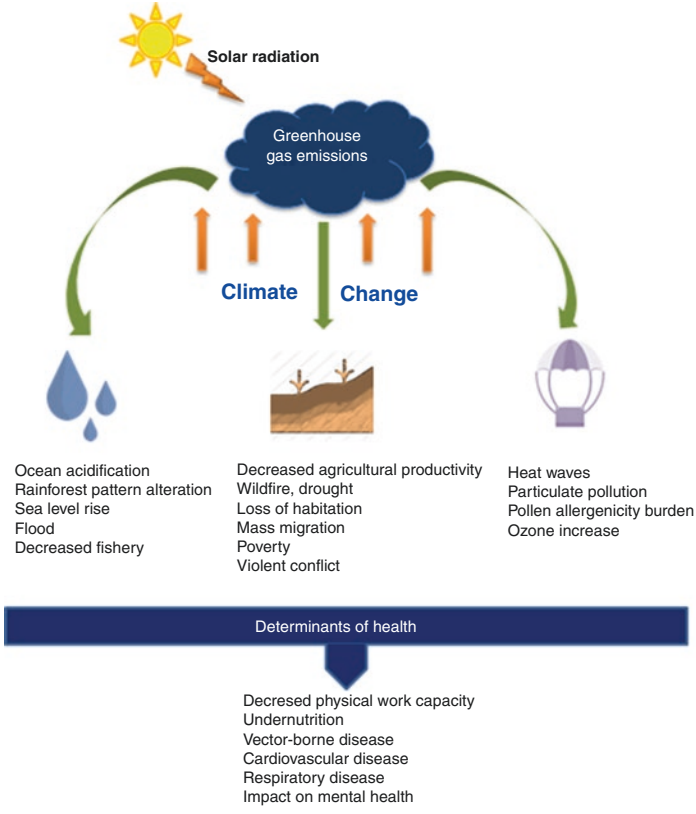

Fig. 3.1 The association between climate change and health. (Data derived from [5])

Skill-Building Exercise: Greenhouse Gas Emissions and Public Health – An Inverse Association

Take a moment to consider the impact of climate change over the next generations. How do you envision human health will be affected by changes in the climate?

Long-term climate change directly and indirectly impacts life as we know it in disruptive ways. The 2018

Lancet Countdown report highlights the following examples of climatological change and consequence [5]:

- Power outages caused by powerful storms or wildfires that paralyze hospitals and transportation
- Warmer average temperatures leading to drought and reduced agricultural productivity, threatening food security with consequent nutritional effects, poverty, mass migration, or violent conflicts
- Decreased labor productivity and increased occupational hazards in risk groups (e.g., construction workers, farmers) due to increased risk for heat strokes
- Rising sea levels impacting freshwater supply for those living in low-lying zones
- Ocean acidification reducing fishery, leading to undernutrition
- Biodiversity loss and ecosystem collapse leading to changing patterns of diseases, such as:
  - Vector-borne infectious diseases (e.g., malaria, Lyme disease, mosquito-borne dengue fever)
  - Respiratory disease due to overabundance of mold or fungi
  - Mental health problems such as anxiety and depression associated with weather-related traumatic events

Although some of the current damage to our planet might be irreversible, it is not too late to positively alter the course for future generations [6]. The Fourth National Climate Assessment from the US government on the impact of climate change on society provides hope that humanity can still change course and temper further negative effects associated with climate change [4]. This study encourages that if action is taken now, mitigation efforts might begin to show results by the middle of the century [4]. The 2018 Lancet Countdown on health and climate change by Watts and colleagues provides a snapshot and further direction for multiple global indicators at the intersection between climate

change and health [5]. Watts and colleagues believe that emphasizing health to "humanize" the climate change narrative will more effectively capture attention and invoke behavior change [5, 6]. At the 2019 United Nations Climate Change Summit, leaders from government, business, and civil society announced potentially far-reaching steps along a roadmap to confront climate change [7]. Aside from the crucial engagement of governments to better apply their influence, the collective voice of individuals has power to accelerate the growing demand for change. Physicians, both as individuals and as a united professional community, have an essential role in such advocacy efforts. It is the hope that wide dissemination of recent research findings will mobilize individuals to action, and increase awareness of the tremendous health impact of climate change at national and international levels, so as to accelerate governmental response.

Did You Know?

(Data derived from [8])

- *Without naturally occurring greenhouse gases through incoming and outgoing radiation that makes the Earth habitable, the planet's average temperature would be near 0 °F (or −18 °C) instead of the much warmer 59 °F (15 °C).*
- *Eighteen of the nineteen warmest years on record have occurred since 2001.*
- *Winter temperatures in the Arctic have risen by 3 °C since 1990.*
- *Global average sea level has increased nearly 7″ (178 mm) over the past 100 years.*

Carbon Footprint in Medicine

A carbon footprint is measured in "tonnes of carbon dioxide equivalent" [9]. This allows the different greenhouse gases (including the noncarbon-based gasses) to be relatively compared

to one unit of carbon dioxide. Carbon dioxide equivalent is calculated by multiplying the emissions of each greenhouse gas by its 100-year global warming potential [9].

As physicians, we leave behind a carbon footprint which over time is collectively adding to negative impacts on health. Hospitals have one of the highest energy intensities of the commercial/institutional sector [10]. For example, a study looking at the total impact of the healthcare system found that the medical sector is responsible for 8% of the total US greenhouse gas emissions, with hospitals owning the largest share of the contribution at 39% [11]. In recent years, an international study of the Organization for Economic Cooperation and Development (OECD) countries reported that Canada and the United States had the highest hospital energy use intensity, which was almost double that of European hospital energy use [10].

To date, there has been no systematic global standard for measuring the greenhouse gas emissions of the healthcare sector; however, several medical systems around the world are working to find a way to measure and reduce their greenhouse gas emissions [5]. The United Nations Intergovernmental Panel on Climate Change (IPCC) report provided a roadmap detailing society's best possible way forward [1]. For example, researchers have stipulated that in order to limit global warming to only 1.5 °C, a worldwide 50% reduction in carbon emissions is imperative by 2030 [1]. By 2050, 80% of global power will need to be generated by renewable sources, with coal generating no more than 7% of electrical power (down from nearly 40% at present) [1].

Did You Know?

Indicators of investment in low-carbon economy and zero-carbon energy are already evident, with growing numbers of people employed in renewable energy sectors worldwide [5]. For example, in 2017, there were more than 2 million electric cars on the road; China was responsible for more than 40% of electric cars sold globally [5].

Table 3.1 Elements of a climate-friendly hospital [13]

Elements	Description
Energy efficiency	Reduce hospital energy consumption/costs through efficiency and conservation measures
Alternative energy generation	Produce and/or consume clean, renewable energy onsite to ensure reliable and resilient operation
Food	Provide sustainably grown local food for patients and staff
Water	Conserve water Avoid bottled water when safe alternatives exist
Waste	Reduce, reuse, recycle, compost Employ alternatives to waste incineration
Transportation	Use alternative fuels for hospital vehicles Encourage walking and cycling to the facility Promote staff, patient, and community use of public transport Site healthcare buildings to minimize the need for staff and patient transportation
Green building design	Build hospitals and medical care facilities that are responsive to local climate conditions and optimized for reduced energy and resource demands

Operating rooms can contribute to a significant proportion of carbon footprint; however, each specialty has its own contributions and thus opportunities to reduce carbon and save money [12]. In this vein, the World Health Organization has identified seven elements of a climate-friendly hospital, as summarized in Table 3.1 [13]. Furthermore, studies have indicated that reducing the carbon footprint of healthcare requires action not only to cut waste and energy use but also to reform care pathways (e.g., reducing avoidable hospital admissions and length of stay) [12]. As such, the health sector can play an essential role in mitigating climate change effects.

For concerned physicians, there are many ways to reduce their carbon footprint, both within personal and medical communities. Physicians can importantly adopt a "green" perspective and endorse less environmentally harmful practices. The following are a few examples of immediate actions to implement in order to reduce healthcare's carbon footprint [5, 14]:

- Develop strategies to reduce professional airplane travel, where feasible. Instead, adopt a greater reliance on telecommunication, videoconferencing, and online platforms for professional medical education and networking.
- Provide central locations and remote interviewing modalities to residency training programs.
- All physicians must travel to their place of work. Where feasible, changing the method of commute to walking or cycling instead of driving by car will not only reduce one's carbon footprint but also increase physical activity. Consider public transportation and car-pooling when distance or weather makes these options less feasible.
- Telemedicine services (videoconferencing technology) have the potential to reduce travel for appointments and, subsequently, carbon emissions.
- The "throw-away" convenience culture, which allows purchase of disposable items with which to eat and drink, impacts one's well-being and the carbon footprint. Store utensils and dishes at work or bring reusable containers from home.
- The meals we consume also contribute to the carbon footprint. Consumption of red meat, particularly processed red meats, for example, has been associated with increased greenhouse gas emissions [5]. Eating fewer processed meals and bringing more fresh foods from home can help improve one's health and also reduce the dietary carbon footprint. However, this has drawn some controversy as meat consumption reflects only one aspect of sustainable diets, which is unlikely to have equal health implications for high-income countries with high-level ruminant meat (e.g., beef, bison, and lamb) consumption versus low-income countries with low ruminant-meat consumption [5].
- Although some hospitals have lights with automatic sensors, others still rely on switches which can be turned off manually. Turning off lights before leaving home and work reduces electricity use. Turning off computers and screens at home and work before leaving also helps.

Although the current politicization of climate change makes it challenging to take meaningful and necessary actions, physicians have a critical role to play in encouraging comprehensive solutions to climate change [15]. They must continue to educate themselves about the health hazards of climate change to patients, medical practices, communities, and their own well-being, as well as to educate the public [15]. Some argue that environmental sustainability should be included alongside other quality of healthcare dimensions such as safety and patient-centeredness [12]. To date, recycling efforts in healthcare rely largely on dedicated individual staff within departments or sites [12]. In a 2019 national survey of 426 respondents on attitudes and barriers to recycling and environmental sustainability efforts among Canadian anesthesiologists, 97.5% were willing to recycle but only 30.2% did so [16]. In this study, lack of support from medical leadership and inadequate information/education on how to expand sustainability programs at their institutions were listed as barriers. As future environmental and waste reduction practices advance at local, municipal, and state levels, health authorities will need to align their operations to ensure compliance.

Skill-Building Exercise: Pause and Reflect

Healthcare professionals, including physicians, have a history of driving change to combat healthcare crises. Physicians believe that climate change is one of the greatest public health challenges of the twenty-first century [17]. For example, in 2019, the American Medical Association was among several medical and public health groups that issued a call to action asking the US government and business and civil society leaders to recognize climate change as a health emergency and to work across government agencies and with communities and businesses to prioritize action on mitigating the climate change effects [17]. Take a moment to reflect on the following questions below:

- Who are the physicians you know in your local area advocating for a sustainable response to climate change?
- What are the barriers to physicians advocating more actively for a sustainable response to climate change?
- What are physicians going to do about this global crisis going forward?
- How can *you* as an individual physician help fight climate change?

Pursuing Humanistic Medicine in a Rapidly Changing World

Humanistic Attributes of the Healthcare Professional

Medical humanism (detailed elsewhere in this volume) is based on attitudes and behaviors characterized by humility, compassion, and respect between medical professionals and their patients [18]. Figure 3.2 briefly illustrates the key humanistic attributes a medical professional must demonstrate [18, 19]. (See Chap. 1, *Humanism and the Physician*, for further details on medical humanism.)

Because the healthcare industry is a substantial contributor to climate change, accounting for almost a tenth of US greenhouse gas emissions, physicians must consider the related stakes for human health [11]. In this view, many argue that physicians have a professional responsibility to take action, as key players in the healthcare system and advocates for individual, community, and global health. Along these lines, practicing medicine in a humanistic way remains increasingly important in this changing healthcare landscape.

As discussed further in Chaps. 1 and 16, cultivating and supporting humanistic attributes among medical trainees is essential [18]. As illustrated in Fig. 3.2, the following is a brief description of key humanistic attributes of a medical professional [18]:

- *Integrity* refers to the correlation between one's expressed values and one's behaviors.

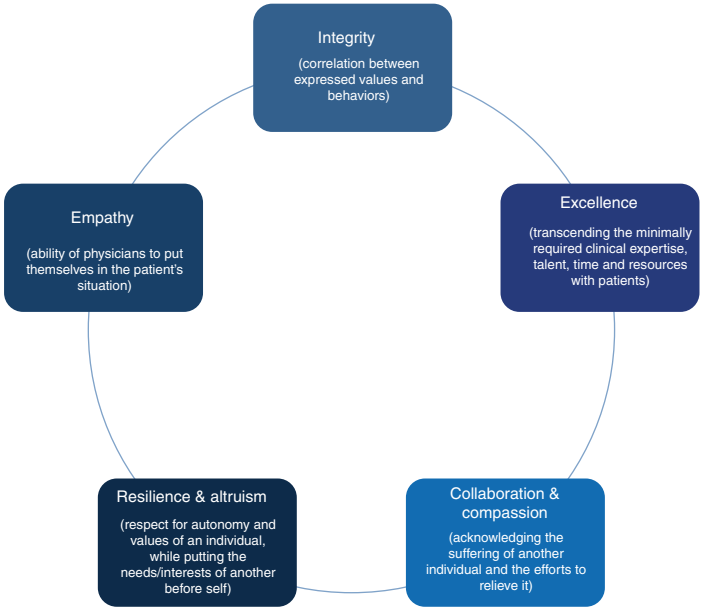

Fig. 3.2 Key humanistic attributes of a medical professional

- *Excellence* in clinical service represents sharing beyond what is minimally required of one's clinical expertise, talent, time, and resources with individual patients, to include community and population health needs.
- *Compassion* refers to a collaborative approach that acknowledges the suffering of another individual and the efforts to relieve it.
- *Resilience* and *altruism* concern the respect for autonomy and values of an individual, while putting the needs and interests of another before self.
- *Empathy* is the ability of physicians to put themselves in the patient's situation.

Regarding the attribute of empathy, research has found a relationship between medical trainees' empathy and burnout, which

may have further implications in the designing of interventions to promote trainee well-being [20]. The skill required to effectively and sustainably practice medicine amid global climate change is likely to remain a subject of ongoing debate. Nevertheless, there is a clear role for medical education to build awareness and capacity by integrating this important topic of climate change into core teaching, as an opportunity for future physicians to develop insights and skills essential for practicing humanistically in a climate-changing world [21].

Digital Physician in a Humanistic Medical World

Humanistic professional talents, alongside the technology skill requirements of modern medicine, can be fostered and learned during medical training [19]. Current practice is for medical educators to increasingly choose or engage in online teaching [22]. This implies the need to foster proficiency to teach, promote, and sustain humanistic values through digital methods.

Recent years have seen a surge of innovations and adjustments to meet required milestones in medical education across the continuum, supporting new models of learning and assessment of acquired competency. In the same way that one cannot safely drive a car using only the rear-view mirror, programs cannot continue to educate medical trainees using only curricula that are historically informed and situated. Looking into the future, medical education innovators must prioritize incorporation of digital and emergent technologies. Virtual medicine can provide medical educational innovation for trainees, including the teaching of humanistic attributes [23]. For example, a study has shown that virtual reality immersion training can be an effective teaching method to help medical trainees develop empathy [23]. Virtual medical advancements also expand patient care options; for example, virtual medicine supports provision of medical care to patients in the comfort of their own homes, spanning geographic boundaries and limiting the carbon footprint [24].

Digital Humanism

Digital humanism is the convergence between our complex cultural heritage and technology and includes the application of digital resources in the humanities [25]. How digital humanism is set to unfold in future medical care frameworks remains to be seen. Channeling the values of humanism into the core of technological development has the potential to support the creation of "humane technology" [25]. The ideal would be the creation of interfaces that are responsive to human needs and considerate of human frailties [25].

In the case of healthcare, digital technologies and software algorithms must be designed to reflect humanistic attitudes and approaches. As such, these digital technologies need to incorporate certain attributes, including the following [25, 26]:

- Accessibility to anyone, beyond social, financial, or educational barriers.
- Safeguarding of sensitive patient information as a high priority (e.g., unauthorized access to large data on genetic and genomic information could jeopardize patients).
- Be governed by effective regulations, rules, and laws, based on a broad public discourse.
- Be a support (but not replacement) to human decision-making through automated decision-making systems. The transparency and accountability of smart algorithms should be among the first concerns of health technology developers.
- Be a promoter of diversity and collaboration among different disciplines as well different groups in society, so as to increase the applicability, effectiveness, and efficiency of health-related technological products.
- Maintaining a clear vision aligned with new medical education standards and curricula, combining knowledge from the humanities, social sciences, and engineering studies.

The Practice of Humanistic Medicine

As illustrated in Fig. 3.3, the practice of humanistic medicine typically requires the following two elements [27]:

(i) Sufficient time
(ii) Appropriate focus

Fig. 3.3 Key elements of practicing in a humanistic medicine

In the high-speed, contemporary work environment within which healthcare is delivered, both the elements of *time* and *focus* may be challenged. Sufficient time is required for nurturing the "shared presence" between physician and patient, or between educator and medical trainee, in order for the interpersonal experience to be transformative [27]. Moreover, our culture has expeditiously become one driven by digital technologies that share information instantaneously (e.g., e-mail messages, smartphone texting, laboratory results auto-downloading into EMRs at all hours). The speed at which information is shared and the demands associated with using these new technologies and devices have set a quickening pace for the human race.

Key Point

There will be times when physicians feel that they require more *time* spent directly with the patient than is available in the brief, increasingly complex consultations they face. As healthcare professionals, taking the necessary time to show compassion and provide humanistic care for patients is a priority to be preserved.

Physicians, and society as a whole, are increasingly living in an age of distraction partly created by technology and the multiple electronic signals constantly received [27]. Modern life is

technology-driven and information-saturated. Information, even if helpful, can become a distraction if one is not prioritizing, evaluating, or analyzing it. In an effort to facilitate the creation and sharing of information, ideas, and other forms of expression via virtual communities and networks, people have created and use technologies such as Facebook, Twitter, WhatsApp and other virtual worlds, which in turn have been shown to challenge our ability to focus.

Since the introduction of the mobile phone in the 1980s, these devices have become almost ubiquitous worldwide. The technologies of today (e.g., communication devices, personal computers, and the Internet) confer nonstop information, often leading to distraction and, in some cases, to health problems. Studies have shown that small screen and internet technology can become lifestyle determinants of health and illness [28]. Recent research has been interested in conditions stemming from misuse or overuse of technology; the following are some examples:

- "Nomophobia" (an acronym for "NO MObile Phone PhoBIA") is the fear of having no mobile phone handy [29].
- "Phantom vibration or ringing" is the sensation that a phone has vibrated or rung when it has not [30].
- "FoMo," which is an acronym for "Fear of Missing Out," reflects a compulsive concern that one may miss rewarding experiences from which one is absent [31].

Did You Know?

In a preliminary study of 946 Australian youth (aged 15–24 years), 61% of subjects checked their smartphones upon awakening in the morning [32]. In this study, factors relating to one's self-concept and approval from others both impacted on young people's mobile phone involvement [32]. However, a large-scale representative panel data found that social media use is not, in and of itself, a strong predictor of life satisfaction across the youth population [33]. Instead, those researchers found that social media effects are small, at best, and contin-

gent on research methods. It is crucial that scientists and policy makers cooperate more closely to unravel the complex constellation of effects shaping individual health and lifestyle in the digital age.

One of the challenges with any new technological device in medicine is its potential to emphasize technology over the patient, subsequently compromising the connection that lies at the center of the patient-physician therapeutic relationship [27]. For example, many physicians struggle with the use of electronic medical records (EMRs). Research has shown that today's physicians are spending more than twice the amount of time looking at screens than working with patients [34]. For every hour of providing direct face-to-face clinical care to patients each day, physicians spend nearly two additional hours on EMR and desk work [34]. Moreover, physicians spend up to 2 hours of personal time each night outside of office hours on EMR documentation [34]. EMRs generally improve workflow; however, in some places an EMR was shown to amplify already broken workflows and processes [35]. (See section "The Future of Work: Deep Versus Shallow Work" for more details on the impact of technology in medicine.)

When a physician spends more time looking at the computer than the patient, it disrupts rapport and the flow of the conversation, as the physician may be perceived as distracted or disengaged [36]. Consequently, the patient-physician relationship, which is the heart of medicine, can be negatively impacted by technology at the bedside and in patient care rooms [37]. Although this may not be directly related to lower patient satisfaction, it could affect how openly patients engage in discussing their own concerns and needs [36].

Nevertheless, the force of technological advancement and progress cannot be ignored, and physicians must endeavor to prioritize time in the real world with their patients, in addition to the requirements of virtual world. Consequently, physicians must find a balance between establishing face-to-face human connections with rationally gauging their use of digital devices (Fig. 3.4). For instance, artificial intelligence, or AI (detailed later in section "Artificial Intelligence Technology in Medical Education and Clinical Practice"), has the potential to transform the daily work

Fig. 3.4 Balancing act of the physician between face-to-face human and digital device connection

of the physician from notetaking to diagnosis and treatment, potentially reducing the cost of healthcare and increasing patient survival. By freeing physician time from administrative tasks that interfere with direct patient connection, AI could create space for the humanistic therapeutic alliance that takes place between a physician who can listen and a patient who needs to be heard [37].

Skill-Building Exercise: Pause and Reflect

As humans live longer and more people require healthcare, pressure is building for physicians to care for more patients. Thus, physicians may feel compelled to spend a shorter time with each patient. Limited face-time with patients during a medical visit may create heightened stress for physicians and can compromise their ability to more fully know the patients they treat.

Imagine how the future of medical service delivery might look 100 years from now. How can physicians prevent the practice of medicine from being replaced by more efficient, profit-driven, assembly-line cybernetic medicine where humanistic physicians may have a lesser role?

The Skills of Focusing When Distracted: What Can Be Done Now

Our ability to sustain attention is under scrutiny. Constant distraction is the seeming challenge we face more than ever before in human history. Our prefrontal cortex governs attention and executive functioning [38]. Despite media multitasking (i.e., referring to the simultaneous use of different forms of media) becoming a rapidly growing societal trend, processing multiple incoming streams of information is associated with a distinct approach to how information is fundamentally processed and stored. For example, one study asked participants whether they concurrently used other forms of media at the same time as the primary media, using qualifiers such as "most of the time," "some of the time," "a little of the time," or "never" [39]. This study found that heavy media multitaskers performed worse on a test of task-switching ability than light media multitaskers, likely due to decreased ability to filter out interference from the irrelevant task set [39]. However, other researchers found no performance differences between heavier and lighter media multitaskers [40].

Some argue that our ability to multitask is a "continuous partial attention" where the brain switches back and forth quickly between tasks, and the ability to focus on either task declines [39]. Given the potential for such inefficiencies and associated costs in healthcare, there needs to be a fundamental cultural shift and considerations as to how technology can improve efficiency rather than hinder physicians' daily practice [41].

Digital technology will remain an integral part of medical practice. If medical trainees do not learn how to concentrate and eliminate distractions, they could have a more difficult time succeeding at work [42]. In a study of 94 participants comparing heavy, intermediate, and light media multitaskers, the speed at which implicit learning occurred was slower in heavy media multitaskers relative to both light and intermediate media multitaskers [42]. Exercises that strengthen attention, like mindfulness practices, should be integrated into medical education curriculum. Some even advocate for a daily "digital holiday," when trainees are relieved from distraction by devices [43].

Skill-Building Exercise

If you have an important project deadline coming up, consider setting aside protected time daily to get work done. Create a "sanctuary" space where there are no distractions such as e-mail or phone. Allow for several hours of uninterrupted work.

The Myth of Perpetual Digital Connection in Medicine

The modern work environment has been drastically changed by new modes of communication and information technologies. Physicians can feel overwhelmed by the pressure to respond at all hours, while burnout and other occupational health-related issues are on the rise [35]. Physicians are at high risk of losing the boundary between professional and personal life if this has not happened already. Mobile technology allows for remote working. Work commutes no longer disconnect us. Home and weekends are no longer a place and time to disconnect since physicians not only perform after-hours duty service, but now have access to information and work that were previously confined to the actual workplace. Digital connectivity may be an etiological factor in the erosion of leisure time. Most physicians use one smartphone for both their professional and personal lives. When physicians feel the need to be reachable on weekends, they feel obligated to verify messages in the event that anything "urgent" has come up. Work, therefore, has the capacity to follow physicians everywhere. Yet, although digital technologies have the potential to revolutionize healthcare by empowering clinicians to help them deliver the best care they can, only time will tell regarding how technology will impact on physician well-being and quality of life, but the data may be promising [37]. (See later in section "Check Your Learning," regarding further illustration of how potential digital tools could benefit physicians and their well-being.)

The "right to disconnect" is a human rights law that originated in France in 2017 [44]. It concerns the ability of people to disconnect from work and primarily not to engage in work-related electronic communications such as e-mails or text messages outside of working hours, although its utility remains to be seen [44]. Several other countries, primarily in Europe, are following France's model and granting their workers similar rights to disconnect, while in some cases this right to disconnect is present in the policy of large companies [44]. The responsiveness required of physicians beyond regular working hours necessitates further attention in addressing physician wellness and well-being.

Although it is tempting for governments to legislate a healthier approach to work and attempt to mitigate burnout, this remains a complex issue that goes beyond our dependence on digital devices. Real change is likely to result only when institutions prioritize physician experience as highly as they value productivity and patient experience. Only then will physicians and healthcare institutions be able to optimize their relationship, promoting realistic work expectations, and more supportive systems and technologies that are less draining and more fulfilling.

In the digital era, learning from the insights of disciplines outside of medicine is crucial to promote successful digital integration at all levels of modern health and educational organizations [45]. Successfully embracing ideas from outside of medicine and working with colleagues from other disciplines should be promoted to conduct collaborative research and develop integrated training interventions to best develop physicians for the complex, dynamic challenges of modern healthcare delivery [45]. In a recent review, Hategan and colleagues called for medical departments to start partnering with departments of computer science and other technical fields to foster collaborative opportunities, in which a designated technology center of a medical department could feature video-based visits, use of clinical simulators, application of virtual reality devices, and mobile apps, electronic/virtual consults, as well as yet-to-emerge technology [46].

Skill-Building Exercise: The Digital Minimalist

- Could you imagine yourself as a *digital minimalist*?
- How would you accomplish that?

Digital minimalism is an increasingly popular framework for thriving in the digital age where one benefits from being intentional about their adopted technology and abandons that which does not improve their efficiency or well-being [47]. To be a digital minimalist, one must first develop awareness of their relationship with technology. Screen time is defined as the time spent using devices such as smartphones, laptops, tablets, television, or gaming consoles. Smartphones remain the dominant device for consumer media, but criticism continues over screen time. Companies like Google and Apple have introduced screen time controls, but their effectiveness in changing consumer behavior remains to be seen [48].

Did You Know?

For the first time, in 2019, US consumers spent more time using their mobile devices, predominantly smartphones, than watching television [49]. Smartphones account for 70% of that mobile device time. About 90% of smartphone time is spent in apps [49].

Key Point

There are multiple apps available that claim to help curb social media use or to show how much time one spends on their smartphone, with the goal of helping build better screen time habits, block certain distractions, and become more productive, but their effectiveness in changing consumer behavior remains to be determined [50].

The Future of Work: Deep Versus Shallow Work

Patients often present with complex, chronic illnesses and are increasingly better informed than ever before. However, the time allowed for a typical patient consultation has not concurrently evolved to match these developments. Furthermore, physicians face many organizational stressors on a daily basis, such as time spent on EMRs and other administrative tasks. How digital technology innovation could alleviate such pressures and enhance the life-work integration remains to be determined.

As discussed earlier, in addition to electronic medical education, physicians are being prepared to practice in an EMR-mediated world. While many physicians may feel optimistic about the overall benefits of EMRs, they can also feel unsatisfied with the data searches, non-intuitive and multi-click interfaces of existing EMRs [48]. Table 3.2 shows some design capabilities of future EMRs [48].

Efficient EMRs may need to promote "deep work" and minimize "shallow work" [51]. Deep work, a term coined by Newport, refers to tasks that create new value, push our cognitive capabilities to the highest, and are performed free from distractions [51].

Table 3.2 EMR design for the next generation [48]

Not based on paper-chart model
Intuitive graphical user interfaces
Clinician approved
Complete access and use via mobile devices
Improved data entry applications
Extensive use of voice recognition
Measured reductions in clinician time
No data duplication across continuum of care
Improved computer diagnosis
Increased use in medical research and education
Increased use of cloud technology
Longitudinal based record (birth to death)
Not encounter or billing based
Interfaces for biosensors for improved patient monitoring
Big data storage and analysis for precision medicine and forecasting, predictive modeling, and decision optimization
Patient accessibility to personalized health record/information

By contrast, shallow work encompasses all the little tasks that feel like one has to do *right now*, but in reality they are neither urgent nor especially important (e.g., checking e-mail, Facebook, Twitter, site stats, or sales stats). People experience both modes of work. However, in order to accomplish the important tasks, one needs to cluster together or eliminate as much shallow work as possible to not allow it constantly to interrupt the periods of deep focus. For example, as clinicians, we often go through our daily practice seeing patient after patient. But how often do we find ourselves absorbed in shallow work (e.g., unimportant tasks) so that we may feel like we have not accomplished much at all? Later in this text, the section "Case Study I: Learning in the Age of Digital Distraction and Hyperconnectivity" will further illustrate an example of how to balance deep and shallow work.

Skill-Building Exercise: Pause and Reflect

What opportunities do you envision with the use of technologies such as artificial intelligence (AI) in future clinical practice?

How could AI benefit:

- Your workflow?
- Your engagement with patients?
- Your use of diagnostic tools and decision-making approaches?

Artificial intelligence (detailed later in this chapter) will be an essential tool to increase efficiency of the medical system in the era of carbon footprint awareness and limited resources [52]. Projected savings with the use of AI are expected to be seen with the introduction of robot-assisted surgery, virtual nursing assistants, administrative workflow assistance, dosage error reduction, and fraud detection, to name a few [53]. Consider the potential for a shift from traditional healthcare delivery in a centralized "provider" model to a decentralized "patient-centered" model such as

in a community or home setting [54]. Given the connected nature of healthcare via emerging technologies, there are tremendous cost-saving opportunities. Beyond the boards of our more highly resourced healthcare system, AI also has potential to benefit global health and less resourced nations [55]. (Also see section "Artificial Intelligence Technology in Medical Education and Clinical Practice" for more details on opportunities of automation in healthcare system.)

As discussed earlier, in the medical field, we often find ourselves overwhelmed by a myriad of distractions such as EMRs, e-mails, text messaging, and social media. As physicians struggle to find adequate time in daily practice, they can find themselves easily caught up in distractions. Moreover, physicians risk feeling that they are always "on," needing to stay connected to work through the digital world, in a constant state of "working mode" as they battle the limited resource of time and a never-ending "to-do" list. This takes a toll on physician wellness, as work increasingly creeps into personal lives and change work-life integration and fulfillment. It is therefore not surprising that a key driver of physician resilience is occupational wellness. Some methods to escape the feeling of being "busy," yet seemingly accomplishing insufficiently, and some skills regarding the practice of deep work to promote physician wellness are illustrated in Table 3.3. It is essential to counteract the shallow work by accomplishing more

Table 3.3 Strategies to develop deep work habits

Strategy	Description
Adopt new routines and rituals	Retreat for long periods of time (3–4 hours) with no distractions to complete the task at hand
Be intentional toward achieving your set goals	Schedule your new routine by blocking out a period of time in your weekly calendar
Accept feeling of boredom	Embrace boredom and reject the "need" to constantly switch between tasks, which can lead to shallow work and unsatisfying outcomes
Consider a "digital holiday" regularly	Turn off any notifications, pings, or texts that will distract from your primary work. If needed, repeat this more than once a week consecutively

deep work. This could be attained through the process of scheduling blocks of time to achieve one's most meaningful work. To attain contentment and wellness, physicians must be *intentional* and *focused*. Applying weekly deep work can make the difference between an unsatisfying and a more satisfying career.

Artificial Intelligence Technology in Medical Education and Clinical Practice

The rapid evolution of medical education and the impending changes driven by AI technology and other advances require special attention. Medical educators need to understand how to integrate technology into current curricula, focusing not just on technologies of the next 5–10 years, but using strategic foresight to consider the implications of technology on medical practice within the next 20–50 years.

Educational leaders need to prepare medical trainees for practice in a rapidly evolving world of technology and AI. The medical practice of the future may be thought of as a trifecta of sorts, requiring the following:

- Integration of traditional medical knowledge and skill
- Business acumen
- Digital literacy as a part of core curriculum and learning objectives

Proactive changes to medical education are required to remain on par with technological advances, in anticipating a digital era that progresses with yet undefined boundaries [19].

Skill-Building Exercise: Pause and Reflect

Think about your technological footprint. What are the essentials of technology which you may require to perform your job efficiently? Beyond using a smartphone and a laptop, what else would you need for your job?

As noted earlier in this chapter, there may be tremendous time and cost savings with the use of AI, which includes better standards of care for the patient. Opportunities for healthcare automation are highlighted in Table 3.4 [56, 57], whereas a few facts about technologies that clinicians can adopt in their future practice are presented in Table 3.5 [58].

With AI, physicians may find many more opportunities to creatively respond to high demand for the "human touch," while employing services or tools to facilitate concentration and deep

Table 3.4 Opportunities for artificial intelligence (AI) automation in healthcare [56, 57]

Opportunity	Description
Speeding up administrative tasks	Minimize or even eliminate time-consuming documentation by healthcare providers using natural language processing to capture conversation and denote medical records more accurately
Automating routine tasks	Allow AI to complete daily, repetitive tasks such as reading radiologic reports, follow-up, and interpretation of laboratory results
AI nurses	Eliminate routine but important nursing tasks with the assistance of an AI robot to, for example, dispense medications in an accurate and timely fashion allowing the nurse to focus on higher yield patient care
Digital diagnosis	Use technology and big data sets to identify patterns provided by patient symptoms, past medical history, and diagnostic results to provide accurate diagnosis
Treatment design and precision medicine	Provide patients with a proactive approach to medical care by identifying preventive measures to conditions identified in, for example, their genetic code and suggest treatment options tailored to each individual
Drug selection	Use neural networks (AI technology that mirrors neurons in the brain and mimics how humans learn with the ability to see trends and retrieve meaning from data) to expedite the findings of new drug treatments
Robotic surgery	An enhanced robotic surgery assistant can perform with greater accuracy and sensing of nerves and vessels than a human. This technology can improve patient outcomes and speed recovery
Healthcare supervision	Use wearable technology to monitor patients and provide real-time metrics directly to patients and physicians, providing mitigation or early identification of acute health crises

Table 3.5 Types of technologies for physicians to adopt in practice [58]

Technology	Description
Augmented reality	Use of augmented reality to educate medical trainees from the cadaver lab to the operating room, visualizing the body in 3D as an effective and risk-free learning tool
Telemedicine	Provide accessibility and timely healthcare consultation for the patients in the convenience of their home
Use of cloud and mobile devices	Through smartphone technology, cloud computing, and medical apps, both physicians and patients can access personal health information at their fingertips
Wearables and healthcare apps	Provide patients with wearables for monitoring and real-time feedback, allowing the potential to address medical issues before they become a problem. Real-time metrics available for physicians' review and diagnostic consideration
"Smart hospitals"	Smart hospital concept is aimed at creating IT environments that rely on optimized and automated processes of specialized and auxiliary procedures. It aims to improve patient satisfaction, optimize workflow, streamline communications with devices, such as sensors, building systems, and hospital electronic records, for more personalized patient care

work to improve their occupational life. Physicians could benefit from a new philosophy of technology use to support their overall well-being: the concept of digital minimalism to overcome work-life disintegration accentuated by contemporary cultural and biological forces.

Artificial Intelligence: A Solution to Improve Work Efficiency?

AI is not a new or novel technology. It has been in existence for years. Yet, the speed and capacity of systems in combination with the massive amount of data that currently exist make it a powerful

and transformative tool with potential impact to all industries, including healthcare. AI, in combination with machine learning, has the functionality to understand, reason, and learn using large data sets to support better decision-making and solve problems that could not be solved before with computational power and that far exceeds the capability of even the brightest minds.

With AI's ability to provide significant improvement in accuracy, speed, and consistency of patient diagnosis and treatment, it is not surprising that physicians are concerned with the potential impact it will have on their role and the patient-physician relationship [59]. As discussed earlier, some experts believe that AI will eliminate the redundant and repetitive tasks currently consuming the physician's time, thereby enabling physicians to focus more fully on the humanistic side of healthcare [60]. Physicians are currently bombarded with low-value administrative tasks to meet stringent policy regulations and minimize liability concerns. Conversational AI technology has the ability to eliminate the consuming hours required for EMR documentation. Using natural language processing (NLP), which is a branch of AI focusing on the interpretation and manipulation of human-generated spoken or written data, and natural language conversational AI, will automate documentation of the most relevant aspects of the care discussion, thus potentially increasing time and attention for the physician-patient interaction [61, 62].

Among the necessary but stressful aspects of medical training are the hands-on technical skill components of various procedures and surgeries. Although senior level oversight is in place for instruction and risk mitigation, there is always the chance of unnecessary errors and undo patient complications [63]. With the use of AI and simulation, medical trainees have the ability to practice in a highly realistic, yet risk-free environment. This advancement in technology provides medical trainees with less stressful options to perfect their technical skills and reduces or potentially eliminates risk of adverse patient outcomes. Later in this text, section "Case Study II: AI, the Modern-Day Stethoscope of 2050" illustrates an example of digital technology integration in medical education and healthcare delivery of the future, as well as its possible anticipated impact on the physician's life.

Table 3.6 Key ethical and legal challenges of using AI in medicine

No clear rules on consent for data use
No clear rules on how patients can opt out during data collection and use
Use of incomplete/selective data, or misuse of data
Risks to privacy that can affect generations
Potential for bias and discrimination

Artificial Intelligence – Ethical and Legal Considerations

Key ethical and legal challenges of using AI in biomedicine, based on values of fairness, reliability, privacy, inclusivity, transparency, and accountability, are summarized in Table 3.6. With any significant transformation such as the use of AI in everyday medical practice, there are ethical and legal issues that need to be considered. For example, some studies have shown that tools such as IBM Watson for Oncology, which is a clinical decision support tool designed to assist physicians in choosing therapies for patients with cancer, may soon become the standard of practice [64]. Medical education which includes understanding the programming rules and algorithms utilized in AI machines will be essential for future practitioners to feel comfortable with these diagnostic tools. Moreover, medical legal discussion on liability when physicians are using these technologies must be clearly defined to protect all parties involved and requires further consideration. This reliance on machines will have implications for policy, ethics, and malpractice law [65].

Check Your Learning

Case Study I: Learning in the Age of Digital Distraction and Hyperconnectivity

Olayemi is a second-year family medicine resident who feels sluggish and as though he is always playing catch up with his work throughout the day. He finds himself running late to clinical

duties in the morning as he tries to squeeze in every possible minute of sleep, which also requires him to miss breakfast. He substitutes meals with coffee from the café in the hospital. He also feels distracted, using his cell phone to check social media accounts and e-mail between patients. As a result, Olayemi has recently struggled to complete his scholarly poster project for the annual research day at his university. With a nutritional deficit, distractions, and poor sleep regimen, Olayemi feels he is not as efficient as he could be.

Feeling like he is always in a rush and always exhausted, Olayemi talks about his struggles with his supportive girlfriend, Yuna. Olayemi decides it is time to make some healthy changes. They sit down and discuss small adjustments he can make to help him feel better and accomplish more.

Olayemi sets more regular sleep and wake times when he is not on-call, to ensure he is getting enough sleep. Given that he lives only a few minutes from the hospital, he decides to walk to work to enjoy some fresh air and quiet time to himself away from his mobile device before starting his busy day.

During his workday, Olayemi sets aside a 20-minute break during lunch to check his social media, texts, and e-mails (something that he called his "shallow work checklist"). Knowing he has carved out a specific time, Olayemi finds himself thinking less often about checking his accounts. In turn, he finds himself more engaged in patient care and is not struggling as much to keep himself on schedule.

Olayemi has one academic day per week and decides to put aside a specific number of hours on this day to work on his academic project. During this time, he turns off his cell phone and makes his scholarly work his only focus. He finds himself far more productive, despite spending fewer hours on his work.

As a physician, Olayemi understands the importance of healthy eating and decides it is time to follow the advice he gives his patients. He begins meal prepping on Sundays with Yuna, which is a way he protects quality time with her in his busy schedule, and it becomes a routine they both enjoy. Olayemi tries to cut out his daily coffee but realizes he misses it, so he decides to cut down to one cup a day. To prevent using a disposable paper cup every

day and contributing to hundreds of cups in waste, he brings his own mug that the café fills for him.

Within a few weeks, Olayemi begins to see positive results. He experiences more energy throughout the day and he is more productive. As a result, he is able to engage in additional research activities within his department, something he finds himself relishing. Focusing on only the task at hand, carving out time for activities he finds important, and planning ahead for a healthy week, Olayemi feels much less overwhelmed and worried about playing catch up with his sleep and at work.

Question 1. **Climate change has been shown through various measurements to have a negative impact on health. Reducing one's carbon footprint with less environmentally harmful practices is something everyone can do every day. In what ways Olayemi has reduced his carbon footprint?**

A. **Walking to work**
B. **Using a mug for his coffee**
C. **Meal preparation at home**
D. **All of the above**

Answer: D ✓

Olayemi has demonstrated various ways to reduce his carbon footprint. Although he has changed his day to day routine to improve his sleep and efficiency, in turn he has also chosen methods that are more "green" in nature. Commuting to work via *walking or riding a bicycle is feasible for Olayemi as it saves him money on gas and less wear and tear on a vehicle, promotes physical exercise, and also reduces his carbon footprint. There is currently a throwaway culture that increases one's carbon footprint* via *buying disposable utensils and containers for food and drink. Olayemi was throwing away multiple cups a day until he switched to using a mug. This not only allows him a reusable container that holds more volume of beverage, but it further reduces his carbon footprint. Meal preparation not only reduces the use of containers, papers, and utensils disposed from purchases "on the go", but also allows more control of the nutritional content of his meals while*

minimizing his carbon footprint. As discussed earlier, processed foods have been associated with adverse health outcomes [5].

Question 2. **The ability to focus when distracted and perpetual digital connection can go hand in hand. Olayemi has targeted these aspects of his day to day function. Which potential adverse outcomes should Olayemi be concerned about if he does not make some changes to his routine?**

A. **Perpetual inefficiency**
B. **Burnout**
C. **Poor work performance**
D. **All of the above**

Answer: D ✓
All of the above are potential outcomes if Olayemi does not make healthy changes to his routine. Poor sleep and frequently checking his mobile device lead him to pay less attention to his daily responsibilities. Scheduling out time to address e-mails, texts, and social media can help reduce his distraction and enhance his ability to be more efficient during the time set for work on his projects. Feeling pressure to respond immediately via *electronic communication impacts our ability to focus on work and to disconnect from work! This may eventually lead to feeling overwhelmed and then to burnout. As discussed previously, the "right to disconnect" is a human rights law developed and used in other industries, which could be adapted and integrated into medical systems as a stepping stone toward improving the wellness and resilience of physicians* [44]. *In addition, there are apps available showing us how time is spent on our smartphones, which might help limit screen time, block distractions, and boost productivity.*

Case Study II: AI, the Modern-Day Stethoscope of 2050

Imagine Julia, a third-year internal medicine resident in the year 2050. Her duties include supervising junior residents for the third consecutive month on an inpatient unit at a tertiary care hospital

and providing virtual care for cross provincial referrals. Julia cares deeply about her patients. In order to keep up with the demands, she has been sleeping fewer hours (about 5.5 hours a night) for the past 3 months. She has the ability to leverage a robotic physician to interact with her patients from the comfort of her home during her night call duties for the hospital. Despite this, her sleep continues to be disrupted and anxiety heightened anticipating these complex cases. A typical day for her starts at 5:45 AM. She turns off her alarm clock, displayed as a digital time overlay built into a special pair of glasses that she wears at night; these glasses also have the capacity to display a video to assist through deep breathing and relaxation exercises for stress relief in order to promote a more optimal sleep. Despite this, she starts her day with feelings of anxiety as she reviews more than 50 alerts from her virtual care patients' wearable devices and home monitoring systems. After getting ready for work, she accompanies her morning coffee with verbal dictations for treatment plan adjustments using connected mobile apps; she tailors treatment protocols as suggested by the program. As she makes her way to the hospital in her driverless electric car, she continues to review diagnostic results from her inpatients in anticipation of questioning from her attending physician at morning rounds. Given the use of home monitoring devices and personalized scanners, only the most complex patients are treated in hospital. As Julia and her team meet with inpatients during morning rounds, she struggles with the desire to empathize with her patients and their family caregivers, often wishing to express how deeply she understands their suffering. For fear of being seen as "too close" to her patients, and thus fearing judgment of being "unprofessional," she avoids sharing her feelings not only with patients but also with her peers, although this leads her to feel more disconnected from herself and her work.

With the use of conversational AI, relevant progress notes are automatically documented based on the discussion between Julia and her patients, taking away some administrative burden; yet, Julia feels that "big brother" is always monitoring, adding to some

anxiety. Much like the everyday use of the stethoscope in the twenty-first century, Julia has the ability to tap into cognitive computers including AI, machine learning, supercomputers, and predictive analytics as everyday tools that automate complex decision making with big data. The resources to which she has access span geographic boundaries, consisting of the most up-to-date global research evidence. Given her perfectionistic ways and desire to provide her patients with the best standards of care, she recently subscribed to a publication that details the latest emerging medical technology.

But Julia soon begins to feel incompetent, overwhelmed by the inability to "keep up" with her reading, and she becomes increasingly critical of herself. Although she lives in a century that is more connected than ever, even having the ability to speak with her family halfway across the country using holographic telepresence, she frequently "runs out of time" to connect with her social supports outside of work. For this reason, she feels she has more detached responses toward others, which alienated her from a few friends and family recently.

While initially hesitant, Julia decides to access counseling services through the local resident affairs wellness center. There, she endorses feeling constantly fatigued and that she finds it a burden to engage with her patients. She denies feeling depressed, anhedonic, hopeless, or suicidal but does disclose feeling anxious about entering the hospital each day and dreads the constant bombardment of information to her mobile device, anticipating something will be overlooked and inevitably goes wrong under her care. She is sleeping less lately, despite implementing digital mindfulness exercises. Notwithstanding her sleep being already disrupted, she often finds herself drinking two to three glasses of wine to fall asleep. Julia is hesitant to further engage with a mental health clinician, but she is interested in using additional virtual reality tools in the comfort of her own home, which will initially focus on assistance with regulating her sleep and assist with her anxiety symptoms. She thought: "If I just survive this year of residency, I will be fine and I'll regain control over my life."

Question. **Although few would dispute the substantive positive impacts that technology will have on prevention, personalized medicine, diagnosis, and treatment planning for the patient, what digital tools could benefit physicians like Julia who may experience physician burnout?**

A. **Virtual or augmented reality**
B. **Conversational AI**
C. **Technology to support work from the comfort of physician's home**
D. **All of the above**

Answer: D ✓

Recognizing the signs and symptoms of physician burnout is discussed elsewhere in this volume (see Chap. 10, Recognizing Compassion Fatigue, Vicarious Trauma, and Burnout). However, most of the physicians should be able to recognize that the persistent feelings of being work overloaded, unsatisfied, isolated, and unappreciated in professional life may be symptoms of burnout, as in Julia's case [66]. *Persistent burnout should prompt clinicians and organizations (as described elsewhere in this volume; see Chaps. 17 and 18) to further develop strategies that promote workplace engagement, job satisfaction, and resilience, which includes efficient and ecofriendly technology use.*

As technology continues to "disrupt" medicine for the benefit of the patient and systems, physicians must be proactive in advocating for technology to help themselves in their medical practice, reset workplace and personal expectations, and adopt healthier attitudes. As with the digital transformation, there must be a cultural change establishing a new dynamic between the patient, physician, and technology with the fundamental of humanistic connection in place for both the patient and physician.

Future tools such as virtual or augmented reality may become the gold standard treatments in supporting sleep or anxiety disorders, similar to Julia's case [67]. *Technology, such as conversational AI, has the potential to decrease administrative burden for physicians of the future; however, there are ethical considerations that needs to be further addressed* [68]. *The attempt to automate*

and reproduce intelligence in medicine is, at its best, probabilistic and not deterministic [68]. *Similar to considerations of autonomous vehicles, there is the question of who is morally responsible when a medical adverse event occurs. The dilemma still remains regarding how it is determined where responsibility or accountability lies, the role of humans in the AI decision-making process, defining the responsibility of the physician relying on AI, the hospital providing that technology, the software engineer behind the technology, and the corporation commercializing it* [68].

Moreover, virtual medicine, home monitoring devices, and wearable technologies will minimize the need for centralized care within the hospital. This will reduce unnecessary visits for the patient while allowing physicians to work in the comfort of their homes, which in turn may accommodate the physician's busy schedule and promote an environmentally friendly ecological footprint. Although working from home has the potential for system cost savings, this has the strongest possibility for blurring the lines of personal and professional lives for physicians by bringing their practice more notably into their home, and this needs sensible consideration.

In summary, these are all examples physicians should consider among the introduction of emergent technologies in order to optimize efficiency and improve physician well-being, and thus the correct answer is D. (See also Table 3.5 for other technologies with potential usage in the future of medicine.) Physicians of the future must leverage the emerging tools to work smarter and not just harder! Burnout will be a continuing theme in the future of healthcare if culture change is not championed as medical technology inevitably continues to transform healthcare.

Key Takeaways

- The healthcare system contributes to the increasing global carbon footprint, but there are feasible ways to reduce this [5].
- Given the growing evidence that climate changes have the potential to adversely affect health, medical schools should incorporate curricula to reflect the health risks

associated with a changing climate [69]. In this view, an increasing number of medical schools are implementing changes to their curriculum to incorporate timely and current content [69].

- Integrating climate change topics into medical curricula provides an opportunity to develop awareness and skills needed for practicing medicine in a humanistic manner and in a climate-changing world.
- Physicians are being increasingly called upon to engage in skillful adoption and integration of technology in a rapidly changing ecofriendly digital world.
- The argument for using digital technology to provide healthcare is immutable and a vision of medicine's future is optimistic. Technological advances are changing the way medicine is practiced and the way physicians interact with patients. Finding a way to deliver optimal face-to-face humanistic care, while living in a digital world, will transform the way physicians work in the future.
- With technological advances come potential distractions, and medical trainees need to learn how to focus and eliminate these by building exercises that strengthen attention as part of the curriculum.
- Digital technology allows the ability to stay connected to work more easily and continuously, which in turn could perturb work-life integration and lead to burnout. "Always-on" behavior can be detrimental to well-being, and physicians need to learn how and when to hit the pause button.
- Artificial intelligence (AI), although not a new technology, is being used more in medicine but there is concern that it may reduce the humanistic approach [59, 60].
- The benefits of AI may be such that physicians are provided training and practice in a risk-free, highly realistic environment with the opportunity to trial various case scenarios and a less stressful method to enhance skills.
- With new technologies, there will be new medical legal implications for liability which will govern new policy on the ethics of reliance on machines [64, 65].

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